Sandy Lane and Ellerman Heights Lift Stations Replacement

Design Analysis Report

Saint Paul, Alaska

Owner
City of St. Paul
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Funding Agencies
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Table of Contents

Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
AEC	Aleut Corporation
City	City of Saint Paul
CMU	cement masonry block
CSP	City of Saint Paul
DAR	Design Analysis Report
ft	feet
FRP	Fiberglass Reinforced Plastic
GFCI	ground-fault circuit interrupter
GFRG	Glass Fiber Reinforced Gypsum
HDPE	High-Density Polyethylene
Kuna	Kuna Engineering
LS	Lift Station
O&M	Operations and Maintenance
PER	Preliminary Engineering Report
ROW	right of way
sq ft	square feet
TDX	Tanadgusix Corporation
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VSW	Village Safe Water

1.0 EXECUTIVE SUMMARY

The City of Saint Paul, in cooperation with the Alaska Department of Environmental Conservation and Village Safe Water Program (VSW) has selected Kuna Engineering (Kuna), to design replacement lift stations for the Sandy Lane Lift Station and the Ellerman Heights Lift Station.

The Sandy Land LS and Ellerman Height LS were originally constructed in 1988 and 1989. The lift station are failing apart due to age, corrosion, and wear. The pumps are inside the wet wells which is a confined space. This increases the safety risk for the operators every time they check or work on the pumps. In a 2020 PER, the lift stations were evaluated, and alternatives were reviewed. The PER recommended replacing both lift stations and outlined the scope of work for the project. In 2021, the project was funded for design and construction. In 2022, Kuna was selected to provide the engineering for the project.

The new lift stations will be located within the existing lift station right-of-way. No additional easement is expected to be required. The lift stations will consist of a concrete wet well and a lift station building. The lift station building will have two self-priming chopper style pumps mounted to the floor. The pumps will be on the surface, instead of submerged in the wet well. This reduces the need for a dry well or valve vaults. Operators will rarely need to enter the confined space of the wet well.

Several building layouts were considered. Option 1 has three separate rooms; wet well, pump, and electrical. Option 2 has two separate rooms: pump and electrical with the wet well adjacent to the building. Option 3 has one larger room with combined pump and electrical areas. Option 3 has a smaller overall footprint. It also significantly reduces the cost of the building.

The building will be 12-foot by 18-foot. The foundation will be concrete spread footings with a floating concrete slab. The design has focused on a building that can withstand the wet and corrosive environment in Saint Paul. The City was consulted during the design on which materials work best in Saint Paul. For example, the exterior building will be cedar siding and zinc standing seam roof, with insulated fiberglass doors.

A summary of project costs are found below. The 2020 original construction estimate was $1,375,000 with one year of 3 % inflation. The 2021 and 2022 construction inflation rates have been estimated at 20% and 15%. This 2023 construction cost estimate is $1,553,000. This is approximately 10% overall increase, which is below the two-year inflation.

The 2023 construction cost estimate is formatted by contract bid tabs. Each bid tab includes the materials, labor, and equipment cost for that bid tab. The 2020 estimate appeared light on shipping costs. The 2023 estimate had savings with the pumps, controls, and lift station systems.

ITEMS	TOTALS
GENERAL BID TABS	$571,850
CONSTRUCTION BID TABS	$596,000
CONTRACT BID TABS	$385,391
TOTAL CONSTRUCTION COSTS	$1,553,241
CONSTRUCTION ADMINISTRATION	$232,986

2.0 INTRODUCTION

The City of Saint Paul (CSP), in cooperation with the Alaska Department of Environmental Conservation (ADEC) and Village Safe Water Program (VSW) has selected Kuna Engineering (Kuna), to design replacement lift stations for the Sandy Lane Lift Station and the Ellerman Heights Lift Station (LS). This Design Analysis Report (DAR) summaries the design approach and project cost. A Preliminary Engineering Report (PER) was completed to elevate the project.[1]

3.0 BACKGROUND

The City of Saint Paul, Alaska (City) is a second-class city located on Saint Paul Island in the Bering Sea off the west coast of Alaska. It is approximately 750 miles west of Anchorage and is only accessible by air or sea. The City is home to roughly 359 residents and has 145 non-seasonal homes.

The Sandy Land LS and Ellerman Height LS were originally constructed in 1988 and 1989, respectively, and serve many of the residents of the City. Since their construction, the lift stations have degraded significantly from corrosion of their steel tanks, pumps, piping, and electrical controls. Due to the design of the lift stations, there are significant challenges and risks associated with maintenance. The drywells do not allow ease of access to individual components and are considered confined spaces requiring a minimum of two City staff be present to access them during maintenance activities. Wastewater transferred by the lift stations is eventually directed to an outfall pipe that discharges into the Bering Sea.

In a 2020 PER, the lift stations were evaluated, and alternatives were reviewed. The PER recommended replacing both lift stations and outlined the scope of work for the project.

In 2021, the project was funded for design and construction. In 2022, Kuna was selected to provide the engineering for the project.

3.1. Location

Saint Paul Island is the largest island in the Pribilof Archipelago, located at 57°1 0'N 170°15 'W in the Bering Sea, approximately 750 air miles west-southwest of Anchorage, Alaska. Saint Paul Island is approximately 11 miles long by four miles wide, with a maximum land surface elevation of about 665 feet above sea level. The City is located on a peninsula on the southern coast of the island. The City is a Second-Class City, organized in 1971 with a boundary encompassing the entire island to three miles offshore. See attached 35 percent Submittal Drawings, Sheets G00 and G01 for Location and Vicinity Maps.

Saint Paul Island is accessible only by air or sea. The community is located about three miles from the Saint Paul Island Airport. The state-owned airport has a single 6,500-foot long paved, lighted runway with year-round passenger and cargo service through RavnAir and Alaska Central Express. The federally maintained harbor has deep draft commercial docks, a small boat harbor for local fishing fleet and boat launch ramp. Scheduled freighter service is available year-round from Seattle and Dutch Harbor.

