City of Chefornak

Design Analysis Report

Chefornak Pump House 2

Chefornak, Alaska

Prepared by:

CE2 Engineers, Inc.

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I. Executive Summary

The Design Analysis Report (DAR) for the proposed Pump House 2 project is the next to final step in design of this facility. The proposed Pump House 2 at Chefornak is being designed to incorporate the two water wells in the south end of the community to supply water to the existing water distribution loop. This loop supplies water to:

- Watering Points
- School
- Clinic
- Fish Processing during the fishing season
- Temporary Washeteria

This project was the third priority of improvements to the Chefornak Water and Sewer System.

The proposed Pump House 2 will be 20-ft wide x 24-ft long with 8-ft high sidewalls, placed atop a 6-in steel Micropile foundation. Plan View and Elevations of the proposed facility are shown on Sheets A1.0 and A2.0 of the Pump House 2 Improvements 35% Reissued plan set dated Feb. 2016 (Appendix A).

The building will contain one each 2,500-gallon HDPE water storage tank and well controls. It will also contain a pressure pump system, backup water distribution loop circulation pump, and a building and water distribution backup heat exchanger and controls, used if the waste heat recovery system at the City Power Plant and backup distribution loop heating system at Pump House 1 is not available for any reason.

Geotechnical considerations necessitated a steel pipe Micropile-type foundation, due to the widely varying areas of frozen and thawed subsoil that prevented the use of a passively cooled gravel fill foundation and Triodetic foundation space frame. Fortunately, the building site has an ancient lava flow underlying the soil at a depth of 30 feet that has supported a number of structures in the area using piles driven or drilled to this bedrock layer.

The Micropile foundation grid was installed Fall 2015 while the ground surface was frozen. This operation was performed in conjunction with the Washeteria / Water Tank, and Pump House 1 Micropile foundation projects to minimize mobilization and demobilization costs for each project. A tentative construction schedule is envisioned as follows:

- The building shell and internals would be constructed in summer-fall 2017 after materials arrive on the first barge to Chefornak. This construction

timeframe will be scheduled after the Washeteria and Pump House 1 are completed and when grant funding is in place to finance the project.
- The well field will be connected to Pump House 2 with an arctic pipe duct set on helical piers.
- The existing water distribution loop will be connected to Pump House 2 through a junction box and an aluminum utilidor set on treated wood sleepers.

Capital costs for Pump House 2 improvements are estimated at **$995,085**. This assumes no filtration of the well water. Details of the capital cost estimate are presented in section VI. Cost Estimates.

Annual operating costs for Pump House 2 improvements are estimated at **$32,424 per year**. Details of the operating cost estimate are presented in section VI. Cost Estimates.

II. Introduction/Purpose/Background

The proposed Pump House 2 in Chefornak is being designed to connect the two wells, drilled in 2002, to the existing water distribution loop. The pump house will provide heating for the raw water lines between the well field and the pump house, storage of 2500 gallons of water, water pressurization, and backup circulation pumping of the existing water distribution loop. Chlorination of raw water is optional, if desired by the City of Chefornak.

The proposed Pump House 2 will be 20 ft wide x 24 ft long x 8 ft high at the end walls. It will have a gable roof with a 4:12 pitch. Engineered wood floor joists and rafters will be used for floor and roof, respectively. Floor and ridge beams will be glued-laminated timber. Walls will be structural insulated panels (SIP).The foundation will be 6-in pipe Micropiles.

Plan view and elevations of the proposed facility are shown on Plan Sheets A1.0 and A2.0 of the 35% plan set in Appendix A.

A. Location

The site for proposed Pump House 2 is located on Lot 4, Block 18, Plat 97-3 (South Chefornak Subdivision). The site is situated in the south area of the built-up community, on a presently vacant lot owned by the City of Chefornak. We understand ownership was transferred as a part of a large land transfer by the Chefarnrmute Village Corporation under the terms of the Alaska Native Claims Settlement Act (ANSCA). The transfer is in the process of being recorded at the Bethel Recording District, and the Trustee Deed will be placed in Appendix B recording is completed.

B. Existing Site Conditions

The existing site is on a relatively flat area, covered in local grasses, with some standing water on about 5 percent of the lot. The lot slopes down to the north, but there is adequate room for the building on the flat area of the lot. The area between the proposed Pump House 2 site and the well field 650 feet to the south consists of tundra and hummocks. A small shallow drainage ravine, about 150 ft wide and two-thirds the way from the proposed pump house site to the well field, consists of swampy ground with some standing water with a very slow eastward flow.

C. Existing Facilities

As Pump House 2 will be a new building, there are no existing facilities on Lot 4. There are presently two each 6-in wells 277 feet deep at the well field area, along with a power pole nearby with a temporary 240/120 single phase service.

D. Water Source

The existing water source consists of two each 6" pipe cased wells drilled down through 277 feet of silt, ash, and lava to a five foot thick aquifer. After initial well development (surging and pumping) an extensive test-pumping program was performed on Well W02-3 to gain knowledge of long-term water quality, with respect to Total Dissolved Solids (TDS). Pumping of this well began around May 25, 2005 to August 11, 2006, a period of 15 months. Initial pumping was performed at 10 gpm, and TDS climbed to 3000 mg/l, a high value. Seawater is 36,000 mg/l, as a comparison. After 12 months of pumping, a flow limiter was placed on the discharge line from the well and flow was limited to 5 gpm. TDS dropped to 1,000 mg/l. The flow limiter was changed to 3 gpm, and TDS dropped and stabilized at 600 mg/l.

It became apparent that a thin layer of fresh water was sitting atop a layer of brackish water, and that maintaining a low discharge flow rate from a well would enable the City to keep the TDS levels down to 600 mg/l. It was also noted that seasonal recharge of the aquifer occurred from June through August of each year. Well logs and a well pumping graph showing TDS versus time, and well water quality data is shown in Appendix C.

The raw water quality parameters are shown below for the two wells with results from samples taken in September 2002.

Water Parameter	MCL*	Well W02-2	Well W02-3
Total Organic Carbon, dissolved		5.82 mg/l	5.60 mg/l
Total Organic Carbon		5.38 mg/l	5.26 mg/l
UV254		n/m	n/m
Total Dissolved Solids	500 mg/l	390 mg/l	435 mg/l
Turbidity	0.5 NTU	01.16 NTU	2.21 NTU
True Color	15 PCU	80 PCU	80 PCU
CO_3 Alkalinity		20 mg/l	15 mg/l
HCO_3 Alkalinity		250 mg/l	246 mg/l
Hardness as $CaCO_3$		10.0 mg/l U	10.2 mg/l U
pH	6.5 to 8.5	8.80	8.70
Aluminum	0.05 to 0.2	n/m	n/m
Calcium		0.556 mg/l	1.01 mg/l
Magnesium		3.06 mg/l	0.91 mg/l
Silver	0.1 mg/l	n/m	n/m
Nitrate-N (measured as nitrogen)	10.0 mg/l	0.208 mg/l	0.200 mg/l

Water Parameter	MCL*	Well W02-2	Well W02-3
Nitrite-N (measured as nitrogen)	1.0 mg/l	0.200 mg/l U	0.200 mg/l U
Bromide	0.1 mg/l	n/m	n/m
Antimony	6 µg/l	ND	ND
Arsenic	10 µg/l	2.00 µg/l U	2.00 µg/l U
Barium	2000 µg/l	9.84 µg/l	29.0 µg/l
Beryllium	4 µg/l	0.40 µg/l U	0.40 µg/l U
Cadmium	5 µg/l	ND	ND
Chromium	100 µg/l	ND	ND
Copper	1000 µg/l	1.9µg/l	1.52µg/l
Cyanide	0.2 µg/l	ND	ND
Fluoride	2 mg/l	ND	ND
Mercury by Cold Vapor	0.2 µg/l	ND	ND
Nickel	100 µg/l	ND	ND
Selenium	50 µg/l	ND	ND
Thallium	2 µg/l	ND	ND
Chloride	250 mg/l	18.8 mg/l	64.5 mg/l
Langelier Index @40F		-0.33	-0.07
Langelier Index @140F		-0.75	1.01
Iron	0.3 mg/l	0.134 mg/l	0.340 mg/l
Odor (TON)	3 TON	ND	ND
Manganese	0.05 mg/l	0.013 mg/l	0.032 mg/l
Sodium	250 mg/l	123 mg/l	139 mg/l
Sulfate	250 mg/l	ND	ND
Zinc	500 mg/l	2.33 µg/l	2.00µg/l U
Total Potential	80 µg/l	n/m	n/m
Total Potential HAA5	60 µg/l	n/m	n/m
Ammonia (as nitrogen)		n/m	n/m
Dissolved oxygen		n/m	n/m
Hydrogen sulfide		n/m	n/m
Carbon dioxide		n/m	n/m

n/m not measured ND not detected

* MCL Maximum Contaminant Level, as set by the Environmental Protection Agency (EPA

The water from the existing City well source, as well as the water from the pair of 2002 wells to the south of the community, has a problem with treatment using conventional methods of coagulation and multimedia filtration because of the high levels of TDS, which interferes with the coagulation process. However, for the past 30 years, minimal treatment has been performed on the City well source, which is similar to this well

field for Pump House 2. There has been some multimedia filtration, but aside from chlorination and the above-mentioned filtration, no other treatment steps were taken. The water has been used for bathing, clothes washing, hand washing, and steam baths, but not for drinking.

E. Site Plan

The location of the proposed Pump House 2 is shown below in Figure 1. It is located on Lot 4, Block 18, Plat 97-3 (South Chefornak Subdivision). The full site plan is shown in sheet C2 of the 35% plan set (Appendix A).

Figure 1—Proposed Location: Pump House 2

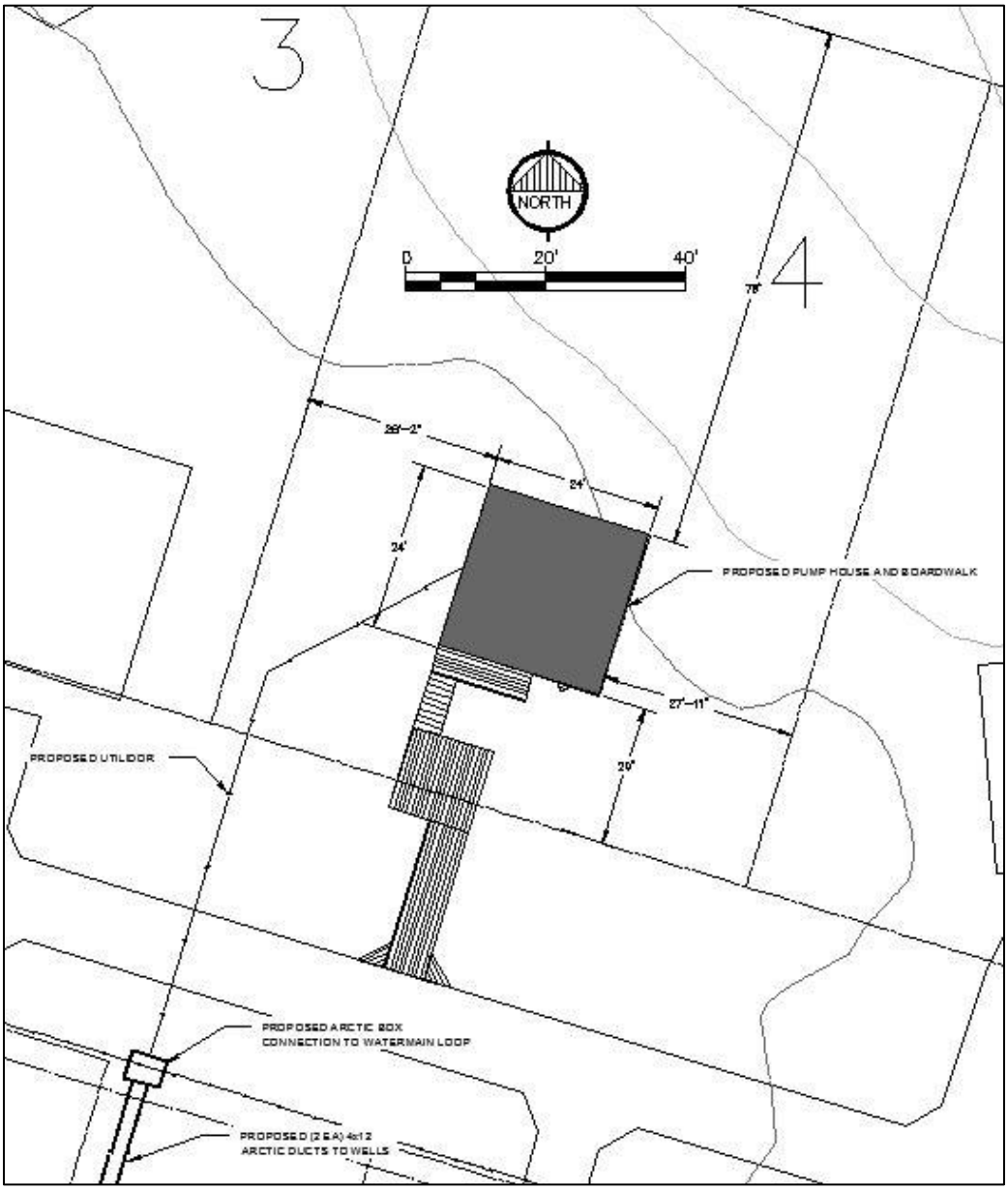
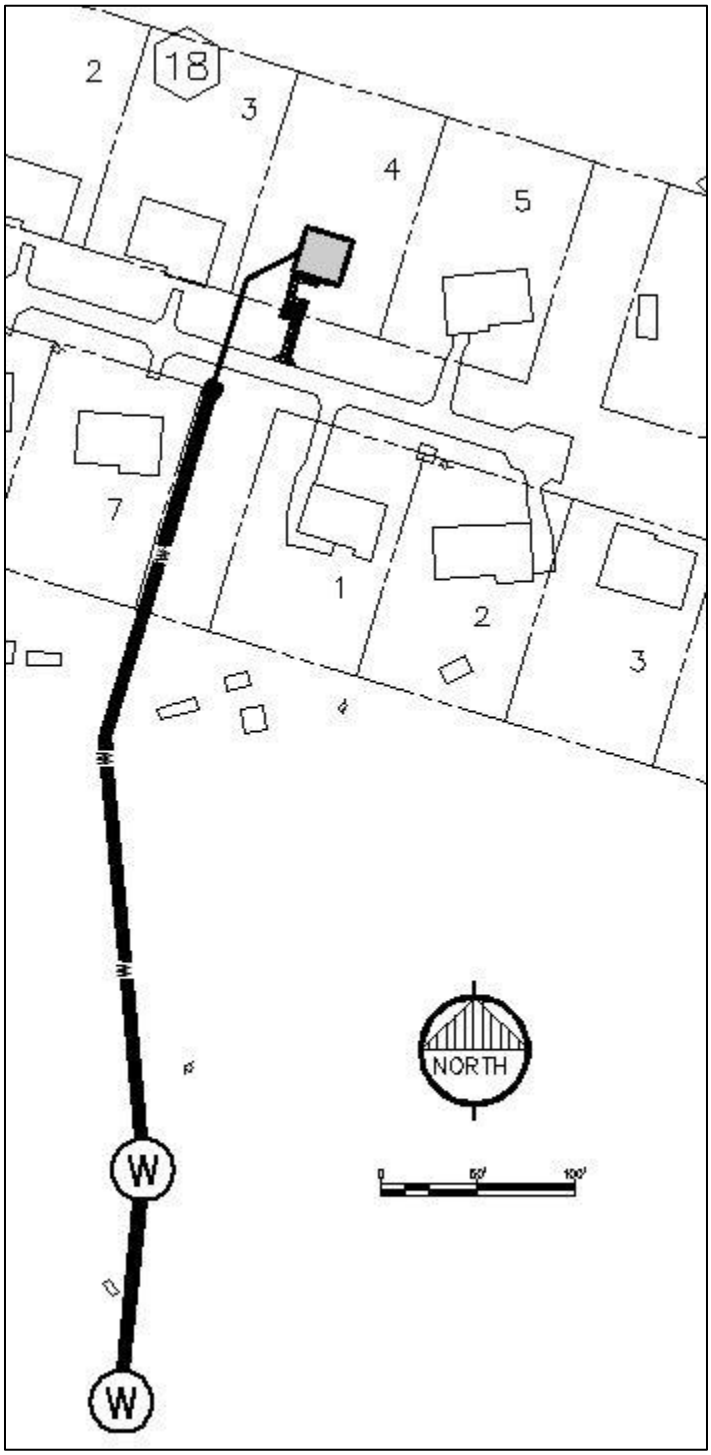


Figure 2 below shows the site plan of proposed Pump House 2 with the connecting utilidor, junction boxes, water transmission line, and well field.

Figure 2—Vicinity Map of Pump House 2, Connecting Pipelines, and Well Field



III. Design Requirements and Considerations

A. Population/Design Life

Based upon U.S. Census Data for census years 1990, 2000, and 2010, and a 2012 population estimate, population is shown in tabular form below.

Year	Population	Difference	Annual Pct. Increase Equivalent
1990	320	-	-
2000	394	79	2.1%
2010	418	24	0.6%
2012	434	16	0.4%
2034 (projected)	*458*	*24*	*0.5% (assumed)*

As seen from the above figures, the population growth rate has been steadily dropping in the last 30 years. A conservative estimate for an annual growth rate in the next 20 years (assuming a design life of 20 years) is 0.5%. With this in mind, the 20-year design horizon population figure is estimated at 458.

B. Soil Conditions

Chefornak is located on the south bank of the Kinia River, about 6 miles east of Etolin Strait. It lies near the present coastal margin of the Yukon-Kuskokwim Delta, which is comprised of thick unconsolidated alluvial, deltaic, and Aeolian deposits of silts and fine sands, with some gravelly sands. Sediments in this area are at least 237 ft thick. Basaltic flows from Tern Mountain, about 5.5 miles to the south, extend northward to beneath the City of Chefornak. The City well drilled in Chefornak lies on a recent volcanic sequence within about 30 feet of the surface. This lava flow is about 27 ft thick. Soil conditions around the existing City pump house consist of about 1 ft of organics, followed by about 16 ft of areas of frozen or thawed silt, fractured basalt, and hard basalt.

C. Regulatory Requirements

- Applicable Codes: Title 13 of the Alaska Administrative Code, Chapters 50 through 55, was adopted and amended to the 2009 International Building, Fire, and Mechanical Codes, as adopted and amended by the State of Alaska.
- Design Minimum Temperature: -50°F
- Design Degree-Days for heating to 65°F: 13,200 °F*Days / year
- Design Degree-Days for heating to 50°F: 7,900 °F*Days / year

- Design ground snow load: 40 lb/sf. Note that snow drifting is a significant factor in Chefornak. The structural engineer must take drifting into account during design.
- Maximum Wind, 3-second gust: 130 MPH, Exposure C.
- Seismic Design: Site Class D, Spectral response acceleration at short period--- S_{DS} = 0.15, for long period--- S_{D1} = 0.07

D. Pump House 2 Design Criteria

1. Geotechnical Considerations

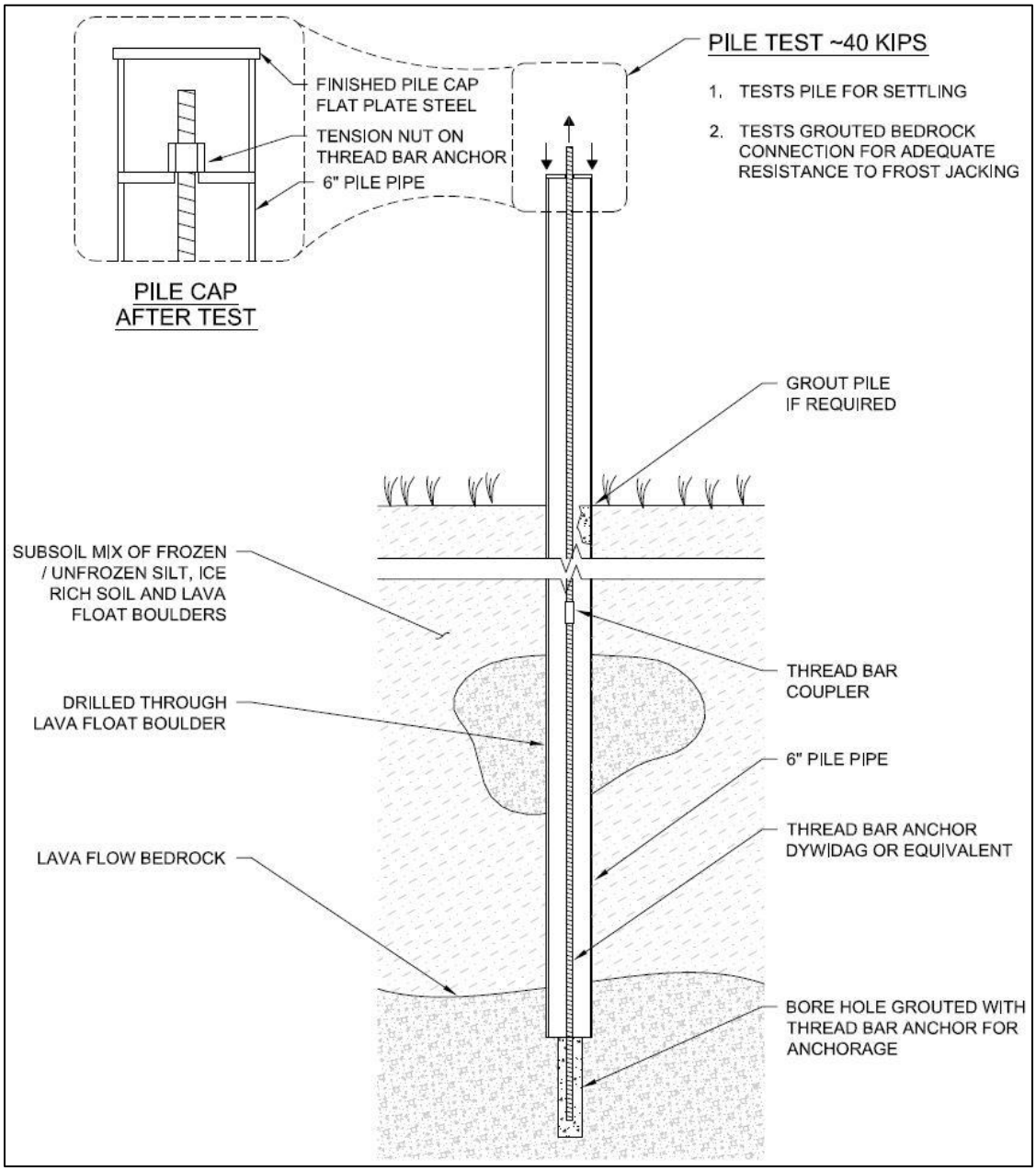
Soil sampling was performed for the site of Pump House 2 on August 20-21, 2014, by Golder and Associates (Golder). A Hilti impact hammer was used to sample soils down to about the 6-ft level. Golder's geotechnical report is presented in Appendix D.

Golder's recommendation is to use a 6-in pipe Micropile, end bearing, in bedrock (ancient lava flow), for a foundation. This can be accomplished with the use of a portable drill rig, which can be flown in via small air freighter into Chefornak.

The foundation design is to drive the piling down to an obstruction (lava boulder floating in matrix of silt and ash), and then the obstruction is drilled about 2 ft. If soil is encountered after going through the obstruction, then the pile is continued until bedrock, where further drilling of about 1.5 ft depth is done to seat the pile. See Figure 3 below for a section of a typical Micropile, as envisioned for Chefornak.

General loadings on piles will range from 7 to 14 kips. Uplift from frost heave (estimated at 30 kips for three feet of seasonal frost) will require that these Micropiles be rated for uplift in excess of the static loading, due to 40 psi ice adhesion along the pile perimeter through the expected active layer for frost uplift. This ice adhesion translates to almost 10,000 lb per foot of 6-in pipe. It will be necessary to have a tension bar grouted into the bedrock at each pile to resist this frost uplift in the soil active layer. Micropiles should be tested for 30 kips of uplift.

Figure 3—Typical Foundation Micropile



2. Building Shell and Foundation Structural Design

a. Building Form

The building will be a one-story rectangular structure, 20-ft wide x 24-ft long x 8 ft high endwalls, with a gross area of 480 sq ft. with an open ceiling. The roof will consist of a ridge beam and columns embedded in structural insulated wall panels (SIP), supporting engineered wood beam rafters with a clear span between the ridge and the exterior side walls. The ends of the roof beams will be configured in gable fashion.

The floor will be standard wood joist construction (BCI or LVL type joists) sitting on glu-lam beams, which in turn are supported on a 6-in Micropile pipe foundation.

Partition walls will be non-structural and will be 2x4, or 2x6 framing, as required.

Building outside walls will be 8-in thick SIP panels, and the roof will be constructed of engineered joists (BCI's) with treated OSB or plywood sheathing.

Wind will be the governing factor in designing the structure to resist wind pressures and the resulting overturning moment on Pump House 2 when the 2500-gal water tank is empty (worst case).

b. Exterior and Interior Materials

Exterior materials for the roof and walls will be treated OSB or plywood, sheathed with metal roofing and siding. The soffit on the underside of the floor will be plywood. The area under the foundation will be secured with chain link fencing to prevent unauthorized entry under the building.

Interior materials will be OSB or plywood on the walls and ceiling, with vapor barrier and 5/8" gypsum wallboard bonded to white FRP panels on the surface for cleanliness. Structural subfloor will be 1-1/8" thick plywood covered with 3/8" thick underlayment and an epoxy floor.

3. Internal Water Storage Tank

a. Design Criteria

The following design criteria govern the parameters of the City well pump and Pump House 2 water storage tank:

- Continuous water demand is greatest when the school is pumping water continuously to feed its UF/RO process, about 7 gpm, or about 3500 gallons per day for a typical fill cycle of the school water tanks. Most of this demand will be handled through the 22,000 gal storage tank at the future Washeteria.
- Pumping well water from the 2002 well field is limited by the results of long-term pumping tests to 6 gallons per minute (gpm) when the two wells are pumping together. Average demand for Pump House 2 pressure pumps would be 5.6 gpm if Pump House 2 was the only source and Pump House 1 was offline. The design goal is to minimize the level of total dissolved solids (TDS) in the pumping of water from the two wells. To accomplish this goal, the closer the wells are pumped to the average daily flow rate, the lower the TDS will be relative to higher pumping rates with higher well draw downs (with possible up-coning of higher saline water below the well pump. In the case of the two wells, it has been shown by well pump test data that TDS should be around 600 mg/liter with continuous pumping at 3 gpm per well.

- Water storage in Pump House 2 should be 2500 gallons, as this will allow about 7 hours continuous demand at 6 gpm without running the two well pumps.
- Tankage should be 1 ea 2500-gallon HDPE vertical upright tank, approximately 8 ft dia x 7.5 ft high, NSF 61 listed, and a floor pressure not to exceed 500 lb/sf on the floor of Pump House 2.
- There must be two ports: one for drawing water out of the tank (tank suction), and another for filling the tank on the top of the tank. An air gap should be provided above the top of the tank with a standpipe extended down to the bottom of the tank interior to minimize splashing and disturbing of the water surface. This will maximize accuracy of the ultrasonic tank level-sensing unit.

b. Foundation

The tanks will sit on the finished floor of Pump House 2 atop a lined basin that will catch condensation from the tank walls, preventing water from accumulating on the Pump House floor. The loads on the floor area supporting the water storage tanks will be additional Micropiles, as determined by the Structural Engineer.

4. Building Shell Thermal Design

The thermal envelope of Pump House 2 is designed to provide exceptionally low heat loss. The walls will be 8-inch rigid Styrofoam in SIP panels, so the insulation value of the walls will approximately be R-30. The roof will consist of 14 in deep BCI type rafters and 12 in of fiberglass insulation for an approximate R-40 insulation value. The floor would be BCI type joist construction with 12 in of fiberglass insulation for an approximate R-40 insulation value.

5. Water Treatment

Water used for the past thirty years in Chefornak from the existing PHS well has had minimal treatment, mainly consisting of filtration with multimedia filters—generally without coagulant—and chlorination. The water produced is not used for drinking, due to higher levels of total dissolved solids (TDS) up to 1000 mg/liter. This water is instead considered “utility” water for hand washing, bathing, steam baths, and laundry.

Disinfection of Water. Disinfection of the water used in the distribution loop is optional, as this water comes from true groundwater, and the water is not used for drinking. Disinfection can be accomplished by injecting well water before entering the 2,500-gal water storage tank with a sodium hypochlorite solution via a peristaltic pump. If only occasional disinfection is needed, then a sodium hypochlorite solution of 1% strength would be prepared from common 5% solution of household bleach.

A problem with chlorination in this type of water is the formation of disinfectant byproducts (DBP) from contact of the organic carbon with dissolved hypochlorite in the water. The EPA has set limits on DBP, and exceeding these limits will cause violations. Unless there is an overriding reason to chlorinate, it should not be used.

The school UltraFiltration/reverse osmosis (UF/RO) water treatment process has issues with chlorinated water.

6. Distribution System Water Use and Design Considerations

It is critical to have adequate water available in the existing water distribution system:

- The watering points require adequate water to operate so the public can obtain water for bathing and washing clothes;
- To maintain circulation in winter, and to prevent freezing of the water distribution, it is necessary to have water from the 2002 well field available to pump into the system;
- It is necessary to have an adequate flow of water to supply the school Ultra Filtration/Reverse Osmosis (UF/RO) water treatment system with adequate water to fill their potable water tanks without interruption.
- It is necessary to have a continuous flow of water through the 3-in HDPE water loop piping of 20 to 40 gpm to keep enough heat in the far reaches of the 10,000 LF water loop.
- Pump House 1 would be the primary water supply (2/3 of demand), with Pump House 2 being secondary supply (1/3 of demand).
- Pump House 1 would run the distribution system loop pumps, with Pump House 2 being the backup circulation pump system.
- The distribution water loop would be heated from waste heat off generators in the City Power Plant. Pump House 1 would provide backup heat for the distribution system, with Pump House 2 being the secondary backup heat source for this critical function.

7. Wastewater Generation

Wastewater generation must be minimal in this facility. The only economical solution to the disposal of wastewater is to haul it away by the existing wastewater vacuum tank trailer or sled.

Condensate from the water tanks sweating also needs to be accommodated, as well as incidental uses generating wastewater, such as mopping and cleaning.

To accommodate this wastewater, a central rectangular HDPE sump of 50 gallons capacity should be designed into the building floor to store this generated wastewater. When the sump becomes full, it would be pumped by hose and sump pump into the City vacuum trailer or other wastewater tank for disposal.

8. Drainage, Waste, and Vent Piping Requirements

Drainage, Waste, and Vent (DWV) piping will be minimal with this low wastewater generating system in Pump House 2. The only venting would be for a hand wash sink

and the holding tank. If the hand wash sink is less than 6 ft from the holding tank, then the holding tank can be vented with a 2 in vent, which will terminate near the building ridge (to avoid being sheared off by sliding ice on the roof. The vent-through-roof pipe should be 3 in nominal size, and should be insulated through the ceiling and outside to minimize frost buildup.

9. Distribution System Piping Connections

The existing water distribution system for the watering points, school, Washeteria, clinic, or other load is an 8 in inner pipe duct x 15 in OD arctic pipe carrying two each 3 in SDR11 HDPE water pipes. These two water pipes form a circulating water loop that circulates heated water through the arctic pipe duct that keeps the distribution system warm. Connections to this water distribution piping at the building will be done through an insulated Utilidor from the distribution system junction box on the south side of the boardwalk to the building, designed to allow for movement of the Utilidor meeting the building wall without undue stresses.

10. Heat Loads and Air Requirements

The heating system in Pump House 2 will be a simple 2-pipe hydronic system, with the following heat loads and preliminary heat estimates for 65°F inside temperature and -50°F outside temperature:

- Heating building envelope using unit heaters: 8,700 BTU/hr
- Heating building make-up air for ventilation: 13,100 BTU/hr
  1 air change per hour;
- Providing heat for well field and arctic pipe transmission: 20,000 BTU/hr
- Providing backup heat for water distribution loop: 150,000 BTU/hr

  Total Estimated Worst Case Heat Load at -45°F outside temp: **191,800 BTU/hr**

The heating boilers will be two ea 100,000 BTU/hour input high efficiency oil-fired cast iron units, using a 50% propylene glycol/deionized water mixture of heat transfer fluid. It is important to not use local water in the mix, as it may be too high in total dissolved solids. Since the secondary backup 150,000 BTU/hr heat exchanger may never be used, two 100,000 BTU/hr boilers would serve adequately. Larger capacity boilers would operate on very short cycles, which is not a good operating regime in normal operation.

The intent of the heating system design is to minimize the amount of heat production required for Pump House 2 by utilizing waste heat from the City power plant to keep the water distribution loop heated to 50°F. If the water distribution loop is heated by recovered waste heat, then the maximum heat load at -50°F outside temperature would be about 102,000 BTU/hr.

The temperature differential between hydronic supply and return will be 20°F. One hydronic pump with backup will be required for the hydronic heating system. The pump will be a canned rotor type with internal variable speed control to provide a constant pressure head as loads come on and off the heating system.

All piping, boilers, and appurtenances will be well insulated to minimize standby losses, thus saving heat energy. Coils will be operated by thermal or motorized valves to put the heat where it is needed, and not wasted in standby losses.

Pump House 2 is a low occupancy building, so ventilation requirements will be minimal: 0.5 air changes per hour for unoccupied space, and 1.0 air changes per hour for an occupied building (usually one operator for a limited time. This translates to 50 cfm for unoccupied and 100 cfm for an occupied building.

11. Ventilation and Air Makeup System

The ventilation and air make up system will consist of a motorized damper and arctic air intake hood, coupled with an exhaust fan, rated to 200 cfm with speed control, and a motorized damper in the exhaust duct with weatherproof exhaust hood.

12. Electrical

Electric power will come directly from the nearby City electrical distribution system. It will go through a 100-amp meter/main with a 100-amp circuit breaker on the outside of the building. See one-line diagram on Sheet E4.1 of the 35% Plan Set (Appendix A).

To minimize electrical power use in this high cost area, high efficiency motors will be used and run time minimized or run speeds reduced by variable speed drives where appropriate. Interior lighting will be accomplished using LED wraparound tube type lamps with prismatic lenses. Outside lighting will consist of LED fixtures on photocells.

E. Pump House 2 Well Field Design Criteria

The existing wells W02-2 and W02-3 were drilled in 2002 and flow tested for 15 months, starting in May 2005. It was found that if the flow rate of each well was limited to 3 gpm, then the total dissolved solids (TDS) would not climb higher than 600 mg/liter. With this in mind, it was decided to use this well field as a backup to the existing City well, and to supplement the present flow of the City well.

1. Geotechnical

Well W02-2 was drilled down to 278-foot depth, and well W02-3 was drilled to 302-foot depth. The wells passed through multiple clay, lava flow, and silt layers before encountering the water bearing sand layer. Well drilling logs are presented in Appendix C.

2. Well Heads

The wellheads will have to be shortened to keep the height of the bases of the arctic pipe transmission lines connecting the well head arctic boxes limited to 2 ft above the surface of the ground at the well field. The exposed well pipe above the ground will be insulated with a piece of 8 in x 15 in arctic pipe slipped over the 6 in steel well casing. The wellhead arctic box on the top of the well casing will be constructed of 1/8 in thick aluminum, with 4 in of extruded rigid Styrofoam insulation around all sides, bottom, and top of the box.

The well will have a sanitary seal on top, with a pitless adaptor on the side of the well for the drop pipe. All this will be inside the wellhead arctic box.

A method for hoisting out the well pump and HDPE drop pipe will be provided so that the well pump and drop can be hoisted out by hand or by use of a small portable electric winch.

3. Well Connection to Pump House 2

The well drop pipe will be connected to the side of the well casing inside the well with a 1 in pitless adaptor for easy connection to the HDPE pipe connecting the well to Pump House 2. Two each 4 in HDPE by 12 in outside diameter (OD) arctic pipes will be used to connect the well head box to the water distribution system box on the outside of the Pump House. After that, a Utilidor will run from the water distribution box to Pump House 2 that will carry both 3" HDPE water distribution pipes and the well HDPE pipes. The two arctic pipes will serve as a transmission line duct to house:

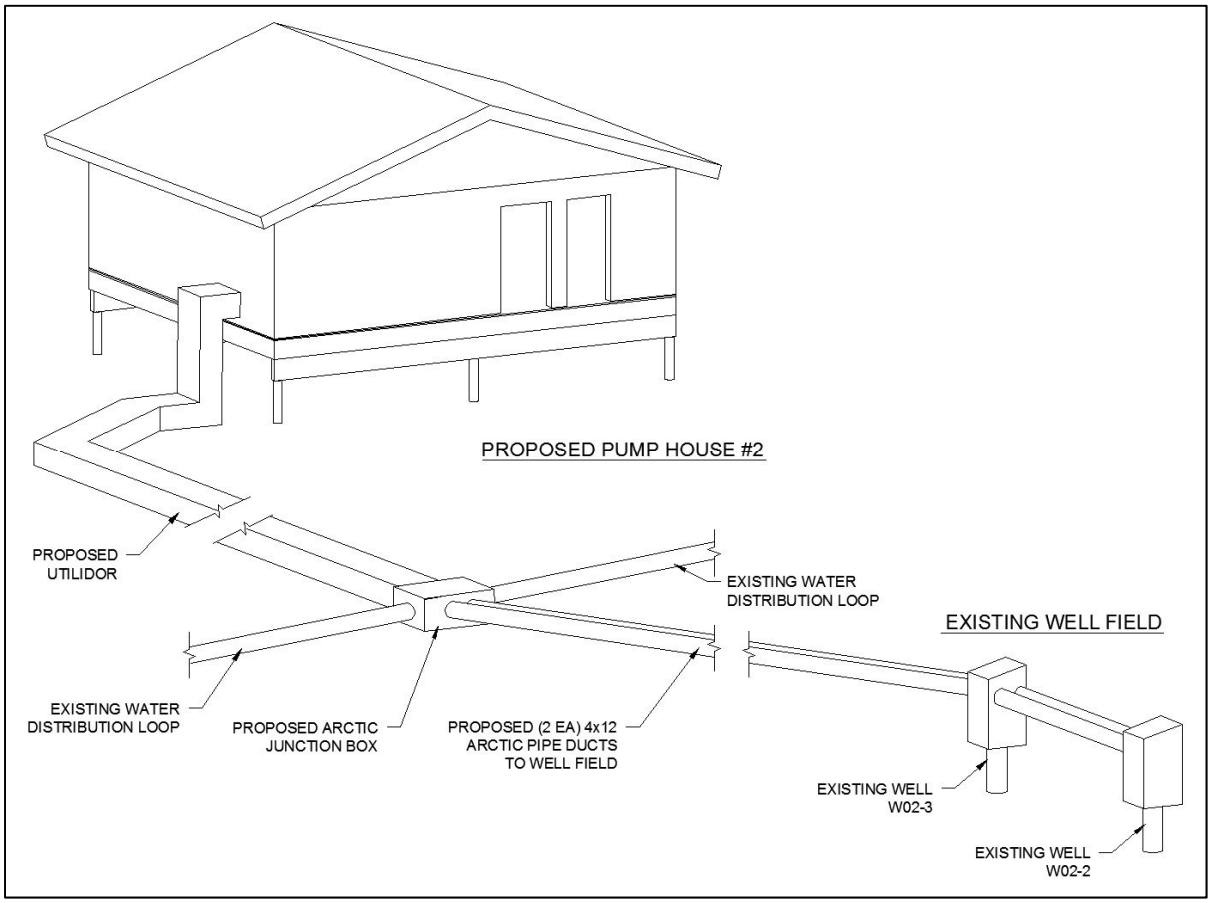
- Two well water 1" HDPE delivery pipes, running from the well heads to the Pump House;
- Two well water 1" HDPE return pipes, running from the pump house to the Well Heads;
- A hydronic loop to keep both arctic pipe transmission ducts and well junction boxes warm, using 1" PEX, running about 5.5 gpm.

