

CE2 Engineers, Inc.

TECHNICAL MEMORANDUM

TO: Susan Randlett, P.E., Village Safe Water

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SUBJECT: Saint George Sewage Outfall Options

DATE: October 22, 2012

This Technical Memorandum will discuss the range of options for correcting the dilapidated condition of the sewage ocean outfall pipe at the City of Saint George on Saint George Island, and will make recommendations for a course of action to deal with the problem.

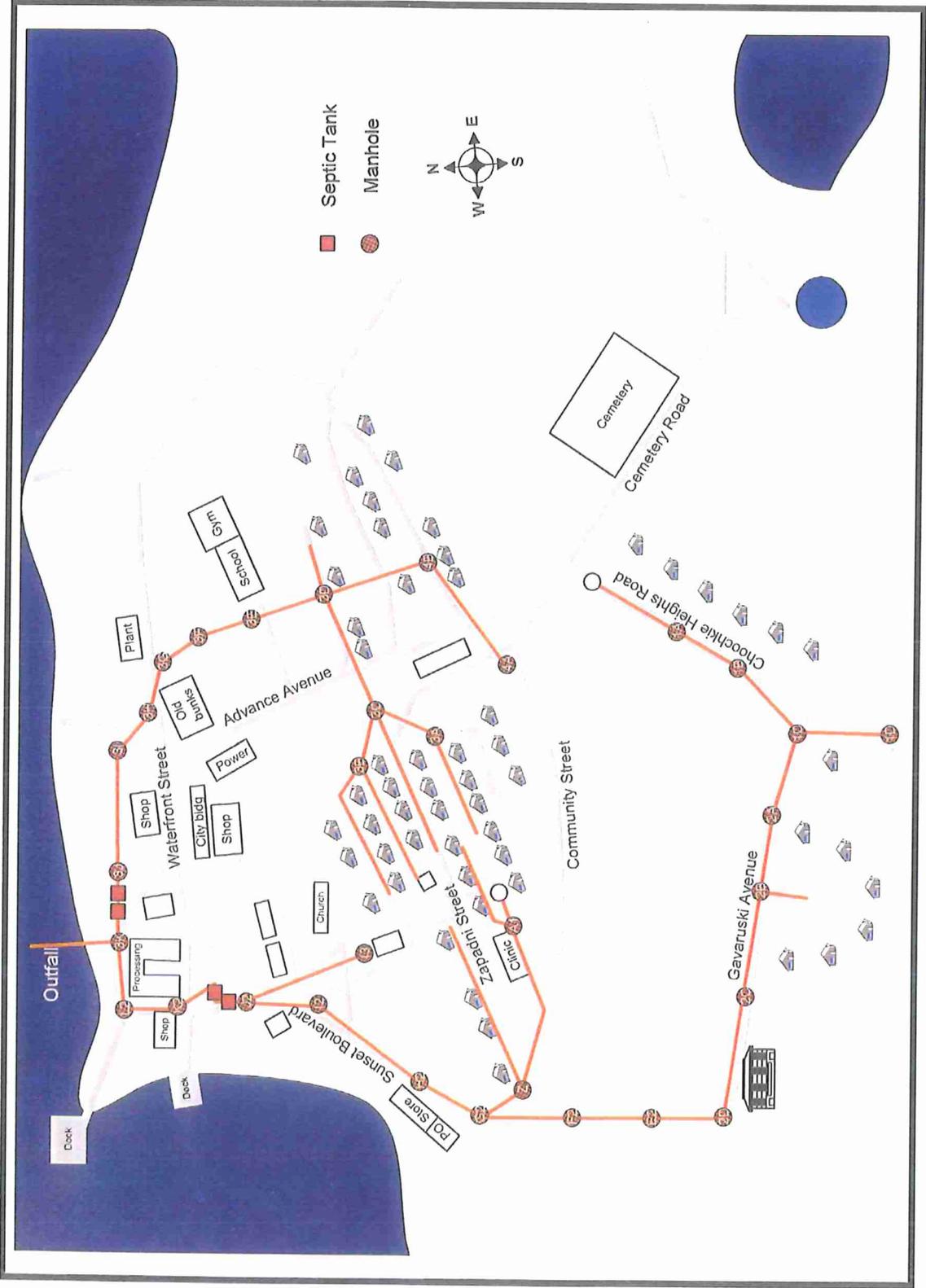
BACKGROUND

The City of Saint George is served by a gravity flow sewer system that uses septic tanks and an ocean outfall. The system of sewer mains collects wastewater from the toilets, sinks, and drains of houses and businesses. These sewer mains are sloped so the wastewater flows downhill to the septic tanks. Much of the solids in the wastewater settle into the septic tanks, while the clarified wastewater effluent flows out of the septic tanks through the outfall pipe to the ocean. The outfall pipe extends 315 feet into the Bering Sea discharging at approximately 14 feet below mean lower low water (MLLW). The ocean outfall was constructed in the 1950s.