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[1] Polar Consultants. (2020). *Preliminary Engineering Report for City of Saint Paul Wastewater Lift Station* (VSW # 19ER33). VSW.

The two lift stations are both within the town site. Sandy Lane LS is located east of the school's playfield on a gravel pad along Bartlett Road. The Sandy Lane lift station has been identified as both "Old Town" and "Sandy Lane" in previous drawings and reports. This project will use the name Sandy Lane. Ellerman Heights LS is located west of the Aleut Tribal Office along Polovina Turnpike. Both lift stations are within existing CSP utility easements.[2]

3.2. Existing Site Conditions

The CSP provides sewer utility service through Certificate of Public Convenience and Necessity Number 690. The service area includes the entire island. CSP also provides water, electricity, solid waste, bulk fuel storage, law enforcement, fire protection, emergency medical, search and rescue, and harbor master services to the community, maintains community roads, and operates the community gas station.

3.2.1. Existing Facilities

The existing sewer system consists of gravity sewer collection, lift stations, septic tank primary treatment, force mains, and septic effluent ocean outfall. The system collects sewage from three general service areas within the community including Old Town (Sandy Lane), Harbor District, and Ellerman. The Old Town and Harbor District utilize black water lift stations and force mains to transport black water to septic tanks at East Landing. The Ellerman area has septic tanks installed in two locations and utilizes a common septic effluent lift station and force main to transport septic effluent to the East Landing control manhole. Septic effluent from all of the septic tanks come together at the East Landing control manhole and gravity flows into an ocean outfall. See attached 35 percent Submittal Drawings, Sheet G03 for the sewer system schematic.

3.2.1.1. Sandy Lane Lift Station

The Sandy Lane LS is located on a gravel pad raised approximately four feet above surround area. The site is surrounded by a six-foot chain link fence. There is a utility pole with a lights, siren, and electrical meter. A transformer is located on the northside of the pad. A water main runs along the northside of Bartlett Road.

Wastewater flows by gravity mains into the terminal manhole, MH#17F. It then flows into the wet well. The dry well is located east of the wet well and contains the pumps, controls, and other equipment. The pumps lift the wastewater into the force main and then heads eastwards to the outfall.

3.2.1.2. Ellerman Heights Lift Station

The Ellerman Heights LS is located along Polovina Turnpike. It is slightly higher elevation than the road. There is no fencing on the site. There is a utility pole with a lights, siren, and electrical meter. A transformer is located north of the lift station along the road. A water main runs along the northside of Bartlett Road. A hydrant is located approximately 15 feet away from the wet well.

Wastewater flows by gravity mains from both the North and South Ellerman service areas. Both areas have septic tanks but not all the wastewater going to the lift station is septic effluent. The North Ellerman service area collects sewage and flows by gravity south along Polovina Turnpike into two septic

[2] Polar Consulting. (2020).

tanks adjacent the existing lift station. The septic tank effluent flows from the last tank directly into the wet well.

The South Ellerman service area collects sewage and flows by gravity north along Polovina Turnpike into terminal manhole MH#7D. It then flows into the wet well. The dry well is located east of the wet well and contains the pumps, controls, and other equipment. The pumps lift the wastewater into the force main and then heads south towards the outfall. CO#1 is just east of MH#7D. CO#1 has what appears to be air release valves which drain into MH#7D.

3.2.2. Land Status

Tanadgusix Corporation (TDX), the native village corporation, owns the land at both lift stations. The Aleut Corporation (AEC), the regional native corporation owns the subsurface rights. Both lift stations are within existing CSP utility easements provided by TDX.

Sandy Lane LS is located within an existing 150-foot by 50-foot utility easement. The easement was recorded November 23, 1987, Aleutian Recording District, Book 27, page 391. The easement is located within Lot 1, Block 2, Seal Beach Subdivision, Plat 2013-21, which is owned by TDX.

Ellerman Heights LS is located within an existing 110-foot by 50-foot utility easement. TDX provided easements for utilities inside the CSP townsite, including Ellerman Heights LS, in Section 3.0 of the “Final Settlement Agreement” between CSP and TDX dated September 12, 2013. The Ellerman Heights LS is shown in Exhibit 26, dated March 29, 2013, of the agreement.

The Ellerman Heights LS easement is located within two parcels. The northern parcel is Lot 6, Block 1, TDX Subdivision, Plat 94-39. The southern parcel is Lot 9, Block 28, Tack A, US4943. Both parcels are owned by TDX. The southern parcel was leased to the federal government for a building that was not constructed. The status of this lease is not known.

Both lift stations are within the existing easements. No additional easements should be necessary.

4.0 DESIGN REQUIREMENTS AND CONSIDERATIONS

4.1. Building

4.1.1. Site Civil

4.1.1.1. Soil Conditions

Saint Paul Island is of recent volcanic origin and is composed of a series of interconnecting cinder cones, lava flows, and volcanic debris fields.

Within the proposed project areas, both sites were excavated and filled for original lift station construction with moderate finish grades that slope away from the sites to original grades. Soils at the two lift stations consist of a thin layer of organics over scoria fill work pads. Sandy Lane site is estimated to be six to eight feet thick scoria. The Ellerman pad is estimated to be two to three feet thick scoria.

Geotechnical test holes for prior road and utility projects show medium to dense sand underlying both sites to bottom of test holes at 12-feet. Both sites are presumed to be underlain at unknown depth by basaltic bedrock.[3]

4.1.1.2. Select Fill Material and Source

There is a developed borrow material pit located 2.5 and 2.8 miles from the lift stations. The pit is on TDX land, and the subsurface rights are owned by AEC. The material is blasted and ripped from the pit's bedrock. There are stockpiles of multiple material throughout the pit site. The stockpile includes borrow material, riprap, and crushed gravels. There appears to be enough stockpiles of crushed gravel to complete the projects.

4.1.1.3. Excavation

It is not anticipated that either site will be difficult to excavate with local equipment. It is likely that tidally influenced groundwater will be encountered eight to ten feet deep. Construction will probably require sheet piles, caisson, or other mechanical protection to maintain slope stability. There is not enough room to excavate using cut slopes. The wet well excavations would need to be at least 60-feet wide. Mechanical trench protection will also protect existing structures like manholes, piping, and septic tanks from being undermined or damaged.