An electrical conduit outside the arctic pipe will house control wiring for the well pumps and emergency thawing heat tapes for each well.

To keep the well water transmission line running and available at any time, some waste heat could be drawn off the water distribution loop (maximum of 25,000 BTU/hr) to keep the transmission line thawed. This would work except in the coldest weather, when the boilers would keep the system warm. By doing it this way, oil consumption for well transmission line heating would be between 50 and 100 gallons per year.

A conceptual view of the well and connecting piping to the proposed Pump House 2 is presented in Figure 6 on the next page.

Figure 4-Conceptual drawing of Pump House 2 Utilidor and Well Field arctic pipe connections



4. Well Line Heating

The well transmission ducts will be heated with a 1 in PEX hydronic heating loop, using a propylene glycol mix as the heating medium. Heating using oil-fired hydronic heat costs one-third of the cost of electric heat, so over a year, savings are substantial.

To keep the well water transmission line running and available at any time, some waste heat could be drawn off the water distribution loop (maximum of 25,000 BTU/hr) to keep the transmission line thawed. This would work except in the coldest weather, when the boilers would keep the system warm. Through this method, oil consumption for well transmission line heating would be between 50 and 100 gallons per year.

Backup electric self-limiting heat trace of 8 watts per foot will be provided to thaw the well and connecting lines in an emergency.

5. Tank Fill and Draw

The single 2,500-gallon water storage tank will be filled from the top. The tank will have a 2-in FIPT draw fitting with suction elbow inside the tank for connecting to the pressure pumps, or for draining down the tank during cleaning or other maintenance functions.

IV. Land Status/Site Control

A. Land Status

The site for the proposed Pump House 2 facility is Lot 4, Block 18, Plat 97-3 (South Chefornak Subdivision). At the time of writing, this lot is in the process of being transferred from Chefarnrmute Corporation to the City of Chefornak.

B. Site Control

The City of Chefornak will own the lot on which the proposed Pump House 2 will be located. Site control documents for this property, as described in section IV.A above, will be placed in Appendix B after recording is completed.

V. Environmental Determinations and Permit Requirements

An Environmental Assessment is required for all of Chefornak Indian Health Service grants for water and sewer improvements. An Environmental Assessment document is now being prepared for all Chefornak projects by State of Alaska, Village Safe Water, under contract with a private firm.

There also will be a requirement for getting an archaeological clearance from the State Historic Preservation Office. The Association of Village Council Presidents (AVCP) has had archaeological investigations conducted in the area, and may well have clearances in place for their work that could apply to the existing site.

An approval to construct and operate will be required by Alaska Department of Environmental Conservation, Drinking Water Division.

An Approval to Construct will be required after plan review from the State of Alaska, Department of Public Safety, State Fire Marshal, Plan Review Bureau, Anchorage office.

VI. Cost Estimates

A. Conceptual Budget

1. Capital Costs

CHEFORNAK PUMP HOUSE 2 --- 35% CAPITAL COST ESTIMATE

Line No.	Cost Description	Qty	Unit	Unit Cost	Extended Cost
1	Pile Foundation	9	EA	$ 5,750	$ 51,750
2	Foundation Beams	3	EA	$ 500	$ 1,500
3	Building Shell / Lumber Pac / Finishes	1	Lot	$ 102,500	$ 102,500
4	Mechanical	1	Lot	$ 52,500	$ 52,500
5	Electrical and Controls	1	Lot	$ 45,000	$ 45,000
6	Well Field Improvements and Transmission Line	1	Lot	$ 79,000	$ 79,000
7	Labor (5-man force acct crew)	140	Day	$ 1,250	$ 175,000
8	Equipment Rental	12	Month	$ 3,500	$ 42,000
9	Freight	1	Lot	$ 65,000	$ 220,500
10	Support	1	Lot	$ 20,000	$ 20,000
11				**SUBTOTAL**	**$ 789,750**
12	Engineering @10%				$ 78,975
13	Construction Management @16%				$ 126,360
14				**TOTAL**	**$ 995,085**

Notes:

1. Estimate assumes no filtration.
2. Estimate based on force account pay rate $20-$21/hr ST, with 6-10's schedule.
3. VSW to provide on-site superintendent.
4. VSW superintendent/EMT costs not included.

2. Operation and Maintenance (O&M) Costs

The following O&M budget has been developed using values calculated from estimated performance of the plant, coupled with an estimated amount for City administrative tasks. Repair and replacement of equipment, as well as annual capital replacement cost over the estimated life of the building have been included.

Expense Category	Annual Estimate
Administration	$ 3,000
Labor	$ 8,000
Miscellaneous Materials	$ 300
Electricity	$ 5,400
Heating Fuel	$ 3,600
Water Treatment	$ 2,100
Sewage Treatment	$ -
Insurance	$ 1,600
* Repair and Replacement Accoun	$ 4,025
Other	$ 750
* Capital Replacement Account	$ 3,649
Total Annual Expenses	**$ 32,424**

Administration	
Administrator	$ 1,000
Clerk	$ 300
Office Supplies	$ 100
Postage	$ 100
Occupancy Costs	$ 100
Other	
Total Administration	**$ 1,600**

Labor	
Operator I	$ 5,000
Operator II	$ 2,500
Training	$ 500
Other	$ -
Other	$ -
Total Labor	**$ 8,000**

Miscellaneous Materials	
Cleaning Supplies	$ 300
Other	$ -
Other	$ -
Total Miscellaneous Materials	**$ 300**

Electricity	
Electricity (9819 kwh/yr),	$ 5,400
at $0.55/kwh	
Total Electricity	**$ 5,400**

Heating Fuel	
Fuel (600gal/yr, $6.00/gal)	$ 3,600
Other	$ -
Total Fuel	$ 3,600

Water or Water Treatment	
Chemicals	$ -
Testing	$ 2,000
Postage/Freight	$ 100
Filter elements	$ -
Total Water/Water Trtmt	$ 2,100

Sewer or Sewage Treatment	
Chemicals	$ -
Other	
Other	
Total Sewer/Sewer Trtmt	$ -

Insurance	
Building Insurance	$ 1,600
Liability Insurance	$ -
Other	$ -
Total Insurance	$ 1,600

Other	
Vehicle Expense	$ 500
Gasoline	$ 250
	$ -
Total Other	$ 750

This O&M cost estimate assumes no filtration.

VII. Recommendations

1. The foundation for the building should be Micropiles anchored to bedrock, for resistance to settlement and frost heave.
2. To be cost effective, all Micropiles for Pump House 1, Pump House 2, and the Washeteria should be placed simultaneously to minimize mobilization and demobilization costs for each project (estimated 70 piles total).
3. The Pump House 2 building shell should be engineered wood joists for the floor, with SIP walls and engineered wood rafters for most rapid erection of the shell. Roofing and wall siding should be standard 3-ft-wide ribbed roofing for ease of installation and maintenance.
4. Clearance under Pump House 2 should be a minimum of 3 ft to allow for wind to be unobstructed to the maximum extent to prevent snow drifting around building. If possible, metal wire perimeter fencing should be 4-inch square mesh to minimize obstruction to winds.
5. An adequate amount of shelving and cabinet space should be allowed for water testing, recordkeeping, and spare parts.

Appendix A

Chefornak Pump House 2 Improvements 35% Reissued Plan Set

CITY OF CHEFORNAK, ALASKA

PUMP HOUSE 2 IMPROVEMENTS

IN COOPERATION WITH STATE OF ALASKA
VILLAGE SAFE WATER AND THE CITY OF
CHEFORNAK, ALASKA

35% REISSUED - FEB. 2016

PROJECT LOCATION

Location Map

CE2 ENGINEERS, INC.

PO BOX 232946 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

STATE OF ALASKA
49TH
PAUL C. WESNER
CE-10276
REGISTERED PROFESSIONAL ENGINEER

Consultant

RECORD DRAWING CERTIFICATE

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

NAME DATE

Construction Foreman —

FINAL DESIGN (Date) —

ADEC APPROVAL (Date)

Construction Period (From) — (To) —

As-Builts (Date)

SHEET INDEX

No.	Title
GENERAL	
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G2.0	VICINITY MAP
G3.0	SYSTEM SCHEMATIC PROCESS DESCRIPTION
G3.1	DESIGN CRITERIA
G4.0	GENERAL NOTES AND LEGEND
G5.0	GEOTECHNICAL INFORMATION
G5.1	GEOTECHNICAL INFORMATION
G5.2	GEOTECHNICAL INFORMATION
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S0.1	STRUCTURAL NOTES
S1.1	FOUNDATION PLAN
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E1.1	ELECTRICAL SITE PLAN
E2.1	ELECTRICAL PLANS
E3.1	ELECTRICAL DIAGRAMS AND DETAILS
E3.2	ELECTRICAL DIAGRAMS AND DETAILS

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CONSTRUCTION RECORD

FIELD BOOK
STAKING
FOREMAN
AS-BUILT
INSPECTOR

STATE OF ALASKA — 49th — PAUL C. WEGNER — CE-10276 — REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE #2 IMPROVEMENTS

VICINITY MAP

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.

PO BOX 232949 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____
Date SEPT. 2014
Designed ____
Drawn CM
Approved PCW

Sheet No. G2.0

SHEET ____ OF ____

SYSTEM SCHEMATIC DESCRIPTION

(1) **PUMPHOUSE 1.** THIS PUMPHOUSE IS THE MAIN WATER SOURCE FOR THE CITY OF CHEFORNAK'S WATER FOR THE WATERING POINTS, WASHETERIA, AND SCHOOL. WATER FROM THE EXISTING PHS DRILLED WELL IS PUMPED AT APPROXIMATELY 15 GPM INTO THE PUMPHOUSE. IT FLOWS THROUGH TWO CARTRIDGE FILTERS, IS CHLORINATED, AND THEN FLOWS INTO TWO EA 2500 GALLON VERTICAL HDPE PLASTIC TANKS. A LEVEL CONTROL SYSTEM KEEPS THE TANKS WITHIN THREE-QUARTERS AND FULL LEVELS OF THE TANK.

PRESSURE PUMP P-1 PROVIDES CONSTANT PRESSURE (ADJUSTABLE) FROM 40 TO 60 PSI, USING A PRESSURE SENSOR AND A VARIABLE FREQUENCY DRIVE (VFD). HYDROPNEUMATIC TANK HT-1 PROVIDES A CUSHION FOR STOPPING AND STARTING PP-1 SMOOTHLY.

CIRCULATING PUMP CP-1 CIRCULATES 20 TO 40 GPM OF WATER THROUGH COMMUNITY WATER DISTRIBUTION LOOP. HEAT EXCHANGER HE-1, ALONG WITH CIRCULATING PUMP CP-3 PROVIDES BACKUP HEAT FOR THE WATER DISTRIBUTION LOOP IF THE WASTE HEAT RECOVERY SYSTEM AT THE POWER PLANT FAILS TO HEAT THE LOOP.

(2) **WATER DISTRIBUTION LOOP.** THIS INSULATED LOOP DISTRIBUTES WATER TO THE WATERING POINTS, THE SCHOOL, CLINIC, WASHETERIA, AND OTHER USERS THROUGH 2 EA 3-IN HDPE BARE PIPES CONTAINED IN AN INSULATED 8-IN ARCTIC PIPE DUCT. THE DUCT LENGTH IS APPROXIMATELY 5,000 FT LONG AND THE WATER LOOP IS APPROXIMATELY 10,000 FT LONG.

THE WATER LOOP IS HEATED BY RECOVERED ENGINE HEAT AT THE CITY POWER PLANT, BUT CAN BE HEATED FROM EITHER PUMPHOUSE 1 OR 2 IN CASE THE HEATING SYSTEM AT THE CITY POWER PLANT FAILS.

(3) **TYPICAL WATERING POINT.** THIS WELL INSULATED AND HEATED WATERING POINT DISPENSES WATER TO CUSTOMERS THROUGH A HOSE. IT ALSO SUPPLIES LARGER AMOUNTS OF WATER FOR HIGHER FLOWS THROUGH A CAM-LOCK HOSE CONNECTION ON THE SIDE OF THE ENCLOSURE.

(4) **PUMPHOUSE 2.** THIS PUMPHOUSE WILL BE THE BACKUP WATER SOURCE FOR THE CITY OF CHEFORNAK'S WATER FOR THE WATERING POINTS, WASHETERIA, AND SCHOOL. WATER FROM THE EXISTING 2002 DRILLED WELL FIELD WILL BE PUMPED AT APPROXIMATELY 6 GPM INTO THE PUMPHOUSE TO MINIMIZE INCREASED SALINITY. WELL WATER WILL FLOW THROUGH TWO CARTRIDGE FILTERS, CHLORINATED, THEN INTO 1 EA 2500 GALLON VERTICAL HDPE PLASTIC TANK. A LEVEL CONTROL SYSTEM WILL KEEP THE TANK WITHIN THREE-QUARTERS AND FULL LEVELS OF THE TANK.

CONT'D SYSTEM SCHEMATIC DESCRIPTION

PRESSURE PUMP PP-2 WILL PROVIDE CONSTANT PRESSURE (ADJUSTABLE) FROM 40 TO 60 PSI, USING A PRESSURE SENSOR AND A VARIABLE FREQUENCY DRIVE (VFD). HYDROPNEUMATIC TANK HT-2 WILL PROVIDE A CUSHION FOR STOPPING AND STARTING PP-1 SMOOTHLY.

BACKUP CIRCULATING PUMP CP-2 CIRCULATES 20 TO 40 GPM OF WATER THROUGH COMMUNITY WATER DISTRIBUTION LOOP. HEAT EXCHANGER HE-4, PROVIDES HEAT FOR THE CIRCULATING WATER LINES TO THE WELLS

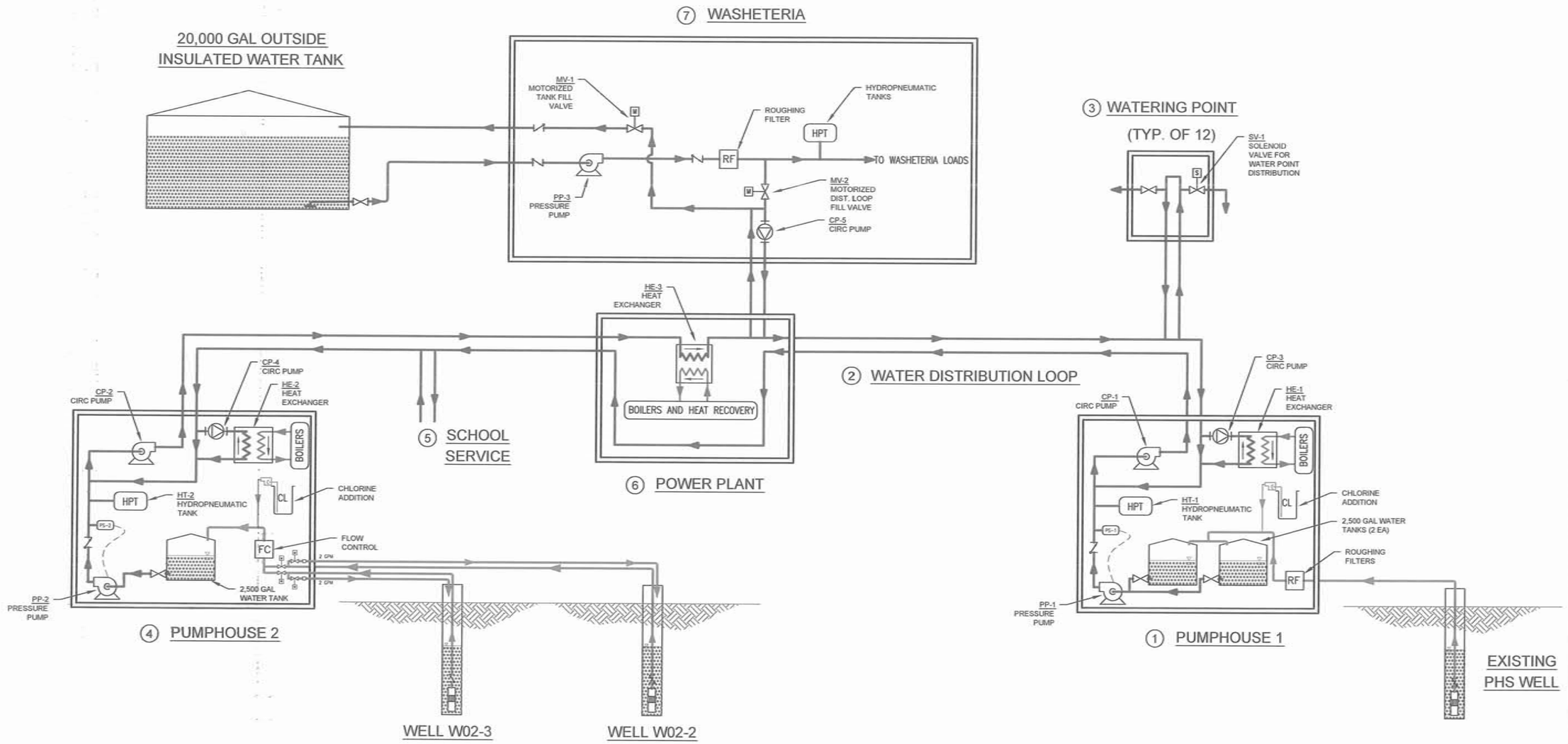
(5) **SCHOOL SERVICE.** A CIRCULATING LINE IN AN INSULATED ARCTIC PIPE DUCT FROM A JUNCTION BOX ON THE WATER DISTRIBUTION LOOP GOES TO THE WATER TREATMENT MODULE AT THE SCHOOL, WHERE THE WATER UNDERGOES AN ULTRAFILTRATION/REVERSE OSMOSIS TREATMENT PROCESS TO PRODUCE POTABLE WATER FOR SCHOOL USE.

(6) **CITY POWER PLANT.** A HEAT RECOVERY SYSTEM EXTRACTS HEAT FROM THE ENGINE GLYCOL COOLING SYSTEM AND USES THAT HEAT TO WARM THE WATER THROUGH HEAT EXCHANGER HE-3 UP TO 55°F FOR OUTGOING WATER TO THE DISTRIBUTION LOOP. HEAT EXCHANGERS IN PUMPHOUSES 1 AND 2 PROVIDES BACKUP FOR HEATING THE WATER DISTRIBUTION LOOP FOR MAXIMUM SURVIVABILITY.

(7) **WASHETERIA.** THE 22,000-GAL VERTICAL INSULATED WATER TANK IS USED TO MEET THE NEEDS OF THE WASHETERIA, AND TO PROVIDE A WATER RESERVE FOR THE SYSTEM IF THE EXISTING PHS WELL IS DOWN FOR MAINTENANCE OR A PROBLEM. THIS TANK WILL PROVIDE TWO DAYS OF FEEDWATER FOR THE SCHOOL WATER TREATMENT SYSTEM. THE TANK IS FILLED THROUGH MOTORIZED FILL VALVE MV-1 FROM THE WATER DISTRIBUTION LOOP.

THE WASHETERIA IS PRESSURIZED BY PRESSURE PUMP PP-3. WATER FLOWS THROUGH A CARTRIDGE FILTER TO THE WASHETERIA PLUMBING, AND SYSTEM PRESSURE OF 40-60 PSI IS STORED IN TWO HYDROPNEUMATIC TANKS.

IN THE EVENT WATER IS NEEDED IN THE WATER DISTRIBUTION LOOP, MOTORIZED VALVE MV-2 OPENS AND ALLOWS A MAXIMUM OF 7 GPM INTO THE SYSTEM. CIRCULATING PUMP CP-5 PROVIDES CONTINUOUS CIRCULATION OF WATER BETWEEN THE Washeteria AND THE WATER DISTRIBUTION LOOP TO PREVENT FREEZING.



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CONSTRUCTION RECORD
FIELD BOOK
STAKING
FOREMAN
AS-BUILT
INSPECTOR

STATE OF ALASKA 4918 REGISTERED PROFESSIONAL ENGINEER PAUL C. HESSER CE-10276

PUMP HOUSE #2 IMPROVEMENTS

SYSTEM SCHEMATIC PROCESS DISCRIPTION

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 222048 ANCHORAGE, AK 99523 PH: 907-348-1010 FAX: 907-348-1015

BY	DATE

REVISION

Project No. ____ FEB. 2016
Date ____ PCW
Designed ____ CM
Drawn ____ PCW
Approved ____

Sheet No.
G3.0
SHEET ____ OF ____

DESIGN CRITERIA

COMMUNITY

POPULATION (2012)		434
WATER CONSUMPTION (2034)		8,000 GPD (5.6 GPM AVERAGE FLOW)
CONSISTING OF:		
WATERING POINTS	1,000 GPD	
CLINIC	1,000 GPD	
SCHOOL	3,000 GPD	
WASHETERIA	3,000 GPD	

MAXIMUM SUSTAINED WATER SUPPLY AT PUMP HOUSE 1	14,400 GPD (10.0 GPM)
MAXIMUM SUSTAINED WATER SUPPLY AT PUMP HOUSE 2	8,640 GPD (6.0 GPM)
WATER STORAGE, PUMP HOUSE 1	5,000 GAL
WATER STORAGE, PROPOSED PUMP HOUSE 2	2,500 GAL
WATER STORAGE, PROPOSED WASHETERIA	20,000 GAL

2002 WELL FIELD

WATER SOURCE:	2 WELLS EACH, 277 FT DEEP WELLS, 6 IN DIA.
CONTINUOUS PUMPING RATE	2 @ 3 GPM = 6 GPM AT DESIGN
WATER TREATMENT:	OPTIONAL CHLORINATION

WATER PRESSURIZATION

2 EA 15 GPM MULTISTAGE PRESSURE PUMPS LEAD/LAG, MAX 30 GPM, CONTROLLED BY VFD/PRESSURE SENSOR, SET POINT ADJUSTABLE BETWEEN 40 AND 50 PSIG

1 EA HYDROPNEUMATIC BUFFER TANK, 3 GAL ACCEPTANCE FACTOR

WATER DISTRIBUTION

CIRCULATION: 20 TO 40 GPM @40 TO 59' TDH IN PUMPHOUSE 2

ENVIRONMENTAL

DESIGN MINIMUM OUTDOOR TEMPERATURE:	-50°F
DESIGN ANNUAL HEATING DEGREE DAYS AT 65°F	13,200° F*DAYS/YR
DESIGN ANNUAL HEATING DEGREE DAYS AT 50°F	7,900° F*DAYS/YR

ELECTRICAL POWER

120/240 VOLTS, CENTER TAPPED NEUTRAL, SINGLE PHASE

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CONSTRUCTION RECORD
FIELD BOOK
STAKING
FOREMAN
AS-BUILT
INSPECTOR

STATE OF ALASKA 49TH PAUL C. WESNER 9736987 REGISTERED PROFESSIONAL ENGINEER CE-10276

PUMP HOUSE #2 IMPROVEMENTS
DESIGN CRITERIA
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232048 ANCHORAGE, AK 99523 PH: 907-349-1015 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____ Date FEB. 2016 Designed PCW Drawn CM Approved PCW

Sheet No. G3.1
SHEET ____ OF ____

GENERAL NOTES

1. ALL CONSTRUCTION SHALL BE DONE IN A SAFE WORKMANLIKE MANNER TO INDUSTRY STANDARDS AND IN CONFORMANCE WITH APPLICABLE LOCAL STATE AND FEDERAL CODES AND REGULATIONS. HIGH STANDARDS OF WORKMANSHIP SHOWING A SENSE OF PRIDE BY WORKMEN SHALL BE MAINTAINED. WORKERS SHALL BE PREPARED TO SIGN THEIR INDIVIDUAL WORK AS IF IT WAS THEIR OWN ARTWORK.
2. ALL MATERIALS SHALL MEET OR EXCEED THE MINIMUM QUALITY STANDARDS SPECIFIED IN THE DRAWINGS. ANY MATERIAL IN CONTACT WITH THE WELL WATER OR POTABLE WATER SHALL BE NSF 61 APPROVED. SOLDER CONTAINING LEAD SHALL NOT BE ALLOWED.
3. THE BASIS OF VERTICAL CONTROL IS THE 3" BLM BRASS CAP OF USS 4412, TR-A, CORNER 11, BLOCK 6, AS SHOWN ON SURVEY CONTROL SHEET C1.0 AS POINT INDENTIFIER 616. THE ELEVATION OF THE TOP OF CAP IS 77.68 FT.
4. THE BASIS OF HORIZONTAL CONTROL IS THE BEARING BETWEEN POINT INDENTIFIER 600 AND POINT IDENTIFIER 616 AS SHOWN ON SURVEY CONTROL SHEET C1.0. THE BEARING IS NORTH 7° 14' 42" E WITH A LENGTH OF 2988.5 FEET.
5. EXISTING UTILITIES ARE SHOWN IN APPROXIMATE LOCATION TO THE BEST KNOWLEDGE OF THE ENGINEER AT THE TIME OF DESIGN. UTILITY RECORDS MAY NOT BE COMPLETELY ACCURATE. THE PROJECT SUPERINTENDENT SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF UTILITIES WITHIN EACH CONSTRUCTION REACH PRIOR TO CONSTRUCTION. ALL UTILITIES ARE ABOVE GROUND UNLESS OTHERWISE NOTED.

WATER AND SEWER -	CHEFORNAK WATER AND SEWER UTILITY	(907) 867-8301
ELECTRIC -	NATERKAQ LIGHT PLANT	(907) 867-8213
TELEPHONE -	UNITED UTILITIES, INC.	(800) 478-2020

6. THE PROJECT SUPERINTENDENT SHALL BE RESPONSIBLE FOR MAINTAINING A CLEAN SET OF AS-BUILT "RED LINE" RECORD DRAWINGS SHOWING LOCATION AND SWING TIES TO ALL BURIED SYSTEM COMPONENTS. ALL ELEVATIONS SHALL BE MARKED ASB (AS-BUILT) OR F.C. (FIELD CHANGED) WITH THE CORRECT VALUE INSERTED. DRAWINGS SHALL BE KEPT CURRENT IN RED PENCIL AND UPDATED DAILY IN A NEAT AND LEGIBLE FASHION. A COPY OF THE AS-BUILT DRAWINGS SHALL BE SUBMITTED TO THE CITY OF CHEFORNAK AND THE VILLAGE SAFE WATER PROJECT ENGINEER.
7. GENERAL RESTORATION - THE AREAS IMPACTED BY CONSTRUCTION SHALL BE RETURNED TO PRECONSTRUCTION CONDITION OR BETTER. CONSTRUCTION DEBRIS SHALL BE REMOVED FROM THE AREA AND DISPOSED OF IN A PROPER MANNER. DUE CARE AND CAUTION SHALL BE TAKEN TO AVOID DISTURBING PERSONAL PROPERTY.
8. CONSTRUCTION IN SENSITIVE AREAS - ANY DAMAGE CAUSED BY CONSTRUCTION ACTIVITIES SHALL BE REPAIRED OR RESEEDED AS NECESSARY TO RETURN THE AREAS AFFECTED BY CONSTRUCTION TO ITS PRECONSTRUCTION STATE.
9. THE CONSTRUCTION SITE SHALL BE ADEQUATELY PROTECTED, RESTRICTED AND BARRICADED IN THE BEST PUBLIC INTERESTS OF HEALTH, SAFETY AND WELFARE, WITH VISIBLE AND STABLE BARRIERS, UNDERSTANDABLE, LARGE-PRINT WARNING SIGNS, AND OTHER PRECAUTIONARY EQUIPMENT AND MEASURES AS REQUIRED. ALL SAFETY MEASURES SHALL BE IN CONFORMANCE WITH APPLICABLE STATE OF ALASKA DOT AND OSHA SAFETY REQUIREMENTS.
10. EXISTING BOARDWALK SHALL BE REMOVED ONLY WHERE INDICATED ON THE PLANS AND IN ALL AREAS WHERE THE EXISTING BOARDWALK CONFLICTS WITH THE PROPOSED BOARDWALK ALIGNMENT. REMOVED BOARDWALK MATERIAL WITH ANY SALVAGE VALUE SHALL BE CLEANED OF FASTENERS (NAILS, SCREWS, PLATES, ETC.) AND NEATLY STACKED AT A LOCATION DESIGNATED BY THE CITY. PROVIDE STICKERS BETWEEN EVERY THIRD ROW IN THE STACK. EXISTING BOARDWALK MATERIAL WITH NO SALVAGE VALUE SHALL BE DISPOSED OF AT THE LANDFILL.

GENERAL DESIGN CRITERIA:

SEE SHEET G3.1

WATERLINES / WATER TANK:

TESTING - ALL TESTING SHALL BE IN CONFORMANCE WITH THE FOLLOWING REQUIREMENTS.

A. PLUMBING TESTING - PERFORM A TEST OF WATERLINES. ALL POTABLE WATER PIPING MUST BE PRESSURIZED TO 90 PSI WITH WATER AND LEFT FOR 1 HOUR. AFTER THE INITIAL STABILIZATION PERIOD WITH NO LOSS IN PRESSURE.

B. ALL TESTS SHALL BE WITNESSED BY A REPRESENTATIVE DESIGNATED BY THE OWNER (CITY OF CHEFORNAK). UPON SUCCESSFUL COMPLETION OF A TEST THE RESULTS OF THE TEST SHALL BE DOCUMENTED ON A TEST FORM AND ACKNOWLEDGED BY SIGNATURE OF THE OWNER'S REPRESENTATIVE WITNESSING THE TEST AND BY THE PROJECT SUPERINTENDENT. THE SUPERINTENDENT'S RED LINED AS-BUILT DRAWINGS SHALL ALSO NOTE, FOR EACH SEGMENT OF THE SYSTEM TESTED, THE TIME AND DATE OF THE TEST AND THE NAME OF THE OWNER'S WITNESS. COPIES OF THIS TEST SHALL BE SENT TO VSW ENGINEER.

C. THE CONSTRUCTION MANAGER WILL SUBMIT A QA/QC MANUAL OF ALL TESTING FOR REVIEW.

WATER PIPING SHALL BE BUTT FUSED, HDPE SDR 11 (PE 3408), ROUTED THROUGH AN INSULATED ARCTIC PIPE DUCT. THE DUCT SHALL HAVE A 4"Ø HDPE, SDR 17 CORE PIPE, 3" MINIMUM OF 3-4 LB/CF POLYURETHANE FOAM AND AN 12"ØX16 GAUGE CORRUGATED ALUMINUM JACKET.

DISINFECTION - ALL WATERLINES AND WATER TANKS TO BE DISINFECTED AND TESTED FOR COLIFORM IN ACCORDANCE WITH AWWA C651/3.

BOARDWALK:

ALL BOARDWALK MATERIALS SHALL BE AS SPECIFIED IN THE DRAWINGS AND MEET THE FOLLOWING REQUIREMENTS:

A. LUMBER: HEMLOCK AND DOUGLAS FIR (HEM-FIR) GRADE #2 OR BETTER. ALL SIZES ARE GIVEN IN NOMINAL DIMENSIONS (I.E., 4X12 WILL MEASURE 3 1/2" THICK BY 11 1/2" WIDE).

B. WOOD TREATMENT: ALL WOOD MATERIALS USED SHALL BE TREATED WITH THE WOOD PRESERVATIVE CROMATED COPPER ARSENATE (CCA) AT THE FOLLOWING CONCENTRATIONS:
"SOIL CONTACT" (INCLUDES ALL SLEEPERS) - 0.6 POUNDS PER CUBIC FOOT
ABOVE GROUND (>6" ABOVE GROUND) - 0.4 POUNDS PER CUBIC FOOT

GENERAL STRUCTURAL NOTES

SEE STRUCTURAL GENERAL NOTES, SHEET S0.1

BUILDING FOUNDATION
A FOUNDATION INVESTIGATION WAS PREPARED BY GOLDER AND ASSOCIATES. SOILS IN THE AREA GENERALLY CONSIST OF A VESICULAR BASALT BOLDER MATRIX WITH A THIN ORGANIC MAT OVERLAYING SILT. MARGINAL TEMPERATURE PERMAFROST AS WELL AS THAWED SOIL CONDITIONS EXIST IN THE PROJECT AREA. BEDROCK IS FOUND AT DEPTHS BETWEN 20' AND 30'.

PIPING (GENERAL):

1. ALL PIPING AND FITTINGS SHALL BE NSF-61 COMPLIANT WHERE SUCH PIPING AND FITTINGS ARE IN CONTACT WITH RAW OR POTABLE WATER IN THE WATER TREATMENT OR DISTRIBUTION PROCESS.
2. ALL PIPING SHALL BE LEAD FREE.
3. ALL PLUMBING USING SOLDERED JOINTS SHALL USE A SOLDER CERTIFIED TO NOT TO CONTAIN LEAD (BRIDGET OR EQUAL)

COPPER TUBING AND FITTINGS:

1. ALL COPPER TUBING SHALL BE ASTM B75 DRAWN TEMPER, ANSI/NSF-61 CERTIFIED, TYPE L THICKNESS.
2. COPPER SOLDER FITTINGS SHALL BE PRODUCED IN ACCORDANCE WITH ASME/ANSI B16.22, AND SHALL BE ANSI/NSF-61 CERTIFIED.

SERVICE LINES:

1. HDPE MATERIAL
   A) LISTED BY THE PPI WITH DESIGNATION OF PE-4710
   B) CELL CLASSIFICATION OF PE-445574C OR BETTER IN ACCORDANCE WITH ASTM D3350
   C) MUST EXCEED 1000 HOURS WHEN TESTED IN ACCORDANCE WITH ASTM F1248 RING ENVIRONMENTAL STRESS CRACK RESISTANCE TEST) WITH FEWER THAN 50 PERCENT FAILURES.
   D) APPROVED BY THE NATIONAL SANITATION FOUNDATION (NSF) FOR POTABLE WATER SERVICE.
   E) SHALL CONTAIN TWO PERCENT (2%) CARBON BLACK FOR ULTRAVIOLET (UV) PROTECTION AND SHALL BE HOMOGENEOUS THROUGHOUT.

MECHANICAL: FOR MECHANICAL NOTES SEE SHEET M1.1

HYDRONIC PIPING:

1. HYDRONIC HEAT TRACE:
   HYDRONIC HEAT TRACE (WHERE SPECIFIED) SHALL BE A MINIMUM OF 3/4" DIA. HEAT PEX.

PIPELINE TESTING:

1. GENERAL:
   ALL TESTING SHALL BE IN CONFORMANCE WITH THE FOLLOWING REQUIREMENTS:
   ALL TESTS SHALL BE WITNESSED BY A REPRESENTATIVE DESIGNATED BY THE COMMUNITY. UPON SUCCESSFUL COMPLETION OF A TEST THE RESULTS OF THE TEST SHALL BE DOCUMENTED ON A TEST FORM AND ACKNOWLEDGED BY SIGNATURE OF THE COMMUNITY'S REPRESENTATIVE WITNESSING THE TEST AND BY THE PROJECT SUPERINTENDENT. THE SUPERINTENDENT'S RED LINED AS-BUILT DRAWINGS SHALL ALSO NOTE THE TIME AND DATE OF THE TEST, AS WELL AS THE NAME OF THE COMMUNITY'S WITNESS, FOR EACH PIPE SEGMENT TESTED.
2. GLYCOL HEAT TRACE TESTING - PERFORM HYDROSTATIC TESTING OF GLYCOL HEAT TRACE. HYDROSTATIC TESTS SHALL BE PERFORMED AFTER INSTALLATION. FILL THE LINE WITH WATER AND REMOVE AIR PRIOR TO STARTING THE TEST. PRESSURIZE TO 1.5 X OPERATING PRESSURE (80 PSI) = 120 PSI AND LEAVE FOR A MINIMUM OF 1-HOUR. AFTER THIS INITIAL PERIOD, ADD WATER TO BRING THE PRESSURE UP TO 120 PSI AND BEGIN A 4-HOUR TEST. FOR THE GLYCOL LOOP TO BE ACCEPTED THERE SHOULD BE NO LOSS IN PRESSURE. NO VISIBLE LEAKS SHOULD BE NOTED UPON A VISUAL INSPECTION OF EACH JOINT UNDER PRESSURE.

LEGEND

EXISTING PLAN VIEW	EXISTING PROFILE VIEW	PROPOSED PLAN VIEW	PROPOSED PROFILE VIEW	DESCRIPTION
				PROPOSED BOARD ROAD (WIDTH AS NOTED)
				EXISTING BOARD ROAD TO REMAIN
				EXISTING BOARD ROAD TO BE REMOVED
				GROUND PROFILE
W		W		WATERMAIN
		WM		FUTURE WATERMAIN
		FM		FUTURE WASTEWATER FORCEMAIN
E				OVERHEAD ELECTRIC
POL				PETROLEUM/OIL/LUBRICANTS
				UTILITY POLE AND GUY WIRE ANCHOR
X				FENCE
24				CONTOUR LINE
				SHORELINE
				EXISTING GROUND
				STRUCTURE
				EARTHWORK SLOPE
				NATURAL GROUND OR COMPACTED SOIL
				DIRECTION OF DRAINAGE
				PROPERTY LINE OR SECTION LINE
				MATCHLINE
				PERMANENT EASEMENT
				ALL WEATHER WOOD
CMP (xx.xx)				CORRUGATED METAL PIPE
		A.W.W.		EXISTING GRADE ELEV.
		TOB:		TOP OF BOARD ROAD ELEV.
OR B.C.				BRASS CAP MONUMENT AS NOTED
				TEST HOLE
+ 24.5				SPOT ELEVATION
27				BLOCK NUMBER
3A				LOT NUMBER
IPS				IRON PIPE SIZE (INDUSTRY STANDARD OUTSIDE PIPE DIAMETER)
WW X				6" WELL
		M.B.		MECHANICAL BOLT
		G.R.C.		GALVANIZED RIGID CONDUIT
		ELEV.		ELEVATION

SECTION AND DETAIL DESIGNATIONS

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INSPECTOR

STATE OF ALASKA 49TH PAUL C. WERNER CE-10276 REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE 2 IMPROVEMENTS

GENERAL NOTES AND LEGEND

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232948 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____ Date SEPT. 2014 Designed ____ Drawn ____ PCW Approved ____

Sheet No. G4.0

SHEET ____ OF ____

Golder Associates

November 20, 2014 1405906

Paul Weisner, PE
CE2 Engineers, Inc.
8221 Diamond Hook Drive
Anchorage, AK 99507

RE: GEOTECHNICAL RECOMMENDATIONS FOR PROPOSED PUMPHOUSES, CHEFORNAK, ALASKA

Dear Paul:

Golder Associates Inc. (Golder) is pleased to present this letter report to CE2 Engineers, Inc. (CE2) summarizing our geotechnical exploration and engineering recommendations for the two proposed pumphouses and associated boardwalks in Chefornak, AK (Figure 1).

Our services were performed in general accordance with our proposal to CE2 dated July 23, 2013. Our scope of work consisted of performing a limited, shallow geotechnical probe effort to characterize the near surface soil and thermal conditions. We were requested to develop our geotechnical recommendations for the proposed structures based on the shallow probe findings, our review of existing geotechnical data in the village, and our geotechnical interpretation of site subsurface conditions in the proposed development areas. Based on our discussions, we understand project funding would not accommodate a site-specific exploration program using geotechnical drilling subcontractors and equipment.

Golder Associates Inc.
2121 Abbott Road, Suite 100
Anchorage, AK 99507 USA
Tel: (907) 344-6001 Fax: (907) 344-6011 www.golder.com

6.0 RECOMMENDATIONS

6.1 Pumphouse Foundations

Based on the observed and inferred geologic and thermal conditions at the proposed pumphouse sites the use of a conventional shallow or mat foundation system could result in unacceptable differential settlement. Therefore, the recommended option for the proposed pumphouse foundations is drilled micro-piles seated on basalt with anchors advanced inside the micro-piles and grouted into the underlying basalt rock. Grouted micro-pile foundation systems have been successfully installed in areas of Alaska where challenging soil conditions overly relatively shallow bedrock. Site improvement such as buried utilities and facility access that will be constructed at shallower depths should consider the potential for differential settlement.

While the pile axial loads have not been finalized, CE2 has indicated they are to be in the range of 7-kips to 14-kips (per pile) for geotechnical design purposes. For frost uplift, we have used design stress of 40-pounds per square inch (psi) along the pile perimeter though the expected active layer. At these design loads, the frost uplift will exceed the axial compressive design loads.

The following recommendations include Golder's interpretation of the site geology and ground thermal conditions based on the geotechnical exploration data, prior experience in Chefornak and engineering judgment of permafrost conditions at this site, with consideration of preliminary structure geometry and proposed facility location on the site for the analysis.

6.1.1 Grouted Micro-Pile Foundation Design

The permafrost at Pumphouse #1 is considered "warm" and possibly degraded. Continued warming and thawing of the permafrost will result in unacceptable differential settlement if end bearing conditions are not developed or extensive passive subgrade cooling systems are not used. To accommodate the site conditions the building should be supported on mirco-piles installed to an end bearing condition into the underlying bedrock. The micro-pile founded on bedrock will transfer the structural axial loads to the bedrock. End bearing on suitable rock will also accommodate additional down-drag forces on the piles as the surrounding permafrost warm or thaws. Anchoring the micro-pile with a rock anchor grouted into the underlying bedrock will resist the anticipated seasonal frost uplift forces. This type of foundation system has distinct advantages over other deep foundations in that it can be installed in areas with variable thermal and groundwater conditions and in areas where float rock and boulders may be encountered.

The recommended micro-pile foundation would consist of a minimum 6-inch diameter pipe pile seated on firm, competent bead rock. Schedule 40 or greater pipe piles are recommended with pile wall thickness determined by the structural engineer. Piles may be installed driven with or without predrilling vertically to end bearing in bedrock at the site. If seated on competent bedrock, axial capacities approaching the structural limits of the steel may be possible. It is assumed that the axial capacities and structural limits of the steel piles will be in excess of the actual design loads with a factor of safety of at least three. Golder

Golder Associates

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REGISTERED PROFESSIONAL ENGINEER
STATE OF ALASKA
PAUL C. WEISNER
CE-10276

PUMP HOUSE #2 IMPROVEMENTS
GEOTECHNICAL INFORMATION
CHEFORNAK, ALASKA

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should review the design teams structural capacity needs for the foundation member for confirmation of bedrock support prior to issuing final design documents.

Drive shoes can be used with the piles, however the drive shoes must be of suitable dimension to allow for installed grouted anchors through pile annular space.

To resist the anticipated frost uplift forces the recommended foundation system would include all-thread rods grouted into the basalt rock through the tip of the seated micro-piles. The grouted anchor rods should be 0.75-inch diameter or as recommended by the structural engineer. The design is based on the grouted rods developing at least 80 pounds per square inch (psi) allowable strength along the grout / rock interface. The grouted anchor rods should be installed and grouted at least six (6) feet into competent basalt rock.

6.1.2 Lateral Loading of Grouted Micro-Piles

For preliminary design considerations, Ensoft's software LPile version 2012.6.37 was used to estimate lateral capacity for a range of pile head deflections. The lateral capacity of the piles should be further analyzed as the project develops with coordination from the structural and civil engineers. The pile capacity response to applied lateral loads will be affected by pile stickup height from the ground surface. Structural framing and bracing will further define the pile head conditions as free head, fixed head, or partially fixed head.

Table 1 shows the estimated deflection with applied lateral load for a vertically installed 6-inch diameter, schedule 40 pipe pile with 3-foot stickup through unfrozen silt. For example, a free head pile installed at the site with pile stickup height of three feet would develop a 1-inch deflection at the pile cap with an estimated applied lateral load of 1.4 kips. These preliminary calculations are presented for planning that will require confirmation as the lateral loads and pile geometry are determined. Pile stresses under these lateral loads should be reviewed by the structural engineer.

Table 1: Estimated Lateral Deflection with Applied Lateral Load: 6-inch diameter Grouted Pipe Pile

Pile Stickup	Pile Head Condition	0.25 inch Deflection	0.5 inch Deflection	1 inch Deflection
3 feet	Free Head	0.5 kips	0.85 kips	1.4 kips

6.1.3 Bedrock Contingency Plan

Due to the lack of a site specific geotechnical drilling program the actual depth to competent bedrock is undetermined. Based on previous geotechnical investigations in the area, the depth of competent bedrock is estimated to be between 20 and 30 feet bgs although a large amount of variability can be expected in the area. In the event of the absence of competent bedrock at a depth of less than 50 feet bgs the 6-inch pile can be employed to support the expected loads if additional measures are taken.

Due to the "warm" permafrost at the site and potential for continued thawing the drilled/driven 6-inch pile option will require passive cooling to develop and maintain adequate capacity for the expected axial loads. Driven pile depths of 50 feet, with passive cooling systems installed on the order of 15 to 20 feet into the underlying permafrost will necessary. Without the use of passive cooling to maintain sufficient ad-freeze bond strength the 6-inch pile depth will required pile embedment depths greater than 50 feet with final embedment based on site-specific site conditions.

If this contingency plan is employed we should be notified so that we may review our conclusions and recommendations and provide a detailed thermal analysis detailing the passive cooling geometry and location.

6.1.4 Seismic Design Criteria

Based on site conditions observed, the proposed building locations should meet seismic site class "D" criteria as defined in the International Building Code Seismic site class "D" is defined as, "Stiff soil with an average Standard Penetration Test (SPT) "N" value between 15 and 50 in the upper 100 feet". It is important to note that relative densities based on SPT "N" values were not determined in this area under our scope of services. However, soils with SPT "N" values between 15 and 50 can be reasonably expected at these sites, particularly with depth. It is also reasonable to expect permafrost or basalt rock to be encountered within 100 feet below of the surface in areas around Chefornak.

The criteria are based on mapped spectral response acceleration for short periods (S_s) of 0.2g and mapped spectral response accelerations for a 1 second period (S_1) of 0.13g.

Site coefficient factors F_a and F_v of 1.6 and 2.2, respectively, are considered appropriate to determine seismic characteristics for Site Class "D". Based on these values, the design spectral response acceleration for short period and 1-second period for Site Class "D" can be determined using the following equations:

$SD_s = 2/3\ F_a S_s$ and $SD_1 = 2/3\ F_v S_1$

$SD_s = 0.21g$ and $SD_1 = 0.19g$

Liquefaction of saturated finer-grained soil, in particular fine to medium grained sands, may occur during seismic events. However, based on our site findings and our general knowledge of the area geology, the risk of liquefaction is considered low unless saturated fine grained sand soils are present. If the project warrants a more refined liquefaction analysis, site-specific geotechnical test borings will be necessary as part of the liquefaction assessment.

6.1.5 Grouted Micro-Pile Installation

While bedrock was not observed during this investigation previous explorations have noted discontinuous volcanic flow consisting of vesicular basalt below the silt at variable depths, but generally between 20 and 30 feet below ground surface. However, 40 foot depths, possibly deeper, to suitable end bearing basalt is possible in the area. Due to the lack of a site specific geotechnical drilling program the soil bedrock contact elevation should be expected to vary by up to 10 feet for planning purposes. Additional micro-pile length will be needed if greater variability in depth to bedrock is present. We do not advise reliance on skin friction or adfreeze bond shear strength for long-term pile axial capacity unless a site specific deeper geotechnical site investigation is conducted.

We have assumed the micro-pile can be advanced to a firm, non-yielding state on competent bedrock though the overlying silt and potential float rock with and air-track or similar drill. The annulus would then be cleaned of soil and rock fragments to the bedrock seating surface. After the pile interior annulus is properly cleaned we recommend minimum 0.75-inch diameter 75-ksi all-thread anchor rods be installed below the pile tip. The anchor rods would be installed through a nominal 3-inch diameter, or larger, bore hole advanced inside the pile through the underlying rock.

The anchor will require tremmie-placed grout from the bottom of the anchor upwards with a fast setting Portland cement or Fondue cement grout. If desired by the contractor, fine grained silica sand may be added to the grout mixture at no more than 1 sand : 3 gout by mass ratio. We recommend continuous grouting through the rock section without pre-tensioning. We have assumed that the anchor rods set at least 6 feet into competent hard basalt would be installed through each pile. The basalt through the grouted anchor section may be fractured or have significant voids thus grout loss may occur.

Grout sequencing of the anchors and piles warrants consideration. The anchors should be grouted their full rock embedment lengths with the grout extending no more than one (1) foot above the pile tip if the

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tension testing uses the pile as the reaction base. If the tension testing reaction base is independent of the pile, a thicker grout section inside the pile annular space is permitted.

After the rock section grout has cured, the anchor rods should be tensioned tested. We have assumed tensions will be conducted against the top plate. We recommend tensioning each rock section grouted anchor to 50-kips then backing down the lock off load of 15–kips. The Post Tensioning Institute's recommended practices for proof testing grouted anchors are recommended. Deflection and load measurements should be collected during anchor tensioning as part of the construction installation records.

We have assumed winter construction (frozen ground) for installing the grouted micro-pile foundation. We have based our recommendation on winter construction due to the challenging site conditions and to reduce adverse impacts on the existing tundra surface. If summer construction is under consideration, we recommend using temporary construction mats or an insulated permanent fill pad to protect the tundra surface. We should be notified as soon as possible if construction during thawed surface soil conditions is under consideration.

6.2 Boardwalk Foundations

Based on conversations with CE2 we understand that the preferred foundation for the boardwalk connecting Pumphouse #2 to the existing wells will be helical anchors. Helical anchors need to be sufficiently embedded to resist axial compression, frost heave forces, and lateral forces. Axial compression loads consist of the boardwalk's self-weight and traffic loads. The design axial compression helical anchor loads, used for analysis in this report, are 2.7 kips allowable load per helical anchor. The frost heave force is assumed to be 40 pounds per square inch (psi) uplift force acting over the riser's embedment within the active layer. For a minimum recommended riser diameter of 3.5 inches and an active layer of 4 feet (conservative estimate for the project area), the design frost force is 21 kips. We have assumed a 1,000 pound lateral load applied three feet above the ground surface for the purposes of this analysis.

6.2.1 Helical Anchor Foundation

The helical anchors should consist of a 3.5-inch diameter schedule 80 riser shaft with twin 10-inch diameter helices. The lower helix should be spaced approximately 1-foot from the tip of the riser shaft (manufacturer supplied with an angle cut at the tip). The upper helix should be spaced approximately three helix diameters (30 inches) from the lower helix. The helix pitch and tip cut angle should be as recommended by the manufacturer, but we advise a 3-inch helix pitch. The maximum installation torque should be 13,000 foot-pounds or as recommended by the manufacturer.

Due to the varied site conditions, two installation procedures are required based on the varying thermal conditions within the project area. Embedment criteria is based on the embedment to the uppermost helix, the depth to permafrost (where present), and installation torque.

In permafrost areas, the minimum embedment, to the uppermost helix, should be installed to at least 8 feet below the ground surface or at least 3 feet below the surface of the permafrost, whichever is deeper. For example, if during installation the torque increases at approximately 6 feet below ground surface, indicating permafrost contact, the uppermost helix should be embedded to a depth of 9 feet. Permafrost contact at helical anchor locations should be confirmed during installation by the contractor with adjacent thaw depth probes.

In areas of degraded permafrost (deep surface thaw), the minimum embedment to the uppermost helix should be 15 feet below ground surface, or the average installation torque should exceed the minimum installation torque over the final 3 feet of helical pile installation, whichever is deeper. The minimum installation torque recommendation is 1,500 foot-pounds. For example, if a helical anchor is installed to a depth of 15 feet with an averaged installation torque of 1,200 foot-pounds, installation should continue until the minimum torque requirement is met.

6.2.2 Lateral Loading on Anchors

The surface organic soils will provide virtually no lateral support for the helical anchors. The mineral silt will provide some lateral resistance. For the purposes of this analysis, a 1,000 pound lateral load was applied 3 feet above the ground surface with 3 feet of unfrozen peat overlying unfrozen mineral silt to the full depth of the anchor, a conservative case based on existing subsurface data from the Chefornak area. Under these conditions, the helical anchor will deflect approximately 1-inch at the ground surface. If the 1,000 pound load is applied at 6 feet above the ground surface, the deflection at ground surface will increase to approximately 1.5 inches. The project structural engineer should determine areas of the boardwalk that may require lateral bracing to minimize the lateral deflection where needed.

The above analyses assume that the soil surrounding the helical is flush to the riser surface. During helical anchor installation, the helical must be adjusted to maintain vertical installation. The adjustments made during installation can disturb the soil adjacent to the riser shaft creating a gap. Over time the soil will compress and the gap will close; however, the initial lateral anchor deflection will be increased by the gap surrounding the anchor riser shaft.

We recommend the space between the ground surface and the helical anchor connections or boardwalk timber members be 6 inches to allow frost associated movements in the active layer. It is also recommended that maximum laterally unsupported riser height above the ground surface be no greater than 3 feet, due to potential lateral loading concerns. Anchors in areas with expected lateral loading or with greater than 3 feet between the ground surface and the boardwalk may need lateral bracing or larger dimensioned helical anchor riser sections for lateral stability, as determined by the project structural engineer.

6.2.3 Helical Anchor Installation

Helical anchors should be installed in a continuous manner and advanced at a rate equaling the pitch of the helix for each rotation. The anchor should be "screwed" into the subsurface soil without "auguring." The twin helices should be spaced such that the leading edge of one helix meets with the trailing edge of the previous helix.

A pressure gauge should be attached in line with the hydraulic system to the torque drive head installing the anchors. The pressure measurement should be recorded during installation and converted to torque using the pressure torque calibration for the drive head. The drive head should be calibrated prior to construction activities to determine the pressure torque ratio/curve.

We recommend anchor installation in the late fall or early winter, when the soil temperature will be warmer and therefore less torque may be required for installation. If the anchors are installed during the winter, the amount of torque, required to install the anchors through the frozen surficial soils or permafrost, may be increased and possibly exceed the maximum allowable installation torque recommended by the manufacturer.

At no time should the torque exceed the maximum torque recommended by the manufacturer and in extreme cold, the allowable torque might need to be down-rated. If the maximum installation torque is met during installation, a pilot hole drilled to accommodate the shaft through the frozen surface or permafrost soils allows for installation in areas of hard frozen conditions. Predrilled pilot holes greater than the shaft diameter, to allow penetration through the surface frost, may be required to install the helical anchors without exceeding the maximum allowable torque during the later winter months. Pre-drilling to accommodate installation through the surface frost should be limited to a maximum depth of 3 feet. If predrilling is required, we should be notified to confirm that the contractor's installation methods are consistent with the intent of our recommendations.

If the required torque is not achieved at the initial embedment depth, shaft riser extensions should be added and the helical anchor installed to a deeper depth until the required minimum torque criteria is reached. If the upper most helix is installed to a depth of 20 feet and the required torque has not been

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PUMP HOUSE #2 IMPROVEMENTS

GEOTECHNICAL INFORMATION

CHEFORNAK, ALASKA

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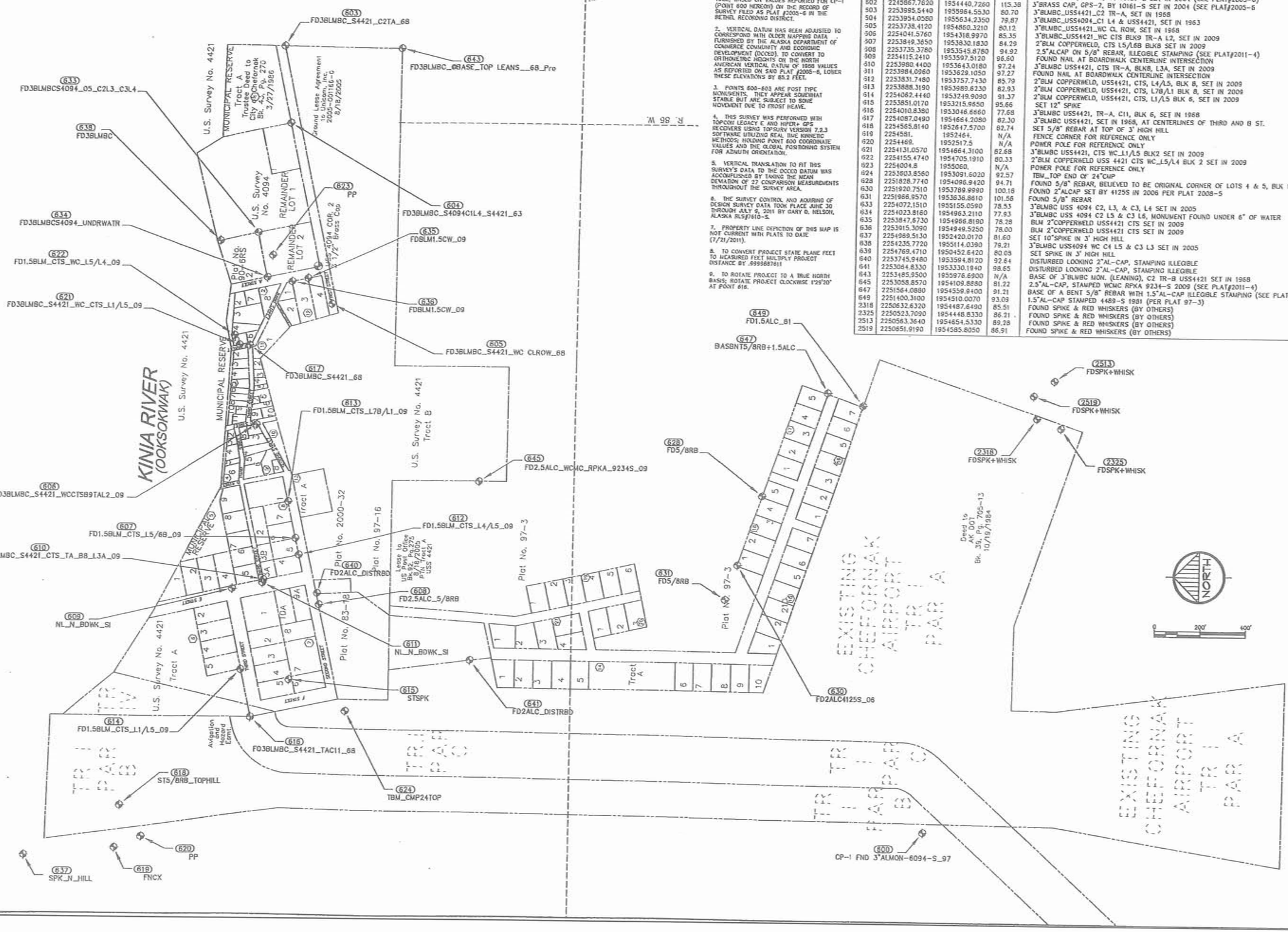

SURVEY NOTES:

1. PROJECT DATA AND COORDINATES ARE SHOWN IN FEET AS ALASKA STATE PLANE ZONE 8 ON THE NORTH AMERICAN DATUM OF 1983; BASED ON VALUES REPORTED FOR CP-1 (POINT 600 HEREON) ON THE RECORD OF SURVEY FILED AS PLAT #2005-6 IN THE BETHEL RECORDING DISTRICT.

2. VERTICAL DATUM HAS BEEN ADJUSTED TO CORRESPOND WITH OLDER MAPPING DATA FURNISHED BY THE ALASKA DEPARTMENT OF COMMERCE COMMUNITY AND ECONOMIC DEVELOPMENT (DCCED). TO CONVERT TO ORTHOMETRIC HEIGHTS ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 VALUES AS REPORTED ON SAID PLAT #2005-6, LOWER THESE ELEVATIONS BY 85.2 FEET.

3. POINTS 600-603 ARE POST TYPE MONUMENTS. THEY APPEAR SOMEWHAT STABLE BUT ARE SUBJECT TO SOME MOVEMENT DUE TO FROST HEAVE.

4. THIS SURVEY WAS PERFORMED WITH TOPCON LEGACY E AND HIPER+ GPS RECEIVERS USING TOPSURV VERSION 7.2.3 SOFTWARE UTILIZING REAL TIME KINNETIC METHODS; HOLDING POINT 600 COORDINATE VALUES AND THE GLOBAL POSITIONING SYSTEM FOR AZIMUTH ORIENTATION.

5. VERTICAL TRANSLATION TO FIT THIS SURVEY'S DATA TO THE DCCED DATUM WAS ACCOMPLISHED BY TAKING THE MEAN DEVIATION OF 27 COMPARISON MEASUREMENTS THROUGHOUT THE SURVEY AREA.

6. THE SURVEY CONTROL AND AQUIRING OF DESIGN SURVEY DATA TOOK PLACE JUNE 30 THROUGH JULY 8, 2011 BY GARY D. NELSON, ALASKA RLS#7810-S.

7. PROPERTY LINE DEFICTION OF THIS MAP IS NOT CURRENT WITH PLATS TO DATE (7/21/2011).

8. TO CONVERT PROJECT STATE PLANE FEET TO MEASURED FEET MULTIPLY PROJECT DISTANCE BY .9999887811

9. TO ROTATE PROJECT TO A TRUE NORTH BASIS; ROTATE PROJECT CLOCKWISE 1°29'20" AT POINT 616.

POINT IDENTIFYER	NORTHING	EASTING	ELEV.	DESCRIPTION
600	2251046.2030	1952669.7760	112.56	CP-1 FND 3"ALMON BY 6094-S SET IN 1997 (SEE PLAT#2005-6)
601	2247914.9780	1954419.7530	101.79	3"BRASS CAP, GPS-1, BY 10161-S SET IN 2004 (SEE PLAT#2005-6)
602	2245867.7820	1954440.7260	115.38	3"BRASS CAP, GPS-2, BY 10161-S SET IN 2004 (SEE PLAT#2005-6
603	2253995.5440	1955984.5530	80.70	3"BLMBC_USS4421_C2 TR-A, SET IN 1968
604	2253954.0580	1955634.2350	79.87	3"BLMBC_USS4094_C1 L4 & USS4421, SET IN 1963
605	2253738.4120	1954880.3210	80.12	3"BLMBC_USS4421_WC CL ROW, SET IN 1968
606	2254041.5760	1954318.9970	85.35	3"BLMBC_USS4421_WC CTS BLK9 TR-A L2, SET IN 2009
607	2253849.3650	1953830.1830	84.29	2"BLM COPPERWELD, CTS L5/L6B BLK8 SET IN 2009
608	2253735.3780	1953545.8780	94.92	2.5"ALCAP ON 5/8" REBAR, ILLEGIBLE STAMPING (SEE PLAT#2011-4)
609	2254115.2410	1953597.5120	96.60	FOUND NAIL AT BOARDWALK CENTERLINE INTERSECTION
610	2253980.4400	1953643.0180	97.24	3"BLMBC USS4421, CTS TR-A, BLK8, L3A, SET IN 2009
611	2253984.0960	1953629.1050	97.27	FOUND NAIL AT BOARDWALK CENTERLINE INTERSECTION
612	2253831.7480	1953757.7430	85.79	2"BLM COPPERWELD, USS4421, CTS, L4/L5, BLK 8, SET IN 2009
613	2253888.3190	1953989.6230	82.93	2"BLM COPPERWELD, USS4421, CTS, L7B/L1 BLK 8, SET IN 2009
614	2254062.4440	1953249.9090	91.37	2"BLM COPPERWELD, USS4421, CTS, L1/L5 BLK 6, SET IN 2009
615	2253851.0170	1953215.9650	95.66	SET 12" SPIKE
616	2254010.8380	1953046.6660	77.68	3"BLMBC USS4421, TR-A, C11, BLK 6, SET IN 1968
617	2254087.0490	1954664.2080	82.30	3"BLMBC USS4421, SET IN 1968, AT CENTERLINES OF THIRD AND B ST.
618	2254585.8140	1952647.5700	82.74	SET 5/8" REBAR AT TOP OF 3' HIGH HILL
619	2254581.	1952464.	N/A	FENCE CORNER FOR REFERENCE ONLY
620	2254469.	1952517.5	N/A	POWER POLE FOR REFERENCE ONLY
621	2254131.0570	1954664.3100	82.68	3"BLMBC USS4421, CTS WC_L1/L5 BLK2 SET IN 2009
622	2254155.4740	1954705.1910	80.33	2"BLM COPPERWELD USS 4421 CTS WC_L5/L4 BLK 2 SET IN 2009
623	2254004.8	1955060.	N/A	POWER POLE FOR REFERENCE ONLY
624	2253603.8560	1953091.6020	92.57	TBM_TOP END OF 24"CMP
628	2251828.7740	1954098.9420	94.71	FOUND 5/8" REBAR, BELIEVED TO BE ORIGINAL CORNER OF LOTS 4 & 5, BLK 18, PLAT 97-3
630	2251920.7510	1953789.9990	100.16	FOUND 2"ALCAP SET BY 4125S IN 2006 PER PLAT 2008-5
631	2251966.9570	1953636.8610	101.56	FOUND 5/8" REBAR
633	2254072.1510	1955155.0590	78.53	3"BLMBC USS 4094 C2, L3, & C3, L4 SET IN 2005
634	2254023.8160	1954963.2110	77.93	3"BLMBC USS 4094 C2 L5 & C3 L6, MONUMENT FOUND UNDER 6" OF WATER
635	2253847.6730	1954966.8190	78.28	BLM 2"COPPERWELD USS4421 CTS SET IN 2009
636	2253915.3090	1954949.5250	78.00	BLM 2"COPPERWELD USS4421 CTS SET IN 2009
637	2254969.5130	1952420.0170	81.60	SET 10"SPIKE IN 3' HIGH HILL
638	2254235.7720	1955114.0390	79.21	3"BLMBC USS4094 WC C4 L5 & C3 L3 SET IN 2005
639	2254769.4710	1950452.6420	80.08	SET SPIKE IN 3' HIGH HILL
640	2253745.9480	1953594.8120	92.64	DISTURBED LOOKING 2"AL-CAP, STAMPING ILLEGIBLE
641	2253084.8330	1953330.1940	98.65	DISTURBED LOOKING 2"AL-CAP, STAMPING ILLEGIBLE
643	2253485.9500	1955976.6900	N/A	BASE OF 3"BLMBC MON. (LEANING), C2 TR-B USS4421 SET IN 1968
645	2253058.8570	1954109.8880	81.22	2.5"AL-CAP, STAMPED WCMC RPKA 9234-S 2009 (SEE PLAT#2011-4)
647	2251564.0880	1954559.9400	91.21	BASE OF A BENT 5/8" REBAR WITH 1.5"AL-CAP ILLEGIBLE STAMPING (SEE PLAT#2011-4)
649	2251400.3100	1954510.0070	93.09	1.5"AL-CAP STAMPED 4489-S 1981 (PER PLAT 97-3)
2318	2250632.6320	1954487.6490	85.51	FOUND SPIKE & RED WHISKERS (BY OTHERS)
2325	2250523.7090	1954448.8330	86.21	FOUND SPIKE & RED WHISKERS (BY OTHERS)
2513	2250563.3640	1954654.5330	89.28	FOUND SPIKE & RED WHISKERS (BY OTHERS)
2519	2250651.9190	1954585.8050	86.91	FOUND SPIKE & RED WHISKERS (BY OTHERS)

RECORD DRAWING CERTIFICATE
THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.
NAME _____ DATE _____

SCALE: AS SHOWN
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CONSTRUCTION RECORD
FIELD BOOK
BY/AKING
FOREMAN
AS-BUILT
INSPECTOR

STATE OF ALASKA 49TH Gary D. Nelson LS 7810 GARY D. NELSON 07-21-11

SURVEY CONTROL

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 223240 ANCHORAGE, AK 99522 PH: 907-345-1015 FAX: 907-345-1015

REVISION	BY	DATE

Project No. _____ Date _____ Designed _____ CM Drawn _____ GN Approved _____

Sheet No. C1.0

G:\ACAD\CHEFORNAK\2014 Pumphouse Improvements\Pumphouse 2\C1.0 SURVEY CONTROL.dwg, 9/29/2014 11:15:53 AM, cmerz, \\Ce2main\LANIER MP C2050/LD520C PCL 6

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CONSTRUCTION RECORD

FIELD BOOK	
STAKING	
FOREMAN	
AS-BUILT	
INSPECTOR	

STATE OF ALASKA 4928 PAUL C. WEBNER CE-10276 REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE #2 IMPROVEMENTS

SITE PLAN

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232048 ANCHORAGE, AK 99523 PH: 907-349-1015 FAX: 907-349-1015

REVISION	BY	DATE

Project No. _____ Date FEB. 2016

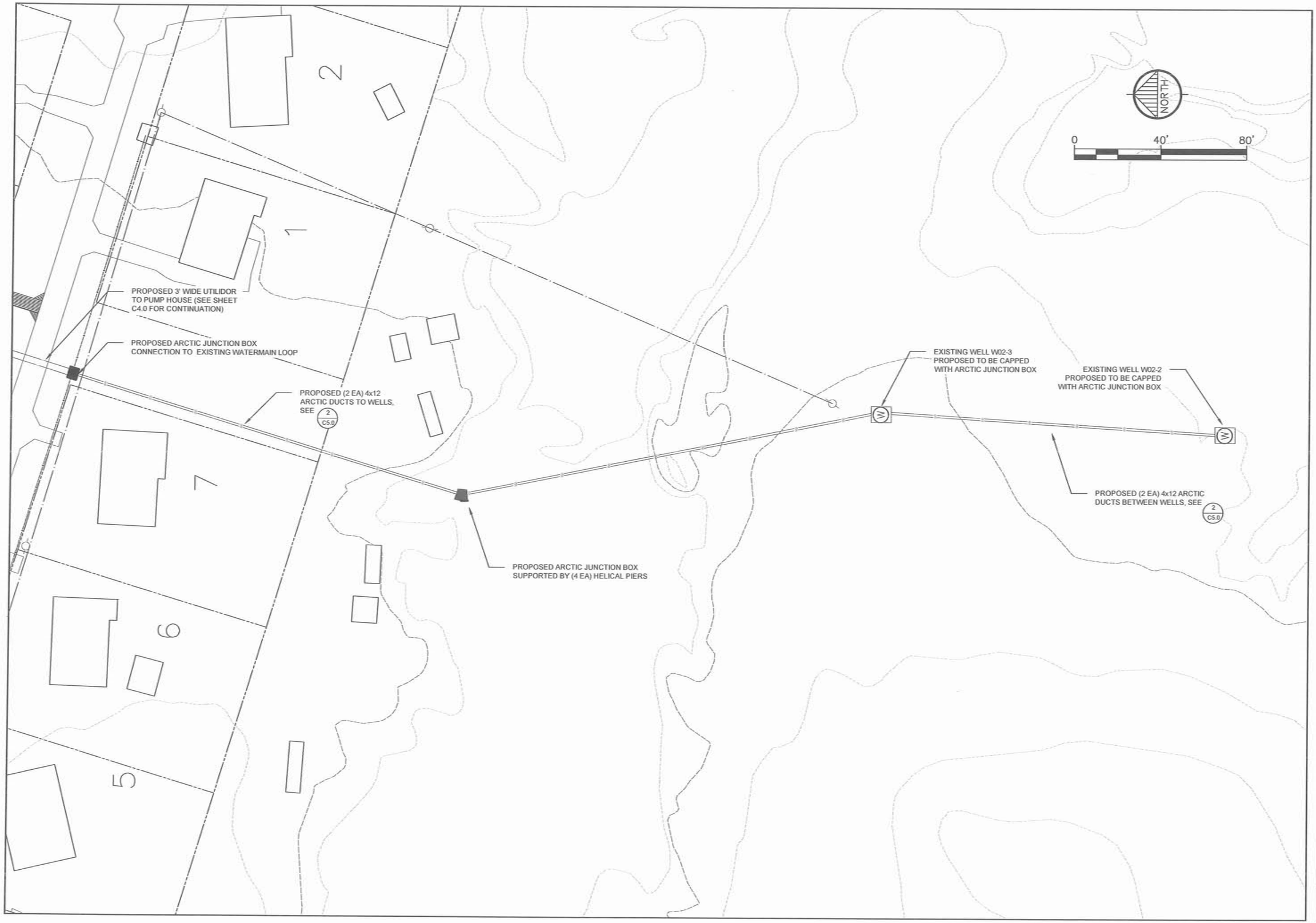
Designed PCW

Drawn CM / JDJ

Approved PCW

Sheet No. C4.0

SHEET _____ OF _____



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NAME _____ DATE _____

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0 1"

CONSTRUCTION RECORD

FIELD BOOK	
STAKING	
FOREMAN	
AS-BUILT	
INSPECTOR	

STATE OF ALASKA 49TH PROFESSIONAL ENGINEER PAUL C. WEGNER CE-10276

PUMP HOUSE #2 IMPROVEMENTS

WELL FIELD SITE PLAN

CHEFORNAK, ALASKA

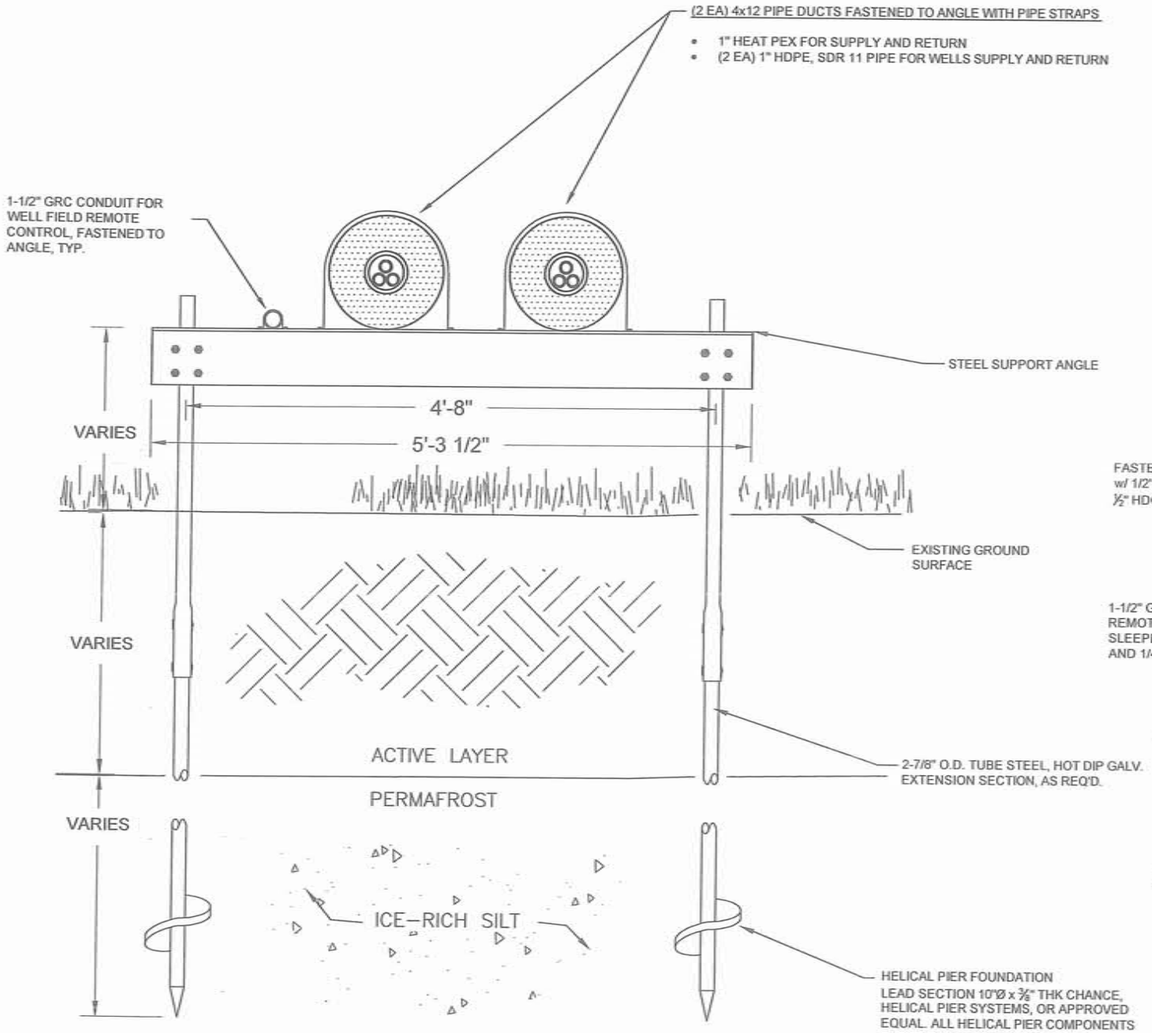
CE2 ENGINEERS, INC.
PO BOX 220946 ANCHORAGE, AK 99522 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____
Date FEB. 2016
Designed PCW
Drawn CM / JDJ
Approved PCW

Sheet No. C4.1

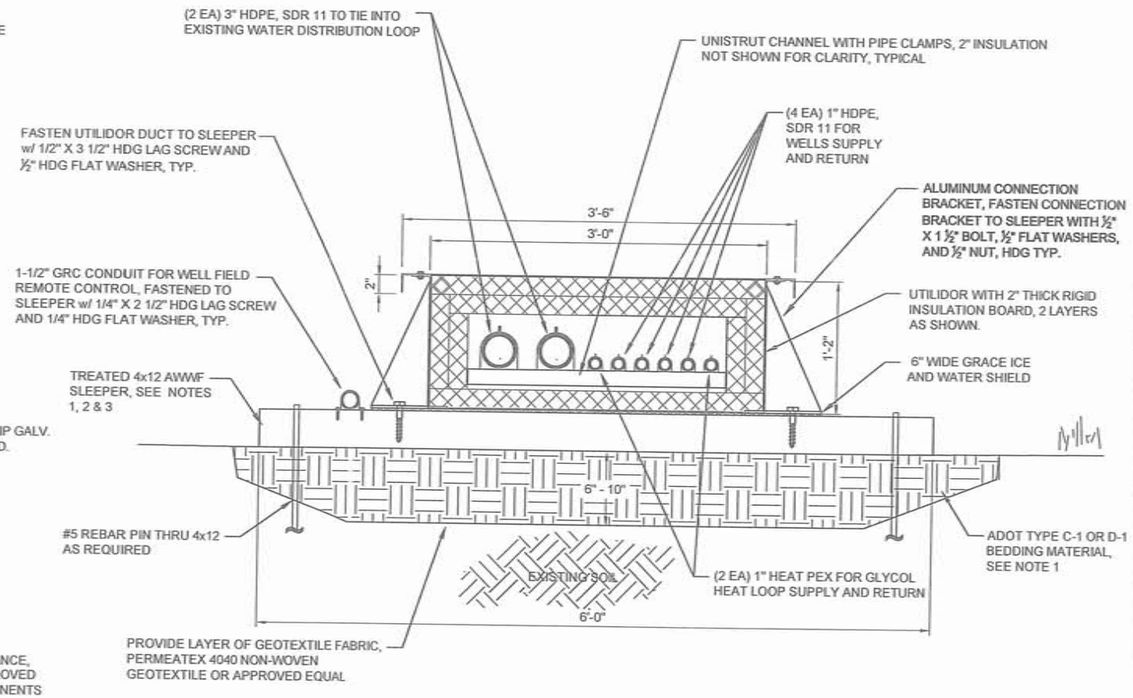
SHEET _____ OF _____



2 C5.0 HELICAL PIER PIPE SUPPORTS TYPICAL
NTS

NOTES:

1. REMOVE ALL ORGANIC MATERIAL 6-10" BENEATH THE 4x12 SLEEPERS AND REPLACE WITH ADOT TYPE C-1 MATERIAL.
2. STACK UP TO 2 SLEEPERS AS FIELD REQUIRED.
3. UTILIDOR SLEEPER SUPPORTS WILL BE PLACED EVERY 6' O.C.
4. PROVIDE INSULATING GASKETS AND/OR COATINGS BETWEEN DISSIMILAR METALS, TYP.