4.1.1.4. Site Grade

4.1.1.4.1. Sandy Lane LS

The area around Sandy Lane LS is low-lying will minimal drainage. What drainage there is flows to the south to culverts under the road. Standing water has been observed in the area during spring and storms. The existing lift station is on a gravel pad approximately four feet above the surrounding area. The pad is graded to have positive drainage.

The pad will be extended approximately 12-feet to accommodate the new lift station. The pad will match the grade and elevation of the existing elevation. The pad expansion is not expected to affect the surrounding drainage.

4.1.1.4.2. Ellerman Heights LS

The area east of the lift station is a high hill that slopes west towards the road. The area surrounding the existing lift station is relatively flat (i.e., less than five percent) but still drains towards the road. Some dirt has been pushed up around the site through maintenance and snow removal.

The new lift station building will maintain the elevations of the existing ground. The surround area will need to be regraded to ensure drainage away from the lift station building, manholes, and septic tanks. It is not expected to impact the surrounding drainage.

4.1.1.5. Utility Piping

All buried sewer piping will be high-density polyethylene (HDPE) pipe. Gravity sewer will have SDR 17. Force main and water services will have SDR 11. Joints will be butt fusion.

[3] Polar Consulting. (2020)

4.1.1.6. Manholes

No manholes are being replaced. The terminal manhole before the Sandy Lane LS is MH17F. It is in fair shape. The inside channel will need to be replaced and a new sewer line will need to be installed for the new lift station. Replacing MH17F would require the contractor to by-pass the sewer from both MH7G and MH16F. Both are approximately 350 feet from the existing Sandy Lane Lift Station.

The is no terminal manhole before Ellerman Heights LS. Two separate sewer lines go into the wet well. One is from the septic tanks to the north and the other is MH7D to the south. There is no manhole between the septic tank and the wet well, just the septic effluent pipe. The manhole access for the septic tank cleanout didn't have any leaks or cracking. MH7D didn't have any leaking or cracks. The lid ring was rusty but still functional. Replacing MH7D would require the contractor to by-pass the sewer approximately 350 feet.

CO-01 is the first force main cleanout for the Ellerman Heights LS. The manhole just provides access to the clean out connections. The lid and lid ring are heavily rusted. The concrete manhole didn't appear to have major cracking or leaks. The water in the bottom appeared to be from surface drainage since the cleanout was buried.

4.1.1.7. Wet Wells

Fiberglass and pre-cast concrete were considered for wet well construction. Fiberglass weighs about one-tenth less than concrete. It comes preformed as a single piece that can reduce construction time and leakage. Fiberglass also has high corrosion resistance. Fiberglass can cost up to three times that of concrete. Fiberglass will need to have a cast-in place base to stop them from floating in saturated soils or flooding.

The two wet wells will be eight foot and nine foot in diameter. They will be approximately 18 feet deep. At those sizes the benefits of fiberglass are reduced, but not the costs. At these sizes the wall thickness will need to be doubled. This increases its weight. Typically, fiberglass manholes are shipped as a single piece. At these dimensions, its bulkiness increases its barging costs to be closer to concrete. Another disadvantage is that fiberglass is more difficult to field locate and adjust, especially for pipe penetrations.

We recommend pre-cast concrete manholes due to the increase durability and strength and decrease in material costs. If desired, contractors could submit fiberglass manholes as a substitution if there is a cost savings.

4.1.2. Architectural

4.1.2.1. Building Classification

Lift stations are classified by code as Type S2 occupancy. It is an unoccupied low fire risk, storage space. The construction classification is Type 5B, unprotected wood frame. The American Disabilities Act does not apply for this project. See Appendix B for full architectural code review.

4.1.2.2. Building Layout

Several building layouts were considered. Option 1 has three separate rooms; wet well, pump, and electrical. Option 2 has two separate rooms: pump and electrical. Option 3 has one larger room with combined pump and electrical areas.

Option 1 was initially considered because it covered the entire wet well and lifts station. The sizing of the building made it difficult to fit within the existing right of way (ROW).

Option 2 was considered to reduce the building footprint and allow more room and flexibility to site the lift stations.

Option 3 was considered because once the wet well was moved outside the risk of interior gases and corrosion from the wet well decreased. The need to have a separate electrical room was reduced. In addition, the electrical space needed for these lift stations is relatively small. Having everything in one room eliminated the need for some additional controls due and provided more room in the pump room for Operations and Maintenance (O&M) operations.

Table 1. Comparison of Building Layout Options

Characteristics	Options		
	1	2	3
Number of Rooms	3	2	1
Wet Room	Y	N	N
Pump Room	Y	Y	N
Electrical Room	Y	Y	N
Combined Pump/Elec.	N	N	Y
Dimensions (ft)	12 x 32	12 x 20	12 x 18
Interior Space (sq ft)	384	240	216

The need to access the wet well is minimal when the pumps are located outside on the surface. Then the benefit of having an enclosed lift station is minimal. Having separate rooms for the pumps and electrical equipment is significantly decreased without the wet well in the building. Combining them into one room allows for more space around the pumps and more room to do O&M.

Option 1 is half as large as Option 2 and twice as large as Option 3. Option 2 is approximately 30 percent cheaper than Option 1 and Option 3 is approximately 60 percent cheaper than Option 1. We recommend Option 3 layout for the lift station.

4.1.2.3. Thermal Envelope (Wall and Roof Systems)

The roof will slope to one side away from the door. It will be rectangular in appearance with three-foot overhangs all around the building to protect the siding.

Advanced continuous insulation methodology for greatest energy savings and building longevity. Roof is clad in a zinc standing seam providing the most protection in harsh seacoast environment. Zinc roofing is much more durable than the typical steel or aluminum roofing material. It typically costs three times more than steel or aluminum but at approximately 100 square feet of roofing for each lift station, the cost difference will be nominal to the overall project cost. It will provide 80 to 100 years roof life, compared to 20 years with typical metal roofs. This is mainly due to zinc's the very high corrosion resistance.