1 C5.0 UTILIDOR SECTION TYPICAL
NTS

RECORD DRAWING CERTIFICATE
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NAME
DATE

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CONSTRUCTION RECORD
FIELD BOOK
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FOREMAN
AS-BUILT
INSPECTOR

REGISTERED PROFESSIONAL ENGINEER
STATE OF ALASKA
PAUL C. NESSER
CE-10276

PUMP HOUSE #2 IMPROVEMENTS

UTILIDOR / PIPE SUPPORT DETAILS

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232048 ANCHORAGE, AK 99523 PH: 907-349-1018 FAX: 907-349-1018

REVISION	BY	DATE

Project No. ____ Date SEPT. 2014
Designed PCW
Drawn CM
Approved PCW

Sheet No. C5.0
SHEET ____ OF ____

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CODE ANALYSIS

PROJECT: CHEFORNAK PUMP HOUSE 2

APPLICABLE CODES:

INTERNATIONAL BUILDING CODE	2009 EDITION
INTERNATIONAL MECHANICAL CODE	2009 EDITION
NATIONAL ELECTRICAL CODE	2008 EDITION
UNIFORM PLUMBING CODE	2001 EDITION
INTERNATIONAL FIRE CODE	2009 EDITION
INTERNATIONAL FUEL GAS CODE	2009 EDITION

CONSTRUCTION TYPE: V-B

BUILDING OCCUPANCY: U (UTILITY - WATER PUMP HOUSE)

GROSS BUILDING AREA: 516 SF.

BASIC ALLOWABLE HEIGHT AND AREA PER TABLE 503

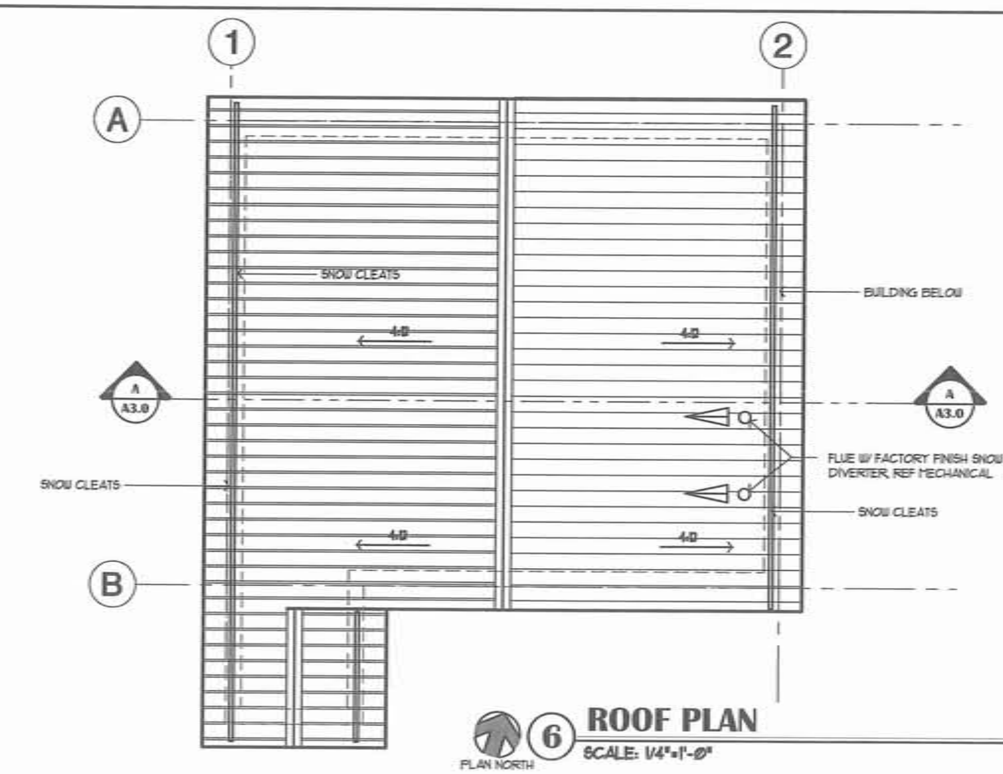
ALLOWABLE AREA: 5,000 SF. (U) 1 STORY = 516 <5,000 = OK

FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

SEPARATION DISTANCE 10' ≤ X < 30' = 0 RATING REQUIRED FOR GROUP U/ TYPE VB

LEGEND

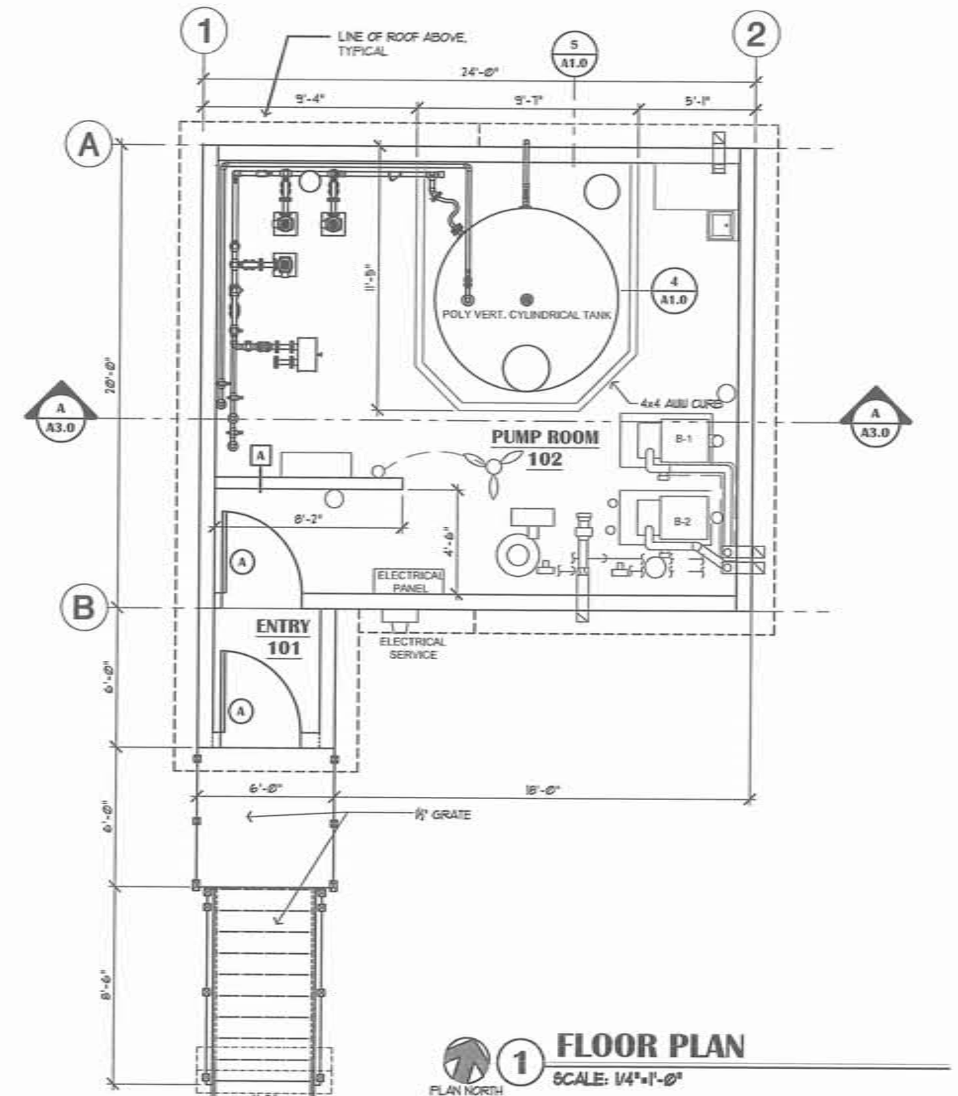
- WALL ASSEMBLY - SEE WALL TYPES.
- DOOR - SEE SCHEDULE
- A1 WALL TYPE INDICATOR - SEE SHEET A1.1
- B DOOR TYPE INDICATOR - SEE SHEET A1.1
- 1 HOUR WALL - FULL HT.
- FE FIRE EXTINGUISHER WITH WALL BRACKET NFPA 10 LB. DRY CHEMICAL (4A-60B:C)
- FENCE BELOW



PLAN NORTH

6 ROOF PLAN

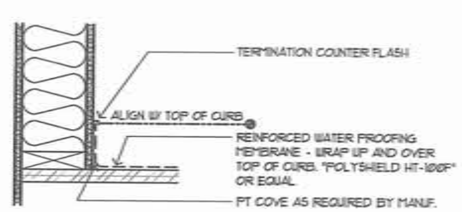
SCALE: 1/4"=1'-0"



PLAN NORTH

1 FLOOR PLAN

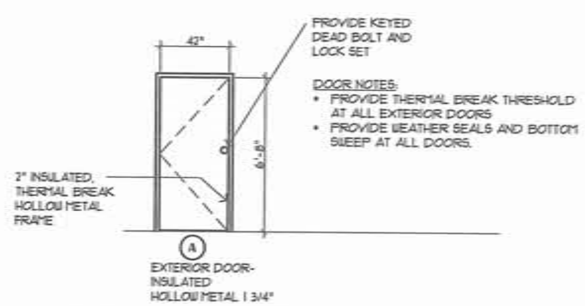
SCALE: 1/4"=1'-0"



5 CURB DETAIL @ EXT. WALL

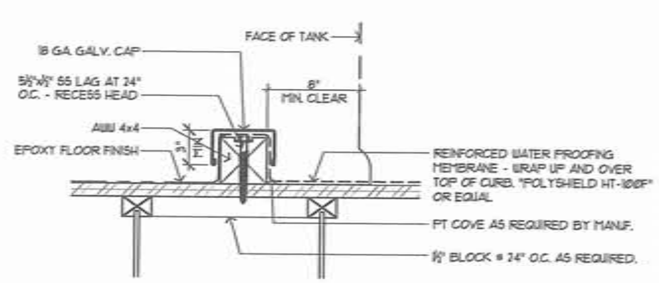
SCALE: 1 1/2"=1'-0"

NOTE:
OCCURS ONLY AT TANK AREA



3 DOOR SCHEDULE

SCALE: 1/4"=1'-0"

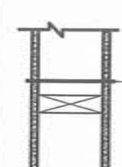


4 CURB DETAIL @ FLOOR

SCALE: 1 1/2"=1'-0"

NOTE:
OCCURS ONLY AT TANK AREA

INTERIOR PARTITION



WALL ASSEMBLY

- 5/8" GWB. TYP "X"
- 2 x 6 WD. STUDS AT 16" O.C.
- 5/8" GWB. TYPE "X"

A AS SHOWN

2 WALL TYPES

SCALE: 1 1/2"=1'-0"

WALL TYPES-GENERAL NOTES:

1. ROOMS AND LAUNDRY ROOMS
2. ALL GWB TO BE TYPE "X"
3. CONTRACTOR TO PROVIDE BACKING AS REQUIRED FOR ALL WALL MOUNTED FIXTURES AND EQUIPMENT. BACKING NOT IDENTIFIED IN WALL TYPES, COORDINATE W/ MECHANICAL DWGS AND MANUFACTURER CUT SHEETS.
4. REFER TO BUILDING SECTIONS FOR EXTERIOR WALL ASSEMBLY
5. INSTALL 3/4" "A/C" PLYWOOD UP TO 8' IN AREAS WITH WALL MOUNTED PUMPS. PAINT WHITE.

vision ARCHITECTURE

SCALE: AS SHOWN

CONSTRUCTION RECORD

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PUMP HOUSE #2 IMPROVEMENTS

FLOOR PLAN

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.

PO BOX 232946 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION | BY | DATE

Project No. ___

Date JAN 22, 2016

Designed CE2

Drawn JH

Approved PCW

Sheet No. A1.0

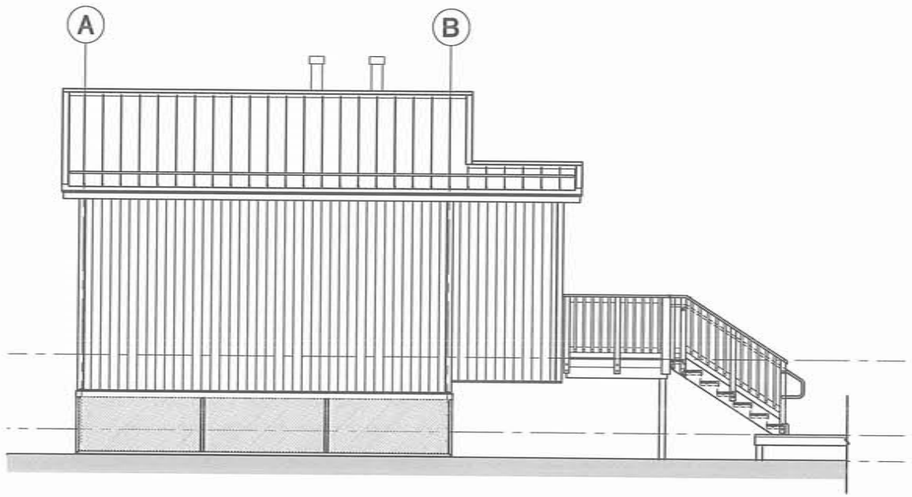
SHEET ___ OF ___

GENERAL SHEET NOTES

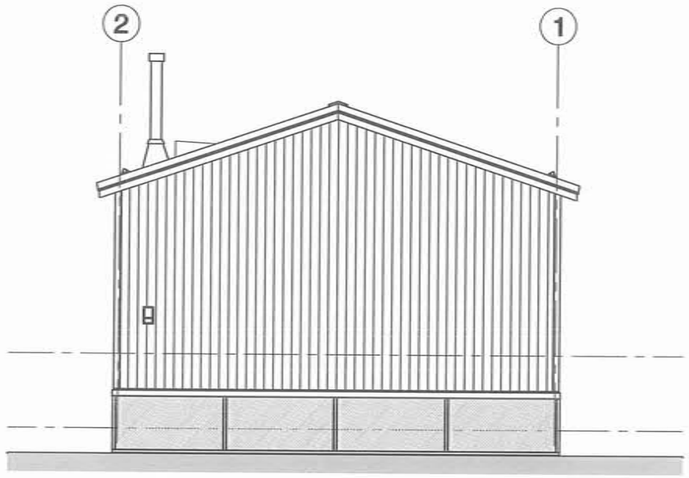
1. REFER TO CIVIL DRAWINGS FOR ALL FINAL SITE ELEVATIONS.

MATERIAL LEGEND

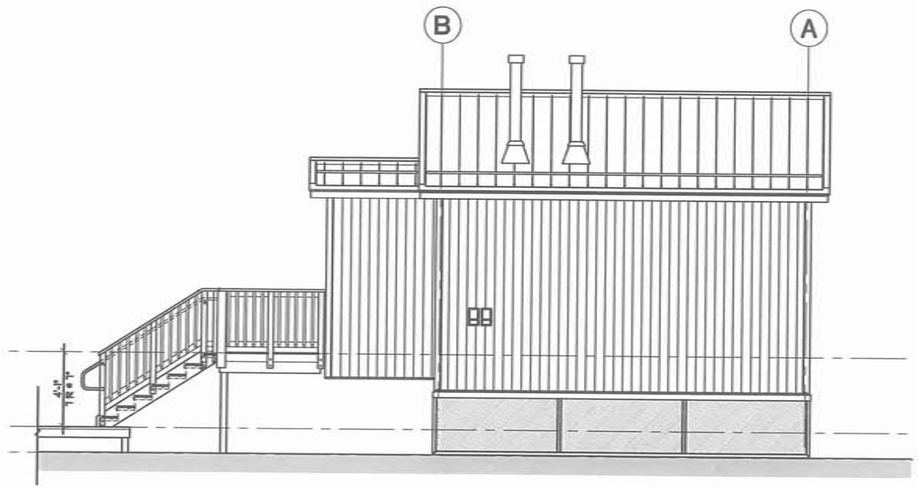
1. "KLIP-RIB" METAL ROOF OR EQUAL
2. METAL SIDING
3. "SNO-GEM" SNOW CLEATS OR EQUAL
4. CHAIN LINK SKIRT W/ TOP & BOTTOM RAIL. PROVIDE 4'W x MAX ALLOWABLE HT. GATE W/ HINGES AND LOCKABLE CLASPS.
5. CONT.VENTED METAL RIDGE CAP. PROVIDE NON-VENTED AT ENTRY COVER



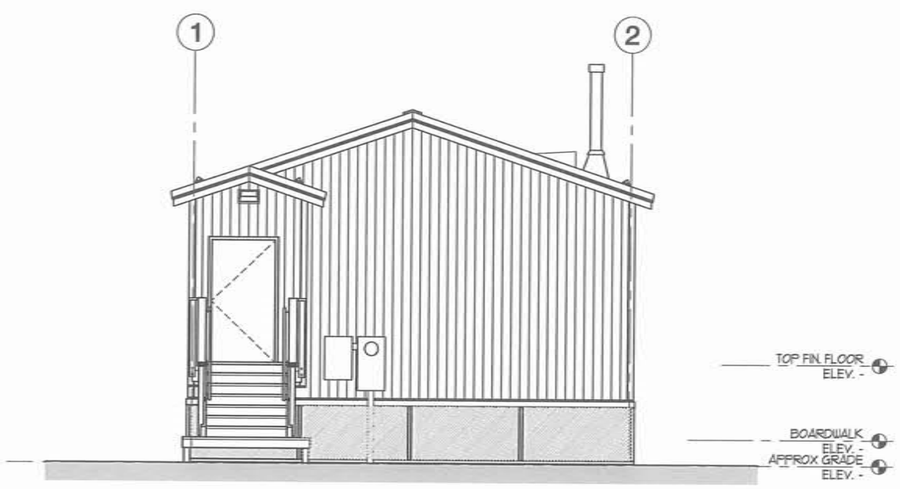
4 WEST ELEVATION
SCALE: 1/4"=1'-0"



3 NORTH ELEVATION
SCALE: 1/4"=1'-0"



2 EAST ELEVATION
SCALE: 1/4"=1'-0"



1 SOUTH ELEVATION
SCALE: 1/4"=1'-0"

Envision Architecture

CE2 ENGINEERS, INC.
PO BOX 232044 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

SCALE: AS SHOWN

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INSPECTOR

PUMP HOUSE #2 IMPROVEMENTS

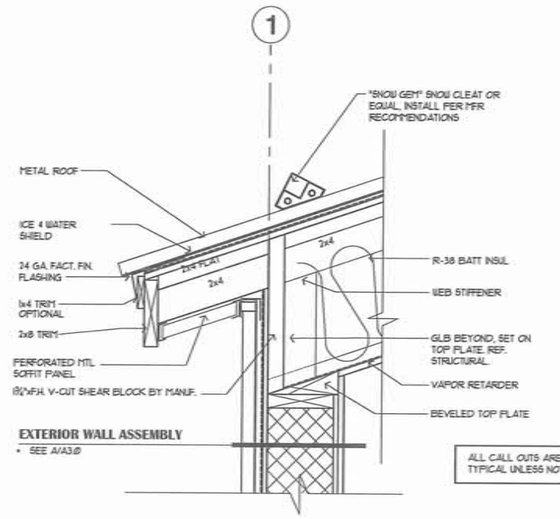
EXTERIOR ELEVATIONS

CHEFORNAK, ALASKA

REVISION	BY	DATE

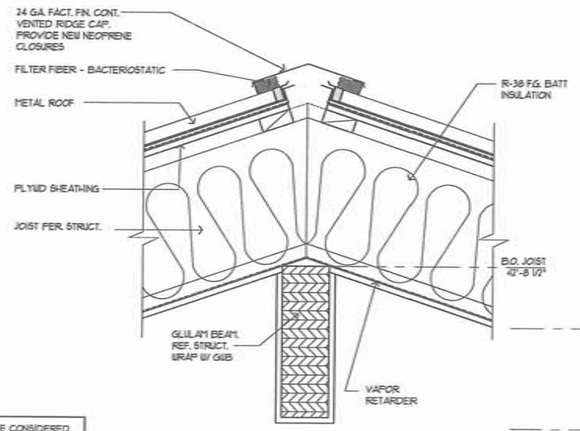
Project No. ____ Date JAN 22, 2016
Designed CE2 Drawn JH Approved PCW

Sheet No. A2.0
SHEET ____ OF ____

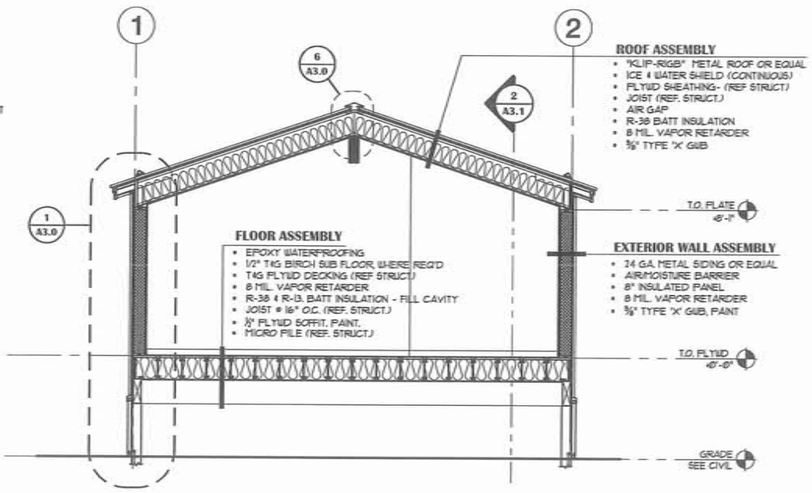


ALL CALL OUTS ARE TO BE CONSIDERED TYPICAL UNLESS NOTED OTHERWISE

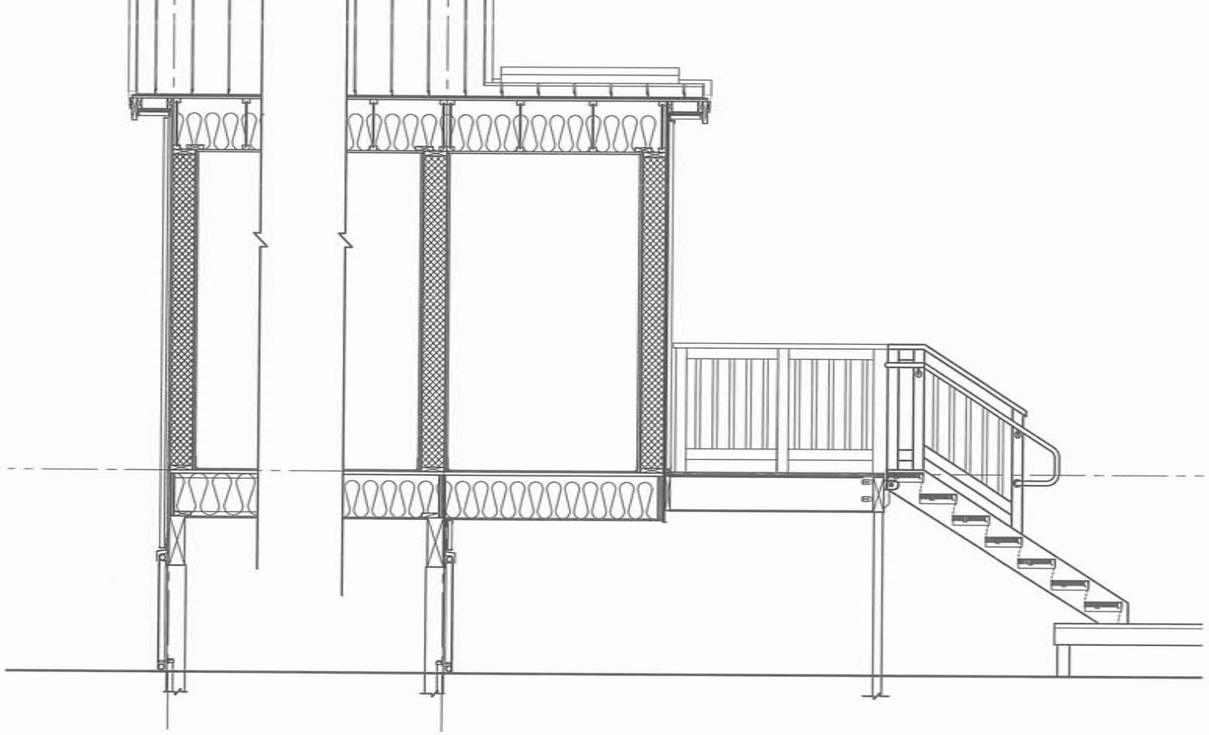
7 EAVE DETAIL
SCALE: 1 1/2"=1'-Ø"



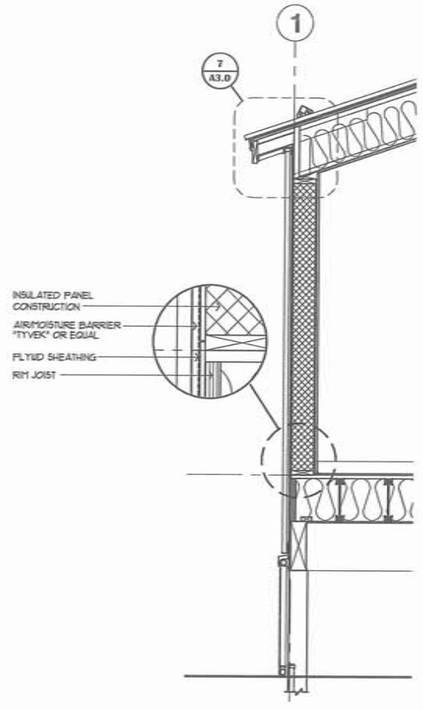
6 RIDGE VENT DETAIL
SCALE: 1 1/2"=1'-Ø"



A BUILDING SECTION
SCALE: 1/4"=1'-Ø"



2 WALL SECTION
SCALE: 1/2"=1'-Ø"



1 WALL SECTION
SCALE: 1/2"=1'-Ø"

Envision Architecture

CE2 ENGINEERS, INC.
PO BOX 232048 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

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FIELD BOOK
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AS-BUILT
INSPECTOR

REVISION | BY | DATE

PUMP HOUSE #2 IMPROVEMENTS

BUILDING SECTION

CHEFORNAK, ALASKA

Project No.
Date JAN 22, 2016
Designed BT
Drawn JH
Approved PCW

Sheet No. A3.0
SHEET ____ OF ____

STRUCTURAL NOTES

THE CONTRACTOR SHALL VERIFY AND COORDINATE ALL DIMENSIONS AMONG THE DRAWINGS BEFORE STARTING ANY WORK OR FABRICATION. ANY DISCREPANCIES FOUND AMONG THE DRAWINGS, SITE CONDITIONS, SPECIFICATIONS AND THESE NOTES SHALL BE REPORTED TO THE ARCHITECT/ ENGINEER AT ONCE.

ALL CONSTRUCTION SHALL COMPLY WITH THE 2009 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED BY THE LOCAL BUILDING OFFICIAL.

SAFETY - THE CONTRACTOR IS RESPONSIBLE FOR MEETING ALL OSHA AND DOSH SAFETY STANDARDS. THE CONTRACTOR IS IN CHARGE OF ALL SAFETY MATTERS ON AND AROUND THE JOB SITE. PROVIDE TEMPORARY ERECTION BRACING AND SHORING AS REQUIRED FOR STABILITY OF THE STRUCTURE DURING ALL PHASES OF CONSTRUCTION.

CODE
2009 INTERNATIONAL BUILDING CODE (IBC)

DESIGN LIVE LOADS

FLOOR LOADS - 100 PSF MINIMUM LL OR ACTUAL EQUIPMENT LOAD

SNOW

GROUND SNOW LOAD = 50 PSF
ROOF SNOW LOAD = 40 PSF
SNOW EXPOSURE FACTOR, Ce = 0.90
SNOW LOAD IMPORTANCE FACTOR = 1.0
THERMAL FACTOR, Ct = 1.0

WIND DESIGN DATA

VELOCITY = 130 MPH HOUR 3 SECOND GUST
IMPORTANCE FACTOR, Iw = 1.0
EXPOSURE C
INTERNAL PRESSURE COEFFICIENT, GCpi = ± 0.18
COMPONENTS AND CLADDING PRESSURES,
ROOF
ZONE 3 - WITHIN 8' OF CORNERS = 92.3 PSF
ZONE 2 - WITHIN 8' OF EAVE AND PEAK = 62.4 PSF
ZONE 1 - EVERYWHERE ELSE = 36.0 PSF
WALLS
ZONE 5 - WITHIN 8' OF VERTICAL CORNERS = 52.5 PSF
ZONE 4 - EVERYWHERE ELSE = 42.6 PSF

SEISMIC DESIGN DATA

Ie = 1.0
Ss = .108g, S1 = 0.06g, SDS = .116, SD1 = 0.09
SITE CLASS D
SEISMIC DESIGN CATEGORY D
SEISMIC RESISTING SYSTEM = BEARING WALL, PLYWOOD SHEARWALLS, R = 6.5
SEISMIC BASE SHEAR = Vs= 34.3 KIPS   Cs = 0.11
EQUIVALENT LATERAL FORCE PROCECURE

OCCUPANCY CATEGORY II

FOUNDATION DESIGN

FOUNDATION DESIGN IS BASED ON PILING DESIGN BY OTHERS.

WOOD PRODUCTS

ALL LUMBER SHALL BE A MINIMUM OF HF#2 FOR ALL BRIDGING, BLOCKING AND FRAMING REQUIRED. MINIMUM FASTENING TO BE PER IBC TABLE 2304.9.1 UNLESS SPECIFICALLY NOTED IN THESE DRAWINGS. PROVIDE POSITIVE CONNECTION UTILIZING SIMPSON HANGERS OR FRAMED BEAM POCKETS TO RESIST VERTICAL AND LATERAL LOADING AT ALL POST CAPS AND BASES, BEARING WALLS.

WOOD I- JOISTS - PROVIDE WOOD I JOISTS AS MANUFACTURED BY BOISE CASCADE, TRUSS JOIST, ROSEBURG OR EQUAL. PROVIDE FULL DEPTH SOLID BLOCKING AT ALL SUPPORTS. COORDINATE ALL HANGERS WITH ACTUAL JOIST SIZE. SUBMIT CONTRACTOR CHECKED ENGINEER SHOP DRAWINGS STAMPED BY AN ALASKAN LICENSED PROFESSIONAL ENGINEER PRIOR TO FABRICATION AND INSTALLATION.

FLOOR SHEATHING - USE APA RATED SHEATHING, TONGUE AND GROOVE, USE 48/24 SPAN RATING.

GLU LAM BEAMS SHALL BE 24F DF/HF WITH Fb=2,400 psi. USE V4 FOR SIMPLE SPANS AND V8 FOR CANTILEVERS OR BEAMS CONTINUOUS OVER SUPPORTS.

ROOF SHEATHING: USE APA RATED SHEATHING. UPPER ROOF SHEATHING WITH SUPPORTS @ 24" O.C. USE MINIMUM 3/4" SHEATHING WITH A 24/16 SPAN RATING.

WALL SHEATHING: USE APA RATED SHEATHING. PROTECT SHEATHING FROM THE WEATHER UNLESS IT IS RATED FOR EXTERIOR EXPOSURE. PROVIDE FRAMING OR BLOCKING BEHIND ALL PANEL EDGES. PROVIDE MINIMUM 3/8" FROM EDGE TO CENTER OF NAIL. DRIVE NAILS FLUSH, DO NOT OVERDRIVE FASTENERS. PROVIDE FASTENERS PER SHEARWALL SCHEDULE.

ALL WOOD IN CONTACT WITH CONCRETE OR EXPOSED TO THE WEATHER SHALL BE PRESERVATIVE TREATED IN ACCORDANCE WITH AMERICAN WOOD PRESERVATIVE ASSOCIATION. PROVIDE PRESSURE TREATED FOUNDATION SILL PLATES, PROVIDE 3X3X229" MIN. PLATE WASHERS FOR FOUNDATION ANCHOR BOLTS.