The roof will be over underlayment, plywood, rigid insulation, water barrier, plywood over 2 x joist framing, and painted gypsum board interior ceiling finish for a total R-35 rating.

Walls are comprised cedar bevel siding, air space, mineral wool insulation, water barrier, plywood sheathing, 2 x stud wall framing, gypsum board, and FRP paneling full height for a total R-24 rating.

Floor slab is concrete slab with concrete sealer. Doors and frame are thermally broken insulated fiberglass. Concrete stem walls are to be insulated with R-11 rigid insulation

4.1.2.4. Interior Materials

The interior walls will be Glass Fiber Reinforced Gypsum (GFRG). This will provide better resistance to rot and mold than plywood or other wall materials. The GFRG will be covered with Fiberglass Reinforced Plastic (FRP) panels. The combination of GFRG and RFP will provide superior mold, corrosion, and rot resistance. It will also minimize maintenance. The cost difference between traditional plywood, cement board, or other more traditional wall construction is nominal with buildings less than 100 square feet.

4.1.3. Structural

Structural design criteria and loading have been calculated and can be found in the attached Sheet S01, 35 percent Drawing Submittal for detailed structural design criteria and notes.

4.1.3.1. General Construction

The lift station building will be wood frame construction. The intent is to use treated lumber throughout the framing, such as the sill plates and rafters.

Masonry block, such a cement masonry block (CMU) was considered for wall construction. Masonry block is very durable and rot resistant. It is often used in lift station construction, but it is more expensive than wood construction. Masonry blocks will be considerable heavier and have a higher risk of being damaged during shipping. It also requires specialty labors to install and has higher installation costs. For these reasons, wood construction was selected over masonry.

4.1.3.2. Foundation Type

The lift station building foundations will have concrete stem wall and spread footing. The top of the footings will be approximately four feet deep. The stem walls will extend one foot above the finished floor. This will protect the exterior and interior walls and sill plates from moisture and rot. The interior floor will be a six-inch floating concrete slab. A six-inch slab will provide better pump mounting than a four-inch slab.

A minimum of two feet of material under the footings will need to be non-frost susceptible gravels. It appears that both sides already have gravel pads under the building and there was no observed frost heaving of structures at the sites.

4.1.4. Mechanical

4.1.4.1. Design Criteria

The code governing the plumbing system is the 2018 version of the uniform plumbing code. The code governing the mechanical system is the 2012 international mechanical code. These codes will be followed during the design and construction of this project. Historical operational data and future projected design criteria was provided by the client and used in the design process.

4.1.4.2. Mechanical Systems and Equipment

Two self-priming chopper style pumps will be mounted in the pump house adjacent to the well. Six-inch suction pipes will run from the bottom of the well to the suction of each pump, the suction lines are reduced to four inches at the pump suction to match the size of the pump suction flange. The four-inch discharge lines of each pump will be increased to six inches and both pumps will be connected to a header. The header will come to a “T” where the branch is routed to the six-inch forced main, and the other side of the “T” will be routed to just outside of the pump house to a cam-lock fitting that can be used to bypass the force main in case of an emergency. A separate six-inch suction bypass line will exit the well and have a cam-lock fitting on the other end in case both pumps need to be bypassed for maintenance.

The pumps will be controlled through a primary and backup float system in the well. The floats will be wired to a control panel that will signal the pumps to start and stop. Each pump will alternate its starting order each time a pump run signal is called for to ensure even pump wear. A meter indicating each pumps overall run time will be displayed on the control box.

In the event of any pump faults or a high level in the well, a strobe light will be activated outside the pump house and a call out notice will be sent to a designative individual.

All piping and equipment installed as part of this project will be stainless steel or other corrosive resistant materials.

4.1.5. Electrical

The codes governing the electrical systems are the latest additions of the National Electric Code, NFPA 70, the National Fire Alarm Code, NFPA 72, and the Life Safety Code, and NFPA 101. These codes will be followed through the design and construction phases of this project.

The work at both the Sandy Lane LS and Ellerman Heights LS will be the same. At this point in the design, it is assumed that wet well will not be inside of the new lift station building.

4.1.5.1. Demolition

The existing utility electric service for both sites will be removed and the conductors back to the transformer will be removed. The entire electrical for the existing lift stations will be removed including all panelboards, conduit and wiring. Any existing communication lines will be demoed back to the closest point of connection.

4.1.5.2. Service Entrance

A new electrical service for each lift station building will be routed underground from the existing 208/120 volt, 45 KVA pad-mounted or pole-mounted utility transformer. The transformer will feed a new 208/120 volt, 3-phase, 4-wire, 125 ampere main service connection on the outside of the new lift station building.

4.1.5.3. Distribution System

All circuits will be routed in conduit raceways. All above ground feeders will be routed in rigid steel conduit, RSC, with buried feeders routed in HDPE or RSC conduit. All raceways will be run in surface mounted electric metallic tubing, EMT, with a minimum size of three-quarter inches. Connections to vibrating equipment will be made with flexible metallic conduit with the exception that liquid tight flexible metallic conduit will be used in all locations exposed to weather, water, oil or grease. All raceways penetrating fire separation walls will be fire stopped and those penetrating thermal barriers will be thermally stopped.

All conductors will be copper, and all circuits will contain an equipment-grounding conductor. The conductors for all feeders and branch circuits in unheated spaces will have insulation type XHHW, which has moisture-resistant thermoset insulation for withstanding cold temperatures. Branch circuits in continuously heated spaces will have insulation type XHHW. The minimum conductor size for branch circuits will be #12 AWG for power and lighting and #14 AWG for control circuits. Circuits will be sized so that the maximum voltage drop from the secondary side of the utility transformer to the terminal device is within the 5 percent allowed by the NEC. All circuit conductors will be identified as each panelboard, pull box and terminal device.

Separate circuits will be used for lighting and receptacle load. Equipment such as motorized equipment greater than one-quarter horsepower, and other such equipment will have their own dedicated circuits. Lighting circuit breakers will be a minimum of 20-ampere. General use receptacles will be limited to a maximum of eight receptacles per circuit and protected with a 20-ampere rated circuit breaker. Special use receptacles will have a minimum of a 20-ampere rated breaker.

The entire distribution system will be grounded and bonded. The grounding system will also be extended to the telecommunications equipment and racks. After the power supply phases have been balanced, typewritten directories will be placed under plastic in frames for each and every circuit.

4.1.5.4. Wiring Devices

The general use receptacles used on this project will be 20 ampere, 125V, grounded type, specification grade, NEMA 5-20R with impact resistant plastic device covers. Non-feed-through ground-fault circuit interrupter (GFCI) type receptacles will be used for all receptacles. Dedicated receptacles will match the proposed equipment and their device plate will be labeled to identify the device’s special characteristics if it is different than the general use receptacles.

4.1.5.5. Emergency Power Systems

The emergency power system for the lift stations will consist of a manual maintenance transfer switch located on the outside of the building. This switch will allow for a generator to be used to provide power to the entire site. The connection to the transfer switch will be an external receptacle.

4.1.5.6. Internal Lighting System

The design of the interior lighting will provide a generally glare free, high-quality lighting and conform to the lighting levels recommended in the latest edition of the IESNA Lighting Handbook. Photometric calculations will be performed as an integral part of the design to ensure that the recommended lighting levels are met. Energy efficient watertight LED type fixture will be surface mounted to the ceiling. The lighting controls will me a simple on off switch located at the entrance door. At this point in the design hazardous location light fixtures will not be required in the lift stations.

4.1.5.7. Exterior Lighting System

Exterior, building mounted LED type fixtures will be used to illuminate the exit door and along the building exterior. The exterior lighting will incorporate dusk to dawn photocell controls for security. An exterior red light will be installed and will activate if there are any lift station system failures.

4.1.5.8. Emergency Lighting Systems

The interior emergency lighting light system will consist of an exit sign exit sign combo unit. Emergency egress lighting will be incorporated with the exterior doorway lighting and powered from the interior exit sign.

4.1.5.9. Telecommunication System

The interior telecommunications will comply with EIA/TIA-568-B, 569-B, and 606 Category 5e standards and I3A, *Technical Guide for Installation Information Infrastructure Architecture*. Cabling will be unshielded twisted pair, 24 AWG, copper.

A new data outlet drop will contain two Category 5e cables and will be home-run back to the patch panel. This will allow the telecommunication outlet to be configured for either voice or data. Copper cabling will be routed from the new main telecommunications entrance. Device outlet faceplates will be modular type with snap-in-jacks.

4.1.5.10. Fire Alarm System

There are currently no plans to install any fire alarm system at the lift stations.

4.1.5.11. Security System

There are currently no plans to install any security system at the lift stations.

4.1.6. Construction

4.1.6.1. Demolition

4.1.6.1.1. Sandy Lane LS

All aboveground equipment associated with the existing lift station will be removed. This includes lift station venting, utility pole, lights, etc. The site fencing will also be removed. All the equipment, controls, piping, and wiring will be removed from the wet and dry wells. Sewer piping will be abandoned in place, though ends will be capped. The wet and dry wells will be cleaned then the top-grade rings and lid removed. The wells will be filled in and abandoned in place.

4.1.6.1.2. Ellerman Height LS

The wet well, dry well, utility pole, and other aboveground items will be removed. All valving in CO01 will be removed. Electrical service line will be abandoned in place. The force main between the existing lift station and CO01 will be removed.

4.1.6.2. Maintenance of Service

4.1.6.2.1. Sandy Lane LS

The new lift station is located on the expanded pad east of the existing lift station. This will allow the lift station to be constructed with minimal interruption of service. Once the lift station is ready for service, the new gravity piping will need to be connected to the terminal manhole. This may require a disruption of service as they connect into the manhole. The contractor will likely have to dam the two upstream manholes and temporarily use those manholes as wet wells. Depending on the contractor's means and methods this may require temporarily by-passing the lift station for 1-3 days.

4.1.6.2.2. Ellerman Height LS

The new lift station building is located on top of the existing dry well. The new wet well will be located at the existing wet well location. There are several ways the contractor could sequence construction to maintain service. One way is to construct the new lifts station first. The existing wet well would be dammed. The contractor could regularly pump the manhole with a vacuum truck or pump directly into the force main at CO01. The contractor will likely have to maintain the service throughout the construction of the lift station.

5.0 ENVIRONMENTAL DETERMINATION AND PERMITS

5.1. City of Saint Paul Zoning Approvals

CSP's Zoning Administrator issues construction permit (Notice to proceed) and occupancy approval for construction projects in CSP (COO 18.15). CSP has adopted the State standards for building, mechanical, plumbing, and electrical codes. The permit will need to be obtained by the contractor prior to any grading or excavation occurs. Construction permits applications require:

- Complete plans and specifications signed by a licensed engineer.
- Survey by licensed engineer identifying the proposed location.
- Detailed plan and schedule for construction.
- Copies of permits required by other local, State, and Federal laws.

5.2. Alaska State Fire Marshal Building Permit

The State will require a fire marshal-issued building permit. The plan review requires submittal of the application and construction drawings stamped by a licensed engineer. The State is taking approximately two weeks to complete the initial review, after which they provide an invoice for the fee. Once the fee has been paid, it takes two to four weeks to issue the building permit. The building permit must be posted onsite throughout the construction phase. Once construction is complete, the contractor will notify the State fire marshal who will then issues a letter approving occupation. We don't anticipate any issues with the review or permit.

5.3. State of Alaska Wastewater Engineering Plan Review

The State will require a wastewater plan review prior to construction. The engineer will need to submit an application, including an engineering cover letter, stamp drawings and specifications, Owner's Statement form, and other design information. Once the application is submitted, the fees are paid online. The State review times are approximately 30 to 60 days. They will issue an Approval to Construct. Once construction is complete, the engineer will need to apply for an Approval to Operate. We don't anticipate any issue with the review that would cause any delays.