ABBREVIATIONS

E.W. - EACH WAY
IBC - INTERNATIONAL BUILDING CODE
I.S. - INSIDE
O.S. - OUTSIDE
F.O.S. - FACE OF STUD
HDG - HOT DIP GALVANIZED
MFG - MANUFACTURER
PFA - POST FROM ABOVE
SIM. - SIMILAR TO
SIP - STRUCTURAL INSULATED PANELS
TYP. - TYPICAL
UNO - UNLESS NOTED OTHERWISE
W.T.E. - WITH THE EXCEPTION
W.W.M. - WELDED WIRE MESH

Olen Associates, Inc.
Construction Management Engineering Inspections
16622 Hanson Drive
Eagle River, AK 99577
Phone: (907) 694-6567
Fax: (907) 694-6566

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FIELD BOOK	
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FOREMAN	
AS-BUILT	
INSPECTOR	

STATE OF ALASKA, 49TH, REGISTERED PROFESSIONAL ENGINEER, CE-9141 — PRELIMINARY NOT FOR CONSTRUCTION

PUMP HOUSE 2

STRUCTURAL NOTES

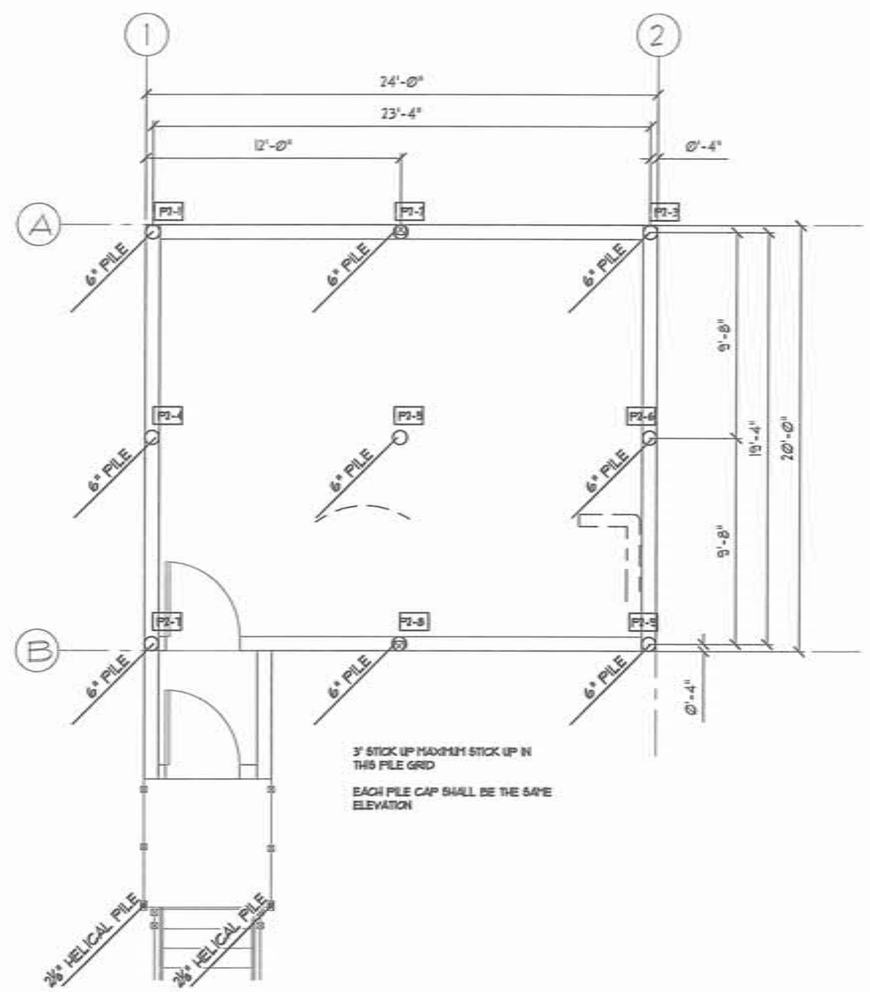
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232946 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. 42754
Date 2/1/16
Designed BCO
Drawn RRJ
Approved OAL

Sheet No. S0.1
SHEET ___ OF ___



1 / SU Pump House 2 - Foundation Plan
Scale: ¼" = 1'-0"

Olen Associates, Inc.
Construction Management · Engineering · Inspections
16422 Hanson Drive, Eagle River, AK 99577
Phone (907) 694-6507 Fax (907) 694-6508 email: bolen@gci.net

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STATE OF ALASKA · 49th · PRELIMINARY NOT FOR CONSTRUCTION · BENJAMIN C. · CE-9141 · REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE 2
FOUNDATION PLAN
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232940 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. 42754
Date 2/1/10
Designed BCO
Drawn RBJ
Approved OAL

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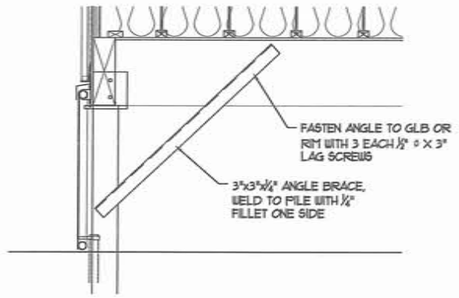

4/S2.1 Brace Connection
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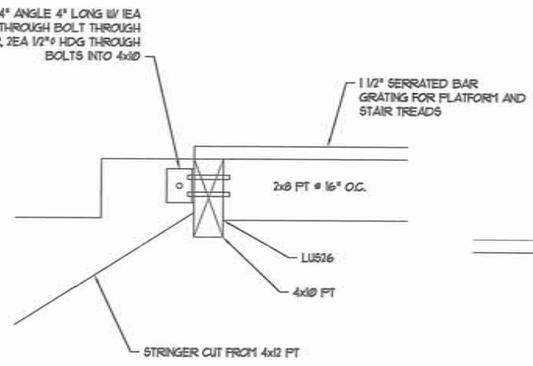

5/S2.1 Stair Stringer Attachment
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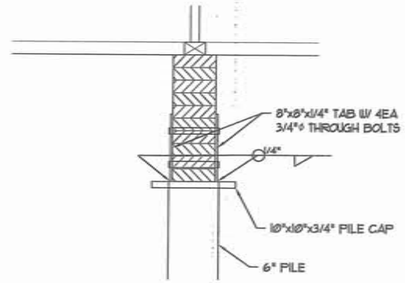
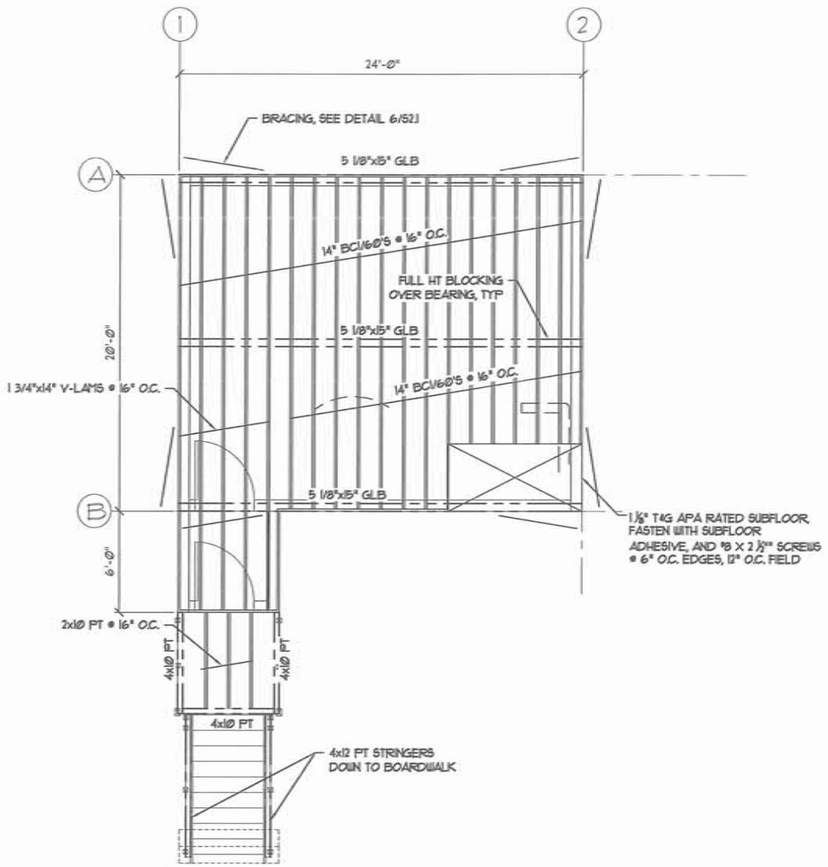
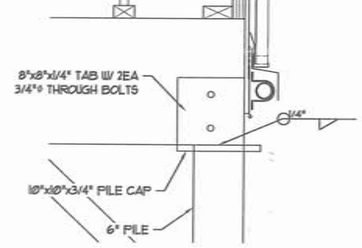


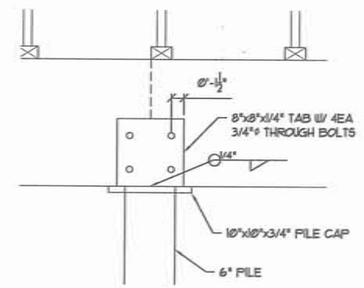
4/S2.1 Pile Cap Detail
Scale: ½" = 1'-0"



1/S2.1 Pump House 2 - Floor Framing Plan
Scale: ¼" = 1'-0"



3/S2.1 Pile Cap Detail - End Pile
Scale: ½" = 1'-0"



2/S2.1 Pile Cap Detail - Interior Pile
Scale: ½" = 1'-0"

Olen Associates, Inc.
Construction Management Engineering Inspections
Phone (907) 694-6907
Fax (907) 694-6909
email: olen@gci.net
M923 Haven Drive
Eagle River, AK 99577

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AS-BUILT
INSPECTOR

STATE OF ALASKA
BENJAMIN C. SCHAEFER
CE-9141
REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE 2

PUMP HOUSE 1
FLOOR FRAMING PLAN

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 222041 ANCHORAGE, AK 99522 PH: 907-349-5515 FAX: 907-349-5515

REVISION	BY	DATE

Project No. 93754
Date 2/1/16
Designed BSCO
Drawn RBM
Approved OAL

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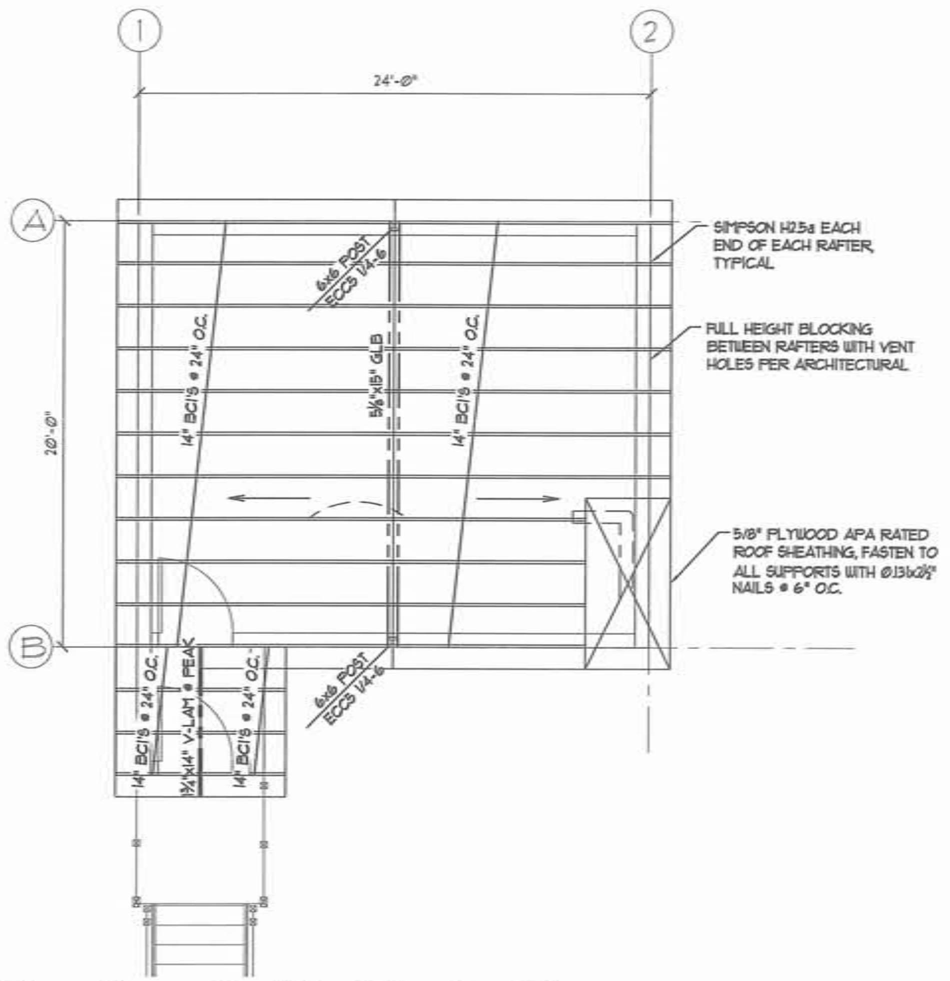

1/S3.1 Pump House 2 - Roof Framing Plan

Scale: ¼" = 1'-0"

Olen Associates, Inc.
Construction Management · Engineering · Inspections
16922 Hanson Drive, Eagle River, AK 99577
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STATE OF ALASKA · 49TH · BENJAMIN C. · CE-9141 · REGISTERED PROFESSIONAL ENGINEER · PRELIMINARY NOT FOR CONSTRUCTION

PUMP HOUSE 2

PUMP HOUSE 1
ROOF FRAMING PLAN

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232949 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. 42754
Date 2/1/16
Designed BCO
Drawn RRJ
Approved OAL

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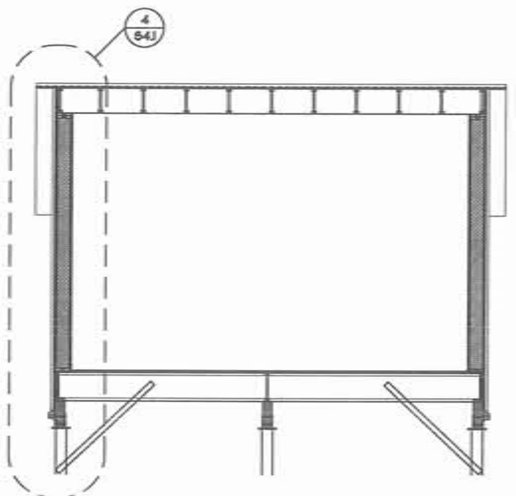
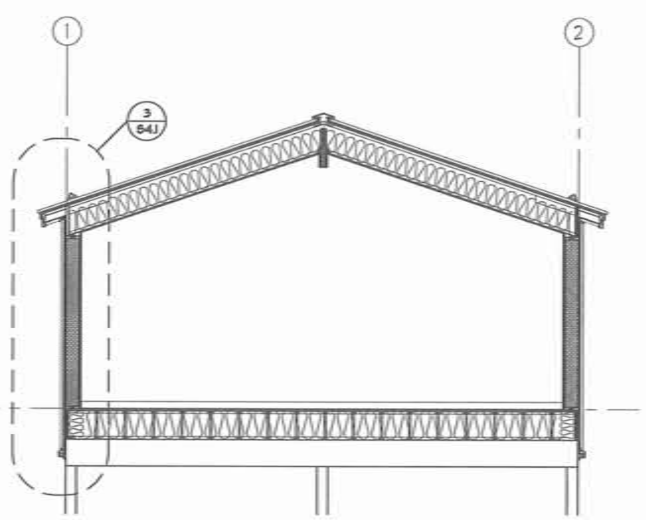
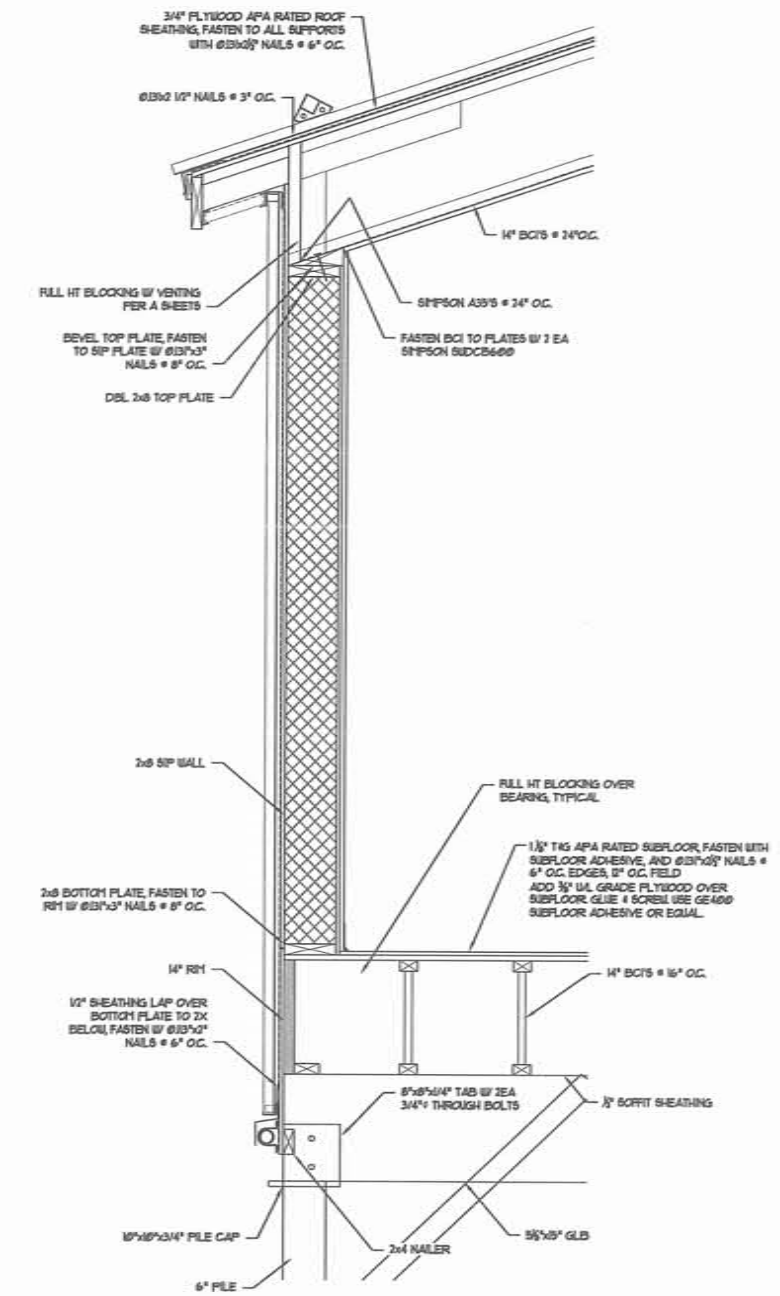


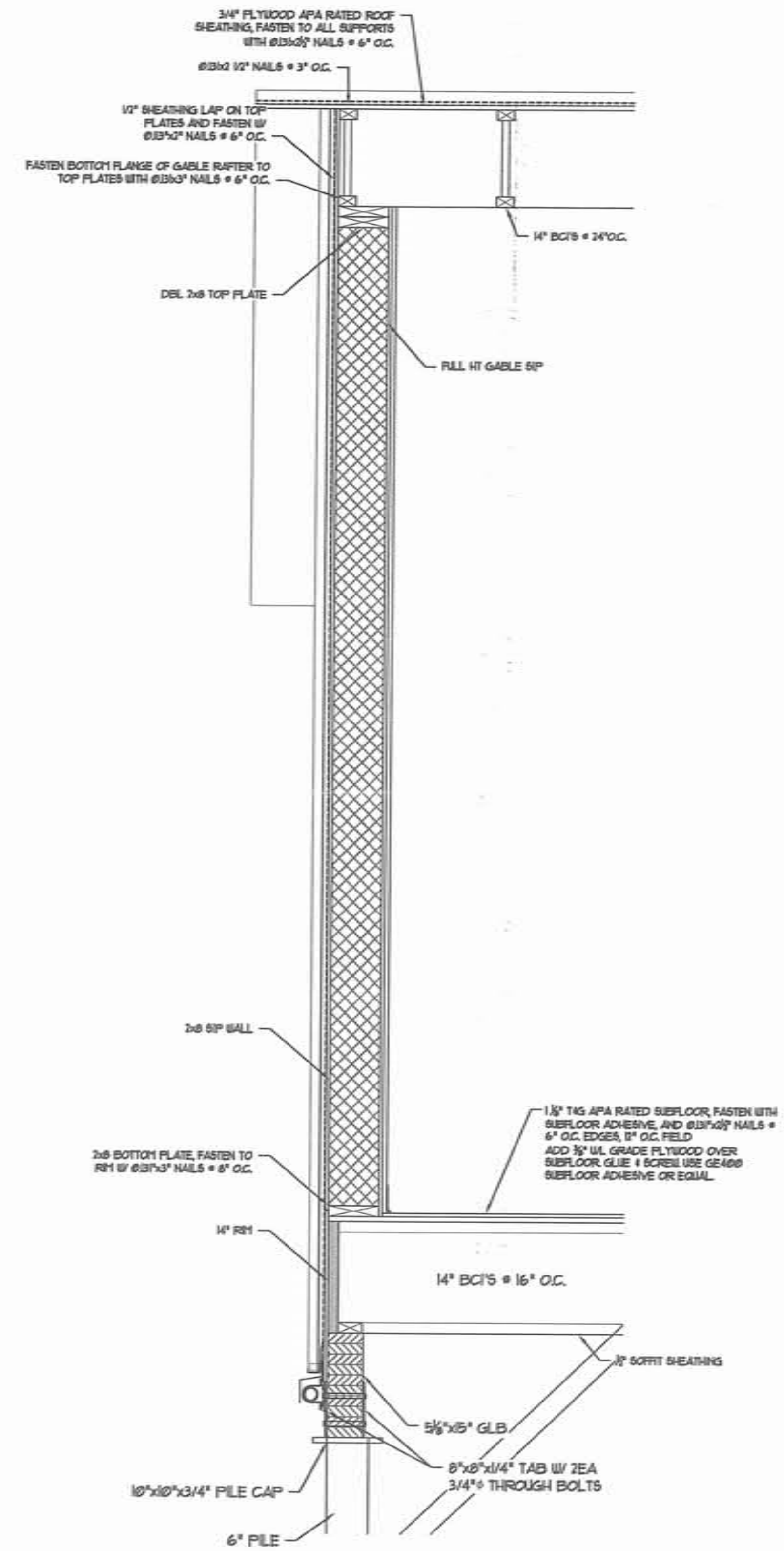
2 S4.1 Pump House 2 - Building Section
Scale: ¾" = 1'-0"



1 S4.1 Pump House 2 - Building Section
Scale: ¾" = 1'-0"



3 S4.1 Wall Section
Scale: 1" = 1'-0"



4 S4.1 Wall Section
Scale: 1" = 1'-0"

Olen Associates, Inc.
Construction Management · Engineering · Inspections
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PUMP HOUSE 2
PUMP HOUSE 1
BUILDING SECTIONS
WALL SECTIONS
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.

REVISION	BY	DATE

Project No.	42754
Date	2/1/16
Designed	BCO
Drawn	RRL
Approved	OAL

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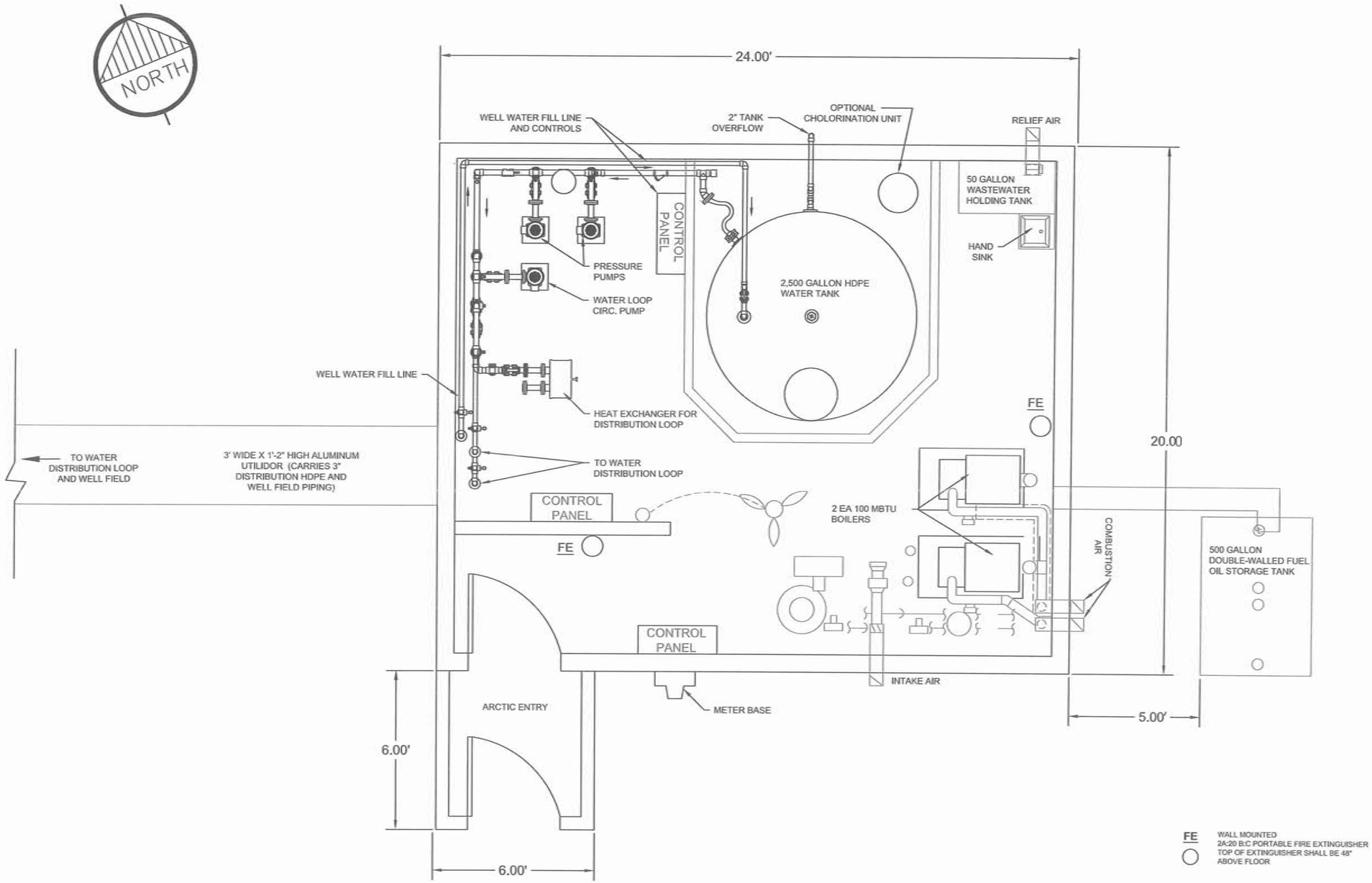

1 P2.0 PUMP HOUSE FLOOR PLAN
1/4" = 1'-0"

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INSPECTOR

STATE OF ALASKA
PAUL C. LEDOUX
CE-16278
REGISTERED PROFESSIONAL ENGINEER

PUMP HOUSE #2 IMPROVEMENT'S
WATER PROCESS PIPING AND EQUIPMENT PLAN
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 222949 ANCHORAGE, AK 99522 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____
Date SEPT. 2015
Designed PCW
Drawn JDJ / CM
Approved PCW

Sheet No. P2.0
SHEET ____ OF ____

G:\ACAD\CHEFORNAK\2014 Pumphouse Improvements\Pump house 2\P2.0 Water Process Piping and Equipment_jdj.dwg, 1/18/2016 2:49:32 PM, jjuelson, Adobe PDF

GENERAL NOTES:

1. PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT REQUIRED FOR COMPLETE SAFE WORKABLE SYSTEMS AS INDICATED ON THE DRAWINGS AND AS SPECIFIED. TEST ALL SYSTEMS TO ASSURE PROPER OPERATION. USE NEW EQUIPMENT OF THE LATEST DESIGN.

2. CONTRACTOR SHALL COMPLY WITH THE APPLICABLE LOCAL, STATE, AND NATIONAL CODES, ORDINANCES, AND REGULATIONS AFFECTING MATERIALS AND METHODS USED AND RECOMMENDED PRACTICES AS SET FORTH BY NFPA, UMC, UPC, NFC, UBC, UL, NEC EXCEPT IN CASES WHERE STATUTES GOVERN.

3. DURING FINAL INSPECTION, DEMONSTRATE THAT THE ENTIRE INSTALLATION OPERATES SATISFACTORILY IN ACCORDANCE WITH DRAWINGS. PROVIDE FLUID AND AIR BALANCE OF MECHANICAL SYSTEMS AND BALANCE REPORT.

4. INSTRUCT OWNERS PERSONNEL FOR OPERATION AND MAINTENANCE PROCEDURES. INSTALL ALL EQUIPMENT PER MANUFACTURERS INSTALLATION INSTRUCTIONS INSTALL EQUIPMENT TO PROVIDE CODE ACCESS FOR MAINTENANCE.

5. PROVIDE ACCESS DOORS FOR CONCEALED EQUIPMENT, VALVES, DAMPERS, AND OTHER MECHANICAL DEVICES REQUIRING SERVICING OR ADJUSTMENT.

6. DO NOT SPRING OR BEND PIPE TO FIT CONDITIONS OR MAKE-UP JOINTS. PROVIDE VALVES FOR BRANCH LINES AS REQUIRED OR SHOWN. MAINTAIN CURRENT "AS-BUILTS" AS THE PROJECT PROGRESSES AND TURN THEM OVER TO THE OWNER AT THE TIME OF FINAL INSPECTION.

LEGEND

SYMBOL	ABBREV.	DESCRIPTION
		FLOW ARROW
—GHS—	GHS	GLYCOL HEATING SUPPLY
—GHR—	GHR	GLYCOL HEATING RETURN
— CW —	CW	DOM. COLD WATER SUPPLY
—CWC—	CWC	DOM. COLD WATER CIRC.
— HW —	HW	DOM. HOT WATER
—HWC—	HWC	DOM. HOT WATER CIRCULATED
—WTHS—	WTHS	WATER TANK HEAT SUPPLY
—WTHR—	WTHR	WATER TANK HEAT RETURN
—W—	W	WASTE OR SEWER
—V—	V	VENT
	VTR	VENT THROUGH ROOF
		BALL VALVE
		PRESS. RELIEF VALVE
		CHECK VALVE
CO CO	C.O.	CLEAN OUT
—FOS—	FOS	FUEL OIL SUPPLY
—FOR—	FOR	FUEL OIL RETURN
	PMP-	PUMP
	ET	EXPANSION TANK
		PRESSURE GAGE'
		THERMOMETER
	TS	THERMOSTAT
NC	NC	VALVE NORMALLY CLOSED
NO	NO	VALVE NORMALLY OPEN
SC	SC	SPEED CONTROL
SW	SW	SWITCH
AAV	AAV	AUTO AIR VENT
	MAV	MANUAL AIR VENT
		CIRCUIT SETTER /BALANCING VALVE
10 X 8		DUCT WIDTH X HEIGHT
RG-1 300 CFM		GRILL NUMBER AIRFLOW AND DIRECTION
TE	TE	TEMPERATURE ELEMENT

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STAKING
FOREMAN
AS-BUILT
INSPECTOR

CAPSTONE ENGINEERING LLC
PMB 169
12110 BUSINESS BLVD
EAGLE RIVER, AK 99577

PUMP HOUSE #2 IMPROVEMENTS
MECHANICAL NOTES
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232048 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION | BY | DATE

Project No. ____ Date SEPT. 2014 ____ Designed FB ____ Drawn JDJ ____ Approved FB

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PROPOSED PUMP HOUSE DESCRIPTION

THE TWO PROPOSED PUMP HOUSES WOULD PROVIDE THE NECESSARY INFRASTRUCTURE THAT WOULD SUPPORT THE ORIGINAL PHS WELL IN THE NORTHEAST CORNER OF THE COMMUNITY, AS WELL AS THE TWO WELLS IN THE SOUTH PART OF THE COMMUNITY DRILLED IN 2002. FEATURES OF THE PROPOSED PUMP HOUSES INCLUDE THE FOLLOWING:

THE BUILDING WOULD BE CONSTRUCTED OF STRUCTURAL INSULATED PANELS (SIP) FOR HIGH INSULATION VALUE, AS WELL AS RAPID ERECTION OF THE BUILDING SHELL.

THE BUILDING FOUNDATION WOULD BE A TRIODETIC® SPACE FRAME ON THE TUNDRA. THIS SPACE FRAME WOULD EVENLY DISTRIBUTE THE BUILDING LOAD EVENLY OVER THE GROUND SURFACE WITHOUT THE EXPENSE OF DRILLING AND SETTING PILES.

AN HDPE VERTICAL TANK OF 2,500 GALLONS CAPACITY WOULD PROVIDE A BUFFER BETWEEN THE WELLS AND THE WATER DISTRIBUTION SYSTEM.

WATER FROM WELLS WOULD ENTER THE BUILDING AND BE FILTERED AND WOULD FLOW INTO THE WATER STORAGE TANK. LEVEL CONTROLS IN THE TANK WOULD CONTROL THE WELL PUMP, AND WOULD PROTECT PRESSURE PUMPS FROM DRY RUNNING.

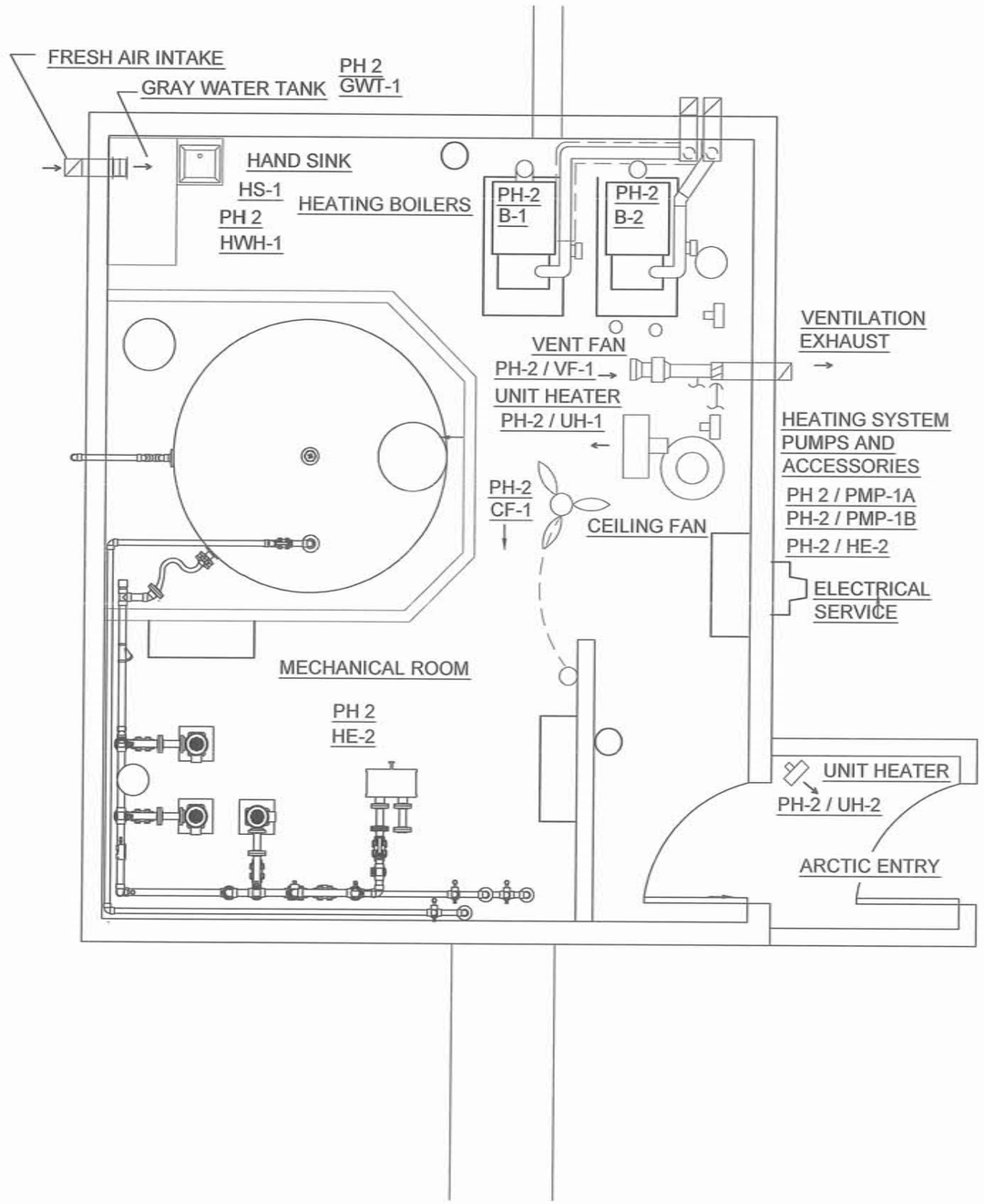
TWO PRESSURE PUMPS WOULD PROVIDE PRESSURIZATION OF THE COMMUNITY WATER DISTRIBUTION LOOP THAT FEEDS THE WATERING POINTS AND THE SCHOOL.

TWO CIRCULATION PUMPS NEXT TO THE PRESSURE PUMPS PROVIDE CIRCULATION OF THE WATER DISTRIBUTION LOOPS, ALONG WITH OTHER CIRCULATION PUMPS IN THE OTHER PUMP HOUSE AND IN THE MECHANICAL AREA OF THE WASHETERIA.

HEAT WOULD BE PROVIDED THROUGH TWO OIL-FIRED BOILERS FOR THE BUILDING SPACE, WELL HEAT, AND BACKUP HEAT OF THE WATER DISTRIBUTION LOOP. .

ELECTRIC POWER FOR THE PUMP HOUSE WOULD BE PROVIDED FROM THE VILLAGE POWER PLANT DISTRIBUTION SYSTEM.

A SIMPLE CONTROL PANEL WOULD PROVIDE AUTOMATIC CONTROL OF THE PUMP HOUSE FUNCTIONS, MONITORING OF THE CRITICAL OPERATIONAL PARAMETERS OF THE PUMP HOUSE AND WELLS, WITH MANUAL OPERATING BACKUP.



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FIELD BOOK
BY/KING
FOREMAN
AS-BUILT
INSPECTOR

CAPSTONE ENGINEERING LLC
PMB 169
12110 BUSINESS BLVD
EAGLE RIVER, AK 99577

PUMP HOUSE #2 IMPROVEMENTS
MECHANICAL PLAN
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232044 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION | BY | DATE

Project No. ____ Date SEPT. 2014 Designed FB Drawn JDJ Approved FB

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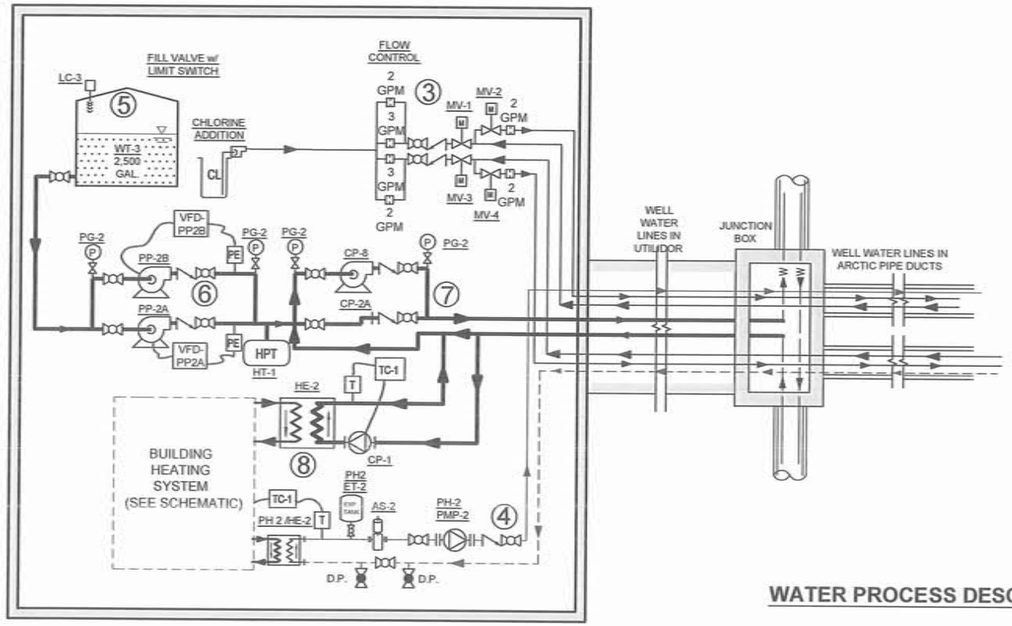
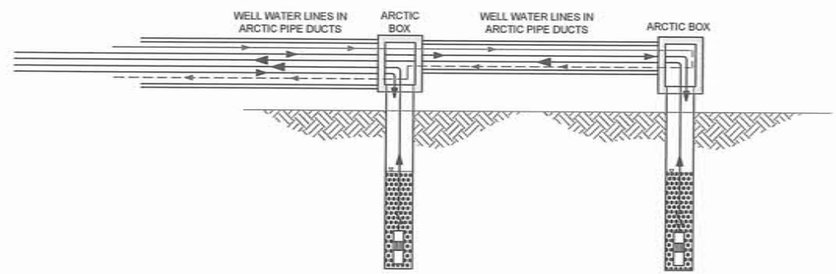


PUMPHOUSE 2



WATER PROCESS DESCRIPTION

1. EXISTING WELL W02-2 SUPPLIES WATER TO PUMPHOUSE 2 AT 3 TO 5 GPM, DEPENDING ON FLOW CONTROLLER SETTING. THE LOW RATE OF FLOW IS SET TO PREVENT HIGH LEVELS OF TOTAL DISSOLVED SOLIDS (TDS) FROM BEING PUMPED OUT OF THE AQUIFER, DUE TO UPCONING OF THE MORE SALINE LAYER OF WATER BELOW THE TOP OF THE WATER BEARING LAYER.