5.4. US Army Corps of Engineers Nationwide Permit

Sandy Lane LS will require additional fill to be placed on the site. US Fish and Wildlife has not mapped Saint Paul Island's wetlands. No known wetlands delineation has been done around the site. It is highly likely that the area surrounding the site would be classified as a wetland. This activity falls under the US Army Corps of Engineers (USACE) Alaska District's Nationwide Permit 58 Utility Line Activities for Water and Other Substances. The amount of fill is less than one-tenth of an acre and does not require any submittals to USACE including a Preconstruction Notification.

No additional fill will be placed at the Ellerman Heights LS.

5.5. State of Alaska Excavation Dewatering Permit

Both wet well excavations are likely to encounter groundwater. The contractor will have to dewater the excavations. The State of Alaska will require the contractor to obtain an Excavation Dewatering Permit. This permit can be submitted to the State online and will outline the contractor's dewatering procedures. There are no anticipated issues with the contractor obtaining this permit.

6.0 COST SUMMARIES

A summary of project costs are found below. The 2020 original construction estimate was $1,375,000 with one year of 3 % inflation. The 2021 and 2022 construction inflation rates have been estimated at 20% and 15%. This 2023 construction cost estimate is $1,553,000. This is approximately 10% overall increase, which is below the two-year inflation.

The 2023 construction cost estimate is formatted by contract bid tabs. Each bid tab includes the materials, labor, and equipment cost for that bid tab. The 2020 estimate appeared light on shipping costs. The 2023 estimate had savings with the pumps, controls, and lift station systems.

Table 2. Construction Cost Summary

ITEMS	TOTALS
GENERAL BID TABS	$571,850
CONSTRUCTION BID TABS	$596,000
CONTRACT BID TABS	$385,391
TOTAL CONSTRUCTION COSTS	$1,553,241
CONSTRUCTION ADMINISTRATION	$232,986

APPENDIX A: TRIP REPORTS

TRIP REPORT

St. Paul Lift Stations Replacement

Date:	January 31, 2023		
To:	Aaron Wheatall, VSW	Project Number:	165.030540
From:	Daniel Nichols, PE, CCCA		

INTRODUCTION

Kuna Engineering (Kuna) was hired by Village Safe Water (VSW) and the City of St. Paul (CSP) to provide engineering services for the Sandy Land and Ellerman Lift Stations Replacement project. Daniel Nichols, project manager, traveled to St. Paul with a Kuna survey team and met with city manager Phillip Zavadil and public works director David Joyner.

October 20, 2022

The team arrived in St. Paul at approximately 4 pm and checked into their apartment. They spent the remaining afternoon touring the community and visiting the lift station sites.

October 21, 2022

At 8 am the team met with David and his staff at the Public Works building. At 9 am Daniel and Phillip were interviewed on radio station KUHB. At 9:30 am, Daniel returned to the Public Works building to discuss the project and goals. From 10:30 am to noon, Daniel toured water and sewer systems with David. From 1:00 to 6:00 pm, the surveyors worked at the Sandy Lane site while Daniel visited and documented conditions of the city infrastructure (i.e., landfill, quarries, docks, etc.).

October 22, 2022

In the morning, surveyors worked at Sandy Lane and Ellerman Heights sites. Daniel documented force main, manholes, clean outs, and outfalls along both routes. In the afternoon, surveyors worked at Ellerman Heights sites and Daniel worked with the public works staff to go through water and sewer plans at the Public Works building.

October 23, 2022

Morning: Worked on organizing data, drawings, and photos. Surveyors worked at Ellerman Heights sites and loop controls. Afternoon: Finished up Ellerman Heights survey.

October 24, 2022

In the morning, Daniel met at Public Works for debriefing. In the afternoon, the weather started to turn and Daniel and the survey crew departed on the Ravn flight to Anchorage.

TRIP REPORT

FINDINGS AND NOTES

Architecture

- Cedar sidings is preferred.
- Fiberglass doors are preferred.
- Stainless steel hardware, where applicable, is preferred.
- Use Fiberglass Reinforced Plastic (FRP) wall panels for interior over plywood, is preferred.
- Metal roofs with hidden fasteners, is preferred.
- Discussed separate rooms for lift station buildings for wet well, pump room, and electrical room. We will compare different layouts during the design analysis process.

Lift Stations

- Keep controls system simple, is preferred.
- No remote control or monitoring needed.
- No siren on lift stations; only a warning light.
- All exterior lighting on building. No utility poles.
- Install a call-out to Emergency Service when there is an issue.
- Security cameras not needed.
- Ellerman Heights LS CO#1 includes what appears to be air gaps valves. One drains into MH#7D. Kuna will investigate further.
- CO#1 manhole had water in bottom but didn't notice leaking. The rim and manhole lid were buried and had significant rust. Water is likely from surface drainage from being buried.
- Septic Tank manhole nearest to Ellerman Heights LS wet well is in fair to good condition. No leaks or cracking were observed.
- No leaks noticed in Ellerman Heights LS MH#7D. The general condition look good.
- Some standing water in Sandy Lane LS MH#17F but generally in good shape. The bottom channel will need to be reformed with outflow set lower to ensure drainage.
- Surface mounted pumps are preferred to reduce construction and O&M costs. Also, it reduces confined space issues. We will have to work with pump manufacturers to make sure it will work.
- Discussed fiber glass vs. pre-cast concrete for manholes and wells. Fiberglass manholes are lighter but not as strong and high material cost. The two materials will be compared during the design analysis process.

Sites

- Removed fencing from Sandy Lane. No fencing around either lift stations.
- Sandy Lane gravel pad may need to be expanded for new lift station.
- Occasionally standing water can happen in the low-lying areas around Sandy Lane, but not on pad. It has occurred less frequently since the road was extended on the southside.
- Sandy Lane pad has large rip rap around on pad's slope and toe. If pad is expanded will add or reuse rip rap.