2. EXISTING WELL W02-3 SUPPLIES WATER TO PUMPHOUSE 2 AT 3 TO 5 GPM FOR THE SAME REASON AS (1) ABOVE

3. THE WELLS ARE KEPT THAWED BY CONTINUOUSLY CIRCULATING 2 GPM FROM THE WELL PUMP THROUGH A FLOW REGULATOR (DOLE VALVE), AND BACK TO THE WELL TO WITHIN 10 FT OF THE TOP OF THE WELL SCREEN. THIS IS DONE DURING THE TIME WATER IS NOT REQUIRED TO BE PUMPED TO PUMPHOUSE 2. MOTORIZED VALVES DIRECT FLOW EITHER BACK TO THE WELL OR TO THE 2500 GALLON WATER TANK IN PUMPHOUSE 2. FLOW INTO THE TANK IS REGULATED BY DOLE VALVES FROM EACH WELL PUMP. TWO PARALLEL DOLE VALVES PROVIDE 2, 3, OR 5 GPM TO THE WELL BY USE OF MANUAL BALL VALVES.

4. THE TOTAL LENGTH OF 4" X 12" ARCTIC PIPE USED AS A DUCT BETWEEN THE WELL FIELD AND PUMPHOUSE 2 IS APPROXIMATELY 1300 LINEAL FEET. THIS IS HEATED BY A HYDRONIC LOOP MADE UP OF 1" COPPER TUBE SIZED PEX, CIRCULATED WITH A CIRCULATING PUMP, AND HEATED FROM THE PUMPHOUSE HYDRONIC SYSTEM THROUGH A SINGLE-WALLED HEAT EXCHANGER

5. A 2500 GALLON VERTICAL HDPE WATER TANK WILL SERVE AS STORAGE OF WATER FROM THE WELL. THE TANK WILL HAVE ITS OWN SELF-CONTAINED ULTRASONIC LEVEL SENSOR FOR LEVEL CONTROL AND INDICATION.

6. PRESSURE PUMPS PP-2A AND PP-2B WILL PRESSURIZE THE WATER DISTRIBUTION LOOP TO A CONSTANT PRESSURE (SETPOINT ADJUSTABLE AT 40 TO 60 PSI). THE PUMPS WILL BE RUN BY VARIABLE FREQUENCY DRIVES (VFD) IN LEAD-LAG FASHION. PUMPHOUSE 2 WELL AND PRESSURE PUMPS WILL BE THE BACKUP SOURCE OF WATER FOR THE WATER DISTRIBUTION LOOP.

7. CIRCULATION PUMP CP 8 WILL KEEP THE CITY WATER DISTRIBUTION LOOP FLOWING AT 20 TO 40 GPM. THESE WILL BE MULTI-STAGE 1750 RPM VERTICAL PUMPS WITH VERY HIGH EFFICIENCY TO KEEP ELECTRICAL COSTS DOWN. THIS PUMP WILL SERVE AS BACK-UP CIRCULATORS FOR PUMPHOUSE 1.

8. BACKUP HEAT EXCHANGER HE-4 PROVIDES HEAT TO THE CITY WATER DISTRIBUTION LOOP IN CASE PRIMARY WASTE HEAT RECOVERY HEAT EXCHANGER IN POWER PLANT OR BACKUP HEAT EXCHANGER IN PUMPHOUSE 1 ARE DOWN. THIS WILL INCREASE RELIABILITY OF THE WATER DISTRIBUTION LOOP SYSTEM.

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CONSTRUCTION RECORD
FIELD BOOK
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FOREMAN
AS-BUILT
INSPECTOR

CAPSTONE ENGINEERING LLC
PMB 169
12110 BUSINESS BLVD
EAGLE RIVER, AK 99577

PUMP HOUSE #2 IMPROVEMENTS

WATER PROCESS SCHEMATIC

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 223044 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	BY	DATE

Project No. ____ Date SEPT. 2014
Designed FB
Drawn JDJ
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Sheet No. M2.1
SHEET ____ OF ____

HEATING SCHEMATIC DESCRIPTION

(1) TWO OIL FIRED HEATING BOILERS OPERATE IN PARALLEL.

(2) EXPANSION TANKS SERVE AS A THERMAL CUSHION FOR 50% PROPYLENE GLYCOL / WATER HYDRONIC HEATING FLUID. AIR SEPARATORS SEPARATE AIR IN THE HYDRONIC PIPING.

(3) MAIN CIRCULATION PUMPS PROVIDES A CONSTANT HEAD . THESE WET ROTOR ROTOR PUMPS HAVE AN INTERNAL CONTROL CIRCUIT THAT VARIES THE SPEED OF THE PUMP, DEPENDING UPON THE HEAT LOAD OF THE SYSTEM.

(4) PH-2 / HE-2 HEAT EXCHANGER PROVIDES HEAT TO KEEP THE WELL AND TRANSMISSION LINE ABOVE FREEZING. TEMPERATURE CONTROL REGULATES THE TEMPERATURE.

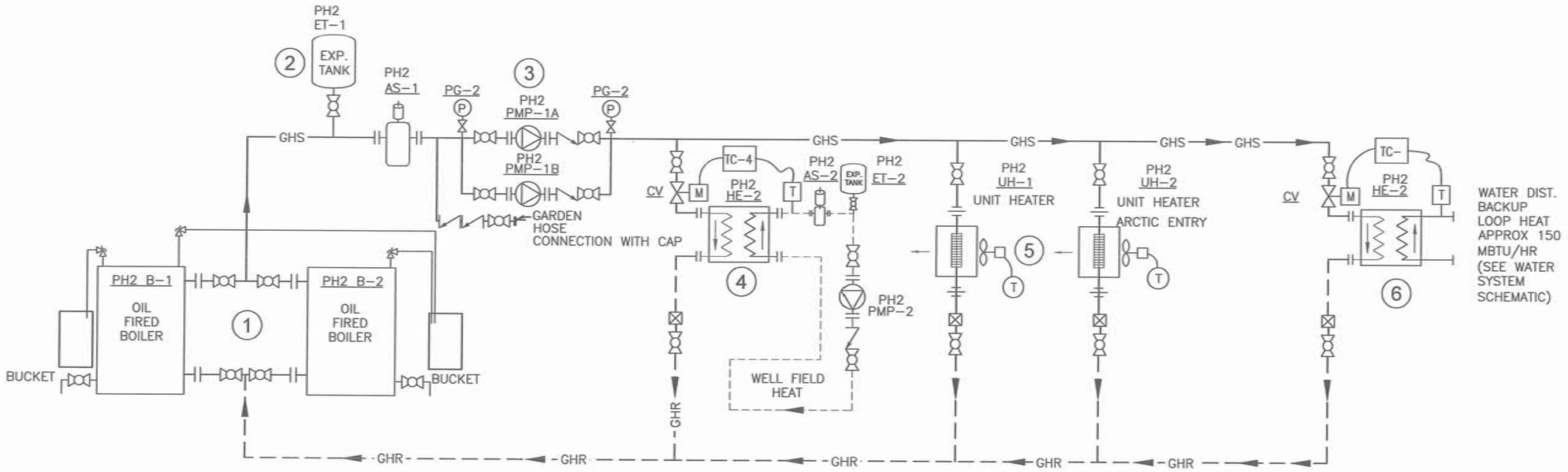
(5) UNIT HEATER HEATS THE SPACE IN THE PUMP HOUSE AND PROVIDE HEAT TO MAKEUP AIR FOR INTERIOR VENTILATION.

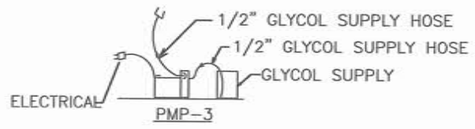
UNIT HEATER PROVIDES HEAT TO ARCTIC ENTRY.

(6) PH 2 / HE-1 HEAT EXCHANGER PROVIDES HEAT TO THE CITY WATER DISTRIBUTION LOOP IN CASE PRIMARY WASTE HEAT RECOVERY HEAT EXCHANGER IN POWER PLANT IS DOWN.

HEATING EQUIPMENT

PH2 B-1, PH2 B-2: HIGH EFFICIENCY OIL FIRED BOILERS. 50/50 PROPYLENE GLYCOL IN SYSTEM
EXPANSION TANKS- BLADDER TYPE TANKS
CIRCULATOR PUMPS: WET ROTOR PUMPS
HE-1: DOUBLE WALL HEAT EXCHANGER
HE-2: SINGLE WALL HEAT EXCHANGER
UNIT HEATERS ARE PROPELLOR TYPE: CONSTANT FLOW FOR COIL, FAN CYCLES ON THERMOSTAT.





PORTABLE GLYCOL FILL PUMP

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AS-BUILT
INSPECTOR

CAPSTONE ENGINEERING LLC
PMB 169
12110 BUSINESS BLVD
EAGLE RIVER, AK
99577

PUMP HOUSE #2 IMPROVEMENTS

HEATING SYSTEM SCHEMATIC

CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
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REVISION	BY	DATE

Project No. ____ Date SEPT. 2014 Designed FB Drawn JDJ Approved FB

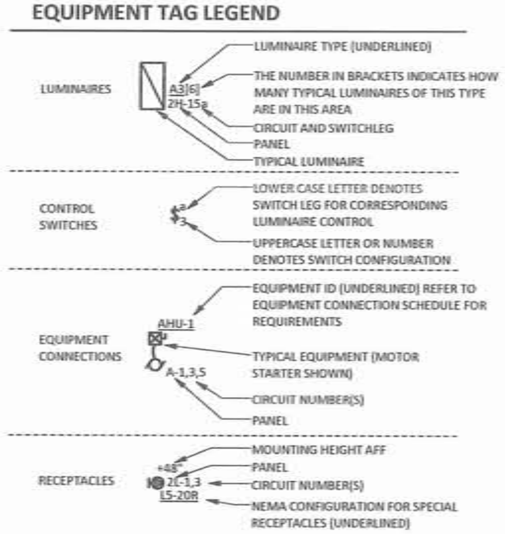
Sheet No. M2.2
SHEET ____ OF ____

ELECTRICAL LEGEND

(NOTE: THIS IS A STANDARD LEGEND AND NOT ALL SYMBOLS ARE NECESSARILY USED.)

- EXTERIOR LIGHT FIXTURE, POLE MOUNTED, HEADS AS SHOWN
- PHOTOCELL CONTROL
- LUMINAIRE - TYPE AS NOTED ON PLAN
- LUMINAIRE - WALL MOUNTED: TYPE AS NOTED ON PLAN
- LUMINAIRE - EMERGENCY LIGHT
- TRACK LIGHTING - TRACK LENGTH AS SCALED: TYPE AS NOTED ON PLAN
- EMERGENCY LIGHTING UNIT (WALL; CEILING; REMOTE HEAD)
- EXIT SIGN (CEILING OR WALL - SEE MODEL NUMBER); SHADE DENOTES FACE; ARROWS AS INDICATED
- COMBINATION EMERGENCY UNIT & EXIT SIGN (CEILING OR WALL - SEE MODEL NUMBER); SHADE DENOTES FACE; ARROWS AS INDICATED
- OCCUPANCY SENSOR LIGHTING CONTROL
- SWITCH - SINGLE POLE, SINGLE THROW, UON
- SWITCH LEGEND
  3 (THREE WAY); 4 (FOUR WAY); L (LOW VOLTAGE); D (DIMMER); K (KEYED); P (PILOT LIGHT); V (VARIABLE SPEED CONTROL); OC (OCCUPANCY SENSOR); T (INTEGRAL MOTOR OVERLOAD [WHERE FHP MOTOR REQUIRES AUTOMATIC CONTROL PROVIDE MOTOR RATED "RELAY IN BOX"])
- POWER DISTRIBUTION PANELBOARD
- METERING DEVICE
- POWER PANELBOARD
- TRANSFORMER: APPROX. PHYSICAL SIZE AS SCALED; ACTUAL RATING AS NOTED ON ONE-LINE DIAGRAMS
- MOTOR CONNECTION
- COMBINATION BATHROOM FAN/LIGHT: TYPE AS NOTED ON PLAN
- NON-FUSED SAFETY SWITCH / DISCONNECT
- FUSED SAFETY SWITCH / DISCONNECT
- ENCLOSED CIRCUIT BREAKER SWITCH
- MOTOR STARTER
- COMBINATION MOTOR STARTER SAFETY SWITCH / DISCONNECT
- PUSH BUTTON CONTROL STATION
- JUNCTION BOX OR EQUIPMENT CONNECTION - FLEX OR RECEPTACLE AS REQUIRED (CEILING; WALL; FLOOR)
- SIMPLEX RECEPTACLE
- DUPLEX RECEPTACLE
- DOUBLE DUPLEX RECEPTACLE
- DUPLEX RECEPTACLE - SPLIT WIRED FOR SWITCH CONTROL OF LOWER OUTLET
- DUPLEX RECEPTACLE - GFCI PROTECTED
- DUPLEX RECEPTACLE - GFCI PROTECTED MOUNTED ABOVE COUNTERTOP
- DUPLEX RECEPTACLE - FLOOR MOUNTED
- DOUBLE DUPLEX RECEPTACLE - FLOOR MOUNTED
- RECEPTACLE - PENDANT MOUNTED FROM CEILING WITH KELLUM GRIPS
- RECEPTACLE - FLUSH MOUNTED IN CEILING
- DRYER RECEPTACLE - 30A, 3 POLE, 4 WIRE NEMA 14-30R
- ELECTRIC RANGE RECEPTACLE - 50A, 3 POLE, 4 WIRE, NEMA 14-50R
- SPECIAL RECEPTACLE - COORDINATE EXACT NEMA CONFIGURATION IF NOT NOTED (SURFACE; WALL)
- GROUND CONNECTION POINT
- TELECOMMUNICATION OUTLET (WALL; FLOOR)
- TELEPHONE VOICE OUTLET
- TELEVISION OUTLET RG-6 QUAD SHIELD HOMERUN, UON
- CONTROL PANEL - TYPE AS NOTED (SURFACE; RECESSED)
- DENOTES AVAILABLE FAULT CURRENT
- LINETYPE/LINEWEIGHT DENOTING FUTURE WORK
- LINETYPE/LINEWEIGHT DENOTING EXISTING WORK TO REMAIN
- LINETYPE/LINEWEIGHT DENOTING NEW WORK
- LINETYPE/LINEWEIGHT DENOTING DEMO WORK
- SMOKE ALARM - MULTIPLE STATION 120VAC/9VDC
- SMOKE AND CARBON MONOXIDE ALARM - MULTIPLE STATION 120VAC/9VDC
- ALARM STROBE - MULTIPLE STATION 120VAC
- CARBON MONOXIDE ALARM - MULTIPLE STATION 120VAC/9VDC
- DUCT SMOKE DETECTOR REMOTE MONITOR/TEST STATION
- SMOKE DETECTOR - DUCT MOUNTED
- SMOKE DETECTOR - PHOTO ELECTRIC
- HEAT DETECTOR - RATE OF RISE
- HEAT DETECTOR - FIXED TEMPERATURE AS NOTED
- FIRE ALARM CONTROLLED MAGNETIC DOOR HOLDER / RELEASE
- FIRE ALARM HORN (WALL; CEILING)
- FIRE ALARM STROBE (WALL; CEILING)
- FIRE ALARM COMBINATION HORN/STROBE (WALL; CEILING)
- FIRE ALARM PULL STATION
- WATER FLOW BELL - 120V CONTROLLED BY FLOW SWITCH
- FIRE ALARM FLOW SWITCH
- FIRE ALARM TAMPER SWITCH
- DOOR ANNUNCIATOR STROBE
- DOOR ANNUNCIATOR HORN/STROBE
- DOOR MAGNET
- DOOR POSITION SENSOR
- REQUEST TO EXIT
- SECURITY CAMERA (FIXED POSITION)
- SECURITY CAMERA (PAN, TILT, ZOOM)

EQUIPMENT TAG LEGEND



MOUNTING HEIGHT SCHEDULE	
EQUIPMENT	HEIGHT
PANELBOARDS (TOP)	72"
SPECIAL SYSTEM PANELS (TOP)	72"
POWER METER BASE (CENTER LINE OF SOCKET)	PER UTILITY
CONTACTORS, MOTOR STARTERS, DISCONNECT SWITCHES (TOP)	66"
RECEPTACLES IN OFFICE AREAS	18"
RECEPTACLES LOCATED IN HAZARDOUS OR S-2 OCCUPANCIES	24" MINIMUM
RECEPTACLES IN NON-FINISHED AND MECHANICAL SPACES	46"
ABOVE COUNTER/BACKSPLASH DEVICES (DENOTED "AC")	4" ABOVE
WALL MOUNTED SWITCHES	46"
TELECOMMUNICATION OUTLETS (WALL MOUNTED DENOTED "W")	18" (WALL MOUNTED 54")
CLOCK OUTLETS (BOTTOM)	80"
HORNS/STROBES/HORN STROBES/DOORBELL RINGER (BOTTOM)	80"
PULL STATIONS, PUSH BUTTONS, DOORBELL PUSHBUTTON	46"

ABBREVIATIONS	
(D)	DEMOLISH
(E)	EXISTING
(R)	RELOCATED
A	AMPERES
AC	ABOVE COUNTER/BACKSPLASH
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AIC	AMPS INTERRUPTING CAPACITY
AL	ALUMINUM
BJ	BONDING JUMPER
C	CONDUIT OR CELCIUS
CAT	CATEGORY
CB	CIRCUIT BREAKER
CO, C.O.	CONDUIT ONLY
CT	CURRENT TRANSFORMER
CU	COPPER
DISC	DISCONNECT
EGC	EQUIPMENT GROUNDING CONDUCTOR
ERCSP	ELEVATOR RECALL CONTROL AND SUPERVISORY PANEL
F	FARENHEIT
FAA	FIRE ALARM ANNUCIATOR
FACP	FIRE ALARM CONTROL PANEL
FHP	FRACTIONAL HORSEPOWER
FLA	FULL LOAD AMPS
FSD	FIRE SMOKE DAMPER
FT	FEET
FU	FUSE
G, GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GEC	GROUNDING ELECTRODE CONDUCTOR
GFEP	GROUND FAULT EQUIPMENT PROTECTION
HP	HORSEPOWER
ID	IDENTIFICATION
IN	INCHES
KVA	KILOVOLT-AMPERE
KW	KILOWATT
LRA	LOCKED ROTOR AMPS
LTG	LIGHTING
MCA	MINIMUM CIRCUIT AMPACITY
MDP	MAIN DISTRIBUTION PANEL
MDS	MAIN DISTRIBUTION SWITCHBOARD
MFS	MAXIMUM FUSE SIZE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
P	POLES
PC	PHOTO CELL
PH, Ø	PHASE
PNL	PANEL
PRI	PRIMARY
REC	RECEPTACLE
RIB	RELAY IN A BOX (MOTOR RATED)
SCCR	SHORT CIRCUIT CURRENT RATING
SE	SERVICE ENTRANCE RATED
SEC	SECONDARY
SSBJ	SUPPLY SIDE BONDING JUMPER
SSEBJ	SUPPLY SIDE EQUIPMENT BONDING JUMPER
SVC	SERVICE
TELECOM	TELECOMMUNICATION
TGB	TELECOMMUNICATION GROUNDING BUSBAR
TMGB	TELECOMMUNICATION MAIN GROUNDING BUSBAR
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
V	VOLTS
VA	VOLTS-AMPERES
VFD	VARIABLE FREQUENCY DRIVE
W	WATTS OR WIRE
WG	WIRE GUARD
WP	WEATHERPROOF (NEMA 4 RATED)
XFMR	TRANSFORMER

ELECTRICAL SHEET LIST	
NUM	SHEET TITLE
E0.1	ELECTRICAL LEGEND & GENERAL REQUIREMENTS
E1.1	ELECTRICAL SITE PLAN
E2.1	ELECTRICAL PLANS
E3.1	ELECTRICAL DIAGRAMS & DETAILS
E3.2	ELECTRICAL DIAGRAMS & DETAILS
TOTAL SHEETS: 5	

GENERAL REQUIREMENTS

26 05 00 - COMMON WORK REQUIREMENTS FOR ELECTRICAL:

ALL ELECTRICAL WORK SHALL BE INSTALLED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE, STATE, MUNICIPAL, FEDERAL LAWS, AND AMENDMENTS GOVERNING THE PROJECT. ALL WORK SHALL BE PERFORMED UNDER THE SUPERVISION OF A CERTIFIED ADMINISTRATOR JOURNEYMAN ELECTRICIAN. CONTRACTOR SHALL SUBMIT REQUEST FOR SUBSTITUTION IN WRITING TO THE ENGINEER. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED CONSTRUCTION PERMITS AND PAY ALL ASSOCIATED FEES. MATERIALS AND EQUIPMENT SHALL BE NEW COMMERCIAL GRADE AND ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION AS SUITABLE FOR THE USE INTENDED. ALL ELECTRICAL EQUIPMENT SHALL INCLUDE THE SEAL OF A NATIONALLY RECOGNIZED TESTING LABORATORY FOR THE PURPOSE FOR WHICH IT IS INSTALLED.

THE CONTRACTOR IS REQUIRED TO COORDINATE THE MINIMUM WORKING CLEARANCES REQUIRED BY THE NATIONAL ELECTRICAL CODE 110.26. THE CONTRACTOR IS REQUIRED TO COORDINATE WITH ALL SUBCONTRACTORS SO THAT ENCROACHMENTS INTO THIS RESTRICTED SPACE ARE PREVENTED.

ALL CABLING, RACEWAYS, CABLE TIES AND COMPONENTS LOCATED IN CEILING SPACES THAT ARE PLENUMS SHALL BE PLENUM RATED.

PENETRATIONS OF FIRE BARRIERS: ALL ELECTRICAL PENETRATIONS THROUGH FIRE RATED BARRIERS SHALL BE SEALED IN ACCORDANCE WITH NEC ARTICLE 300.21. PROVIDE FIRE PUTTY AT ALL BOXES IN FIRE RATED WALLS. CONTRACTOR TO PROVIDE SUBMITTAL OF ALL FIRE RATING SYSTEMS TO BE USED. VAPOR BARRIERS: SEAL ALL VAPOR BARRIER PENETRATIONS TO MAINTAIN SYSTEM INTEGRITY.

ACCESS PANELS: PROVIDE ACCESS PANELS FOR ALL LOCATIONS NECESSARY TO ACCESS ELECTRICAL EQUIPMENT AND JUNCTION BOXES. ACCESS PANELS SHALL BE FIRE RATED EQUAL TO OR EXCEEDING THE ADJACENT WALL OR CEILING CONSTRUCTION AND PAINTED TO MATCH.

SEISMIC: CONTRACTOR TO PROVIDE DEFERRED SUBMITTAL FOR SEISMIC ANCHORING DESIGN FOR ALL EQUIPMENT OVER 400 POUNDS.

26 05 19 - POWER CONDUCTORS:

ALL POWER AND CONTROL CONDUCTORS SHALL BE COPPER UNLESS NOTED OTHERWISE. ALL CONDUCTORS ROUTED IN UNHEATED SPACES OF THE BUILDING, UNDERGROUND, OR LOCATED OUTSIDE OF THE BUILDING ARE REQUIRED TO HAVE TYPE XHHW 90 DEGREE C INSULATION. ALL CONDUCTORS LOCATED IN HEATED SPACES CAN BE XHHW OR THHN 90 DEGREE C INSULATION UNLESS NOTED OTHERWISE. CONDUCTOR AMPACITY SHALL BE BASED ON TABLE 310-15(B)(16) OF THE NEC. USE 60-DEGREE C. RATING COLUMN FOR CIRCUITS TERMINATING ON DEVICES RATED BELOW 100A. USE 75-DEGREE C RATING COLUMN FOR CIRCUITS TERMINATING ON DEVICES AND IN ENCLOSURES RATED 100A AND OVER. 90-DEGREE C. RATING COLUMN CAN BE USED FOR DERATING CALCULATIONS ONLY. PROVIDE UNSHARED DEDICATED NEUTRAL FOR EACH CIRCUIT.

MINIMUM SIZE CONDUCTORS FOR 15 AND 20 AMP BRANCH CIRCUITS MEASURED FROM THE PANELBOARD TO THE FURTHEST DEVICE ON THE CIRCUIT UNLESS OTHERWISE NOTED ON THE DRAWINGS.

120 VOLT BRANCH CIRCUITS:
- 12 AWG UP TO 75 FEET.
- 10 AWG 75 FEET TO 120 FEET.
- 8 AWG GREATER THAN 120 FEET.

277 VOLT BRANCH CIRCUITS:
- 12 AWG UP TO 120 FEET.
- 10 AWG 120 FEET TO 200 FEET.
- 8 AWG GREATER THAN 200 FEET.

INSTALL IN ACCORDANCE WITH NEC REQUIREMENTS FOR AMBIENT TEMPERATURE DERATING, CONDUIT FILL DERATING AND BOX FILL. COLOR CODE CONDUCTORS BLACK, RED, WHITE, AND GREEN FOR 240/120V 1 PHASE 3 WIRE CIRCUITS; BLACK, RED, BLUE, WHITE, AND GREEN FOR 208Y/120V 3 PHASE 4 WIRE CIRCUITS AND BROWN, ORANGE, YELLOW, GRAY FOR ALL 480Y/277 V 3 PHASE CIRCUITS. IDENTIFY GROUNDED CONDUCTORS PER NEC FOR ALL CIRCUITS.

26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS:

ALL CLASS 1 CIRCUITS SHALL BE INSTALLED IN CONCEALED METALLIC RACEWAY EXCEPT WHERE SPECIFICALLY INDICATED ELSEWHERE IN THE SPECIFICATIONS OR SHOWN ON THE DRAWINGS. CLASS 2 CIRCUITS MAY BE INSTALLED IN CABLE TRAYS OR CAT 5 RATED J-HOOKS SPACED NO MORE THAN 4 FT APART WHERE NO CABLE TRAY IS DENOTED. WHERE WIRING OR CABLING IS ROUTED IN NON-ACCESSIBLE LOCATION, A RACEWAY SYSTEM IS TO BE PROVIDED.

-BELOW GRADE: PVC, HDPE OR RMC (RMC MUST BE USED FOR 90 DEGREE BENDS AND STUB UPS).
-EXPOSED INTERIOR: RMC, IMC, OR EMT.
-CONCEALED INTERIOR: RMC, IMC, EMT, OR MC CABLE.
-HAZARDOUS CLASSIFIED WIRING: RMC OR MC-HL. (CONDUIT SEALS PER NEC REQUIREMENTS).
-EXPOSED TO PHYSICAL DAMAGE (INSTALLED EXPOSED BELOW 8 FT): RMC. ALSO PROVIDE RMC FOR ALL PENETRATIONS AND STUB UPS FROM CONCRETE STRUCTURES AND FLOORS. PROVIDE 10 FT MINIMUM STUB OUT FROM UNDERGROUND LIGHT POLE BASES.

MAKE CONNECTIONS TO MOTORS, TRANSFORMERS AND OTHER EQUIPMENT WITH FLEXIBLE METAL CONDUIT (FMC) OF GALVANIZED STEEL. USE FITTINGS LISTED FOR USE WITH FLEXIBLE METAL CONDUIT OF ELECTRO ZINC GALVANIZED MALLEABLE IRON OR STEEL CONSTRUCTION. USE LIQUID TIGHT FLEXIBLE CONDUIT FOR ALL FLEXIBLE EXTERIOR LOCATIONS, WET LOCATIONS AND CONNECTIONS TO PUMPS.

CONCEAL ALL ELECTRICAL RACEWAYS, BOXES, CABLING, CONDUCTORS AND THE LIKE IN WALLS, BELOW FLOORS, SLABS OR ABOVE FINISHED CEILING SPACES. ELECTRICAL EQUIPMENT AND WIRING CAN BE EXPOSED IN MECHANICAL ROOMS, TELECOMMUNICATION ROOMS OR WHERE SPECIFICALLY NOTED. DO NOT ROUTE RACEWAYS ON THE EXTERIOR SURFACE OF THE BUILDING OR THE ROOF UNLESS SPECIFICALLY NOTED OTHERWISE.

PROVIDE ALL WIRING AND EQUIPMENT IN ELEVATOR PITS, WET OR EXTERIOR LOCATIONS USING EQUIPMENT AND WIRING METHODS RATED FOR WET ENVIRONMENTS.

BOXES: PROVIDE PULL AND JUNCTION BOXES AS REQUIRED PER NEC REQUIREMENTS RATED FOR THE ENVIRONMENT INSTALLED. BRANCH CIRCUIT JUNCTION BOXES TO BE ELECTRO-GALVANIZED, 4" SQUARE BY 1 1/2" DEEP MINIMUM FOR USE IN INTERIOR AREAS. PROVIDE 4 11/16" SQUARE BY 2 1/8" DEEP OUTLET BOXES FOR ALL VOICE AND DATA OUTLETS. DO NOT INSTALL BOXES BACK-TO-BACK IN WALLS. PROVIDE SEPARATION TO MINIMIZE SOUND TRANSFER. PROVIDE FIRE RATED PADS TO COVER EACH BOX IN FIRE RATED WALLS WHERE NECESSARY TO MAINTAIN FIRE WALL RATING.

26 24 16 - PANELBOARDS AND SWITCHBOARDS:

BRANCH CIRCUIT: PROVIDE AND INSTALL NEMA PB1; BOLT-ON CIRCUIT BREAKER TYPE. FS W-P-115; TYPE I, CLASS 1 PANELBOARD OF THE RATING AND CONFIGURATION AS SHOWN ON THE SINGLE LINE DIAGRAM AND PANEL SCHEDULES. PROVIDE TYPED CIRCUIT DIRECTORY SHOWING CIRCUITING ARRANGEMENT.

DISTRIBUTION: PROVIDE AND INSTALL I-LINE TYPE; CIRCUIT BREAKER TYPE. CLASS 1 PANELBOARD OR SWITCHBOARD OF THE RATING AND CONFIGURATION AS SHOWN ON THE SINGLE LINE DIAGRAM AND PANEL SCHEDULES.

COORDINATE AND PROVIDE THE EQUIPMENT WITH THE SHORT CIRCUIT CURRENT RATING (SCCR) FOR THE AVAILABLE FAULT CURRENT AT THE POINT OF THE SYSTEM WHERE INSTALLED.

26 27 13 - ELECTRICAL SERVICES:

THE ELECTRICAL CONTRACTOR SHALL CONTACT EACH SERVING UTILITY CO. AND VERIFY EXACT SERVICE REQUIREMENTS FOR POWER, TELEPHONE AND CABLE TV. THE CONTRACTOR SHALL COORDINATE AND PROVIDE ALL REQUIREMENTS OF EACH SERVING UTILITY AND ALL EQUIPMENT SHALL CONFORM TO THE SERVING UTILITY STANDARDS AND REQUIREMENTS.

26 27 26 - WIRING DEVICES:

DEVICE COLOR: WHITE. DEVICE PLATES: FINISHED AREAS-FLUSH SMOOTH WHITE NYLON WITH MATCHING SCREWS. UNFINISHED AREAS - RAISED GALVANIZED STEEL. EXTERIOR AREAS - DIE CAST METAL, POWDERCOAT FINISH, GASKETED, EXTRA DUTY RATED.

RECEPTACLES: PROVIDE 20AMP UL LISTED COMMERCIAL GRADE NEMA 5-20R DUPLEX GROUNDING BACK AND SIDE WIRED. PROVIDE DUPLEX RECEPTACLES WITH CLASS 3 INTEGRAL GROUND FAULT CURRENT INTERRUPTER (GFCI) AND SPECIFIC USE RECEPTACLES WHERE INDICATED ON THE DRAWINGS. THE GFCI SHALL BE INSTALLED IN A READILY ACCESSIBLE LOCATION OR PROVIDE GFCI BREAKER IN PANEL. INSTALL RECEPTACLES WITH GROUNDING POLE ON BOTTOM.

SWITCHES: PROVIDE 20 AMP, 120 V AC, BACK AND SIDE WIRED CONFIGURED AS INDICATED ON THE DRAWINGS. PROVIDE NEUTRAL IN ALL SWITCH BOXES FOR EACH SWITCHED CIRCUIT. DIMMING SWITCHES TO BE RATED AND CONFIGURED TO MATCH THE LOAD REQUIREMENTS.

26 51 00 - LUMINAIRES:

PROVIDE AND INSTALL ALL LIGHTING EQUIPMENT AS SHOWN ON THE DRAWINGS AND DESCRIBED IN THE LIGHTING FIXTURE SCHEDULE. PROVIDE FLUORESCENT FIXTURES WITH RAPID START, CLASS P, CONSTANT WATTAGE, ELECTRONIC BALLASTS. EXTERIOR FIXTURES SHALL BE RATED FOR OPERATION AT LEAST -20 DEG F. PROVIDE LED FIXTURES WITH LONG-LIFE LED'S, COUPLED WITH HIGH EFFICIENCY DRIVERS, L80 PERFORMANCE FOR 50,000 HOURS. DIMMING BALLASTS SHALL BE FLICKER-FREE, LOW INRUSH, 89% EFFICIENT AND LOW EMI. PROVIDE COMPATIBLE DIMMER SWITCH TO DIMMER DRIVER.

CONNECT ALL EMERGENCY LIGHTING UNITS AND MODULES TO THE LOCAL AREA LIGHTING CIRCUITS AHEAD OF ANY SWITCHES OR RELAYS. LOCATE REMOTE TEST SWITCHES AND INDICATOR LIGHTS AS NECESSARY FOR TEST SWITCHES ON EMERGENCY MODULES.

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SCALE:

BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

CONSTRUCTION RECORD
FIELD BOOK
STAKING
FOREMAN
AS-BUILT
INSPECTOR

PRELIMINARY NOT FOR CONSTRUCTION

CHEFORNAK PUMP HOUSE 2
ELECTRICAL LEGEND & GENERAL REQUIREMENTS
CHEFORNAK, ALASKA

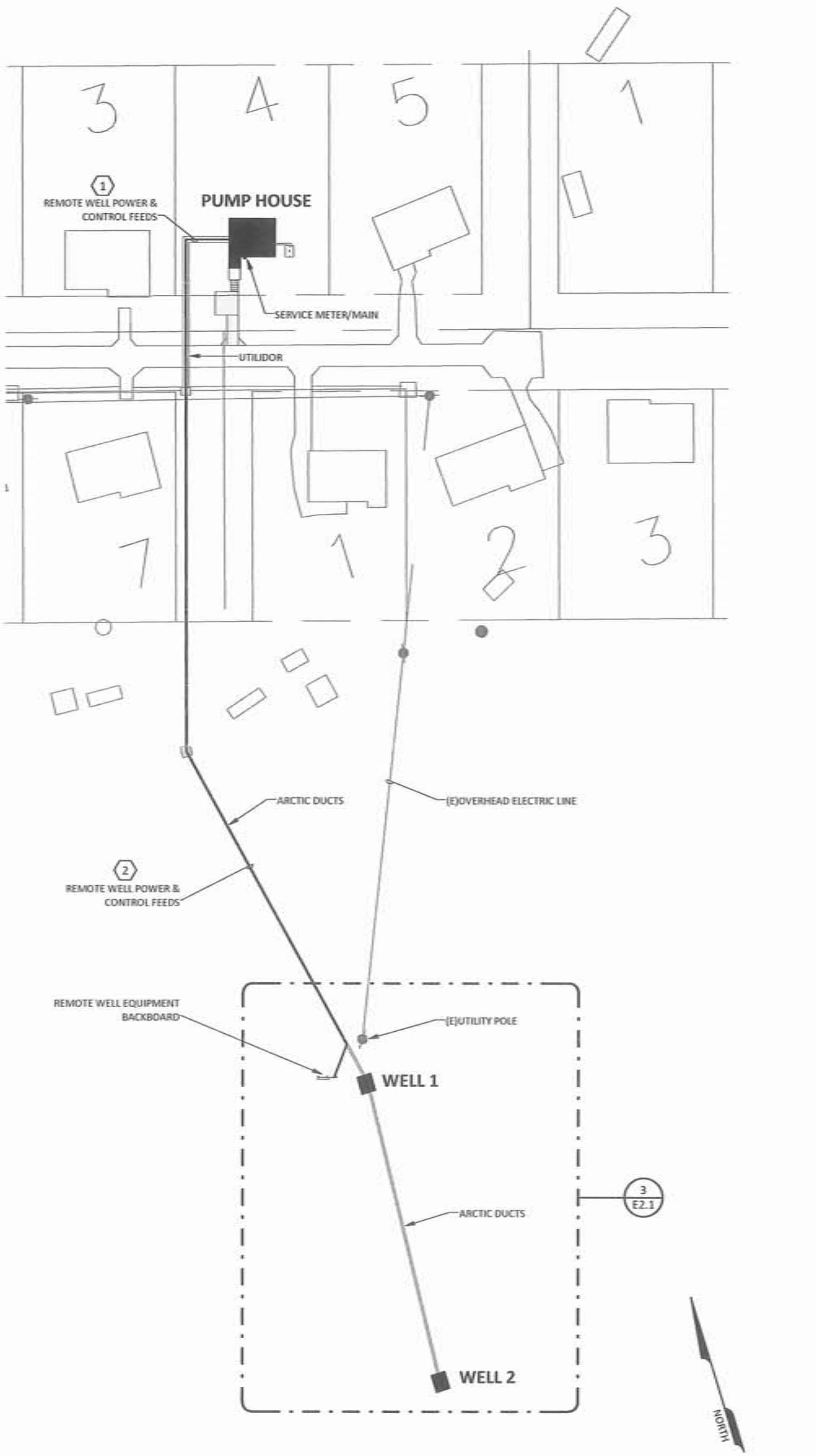
CE2 ENGINEERS, INC.