General

- Material Pit has significant stockpiles crushed materials. Stockpiles included riprap, barrow material, and crushed gravel (e.g. minus two-inch gravels and minus one-inch gravel). It is estimated that enough stockpiled material exists to complete the projects. It is reported that TDX owns the land and Aleut Corporation owns the subsurface rights.
- Polar Consultant working on project in ballfield next to Sandy Lane LS.
- Demolition materials can be disposed of at the landfill.
- TDX Power owns electrical. Chris Davis, EPS is a good resource on the electrical distribution system.

Photo 1: Sand Lane LS Pad (Looking East)

Photo 2: Sandy Lane LS-Riprap slope (Looking South)

Photo 3: Sandy Lift Station (Looking East)

Photo 4: Sandy Lane-MH#17F

	
Photo 5: Sandy Lane LS (Looking Northeast)	Photo 6: Force Main Cleanout (Looking East to Sandy Lane LS)
	
Photo 7: Fire Hydrant at Ellerman Height LS	Photo 8: Ellerman Height LS (Looking Northeast)

Photo 9: Ellerman Height LS-5,000 Gallon Septic Tank Effluent Manhole

Photo 10: Ellerman Height LS-Manhole# 7D

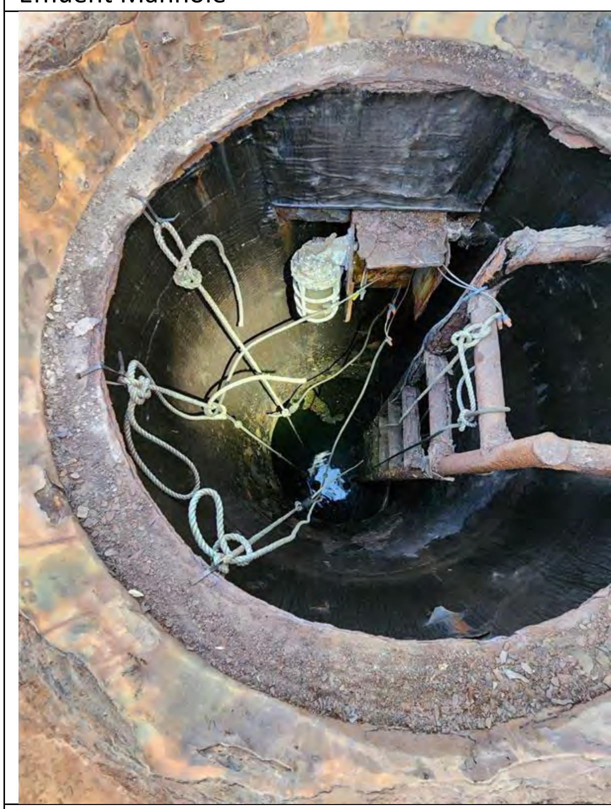

Photo 11: Ellerman Height LS Wet Well

Photo 12: Ellerman Height LS-CO#1

Photo 13: Material Pit

Photo 14: Existing Stockpile, Scoria

Photo 15: Existing Stockpile, Crushed Gravel

APPENDIX B: BUILDING CODE REVIEW

PROJECT INFORMATION

Project name St. Paul Lift Station

Export date 02/01/2023

ARCHITECTURAL CODES

Building Code 2021 of Alaska

BUILDING DATA

Story	Space Name	Occupancy Group	Function of Space	Designed Area (gross sq. ft.)	Area Per Story
1	Equipment Room	S-2	Accessory storage areas, mechanical equipment room	247	247
				Total Gross Area:	247

Sprinkler type	Type of Construction	Fire Separation	High-Rise
Not Sprinklered	VB	-	No

HEIGHTS AND AREAS

Building Area Code Reference 503

Story	Occupancy Group	Designed Area (sq. ft.)	Allowed Area (Aa) (sq. ft.)
-	-	-	Unlimited Area Exemption per Section 507

Building Height in Stories Code Reference 504.4

Single Occupancy

Occupancy Group	Highest Story Above Grade Plane Occupancy Appears On	Highest Allowable Story Above Grade Plane
S-2	1	1

This building qualifies for unlimited area. Unlimited area buildings are restricted to one or two stories, based on various requirements of Section 507. Increasing number of stories may cause the building to no longer be eligible for unlimited area.

Building Height in Feet

Code Reference 504.3

Single Occupancy

Occupancy Group	Highest Elevation Above Grade Plane Occupancy Appears On	Highest Allowable Elevation Above Grade Plane
S-2	12.0 ft.	40 ft.

Average Roof Surface Height Above Grade Plane	Highest Allowable Elevation Above Grade Plane
12.0 ft.	40 ft.

EGRESS INFORMATION

Occupant Loads

Story	Space Name	Occupancy Group	Function of Space	Designed Area (gross sq. ft.)	Designed Area (net sq. ft.)	OLF	Occupant Load
1	Equipment Room	S-2	Accessory storage areas, mechanical equipment room	247	-	300	1

Min. Exits per Space Code References 1006.2.1 1006.3.3

More than one exit must be provided if the space occupant load or maximum common path of egress travel distance are exceeded. More exits may be required under high occupant load or other special conditions (see notes below).

Story	Space Name	Occupancy Group	Function of Space	Cum. Occupant Load of Space	Max Single Exit Cumulative Load of Space	Min. Number of Exits per Space	Max. Common Path of Egress Allowed for Single Exit
1	Equipment Room	S-2	Accessory storage areas, mechanical equipment room	1	29	1	100

Min. Exits per Story Code Reference 1006.3.3

Story	Total Occupancy Load by Story	Minimum Number of Exits or Exit Accesses	Max Exit Access Travel Distance for 1 Exit
1	1	1	75

In addition to single exit eligibility shown above, one exit may be permitted where all spaces are permitted to have one exit or access to a single exit and the exit discharges directly to the exterior at the level of exit discharge

Max. Exit Access Travel Distance Code Reference 1017.2

Maximum exit access travel distance serving each space should be at a maximum the values below for each occupancy group.

Occupancy Group	Max Exit Access Travel Distance
S-2	300 ft.

Max. Dead-End Corridor Length Code Reference 1020.5

Dead-end corridors within each occupancy group should be at a maximum the length given below.