REVISION
NUM | DESCRIPTION

Project No.
Date FEB 2016
Designed BLS
Drawn BLS
Approved EDC

Sheet No.
E0.1

REFERENCED SHEET NOTES	#
1	ROUTE REMOTE WELL POWER & CONTROL CONDUITS WITHIN UTILIDOR. COORDINATE WITH CIVIL.
2	ROUTE REMOTE WELL POWER & CONTROL CONDUITS WITH WATER ARCTIC DUCTS. COORDINATE WITH CIVIL.



1 E1.1 ELECTRICAL SITE PLAN
SCALE: 1" = 40'-0"

0 40 80
SCALE IN FEET

EIC ENGINEERS, INC
ELECTRICAL ENGINEERS
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SCALE:

CONSTRUCTION RECORD
FIELD BOOK
STAKING
FOREMAN
AS-BUILT
INSPECTOR

PRELIMINARY NOT FOR CONSTRUCTION

CHEFORNAK PUMP HOUSE 2
ELECTRICAL SITE PLAN
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.

REVISION
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Approved EDC

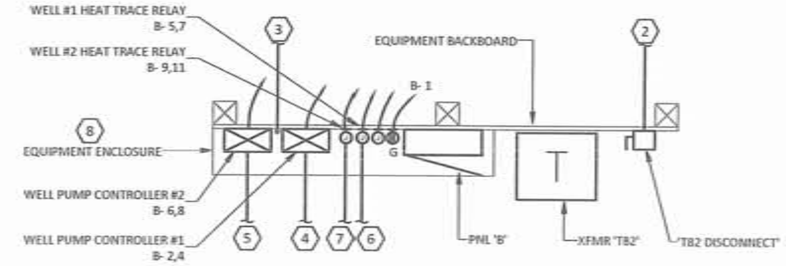
Sheet No.
E1.1

LUMINAIRE SCHEDULE								
NOTES								
(KEY)	'(x)' DENOTES A GENERAL, NON-REFERENCED, NOTE. NUMBERED NOTES ARE REFERENCED IN THE SCHEDULE.							
(A)	QUANTITIES/COUNTS SHOWN IN SCHEDULES ARE FOR CONVENIENCE ONLY. CONTRACTOR TO VERIFY ALL QUANTITIES/COUNTS FROM PLANS.							
(B)	CATALOG NUMBERS ARE FOR GENERAL REFERENCE AND ARE NOT INCLUSIVE OF ALL OPTIONS OR REQUIREMENTS DENOTED ON PLANS AND SPECIFICATIONS.							
(C)	REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATION AND PROVIDE MOUNTING HARDWARE/FLANGES ETC FOR ALL LUMINAIRES FOR CEILING TYPES SHOWN.							
(D)	LUMINAIRES NOTED ON THE FLOOR PLANS AS 'NL' (NIGHTLIGHT) SHALL BE CONNECTED TO UNSWITCHED POWER CIRCUIT NOTED ON DRAWINGS.							
1	NOT USED.							
SCHEDULE								
QTY	TYPE	DESCRIPTION	WATTS	LAMPS	MOUNTING	MANUFACTURER	MODEL	NOTES
7	LB4	1' X 4' LED WRAPAROUND W/ PRISMATIC DIFFUSER	41 W	4600 LM LED	CEILING SURFACE	LITHONIA	LBL4 40L EZ1 LP840	
1	ZW1	LED WALL PACK W/ CUTOFF OPTICS & INTEGRAL PHOTOCELL	20 W	1096 LM LED	WALL 8'	LITHONIA	OLW14	

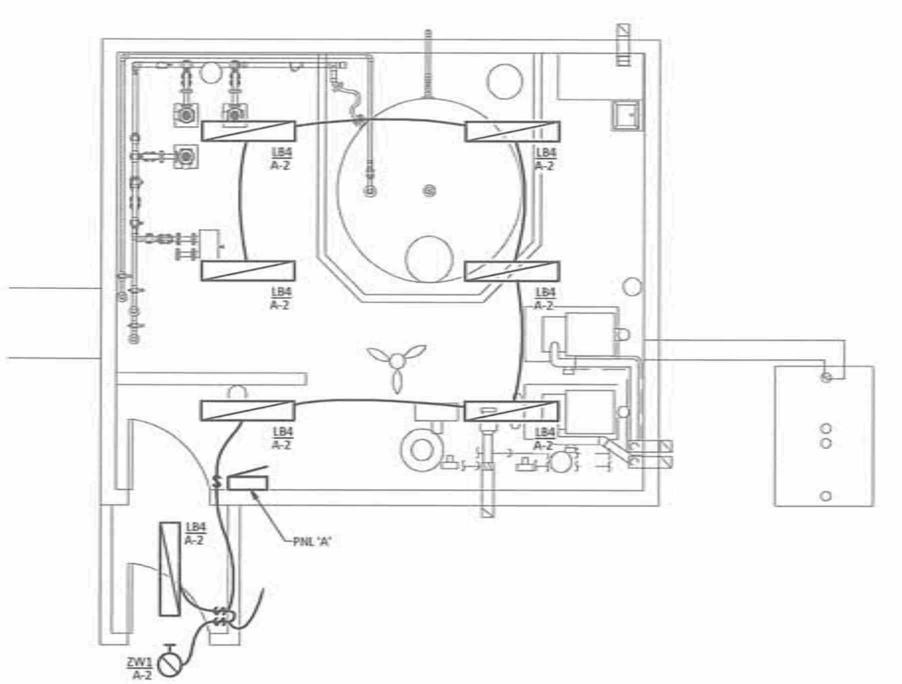
EQUIPMENT CONNECTION SCHEDULE											
NOTES											
(KEY)	'(x)' DENOTES A GENERAL, NON-REFERENCED, NOTE. NUMBERED NOTES ARE REFERENCED IN THE SCHEDULE.										
(A)	QUANTITIES/COUNTS SHOWN IN SCHEDULES ARE FOR CONVENIENCE ONLY. CONTRACTOR TO VERIFY ALL QUANTITIES/COUNTS FROM PLANS.										
(B)	REFER TO FLOOR PLAN DRAWINGS FOR EQUIPMENT TYPE REQUIREMENTS, LOCATIONS AND QUANTITIES.										
(C)	COORDINATE ALL CONNECTION REQUIREMENTS WITH ACTUAL EQUIPMENT SUPPLIED PRIOR TO ROUGH-IN.										
1	NOT USED.										
SCHEDULE											
QTY	EQUIP ID	LOCATION OR FUNCTION	KVA	HP	FLA	MCA	MFS	V	PH	FEEDER (MINIMUM) CU UON	NOTES
1	B-1	BOILER	0.600		5			120	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	B-2	BOILER	0.600		5			120	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	CF-1	CEILING FAN	0.200	FHP				120	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	CP-1	WATER LOOP CIRCULATION PUMP	1.656	3/4				240	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	PP-1	PRESSURE PUMP	2.400	1.5				240	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	PP-2	PRESSURE PUMP	2.400	1.5				240	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	SF-1	SUPPLY FAN	0.696	FHP				120	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	UH-1	UNIT HEATER	0.360	FHP				120	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	WP-1	WELL PUMP	1.920	1				240	1	0.5"C, (2)12 AWG, (1)12 AWG EGC	
1	WP-2	WELL PUMP	1.920	1				240	1	0.75"C, (2)10 AWG, (1)10 AWG EGC	

REFERENCED SHEET NOTES (#)

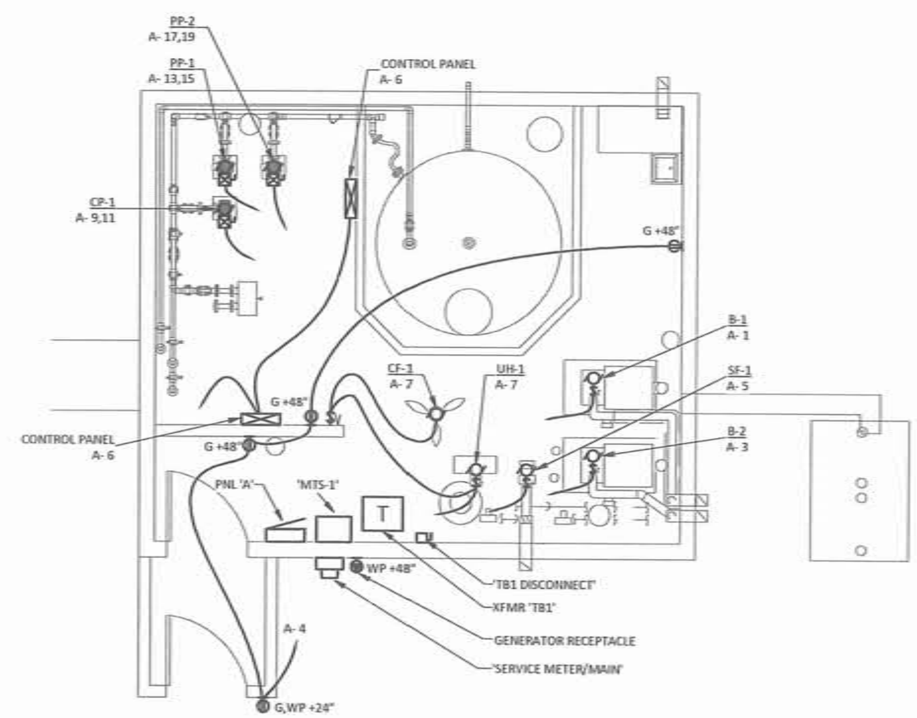
1	PROVIDE POWER CONNECTION TO WELL HEAT TRACE. COORDINATE WITH CIVIL.
2	PROVIDE 480V POWER FEED FROM PUMP HOUSE TO REMOTE WELL EQUIPMENT BACKBOARD. SEE POWER ONE-LINE DIAGRAM FOR DETAIL.
3	PROVIDE 1" CONDUIT FROM REMOTE WELL EQUIPMENT BACKBOARD ENCLOSURE TO PUMP HOUSE FOR ROUTING 24V DC CONTROL WIRING.
4	TO WELL #1 WELL PUMP.
5	TO WELL #2 WELL PUMP.
6	TO WELL #1 HEAT TRACE.
7	TO WELL #2 HEAT TRACE.
8	SEE 3/E3.2 FOR ENCLOSURE DETAIL.
9	ROUTE REMOTE WELL POWER & CONTROL CONDUITS WITH WATER ARCTIC DUCTS. COORDINATE WITH CIVIL.



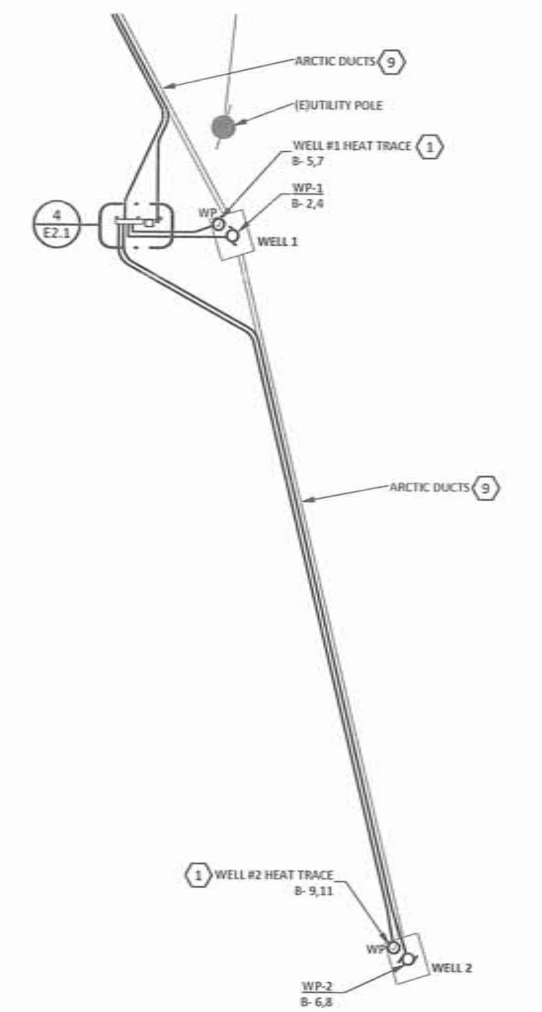
4 E2.1 REMOTE WELL EQUIPMENT BACKBOARD POWER PLAN
SCALE: 1/2" = 1'-0"



1 E2.1 PUMP HOUSE LIGHTING PLAN
SCALE: 1/4" = 1'-0"



2 E2.1 PUMP HOUSE POWER PLAN
SCALE: 1/4" = 1'-0"



3 E2.1 REMOTE WELL POWER PLAN
SCALE: 1" = 20'-0"

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SCALE:
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

CONSTRUCTION RECORD
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INSPECTOR

PRELIMINARY NOT FOR CONSTRUCTION

CHEFORNAK PUMP HOUSE 2
ELECTRICAL PLANS
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232946 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

REVISION	
NUM	DESCRIPTION

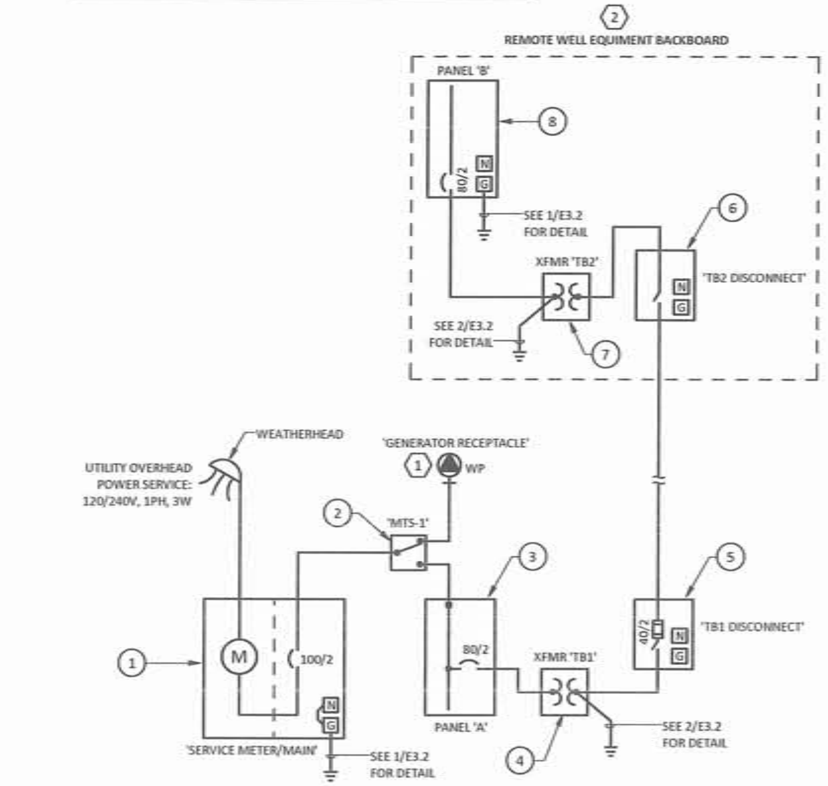
Project No.
Date FEB 2016
Designed BLS
Drawn BLS
Approved EDC

Sheet No.
E2.1

FEEDER SCHEDULE		
ID	AMPERAGE	FEEDER (MINIMUM) CU UON
SERVICE METER/MAIN	100	1.25"C, (3)2 AWG, (1)6 AWG BJ
MTS-1	100	1.25"C, (3)2 AWG, (1)6 AWG EGC
A	100	1.25"C, (3)2 AWG, (1)6 AWG EGC
GENERATOR RECEPTACLE	100	1.25"C, (3)2 AWG, (1)6 AWG EGC
TB1	80	1.25"C, (3)2 AWG, (1)6 AWG EGC
TB1 DISCONNECT	40	1"C, (3)8 AWG, (1)6 AWG BJ
TB2 DISCONNECT	40	1"C, (3)8 AWG, (1)10 AWG EGC
TB2	40	1"C, (3)8 AWG, (1)10 AWG EGC
B	80	1.25"C, (3)2 AWG, (1)6 AWG BJ

SERVICE DEMAND KW ESTIMATE			
TOTAL CONNECTED	POWER FACTOR	DIVERSITY FACTOR	ESTIMATED DEMAND KW
18.04 kVA	0.9	0.75	12.18

TRANSFORMER SCHEDULE						
			CONFIGURATION		LOCATION	
ID	KVA	%Z	PRIMARY	SECONDARY	NAME	NUM
TB1	15	4.88	240V	480V		
TB2	15	4.88	480V	240		



1 E3.1 POWER ONE-LINE DIAGRAM
SCALE: NONE

DETAIL EQUIPMENT

(1) **SERVICE METER/MAIN:**
SE RATED, NEMA 4, TEST/BYBASS SWITCH, 100A BUS, 100A MAIN CB, 240/120V, 1PH, 3W. CIRCLE AW OR EQUIVALENT.

(2) **MANUAL TRANSFER SWITCH 'MTS-1':**
NEMA 1, 100A, 240/120V, 1PH, 3W, 3-POLE (SWITCHED NEUTRAL). ASCO OR EQUIVALENT.

(3) **PANEL 'A':**
NEMA 1, 100A, 240/120V, 1PH, 3W, MAIN LUGS ONLY, 42 SPACE. SQUARE D OR EQUIVALENT.

(4) **TRANSFORMER 'TB1' (STEP-UP):**
NEMA 1, 15KVA, 240V 1PH PRIMARY, 240/480V 1PH SECONDARY, RATED FOR STEP-UP WIRING CONFIGURATION. SQUARE D OR EQUIVALENT.

(5) **TRANSFORMER 'TB1' DISCONNECT:**
NEMA 1, 60A, 480V, 2-POLE, FUSED. SQUARE D OR EQUIVALENT.

(6) **TRANSFORMER 'TB2' DISCONNECT:**
NEMA 4, 60A, 480V, 2-POLE. SQUARE D OR EQUIVALENT.

(7) **TRANSFORMER 'TB2' (STEP-DOWN):**
NEMA 1, 15KVA, 480V 1PH PRIMARY, 120/240V 1PH SECONDARY. SQUARE D OR EQUIVALENT.

(8) **PANEL 'B':**
NEMA 1, 100A, 240/120V, 1PH, 3W, 80A MAIN CB, 24 SPACE. SQUARE D OR EQUIVALENT.

REFERENCED DETAIL NOTES (#)

(1) CONTRACTOR TO FIELD VERIFY PORTABLE GENERATOR RECEPTACLE CONFIGURATION WITH OWNER.

(2) CONTRACTOR TO PROVIDE BACKBOARD AND HEATED EQUIPMENT ENCLOSURE AT REMOTE WELL LOCATION. SEE 4/E2.1 FOR BACKBOARD LOCATION AND LAYOUT. SEE 3/E3.2 FOR ENCLOSURE DETAIL.

EQUIPMENT SCCR SCHEDULE

ALL EQUIPMENT TO HAVE SCCR EXCEEDING THE AVAILABLE SCA AT THE CALCULATED X/R RATIO. WHERE X/R RATIO IS GREATER THAN THE INDUSTRY STANDARD TEST X/R RATIOS THE APPROPRIATE MULTIPLICATION FACTOR SHALL BE APPLIED TO PROPERLY RATE THE EQUIPMENT. DOWNSTREAM BRANCH CIRCUIT EQUIPMENT AND ASSOCIATED CIRCUIT BREAKER RATINGS MAY BE SATISFIED BY USING FULLY RATED EQUIPMENT OR MANUFACTURER TESTED COMBINATIONS PER NEC 240.86(B) TO SERIES RATE FOR THE AVAILABLE SCA AT EQUIPMENT. ALL SERIES RATED EQUIPMENT TO BE CLEARLY LABELED & IDENTIFIED PER NEC 110.22(C). SERIES RATED EQUIPMENT MOTOR LOADS CANNOT EXCEED 1% OF AIC RATING PER NEC 240.86(C).

CONTRACTOR TO VERIFY ACTUAL EQUIPMENT TO BE PROVIDED WITH SERVING UTILITY PRIOR TO EQUIPMENT PROCUREMENT. ANY DECREASE OF TRANSFORMER %Z, CONDUCTOR LENGTHS, OR INCREASE IN TRANSFORMER KVA OR CABLE SIZES TO BE REPORTED TO CONTRACT OFFICER FOR RECALCULATION OF AVAILBLE FAULT CURRENT PRIOR TO PROCUREMENT OF EQUIPMENT. PROVIDE WARNING PLACARD INSTALLED ON SERVICE DISCONNECT PER NEC 110.24 DENOTING ALL PROJECT PARAMETERS REQUIRED BY NEC.

ASSUMED UTILITY SYSTEM CONFIGURATION (BASIS FOR CALCULATION)

SERVICE TRANSFORMER				
KVA	%Z	X/R	SCA (PRI.)	SCA (SEC.)
50	1.20	2.50	1,000,000	17,356

SERVICE AMPS	- FOR FAULT CURRENT CALCULATION ONLY - SERVICE LATERAL	FT
100	1.25"C, (3)2 AWG, (1)6 AWG BJ	17

EQUIPMENT ID	SCAmps	X/R
SERVICE METER/MAIN	13,895	1.30
MTS-1	13,757	1.28
A	12,594	1.11
TB1 DISCONNECT	580	1.01
TB2 DISCONNECT	371	0.55
B	472	0.69

PANEL "A" SCHEDULE

VOLTAGE: 240/120V, 1PH, 3W
OPD RATING: 100 A
MAIN: MLO
LOCATION: PUMP HOUSE
ENCLOSURE: NEMA 1
MOUNTING: SURFACE

CKT	LOAD DESCRIPTION	AMP	P	A		B		P	AMP	LOAD DESCRIPTION	CKT
1	MTR: B-1	20	1	0.60	0.34			1	20	LTG: EXTERIOR,PUMP HOUSE	2
3	MTR: B-2	20	1			0.60	0.72	1	20	REC: EXTERIOR,PUMP HOUSE	4
5	MTR: SF-1	20	1	0.70	1.00			1	20	NCNT: CONTROL PANELs	6
7	MTR: CF-1,UH-1	20	1			0.56	0.00	1	20	SPARE	8
9	MTR: CP-1	15	2	0.83	0.00			1	20	SPARE	10
11	–	–	–			0.83	0.00	1	20	SPARE	12
13	MTR: PP-1	20	2	1.20	0.00			1	20	SPARE	14
15	–	–	–			1.20	0.00	1	20	SPARE	16
17	MTR: PP-2	20	2	1.20	0.00			1	20	SPARE	18
19	–	–	–			1.20	0.00	1	20	SPARE	20
21	PNL 'TB1 DISCONNECT' VIA XFMR...	80	2	3.13	0.00			1	20	SPARE	22
23	–	–	–			3.95	0.00	1	20	SPARE	24
25	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	26
27	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	28
29	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	30
31	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	32
33	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	34
35	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	36
37	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	38
39	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	40
41	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	42

	A	B
TOTAL KVA/PHASE:	9.0	9.1
TOTAL AMPS/PHASE:	74.9	75.4
PHASE BALANCE %: A-B	1	

SUMMARY BY LOAD TYPE

LOAD CLASSIFICATION	CONNECTED	NEC FACTORS	TOTAL NEC
MTR	12.752 kVA	104.71%	13.352 kVA
REC	0.900 kVA	100.00%	0.900 kVA
LTG	0.340 kVA	125.00%	0.425 kVA
CONT	3.050 kVA	125.00%	3.813 kVA
NCNT	1.000 kVA	100.00%	1.000 kVA

PANEL TOTALS

CONNECTED KVA:	18.042 kVA
NEC CALCULATED KVA:	19.490 kVA
CONNECTED AMPS:	75 A
NEC CALCULATED AMPS:	81 A

PANEL "B" SCHEDULE

VOLTAGE: 240/120V, 1PH, 3W
OPD RATING: 80 A
MAIN: MLO
LOCATION:
ENCLOSURE: NEMA 1
MOUNTING: SURFACE

CKT	LOAD DESCRIPTION	AMP	P	A		B		P	AMP	LOAD DESCRIPTION	CKT
1	REC: ENCLOSURE	20	1	0.18	0.96			2	20	MTR: WELL #1 WP-1	2
3	CONT: ENCLOSURE HEATER	20	1			1.00	0.96	–	–	–	4
5	CONT: WELL #1 HEAT TRACE [1]	20	2	0.51	0.96			2	20	MTR: WELL #2 WP-2	6
7	–	–	–			0.51	0.96	–	–	–	8
9	CONT: WELL #2 HEAT TRACE [1]	20	2	0.51	0.00			1	20	SPARE	10
11	–	–	–			0.51	0.00	1	20	SPARE	12
13	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	14
15	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	16
17	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	18
19	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	20
21	- SPACE -	–	–	0.00	0.00			–	–	- SPACE -	22
23	- SPACE -	–	–			0.00	0.00	–	–	- SPACE -	24

	A	B
TOTAL KVA/PHASE:	3.1	3.9
TOTAL AMPS/PHASE:	26.0	32.9
PHASE BALANCE %: A-B	23	

SUMMARY BY LOAD TYPE

LOAD CLASSIFICATION	CONNECTED	NEC FACTORS	TOTAL NEC
MTR	3.840 kVA	112.50%	4.320 kVA
REC	0.180 kVA	100.00%	0.180 kVA
CONT	3.050 kVA	125.00%	3.813 kVA

PANEL TOTALS

CONNECTED KVA:	7.070 kVA
NEC CALCULATED KVA:	8.313 kVA
CONNECTED AMPS:	29 A
NEC CALCULATED AMPS:	35 A

LOAD CLASSIFICATIONS SCHEDULE

NOTES

(KEY)	'(x)' DENOTES A GENERAL, NON-REFERENCED, NOTE. NUMBERED NOTES ARE REFERENCED IN THE SCHEDULE.
(A)	NOT ALL LOAD CLASSIFICATIONS ARE NECESSARILY USED. ONLY CLASSIFICATIONS FROM LOADS THAT ARE CONNECTED TO EACH PANEL ARE SHOWN IN THE SUMMARY SECTION OF THE PANEL SCHEDULES.
(B)	PANELBOARD BUS RATINGS TO EQUAL OR EXCEED OPD RATINGS SHOWN IN PANEL SCHEDULES UNLESS OTHERWISE NOTED.
1	THE NEC DEMAND PERCENTAGE IS SHOWN AS A WEIGHTED AVERAGE. FOR EXAMPLE 125% OF 100VA PLUS 100% OF 100VA WILL SHOW THE WEIGHTED AVERAGE PERCENTAGE OF 112.5% RESULTING IN 225VA.

SCHEDULE

CLASS.	NEC REFERENCE	DESCRIPTION
CONT	NEC 2014: 210.20(A)	125% OF THE CONTINUOUS LOAD
LTG	NEC 2014: 210.20(A)	LIGHTING LOADS CONSIDERED TO BE CONTINUOUS. 125% OF THE CONTINOUS LOAD.
MTR	NEC 2014: 430.24	125% OF THE FULL-LOAD CURRENT RATING OF THE HIGHTEST RATED MOTOR PLUS THE SUM OF THE FULL-LOAD CURRENT RATINGS OF ALL OTHER MOTORS. (SEE NOTE 1)
NCDN	NEC 2014: 220.60	NONCOINCIDENT LOADS: WHERE IT IS UNLIKELY THAT TWO OR MORE NONCOINCIDENT LOADS WILL BE IN USE SIMULTANEOUSLY, THE LARGEST LOAD WILL BE USED. LOADS CLASSIFIED AS NCDN WILL HAVE ZERO LOAD.
NCNT	NEC 2014: 210.20(A)	100% OF THE NON-CONTINUOUS LOAD
REC	NEC 2014: 220.44	NON-DWELLING RECEPTACLE LOADS = FIRST 10KVA OR LESS AT 100% PLUS REMAINDER OVER 10KVA AT 50%. (SEE NOTE 1)
MCA	(SEE MTR)	THE LOAD IS BASED ON THE GIVEN MCA (MINIMUM CIRCUIT AMPACITY) WHICH INCLUDES 125% OF THE LARGEST MOTOR OF THE UNIT. 100% OF THE MCA LOAD.

PANEL SCHEDULE NOTES

REF	NOTE
'KEY'	'(x)' DENOTES A GENERAL, NON-REFERENCED, NOTE. NUMBERED NOTES ARE REFERENCED FROM THE PANEL SCHEDULES DENOTED BY '[#]'. (NOT ALL NUMBERED NOTES ARE REFERENCED.)
(A)	REFER TO EQUIPMENT SCCR SCHEDULE FOR PANEL SHORT CIRCUIT RATINGS.
[1]	PROVIDE 30mA GFPE CIRCUIT BREAKER.
[2]	PROVIDE RED BREAKER IDENTIFICATION WITH OEM DEVICE THAT CAN BE LOCKED IN THE "ON" POSITION FOR FIRE ALARM CIRCUITS.
[3]	PROVIDE OEM DEVICE THAT CAN BE LOCKED IN THE "OFF" POSITION FOR USE AS DISCONNECT PER NEC.
[4]	PROVIDE SHUNT TRIP CIRCUIT BREAKER CONTROLLED BY FIRE SUPRESSION SYSTEM.

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CHEFORNAK PUMP HOUSE 2
ELECTRICAL DIAGRAMS & DETAILS
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
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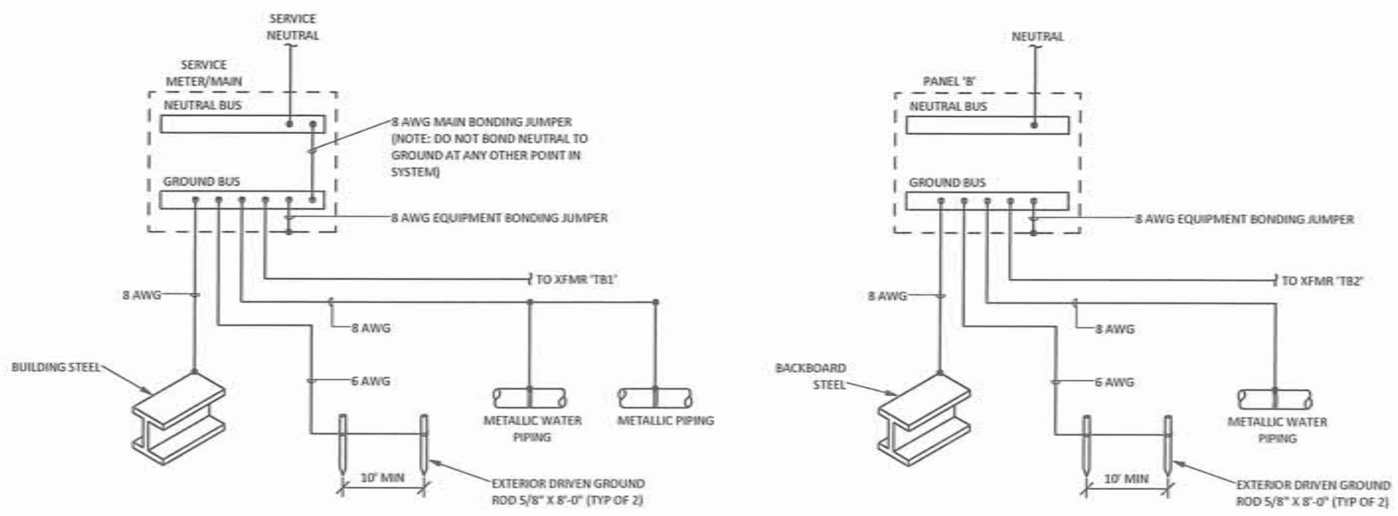
REVISION
NUM | DESCRIPTION

Project No.
Date FEB 2016
Designed BLS
Drawn BLS
Approved EDC

Sheet No.
E3.1

DETAIL NOTES

1. BOND ALL PIPING AND BUILDING DISCONTINUITIES TO PROVIDE ELECTRICALLY CONTINUOUS SYSTEM.PROVIDE BOND JUMPER EQUAL TO GROUNDING ELECTRODE CONDUCTOR FOR THAT SYSTEM.
2. PROVIDE RACEWAY FOR ALL CONDUCTORS. RACEWAY TO BE METALLIC IN PLENUM AIR SPACES. WHERE METALLIC RACEWAY IS USED, BOND EACH END TO THE CONDUCTOR.

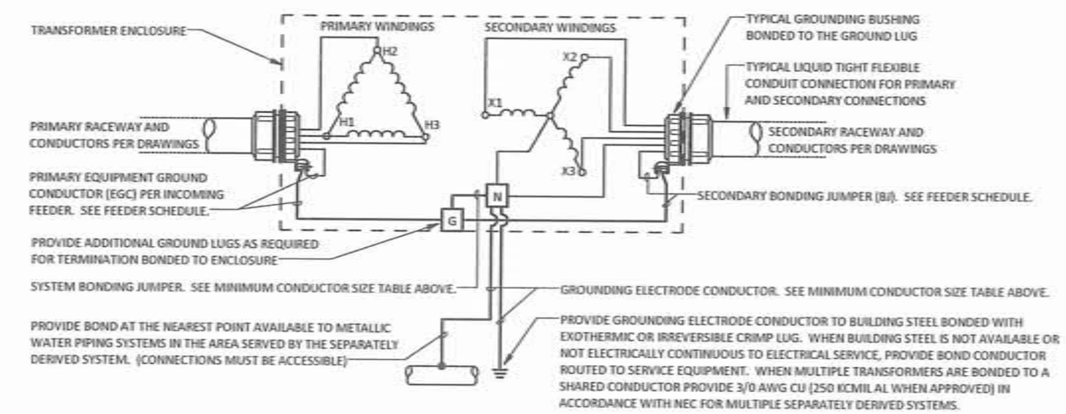


(1/E3.2) GROUNDING SYSTEM DIAGRAM
SCALE: NONE

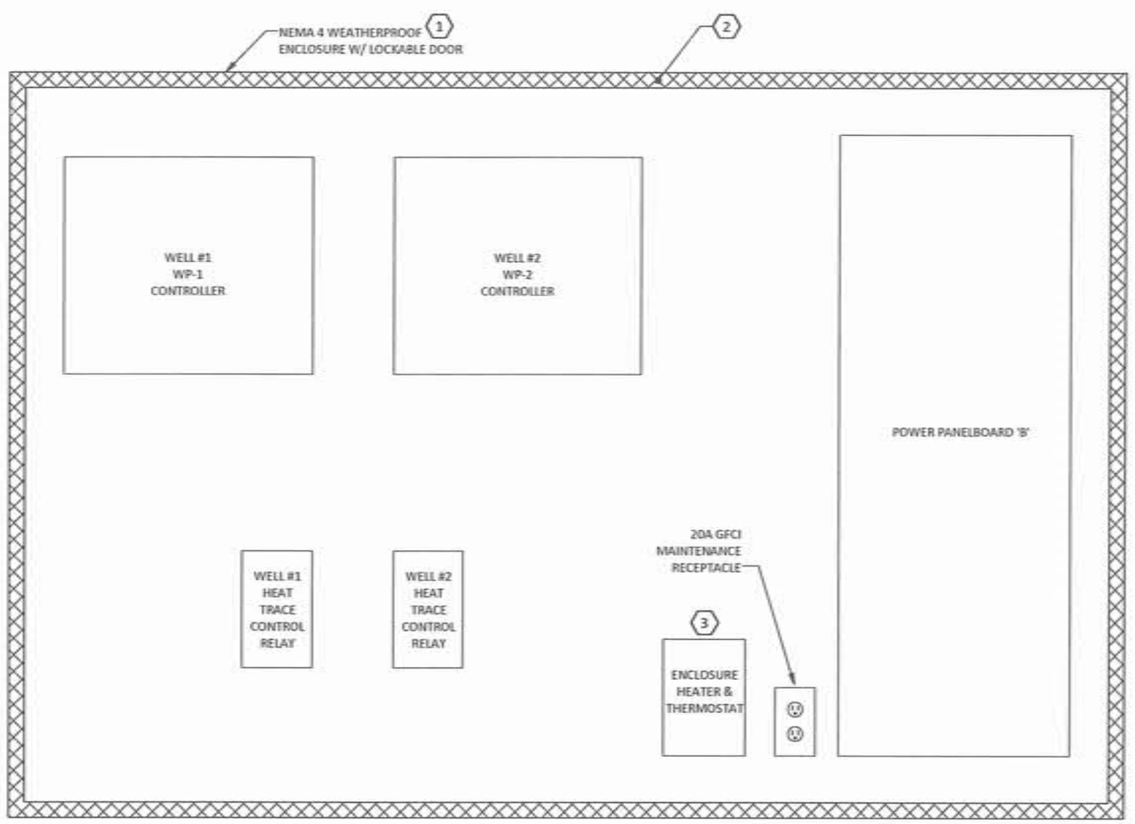
REQUIRED MINIMUM CONDUCTOR SIZE COPPER CONDUCTORS	
XFMR SECONDARY	JUMPER OR ELECTRODE
1/0 AWG OR SMALLER	6 AWG
2/0 AWG - 3/0 AWG	4 AWG
> 3/0 AWG - 350 KCMIL	2 AWG
> 350 KCMIL - 600 KCMIL	1/0 AWG
> 600 KCMIL - 1100 KCMIL	2/0 AWG
> 1100 KCMIL	12.5% * XFMR SECONDARY

"XFMR SECONDARY" DENOTES THE AREA OF THE LARGEST UNGROUNDED SECONDARY CONDUCTOR OR EQUIVALENT AREA FOR PARALLEL SECONDARY CONDUCTORS.
">" DENOTES GREATER THAN.

REQUIRED MINIMUM CONDUCTOR SIZE ALUMINUM OR COPPER-CLAD CONDUCTORS	
XFMR SECONDARY	JUMPER OR ELECTRODE
3/0 AWG OR SMALLER	4 AWG
> 3/0 AWG - 250 KCMIL	2 AWG
> 250 KCMIL - 500 KCMIL	1/0 AWG
> 500 KCMIL - 900 KCMIL	3/0 AWG
> 900 KCMIL - 1750 KCMIL	4/0 AWG
> 1750 KCMIL	12.5% * XFMR SECONDARY



(2/E3.2) TYPICAL TRANSFORMER GROUNDING DIAGRAM
SCALE: NONE



REFERENCED DETAIL NOTES (#)

1. PROVIDE INSULATED AND HEATED WEATHERPROOF ENCLOSURE. CONTRACTOR TO SIZE ENCLOSURE AS NECESSARY PER ACTUAL EQUIPMENT DIMENSIONS.
2. 1" BLUE BOARD INSULATION (FRONT, TOP, SIDES, BOTTOM).
3. PROVIDE 120V ELECTRIC HEATER WITH INTEGRAL THERMOSTAT. SIZE AS REQUIRED.

(3/E3.2) EQUIPMENT ENCLOSURE DETAIL
SCALE: NONE

2/1/2016 9:18:35 AM P:\E14\E14-2149 Chefornak Pump House\050 DWG\E14-2149B_CHEFORNAK_PUMPHOUSE_2_16.rvt

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www.eiceng.com

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CHEFORNAK PUMP HOUSE 2
ELECTRICAL DIAGRAMS & DETAILS
CHEFORNAK, ALASKA

CE2 ENGINEERS, INC.
PO BOX 232949 ANCHORAGE, AK 99523 PH: 907-349-1010 FAX: 907-349-1015

NUM	REVISION DESCRIPTION

Project No.	
Date	FEB 2016
Designed	BLS
Drawn	BLS
Approved	EDC

Sheet No. E3.2

Appendix B

Trustee Deed for Pump House 2 lot, owned by the City of Chefornak

(to be inserted after recording is completed)

Appendix C

Well Information:

Well Field Drilling Logs for Wells W02-2 and W02-3

Well Water Quality Data from CT&E Environmental Services *(September 2002)*

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND & WATER
WATER WELL LOG

Drilling Started: 08 / 16 / 2002, Completed: 08 / 27 / 2002

City/Borough:	Subdivision:	BLOCK	LOT	Property Owner Name & Address:
Chefornak	Old Chefornak Airport	I	A	City of Chefornak, P.O. Box 29, Chefornak, AK 99561

Meridian Seward Township 1 N Range 86 W Section 30 , ____ 1/4 of ____ 1/4 of NE 1/4 of NW 1/4

BOREHOLE DATA: (from ground surface) **Depth**

Material: Type, Color & wetness	From	To
Clay (frozen)	0	17'
Lava Rock	17'	20'
Frozen Gray Clay	20'	30'
Lava Rock	30'	57'
Frozen Black Clay	57'	130'
Frozen Gray Silt	130'	235'
Heaving Fine Sand	235'	237'
Fine Sand (Some Water)	237'	277' 8"

Drilling method: ☐ Air rotary, ☒ Cable tool ☐ Other _____

Well use: ☒ Public supply, ☐ Domestic, ☐ Other _____

Depth of hole: 277' 8" ft, Casing stickup: 3' ft

Casing type: Steel Thickness _____ inches

Casing diameter: 6 inches Casing depth 252' 3" ft

Liner type: NONE Diameter: ____inches Depth:____ ft

Note: .....

Static water (from top of casing): 25" ft on 08 / 27 / 2002

Pumping level & yield: 42' 8" feet after 24 hours at 57 gpm

Recovery rate: _____ gpm, Method of testing:_____

Development method: surge & bail Duration: 12 hours

Well intake opening type: ☐ Open end ☐ Open hole , Other ☐

☒ Screened; Start: 252' 3" ft, Stopped 277' 3" ft

Screen type: 10 slot Slot/mesh size 0.010

☐ Perforated; Start:_____ ft, Stopped _____ ft

Start: _____ ft, Stopped _____ ft

Gravel packed ☐ Yes ☒ No From _____ ft to _____ ft

Note: 5-5' lengths of 0.010 screen with packer

Grout type: Bentonite Volume 200 pounds

Depth; from 10 ft, to 20 ft

Pump intake depth: _____ ft

Pump size _____ hp Brand name _____

Was well disinfected upon completion? ☒ Yes ☐ No

Method of disinfection: Sodium Hypochlorite Solution

Driller comments/ disclaimers:.....

.....

Well No. 02-3 Chefornak

Well driller name: Roy Longbotham, Jr.

Company name: R & L Drilling & Leasing

Mailing address: 18957 Avenue 318

City: Visalia State: CA Zip 93292

Phone number : (_____) _____- _____

Drillers signature:

Date: _____/_____/_____

Alaska state law requires that a copy of this well log be forwarded to the Department of Natural Resources within 45 days (AK statutes 38.05.020, 38.05.035, 41.08.020, 46.15.020 and AK regulations 11 AAC 93.140). Faxes are acceptable.

Alaska DNR, Division of Mining, Land and Water,
550 W 7th Avenue, Suite 1020
Anchorage, AK 99501-3562

Phone (907)269-8639 and fax (907)269-8947

If the well is within city limits, the City of Anchorage requires that a copy of this well log be forwarded to the city within 60 days and another copy of this log be forwarded to the owner of the property, on which the well is located, within 30 days.

City Permit Number: _____

Date of Issue: _____/____/_____

Parcel Identification Number: _____-_____-_____

Is well located at approved permit location? Yes ☐ or No ☐

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND & WATER
WATER WELL LOG

Drilling Started: 07 / 25 / 2002, Completed: 08 / 15 / 2002

City/Borough:	Subdivision:	BLOCK	LOT	Property Owner Name & Address:
Chefornak	Old Chefornak Airport	I	A	City of Chefornak, P.O. Box 29, Chefornak, AK 99561

Meridian Seward Township 1 N Range 86 W Section 30 , ____ 1/4 of ____ 1/4 of NE 1/4 of NW 1/4

BOREHOLE DATA: (from ground surface) **Depth**

Material: Type, Color & wetness	From	To
Tundra (Frozen)	0	11'
Brown Clay	11'	16'
Lava Rock	16'	55'
Black Clay (Frozen)	55'	100'
Silt w/Wood Chips and Ice	100'	135'
Silt Dark Hard Packed	135'	175'
Fine Sand (Frozen)	175'	245'
Fine Sand (Not Frozen)	245'	255' 6"
Fine Sand (Water)	255' 6"	272'
Fine Sand (No Water)	272'	276' 6"
Blue Gray Pack Sand	276' 6"	302'

Drilling method: ☐ Air rotary, ☒ Cable tool ☐ Other _____

Well use: ☒ Public supply, ☐ Domestic, ☐ Other _____

Depth of hole: 276' 8" ft, Casing stickup: 3' ft

Casing type: Steel Thickness 0.322 inches

Casing diameter: 8 inches Casing depth 255' 6" ft

Liner type: NONE Diameter: ____ inches Depth: ____ ft

Note: .....

Static water (from top of casing): 19' ft on 08 / 14 / 2002

Pumping level & yield: 34' feet after 48 hours at 68 gpm

Recovery rate: _____ gpm, Method of testing: _____

Development method: surge & bail Duration: 18 hours

Well intake opening type: ☐ Open end ☐ Open hole , Other ☐

☒ Screened; Start: 255' 6" ft, Stopped 275' 3" ft

Screen type: 10 slot Slot/mesh size 0.010

☐ Perforated; Start: _____ ft, Stopped _____ ft

Start: _____ ft, Stopped _____ ft

Gravel packed ☐ Yes ☒ No From _____ ft to _____ ft

Note: 4-5' lengths of 0.010 screen with packer

Grout type: Bentonite Volume 200 pounds

Depth; from 10 ft, to 20 ft

Pump intake depth: _____ ft

Pump size _____ hp Brand name _____

Was well disinfected upon completion? ☒ Yes ☐ No

Method of disinfection: Sodium Hypochlorite Solution

Driller comments/ disclaimers: .....

Well No. 02-2 Chefornak

Well driller name: Roy Longbotham, Jr.

Company name: R & L Drilling & Leasing

Mailing address: 18957 Avenue 318

City: Visalia State: CA Zip 93292

Phone number : (_____) _____- _____

Drillers signature:

Date: _____/_____/_____

Alaska state law requires that a copy of this well log be forwarded to the Department of Natural Resources within 45 days (AK statutes 38.05.020, 38.05.035, 41.08.020, 46.15.020 and AK regulations 11 AAC 93.140). Faxes are acceptable.

Alaska DNR, Division of Mining, Land and Water,
550 W 7th Avenue, Suite 1020
Anchorage, AK 99501-3562

Phone (907)269-8639 and fax (907)269-8947

If the well is within city limits, the City of Anchorage requires that a copy of this well log be forwarded to the city within 60 days and another copy of this log be forwarded to the owner of the property, on which the well is located, within 30 days.

City Permit Number: _____

Date of Issue: _____/_____/_____

Parcel Identification Number: _____-_____-_____

Is well located at approved permit location? Yes ☐ or No ☐

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658001
Client Name	Chuck Eggener Consulting Engr.
Project Name/#	Chefornak Water & Sewer Proj
Client Sample ID	CYF-W-02-2
Matrix	Drinking Water
Ordered By	

All Dates/Times are Alaska Standard Time

Printed Date/Time	09/17/2002 15:21
Collected Date/Time	09/02/2002 8:30
Received Date/Time	09/03/2002 8:52
Technical Director	Stephen C. Ede
Released By	Rhonda Strucker

Sample Remarks:

VOCs by EPA 524.2 were analyzed by CTE ESI of Ludington, MI.
EPA 200.7 ICP Metals - MS/MSD recoveries for Na was outside of acceptance criteria; post digestion spike was successful.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Magnesium	1.06	0.100	mg/L	EPA 200.7		09/06/02	09/07/02	MTG
% Difference	2.0		%	SM20 1030E			09/13/02	KAW
Total Organic Carbon,Dissolved	5.82	0.500	mg/L	EPA 415.1			09/09/02	JDT
Calcium	0.556	0.100	mg/L	EPA 200.7		09/06/02	09/07/02	MTG
Waters Department								
Alkalinity	270	10.0	mg/L	SM20 2320B			09/04/02	AS
CO3 Alkalinity	20.0		mg/L	SM20 2320B			09/04/02	AS
HCO3 Alkalinity	250		mg/L	SM20 2320B			09/04/02	AS
OH Alkalinity	0.00		mg/L	SM20 2320B			09/04/02	AS
Resistivity	16.7	1.00	ohm-m	SM19 2510A			09/04/02	AS
Foaming Agents (MBAS)	0.500 U	0.500	mg/L	SM20 5540C	(<=0.5)		09/03/02	KLP
Total Organic Carbon	5.38	0.500	mg/L	EPA 415.1			09/09/02	JDT
Microbiology Laboratory								
Total Coliform	7 OB, No Coli		col/100mL	SM18 9222B	(<=1)		09/03/02	KAP
Inorganic Contaminants								
Antimony	1.00 U	1.00	ug/L	EPA 200.8	(<=6)	09/06/02	09/10/02	KGF
Arsenic	2.00 U	2.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Barium	9.84	3.00	ug/L	EPA 200.8	(<=2000)	09/06/02	09/10/02	KGF
Beryllium	0.400 U	0.400	ug/L	EPA 200.8	(<=4)	09/06/02	09/10/02	KGF
Cadmium	0.100 U	0.100	ug/L	EPA 200.8	(<=5)	09/06/02	09/10/02	KGF
Chromium	4.00 U	4.00	ug/L	EPA 200.8	(<=100)	09/06/02	09/10/02	KGF
Cyanide	0.0050 U	0.0050	mg/L	SM20 4500CN-C,E	(<=0.2)	09/06/02	09/07/02	PLW
Fluoride	0.200 U	0.200	mg/L	EPA 300.0	(<=2)		09/03/02	JDT
Mercury by Cold Vapor	0.000200 U	0.000200	mg/L	EPA 245.1	(<=0.2)	09/09/02	09/10/02	JJB
Nickel	5.00 U	5.00	ug/L	EPA 200.8	(<=100)	09/06/02	09/10/02	KGF
Nitrate-N	0.208	0.200	mg/L	EPA 300.0	(<=10)		09/03/02	JDT

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658001	**All Dates/Times are Alaska Standard Time**	
Client Name	Chuck Eggener Consulting Engr.	**Printed Date/Time**	09/17/2002 15:21
Project Name/#	Chefornak Water & Sewer Proj	**Collected Date/Time**	09/02/2002 8:30
Client Sample ID	CYF-W-02-2	**Received Date/Time**	09/03/2002 8:52
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results		PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants									
Nitrite-N	0.200 U		0.200	mg/L	EPA 300.0	(<=1)		09/03/02	JDT
Selenium	2.00 U		2.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Thallium	0.300 U		0.300	ug/L	EPA 200.8	(<=2)	09/06/02	09/10/02	KGF
Secondary Contaminants									
Chloride	18.8		0.200	mg/L	EPA 300.0	(<=250)		09/03/02	JDT
Color	80.0	*	5.00	PCU	SM20 2120B	(<=15)		09/03/02	AS
Copper	1.39		1.00	ug/L	EPA 200.8	(<=1000)	09/06/02	09/10/02	KGF
Fluoride	0.200 U		0.200	mg/L	EPA 300.0	(<=2)		09/03/02	JDT
Iron	0.134		0.0200	mg/L	EPA 200.7	(<=0.3)	09/06/02	09/07/02	MTG
Langlier Index @ 140 degree F	0.75				SM14 203			09/13/02	KAW
Langlier Index @ 40 degree F	-0.33				SM14 203			09/13/02	KAW
Manganese	12.6		5.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Odor (TON)	1.00 U		1.00	T.O.N.	SM 2150B	(<=3)		09/03/02	AS
pH	8.80	*	0.100	pH units	EPA 150.1	(6.5-8.5)		09/03/02	AS
Sodium	123		100	mg/L	EPA 200.7	(<=250)	09/06/02	09/07/02	MTG
Sulfate	0.200 U		0.200	mg/L	EPA 300.0	(<=250)		09/03/02	JDT
Total Dissolved Solids	390	*	200	mg/L	SM20 2540C	(<=250)		09/05/02	AS
Zinc	2.33		2.00	ug/L	EPA 200.8	(<=5000)	09/06/02	09/10/02	KGF

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658003
Client Name	Chuck Eggener Consulting Engr.
Project Name/#	Chefornak Water & Sewer Proj
Client Sample ID	CYF-W-02-2
Matrix	Drinking Water
Ordered By	
PWSID	0

All Dates/Times are Alaska Standard Time

Printed Date/Time	09/17/2002 15:21
Collected Date/Time	09/02/2002 8:30
Received Date/Time	09/03/2002 8:52
Technical Director	Stephen C. Ede
Released By	Rhonda Strucker

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department								
Hardness as CaCO3	10.0 U	10.0	mg/L	SM17 2340C		09/03/02	09/11/02	KGF
Metals by ICP/MS								
Barium	8.69	3.00	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Iron	250 U	250	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Potassium	4920	500	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Sodium	126000	500	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Silicon	12800	1000	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF

Appendix C

CT&E Environmental Services Inc.

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301
Web: http://www.cteesi.com

Paul Weisner
CE2 Engineers, Inc.

Work Order:	3024009
	Chefornak W&S (1025658)
Client:	CE2 Engineers, Inc.
Report Date:	September 10, 2002

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintaned by CT&E. A copy of our Quality Control Manual that outlines this program is available at your request.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth in our Quality Assurance Program Plan.

If you have any questions regarding this report or if we can be of any other assistance, please call your CT&E Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

U	Indicates the analyte was analyzed for but not detected.
J	Indicates an estimated value that falls below PQL, but is greater than the MDL.
B	Indicates the analyte is found in the blank associated with the sample.
*	The analyte has exceeded allowable limits.
GT	Greater Than
D	Secondary Dilution
LT	Less Than
!	Surrogate out of range

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	3024009001	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 8:30
Client Sample ID	CYF-W-02-2	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By		**Released By**	Denise Heckler

Sample Remarks:
Sample analyzed at the Ludington, Michigan laboratory of CT&E Environmental Services Inc.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
1,1,1,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,1-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.2)		09/07/02	JDS
1,1,2,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,2-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,1-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,4-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.07)		09/07/02	JDS
1,2,4-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromo-3-chloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromoethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.6)		09/07/02	JDS
1,2-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,3,5-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,4-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.075)		09/07/02	JDS
2,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
2-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Isopropyltoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Allyl chloride	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Benzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Bromobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromochloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromodichloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromoform	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromomethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	3024009001	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 8:30
Client Sample ID	CYF-W-02-2	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
Carbon disulfide	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Carbon tetrachloride	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Chlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
Chloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Chloroform	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Chloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
cis-1,2-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.07)		09/07/02	JDS
cis-1,3-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dibromochloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dibromomethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dichlorodifluoromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Diisopropyl ether	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Ethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.7)		09/07/02	JDS
Hexachlorobutadiene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Isopropylbenzene (Cumene)	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Methyl Tertiary Butyl Ether	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Methylene chloride	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
n-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
n-Propylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Naphthalene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
o-Xylene	0.00050 U	0.00050	mg/L	EPA 524.2	(<10)		09/07/02	JDS
P & M -Xylene	0.0010 U	0.0010	mg/L	EPA 524.2	(<10)		09/07/02	JDS
sec-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Styrene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
tert-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Tetrachloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Tetrahydrofuran	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Toluene	0.00050 U	0.00050	mg/L	EPA 524.2	(<1)		09/07/02	JDS
Total Trihalomethanes	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Total Xylenes	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
trans-1,2-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
trans-1,3-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Trichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Trichlorofluoromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	3024009001	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 8:30
Client Sample ID	CYF-W-02-2	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
Vinyl chloride	0.00040 U	0.00040	mg/L	EPA 524.2	(<.002)		09/07/02	JDS
Surrogates								
4-Bromofluorobenzene Surr	98		%	EPA 524.2	85-115		09/07/02	JDS
Dibromofluoromethane Surr	103		%	EPA 524.2	85-115		09/07/02	JDS
Toluene-d8 Surr	95.4		%	EPA 524.2	85-115		09/07/02	JDS

Appendix C

CT&E Environmental Services Inc.
Laboratory Division

Held For Confirmation

Drinking Water Analysis Report for Total Coliform Bacteria

READ INSTRUCTIONS ON REVERSE SIDE BEFORE COLLECTING SAMPLE

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301

MUST BE COMPLETED BY WATER SUPPLIER

- ☐ **PUBLIC WATER SYSTEM I.D. #** ☐☐☐☐☐☐☐
- ☐ **PRIVATE WATER SYSTEM**

☒ *Send Results* ☒ *Send Invoice*

CHEFORNAK W&S — Water System Name/Company Name
PAUL WEISNER — Contact name
907 349 1010 — Phone Number
3491015 — Fax Number
PO Box 232945 — Mailing Address
ANCHORAGE AK — City / State / Zip Code

☐ *Send Results* ☐ *Send Invoice*

Company Name — Contact name
Mailing Address
City — State — Zip Code

SAMPLE DATE: 09 (Month) 02 (Day) 02 (Year)

SAMPLE TYPE:

- ☐ **Routine**
- ☐ **Repeat Sample (for routine sample with lab ref. no. _____)**
- ☒ **Special Purpose**
- ☐ **Treated Water**
- ☒ **Untreated Water**

SAMPLE LOCATION	Time Collected	Collected By
WELL 02-2	0900	P. WEISNER (Please Print)

TO BE COMPLETED BY LABORATORY

Analysis shows this Water SAMPLE to be:

- ☒ Satisfactory
- ☐ Unsatisfactory
- ☐ Sample over 30 hours old, results may be unreliable
- ☐ Sample too long in transit; sample should not be over 30 hours old at examination to indicate reliable results. Please send new sample via special delivery mail.

Date Received 9/3/02
Time Received 0852
Analysis Began 1425

Analytical Method: ☒ Membrane Filter ☐ MMO-MUG

* Number of colonies/100 ml.

Lab Ref. No.	Result*	Analyst
1025658 1A	TNTC Tu Coli	

Sent to A.D.E.C. Anch Fbks Jun ☐ Faxed

Date: _____ Time: _____

Client notified of unsatisfactory results:

☐ Phoned _____ Spoke with ☐ Faxed

Date: _____ Time: _____

BACTERIOLOGICAL WATER ANALYSIS RECORD

MMO-MUG Result: Total Coliform _____ *E. Coli* _____

Membrane Filter: Direct Count TNTC OB Tu Coli Colonies/100 ml

Verification: LTB Neg **EGB** Neg **COLIFIRM** _____

Fecal Coliform Confirmation Neg

Final Membrane Filter Results Satisfactory Coliform/100 ml

Reported By [signature] **Date** 9/16/02 **Time** 1615 hrs

TNTC = Too Numerous To Count
OB = Other Bacteria

Held For Confirmation

Comments:

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658002
Client Name	Chuck Eggener Consulting Engr.
Project Name/#	Chefornak Water & Sewer Proj
Client Sample ID	CYF-W-02-3
Matrix	Drinking Water
Ordered By	
PWSID	0

All Dates/Times are Alaska Standard Time

Printed Date/Time	09/17/2002 15:21
Collected Date/Time	09/02/2002 14:00
Received Date/Time	09/03/2002 8:52
Technical Director	**Stephen C. Ede**
Released By	Rhonda Strucker

Sample Remarks:

VOCs by EPA 524.2 were analyzed by CTE ESI of Ludington, MI.
EPA 200.7 ICP Metals - MS/MSD recoveries for Na was outside of acceptance criteria; post digestion spike was successful.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Total Organic Carbon,Dissolved	5.60	0.500	mg/L	EPA 415.1			09/09/02	JDT
% Difference	1.8		%	SM20 1030E			09/13/02	KAW
Magnesium	1.91	0.100	mg/L	EPA 200.7		09/06/02	09/07/02	MTG
Calcium	1.01	0.100	mg/L	EPA 200.7		09/06/02	09/07/02	MTG
Waters Department								
Alkalinity	261	10.0	mg/L	SM20 2320B			09/04/02	AS
CO3 Alkalinity	15.0		mg/L	SM20 2320B			09/04/02	AS
HCO3 Alkalinity	246		mg/L	SM20 2320B			09/04/02	AS
OH Alkalinity	0.00		mg/L	SM20 2320B			09/04/02	AS
Foaming Agents (MBAS)	0.500 U	0.500	mg/L	SM20 5540C	(<=0.5)		09/03/02	KLP
Total Organic Carbon	5.26	0.500	mg/L	EPA 415.1			09/09/02	JDT
Microbiology Laboratory								
Total Coliform	8 OB, No Coli		col/100mL	SM18 9222B	(<=1)		09/03/02	KAP
Inorganic Contaminants								
Antimony	1.00 U	1.00	ug/L	EPA 200.8	(<=6)	09/06/02	09/10/02	KGF
Arsenic	2.00 U	2.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Barium	29.0	3.00	ug/L	EPA 200.8	(<=2000)	09/06/02	09/10/02	KGF
Beryllium	0.400 U	0.400	ug/L	EPA 200.8	(<=4)	09/06/02	09/10/02	KGF
Cadmium	0.100 U	0.100	ug/L	EPA 200.8	(<=5)	09/06/02	09/10/02	KGF
Chromium	4.00 U	4.00	ug/L	EPA 200.8	(<=100)	09/06/02	09/10/02	KGF
Cyanide	0.0050 U	0.0050	mg/L	SM20 4500CN-C,E	(<=0.2)	09/06/02	09/07/02	PLW
Fluoride	0.200 U	0.200	mg/L	EPA 300.0	(<=2)		09/03/02	JDT
Mercury by Cold Vapor	0.000200 U	0.000200	mg/L	EPA 245.1	(<=0.2)	09/09/02	09/10/02	JJB
Nickel	5.00 U	5.00	ug/L	EPA 200.8	(<=100)	09/06/02	09/10/02	KGF
Nitrate-N	0.200 U	0.200	mg/L	EPA 300.0	(<=10)		09/03/02	JDT
Nitrite-N	0.200 U	0.200	mg/L	EPA 300.0	(<=1)		09/03/02	JDT

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658002
Client Name	Chuck Eggener Consulting Engr.
Project Name/#	Chefornak Water & Sewer Proj
Client Sample ID	CYF-W-02-3
Matrix	Drinking Water
Ordered By	
PWSID	0

All Dates/Times are Alaska Standard Time

Printed Date/Time	09/17/2002 15:21
Collected Date/Time	09/02/2002 14:00
Received Date/Time	09/03/2002 8:52
Technical Director	**Stephen C. Ede**

Parameter	Results		PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Inorganic Contaminants									
Selenium	2.00 U		2.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Thallium	0.300 U		0.300	ug/L	EPA 200.8	(<=2)	09/06/02	09/10/02	KGF
Secondary Contaminants									
Chloride	64.5		2.00	mg/L	EPA 300.0	(<=250)		09/04/02	JDT
Color	80.0	*	5.00	PCU	SM20 2120B	(<=15)		09/03/02	AS
Copper	1.52		1.00	ug/L	EPA 200.8	(<=1000)	09/06/02	09/10/02	KGF
Fluoride	0.200 U		0.200	mg/L	EPA 300.0	(<=2)		09/03/02	JDT
Iron	0.340	*	0.0200	mg/L	EPA 200.7	(<=0.3)	09/06/02	09/07/02	MTG
Langlier Index @ 140 degree F	1.01				SM14 203			09/13/02	KAW
Langlier Index @ 40 degree F	-0.07				SM14 203			09/13/02	KAW
Manganese	31.9		5.00	ug/L	EPA 200.8	(<=50)	09/06/02	09/10/02	KGF
Odor (TON)	1.00 U		1.00	T.O.N.	SM 2150B	(<=3)		09/03/02	AS
pH	8.70	*	0.100	pH units	EPA 150.1	(6.5-8.5)		09/03/02	AS
Sodium	139		100	mg/L	EPA 200.7	(<=250)	09/06/02	09/07/02	MTG
Sulfate	0.200 U		0.200	mg/L	EPA 300.0	(<=250)		09/03/02	JDT
Total Dissolved Solids	435	*	200	mg/L	SM20 2540C	(<=250)		09/05/02	AS
Zinc	2.00 U		2.00	ug/L	EPA 200.8	(<=5000)	09/06/02	09/10/02	KGF

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	1025658004	**All Dates/Times are Alaska Standard Time**	
Client Name	Chuck Eggener Consulting Engr.	**Printed Date/Time**	09/17/2002 15:21
Project Name/#	Chefornak Water & Sewer Proj	**Collected Date/Time**	09/02/2002 14:00
Client Sample ID	CYF-W-02-3	**Received Date/Time**	09/03/2002 8:52
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By		**Released By**	Rhonda Strucher
PWSID	0		

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Metals Department								
Hardness as CaCO3	10.2	10.0	mg/L	SM17 2340C		09/03/02	09/11/02	KGF
Metals by ICP/MS								
Barium	26.2	3.00	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Iron	250 U	250	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Potassium	6110	500	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Sodium	148000	500	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF
Silicon	12600	1000	ug/L	EPA 200.8 Dissolved		09/03/02	09/11/02	KGF

Appendix C

Held For Confirmation

CT&E Environmental Services Inc.
Laboratory Division

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301

Drinking Water Analysis Report for Total Coliform Bacteria

READ INSTRUCTIONS ON REVERSE SIDE BEFORE COLLECTING SAMPLE

MUST BE COMPLETED BY WATER SUPPLIER

- ☐ PUBLIC WATER SYSTEM I.D. #
- ☐ PRIVATE WATER SYSTEM

☒ *Send Results* ☒ *Send Invoice*

CHEFORNAK W&S — Water System Name/Company Name
PAM WEISNER — Contact name
907 349 1010 — Phone Number
349 1015 — Fax Number
PO Box 232945 — Mailing Address
ANCHORAGE — City
AK — State
995 — Zip Code

☐ *Send Results* ☐ *Send Invoice*

Company Name — Contact name
Mailing Address
City — State — Zip Code

SAMPLE DATE: 09 (Month) 02 (Day) 02 (Year)

SAMPLE TYPE:

- ☐ Routine
- ☐ Repeat Sample (for routine sample with lab ref. no. _____)
- ☒ Special Purpose
- ☐ Treated Water
- ☒ Untreated Water

SAMPLE LOCATION	Time Collected	Collected By
WELL 02-3	1400	_____ (Please Print)

TO BE COMPLETED BY LABORATORY

Analysis shows this Water SAMPLE to be:

- ☒ Satisfactory
- ☐ Unsatisfactory
- ☐ Sample over 30 hours old, results may be unreliable
- ☐ Sample too long in transit; sample should not be over 30 hours old at examination to indicate reliable results. Please send new sample via special delivery mail.

Date Received 9/3/02
Time Received 0852
Analysis Began 1425

Analytical Method: ☒ Membrane Filter ☐ MMO-MUG

* Number of colonies/100 ml.

Lab Ref. No.	Result*	Analyst
1025658 2A	8 ab no Coli	KP

Sent to A.D.E.C. Anch Fbks Jun ☐ Faxed

Date: _____ Time: _____

Client notified of unsatisfactory results:

☐ Phoned _____ Spoke with ☐ Faxed

Date: _____ Time: _____

BACTERIOLOGICAL WATER ANALYSIS RECORD

MMO-MUG Result: Total Coliform _____ *E. Coli* _____

Membrane Filter: Direct Count 8 ab no Coli Colonies/100 ml

Verification: LTB Neg BGB Neg COLIFIRM _____

Fecal Coliform Confirmation Neg

Final Membrane Filter Results Satisfactory Coliform/100 ml

Reported By [signature] Date 9/6/02 Time 1615 hrs

TNTC = Too Numerous To Count
OB = Other Bacteria

Held For Confirmation

Comments:

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	3024009002	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 14:00
Client Sample ID	CYF-W-02-3	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By		**Released By**	Denise Heckler

Sample Remarks:
Sample analyzed at the Ludington, Michigan laboratory of CT&E Environmental Services Inc.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
1,1,1,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,1-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.2)		09/07/02	JDS
1,1,2,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,2-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,1-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,4-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.07)		09/07/02	JDS
1,2,4-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromo-3-chloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromoethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.6)		09/07/02	JDS
1,2-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,3,5-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,4-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.075)		09/07/02	JDS
2,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
2-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Isopropyltoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Allyl chloride	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Benzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Bromobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromochloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromodichloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromoform	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromomethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS

CT&E Environmental Services Inc.

CT&E Ref.#	3024009002	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 14:00
Client Sample ID	CYF-W-02-3	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
Carbon disulfide	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Carbon tetrachloride	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Chlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
Chloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Chloroform	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Chloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
cis-1,2-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.07)		09/07/02	JDS
cis-1,3-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dibromochloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dibromomethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Dichlorodifluoromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Diisopropyl ether	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Ethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.7)		09/07/02	JDS
Hexachlorobutadiene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Isopropylbenzene (Cumene)	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Methyl Tertiary Butyl Ether	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Methylene chloride	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
n-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
n-Propylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Naphthalene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
o-Xylene	0.00050 U	0.00050	mg/L	EPA 524.2	(<10)		09/07/02	JDS
P & M -Xylene	0.0010 U	0.0010	mg/L	EPA 524.2	(<10)		09/07/02	JDS
sec-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Styrene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
tert-Butylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Tetrachloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Tetrahydrofuran	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Toluene	0.00050 U	0.00050	mg/L	EPA 524.2	(<1)		09/07/02	JDS
Total Trihalomethanes	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Total Xylenes	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
trans-1,2-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.1)		09/07/02	JDS
trans-1,3-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Trichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Trichlorofluoromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS

Appendix C

CT&E Environmental Services Inc.

CT&E Ref.#	3024009002	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 14:00
Client Sample ID	CYF-W-02-3	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
Vinyl chloride	0.00040 U	0.00040	mg/L	EPA 524.2	(<.002)		09/07/02	JDS
Surrogates								
4-Bromofluorobenzene Surr	99.8		%	EPA 524.2	85-115		09/07/02	JDS
Dibromofluoromethane Surr	96		%	EPA 524.2	85-115		09/07/02	JDS
Toluene-d8 Surr	92.4		%	EPA 524.2	85-115		09/07/02	JDS

CT&E Environmental Services Inc.

CT&E Ref.#	3024009003	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 0:00
Client Sample ID	Trip Blank	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By		**Released By**	Denise Heckler

Sample Remarks:
Sample analyzed at the Ludington, Michigan laboratory of CT&E Environmental Services Inc.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
1,1,1,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,1-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.2)		09/07/02	JDS
1,1,2,2-Tetrachloroethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,1,2-Trichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,1-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloroethene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.007)		09/07/02	JDS
1,1-Dichloropropene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,3-Trichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2,4-Trichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.07)		09/07/02	JDS
1,2,4-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromo-3-chloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dibromoethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,2-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.6)		09/07/02	JDS
1,2-Dichloroethane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
1,3,5-Trimethylbenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,3-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
1,4-Dichlorobenzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.075)		09/07/02	JDS
2,2-Dichloropropane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
2-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Chlorotoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
4-Isopropyltoluene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Allyl chloride	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Benzene	0.00050 U	0.00050	mg/L	EPA 524.2	(<.005)		09/07/02	JDS
Bromobenzene	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromochloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromodichloromethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromoform	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS
Bromomethane	0.00050 U	0.00050	mg/L	EPA 524.2			09/07/02	JDS

CT&E Environmental Services Inc.

CT&E Ref.#	3024009003	**Client PO#**	
Client Name	CE2 Engineers, Inc.	**Printed Date/Time**	09/10/2002 7:15
Project Name/#	Chefornak W&S (1025658)	**Collected Date/Time**	09/02/2002 0:00
Client Sample ID	Trip Blank	**Received Date/Time**	09/05/2002 9:00
Matrix	Drinking Water	**Technical Director**	**Stephen C. Ede**
Ordered By			

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
GC/MS VOLATILE ORGANIC								
Vinyl chloride	0.00040 U	0.00040	mg/L	EPA 524.2	(<.002)		09/07/02	JDS
Surrogates								
4-Bromofluorobenzene Surr	97.4		%	EPA 524.2	85-115		09/07/02	JDS
Dibromofluoromethane Surr	99.2		%	EPA 524.2	85-115		09/07/02	JDS
Toluene-d8 Surr	97.4		%	EPA 524.2	85-115		09/07/02	JDS

Appendix D

Report from Golder Associates:
Preliminary Geotechnical Findings—Chefornak Pump House

TECHNICAL MEMORANDUM

Date:	September 15, 2014	**Project No.:**	1405906
To:	Paul Weisner, PE	**Company:**	CE2 Engineers, Inc.
From:	Peter Calvin, PE; Richard Mitchells, PE		
cc:		**Email:**	p.weisner@ce2engineers.com
RE:	**PRELIMINARY GEOTECHNICAL FINDINGS - CHEFORNAK PUMPHOUSE**		

This technical memorandum provides Golder Associates (Golder) preliminary geotechnical findings for the proposed Chefornak Pumphouse project, including an initial review of the preferred grouted micro-pile foundation for the two pump houses planned for Chefornak, Alaska. This document should serve as a working document based on currently available data and may be revised as the project progresses. This memorandum will be followed by a report providing more detailed engineering recommendations.

The two new pumphouses are planned as part of a water system improvement project in Chefornak Alaska. The structures will be of a similar design, with dimensions of approximately 42 by 30 feet. We understand that the preferred foundation type would be a 6-inch diameter grouted micropile system. The micropile would be drilled and driven to the point it is adequately seated in competent bed rock. A smaller diameter hole would then be drilled into the bedrock and a rock anchor would be grouted in place to resist the anticipated frost uplift forces. This type of foundation system has distinct advantages over other deep foundations in that it can be installed in areas with variable thermal and groundwater conditions and in areas where float rock and boulders could be encountered.

While the pile axial loads have not been finalized, CE2 has indicated they are to be in the range of 7-kips to 14-kips (per pile) for geotechnical design purposes. For frost uplift, we have used design stress of 40-pounds per square inch (psi) along the pile perimeter though the expected active layer. At these design loads, the frost uplift will exceed the axial compressive design loads.

Golder conducted a limited geotechnical investigation at the proposed projects sites in August 2014. Due to limited funding, a site-specific geotechnical drilling program was not authorized. The investigation involved advancing a series of shallow depth hand probes and drill holes to characterize the near surface soil and thermal conditions. The maximum depth of exploration for this investigation was 8 feet below ground surface. For geotechnical data pertaining to the conditions below 8 feet we have relied on the information presented in our February 20, 2013 report to CE2 “Conceptual Geotechnical Considerations for Triodedic Frame Foundation Systems, Chefornak, AK”.

Based on a review of relevant reports and our geotechnical experience in Chefornak, the generalized subsurface conditions in the community consist of an organic mat overlying fine-grained organic and

inorganic silt. Discontinuous volcanic flow consisting of vesicular basalt has been encountered below the silt at variable depths, but generally between 20 and 30 feet below ground surface. However, basalt boulders have been located closer to ground surface in certain areas in and around the community. Degrading permafrost is present in the community, particularly near larger surface water bodies, in damaged tundra areas, and under snow drifts.

During our August 2014 limited geotechnical investigation we found that the thermal conditions at pump house 1 were highly variable ranging from 2 feet to over 8 feet below ground surface near the existing pump house. Additionally pockets of relic seasonal frost were found between 5 and 6 feet below ground surface. The highly variable thermal conditions are likely due to the dumping of backwash from the pump house, standing water and thermal influence of the nearby board walk. The subsurface thermal conditions at pump house 2 were found to be more consistent, likely due to the lack of development in the area. The depth of thaw was found to be between 2 and 3 feet below ground surface.

Based on the information gathered during our limited geotechnical investigation and review of relevant geotechnical reports, the proposed drilled and grouted micro pile foundation is suitable for this application. If seated into competent bedrock the proposed 6-inch diameter pile is expected to provide adequate bearing capacity. Rock anchors will need to be installed inside the pile interior and grouted into competent bedrock to account for the frost uplift forces. Due variable subsurface thermal states the pile diameter may need to be adjusted to account for lateral deflections.

This technical memorandum will be followed by more detailed engineering recommendations when we complete the laboratory analysis and the project loading design is finalized. If you have any comments or questions please contact us.