Occupancy Group	Max Dead-end Corridor Distance
S-2	20 ft.

Dead-end corridor length limits only apply where more than one exit or exit access doorway is required

Dead-end corridor length is not limited where the length of the dead-end corridor is less than 2.5 times of its least width

Min. Corridor Width Code References 1005 1020.3

N/A

Min. Stairway Wid Code References 1005.3.1 1011.2

Story	Stairway	Min. Calculated Value	Min. Value per Sec. 1011.2	Final Min. Stairway Width
1 (See note a)	-			-

a. No stairways entered for these stories

FIRE-RESISTANCE RATINGS

Interior Building Element Fire-Resistance Rating Code Reference 704.1

Story	Interior Building Element Type	Min. Fire Resistance Ratings (hrs.)
All	Primary structural frame	0
	Interior Bearing Walls	0
	Interior Nonbearing walls and partitions	0
	Floor construction and associated secondary structural members	0
	Roof construction and associated secondary structural members	0

Min. Corridor Fire-Resistance Ratings Code Reference 1020.2

Each corridor must meet the minimum fire resistance ratings below

N/A

Required Occupancy Separations Code Reference 508.4

N/A

PLUMBING

Required Plumbin Code Reference 1210

Story	Occupancy Group	Space Description	OL	Water Closets	Lavatories	Bathtubs/ Showers/ Drinking Foundations	Other
1	S-2	Storage structure or warehouse	1	Male: 0.01 Female: 0.01	Male: 0.01 Female: 0.01	-	1 service sink

* Building is unoccupied.

APPENDIX C: OUTLINE SPECIFICATIONS (CSI'S #)

OUTLINE SPECIFICATIONS

Saint Paul, Alaska

Lift Station Replacements

VSW# 22-VSW-SNP-034

DIVISION 01 GENERAL REQUIREMENTS

01 10 00	SUMMARY OF WORK
01 31 19	PROJECT MEETINGS
01 33 00	SUBMITTAL PROCEDURES
01 51 00	TEMPORARY UTILITIES
01 91 00	COMMISSIONING

DIVISION 02 EXISTING CONDITIONS

02 40 21	DEMOLITION

DIVISION 03 CONCRETE

03 10 00	CONCRETE FORMING AND ACCESSORIES
03 20 00	CONCRETE REINFORCING
03 30 00	CAST-IN-PLACE CONCRETE

DIVISION 04 MASONRY

04 20 00	UNIT MASONRY
04 22 00	CONCRETE MASONRY

DIVISION 06 WOOD, PLASTICS, AND COMPOSITES

06 10 00	ROUGH CARPENTRY
06 10 53	MISCELLANEOUS CARPENTRY
06 16 00	SHEATHING
06 83 16	FIBERGLASS REINFORCED PANELING

DIVISION 07 THERMAL AND MOISTURE PROTECTION

07 13 00	SHEET WATERPROOFING
07 15 00	SHEET METAL WATERPROOFING
07 21 00	THERMAL INSULATION

APPENDIX D: DETAILED COST ESTIMATES

Sandy Lane and Ellerman Heights Lift Stations Replacement
35% Construction Cost Estimate

GENERAL BID TABS	QTY	UNIT	UNIT COST	TOTAL
Mob/Demob	1	LS	$400,000	$400,000
Air Freight	1	LS	$40,000	$40,000
Travel	1	LS	$16,800	$16,800
Housing/Per Diem	45	WK/PER	$1,890	$85,050
Survey Controls	1	LS	$15,000	$15,000
Erosin Control/SWPPP	1	LS	$15,000	$15,000
			SUBTOTAL	$571,850

CONSTRUCTION BID TABS	QTY	UNIT	UNIT COST	TOTAL
Excavation	300	FT	$20	$6,000
Trench Stabilization (20 ft Sheet pile)	200	FT	$200	$40,000
Gravel Fill (SL)	100	CYD	$150	$15,000
Gravel Fill (EH)	50	CYD	$150	$7,500
Surface Course Fill (SL)	10	CYD	$175	$1,750
Surface Course Fill (EH)	20	CYD	$175	$3,500
Rip Rap (SL)	30	CYD	$75	$2,250
Precast Wet Well (SL)	1	CYD	$25,000	$25,000
Precast Wet Well (EH)	1	CYD	$30,000	$30,000
(2) Concrete Foundation and Slab	20	CYD	$500	$10,000
(2) 9' x 13' Buildings	432	SQFT	$500	$216,000
Pumps (Set of 2)	2	EA	$48,000	$96,000
Pump Controls	2	EA	$16,300	$32,600
Building Mechanical & Electrical (SL)	1	EA	$15,000	$15,000
Building Mechanical & Electrical (EH)	1	EA	$20,000	$20,000
Water Service (SL)	100	FT	$150	$15,000
Water Service (EH)	26	FT	$150	$3,900
Gravity Sewer Piping and Fittings (SL)	45	FT	$200	$9,000
Gravity Sewer Piping and Fittings (EH)	21	FT	$200	$4,200
Force Main Pipign and Fittings (SL)	5	FT	$175	$875
Force Sewer Piping and Fittings (EH)	11	FT	$175	$1,925
Sewer By-Passing (SL)	3	DAYS	$900	$2,700
Sewer By-Passing (EH)	42	DAYS	$900	$37,800
			SUBTOTAL	$596,000

CONTRACT BID TABS	QTY	UNIT	UNIT COST	TOTAL
Contractor Profits	15%	%	$1,167,850	$175,178
Bonding & Insurance	3%	%	$1,167,850	$35,036
Contingency	15%	%	$1,167,850	$175,178
			SUBTOTAL	$385,391

CONSTRUCTION TOTAL	$1,553,241

CONSTRUCTION ADMISNTRATION	QTY	UNIT	UNIT COST	TOTAL
Construction Adminstration (Engineer)	10%	%	$1,553,241	$155,324
Constructino Adminstration (City)	5%	%	$1,553,241	$77,662
			CONSTRUCTION ADMINSTRATION TOTAL	$232,986