The community is divided into two gravity wastewater collection areas. (See schematic wastewater system diagram Figure 2 on page 2). Sewage from homes and businesses on the south and west side flows through two 5,000-gallon septic tanks (in series) located near the old docks. Sewage from the homes and businesses on the east side of town (east of the hotel) flows through two 5,000-gallon tanks (in series) located near the old carpenter shop. Effluent from both pairs of septic tanks combine at the terminal manhole near the beach and then discharges by gravity through the ocean outfall pipe into the Bering Sea.

At present, the four septic tanks provide primary treatment for wastewater from the two gravity wastewater collection areas. The septic tanks provide primary treatment for the wastewater, and the clarified wastewater effluent flows out of the septic tanks to the terminal manhole, where it is combined from the two pairs of septic tanks and then flows by gravity down the outfall pipe 315 ft and discharges into the Bering Sea.

Figure 1 — City of Saint George Wastewater Collection and Disposal System Diagram



ocean outfall pipe consists of 6-in ductile iron sewer pipe from the terminal manhole 3K in Figure 1 to the discharge end of the outfall. It runs along the surface of the rocky beach, covered with a concrete shell to resist wave and ice action, as shown in the following figures:

Figure 2 — Ocean outfall on beach looking upstream

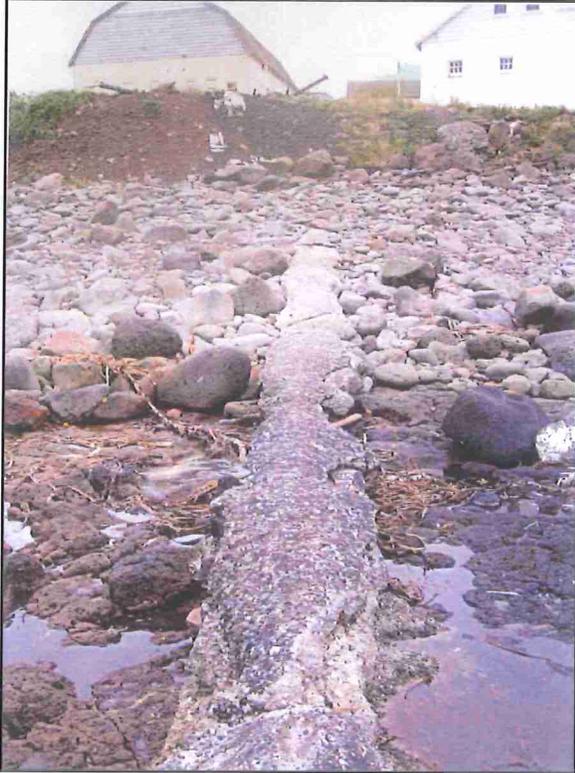


Figure 3 — Ocean outfall looking out to sea



Underwater examination of the outfall pipe showed a break below the water surface in 2010. In the severe winter of 2009-2010, the outfall line froze, causing flooding on the beach with subsequent ice buildup.

WASTEWATER TREATMENT OPTIONS

There are a number of wastewater treatment options available for St. George. They are:

1. **Primary Treatment using Septic Tank System and an Ocean Outfall.**

This option is what is presently being used at St. George. It would require the upgrading of the outfall pipe. The most practical method of upgrading the outfall would be to install a new ocean outfall using directional drilling near the terminal manhole to 25-ft depth MLLW. This length of outfall is about 500 to 600 ft past the terminal manhole out to sea. Because of the difficult logistics to get to St. George with a directional drilling machine, drilling mud, and pumper trucks, the cost could be in the \$1.5 million dollar range.

2. **Secondary Treatment using Primary and Secondary Treatment System and an**

Ocean Outfall.

This option would treat wastewater to a higher standard than just primary treatment. There are several systems on the market now that would require minimal maintenance that could make this system feasible. However there would be additional electricity costs for aeration and pumping that would be a burden on the community. An ocean outfall would still be required. As with Option 1, this cost would include a directionally drilled outfall pipe replacement and a secondary treatment system. Costs would be in the order of \$2.0 to \$2.5 million.

3. Primary and Secondary Treatment using a Lagoon.

The lagoon would consist of a settling cell, followed by a primary cell and secondary cell. The settling cell would allow for sludge settlement, which would remove 50% of the BOD (biochemical oxygen demand). This would make the following cells smaller, which could save some cost over a larger lagoon. Initially, this looks like an appealing alternative. However, the lagoon brings up a serious issue with the water supply. The aquifer of fresh water supplying the community consists of a layer of fresh water from rain and snow melt that fills the cracks in the fractured basalt of the island. This layer of fresh water sits atop of the sea water in deeper strata of the island. Any discharge of treated water from the lagoon will easily enter the fresh water of the aquifer, polluting it. The cells of the lagoon will have to be lined with membranes to prevent polluting the fresh water aquifer. Any tears in the lagoon membrane could introduce contamination to the water supply. In addition, the lagoon will still need to discharge seasonally to the Bering Sea, which will still require an ocean outfall. Cost of this alternative will be in the order of \$2.5 to \$3.0 million.

SOURCES OF FUNDING FOR IMPROVEMENTS

The population of St. George is presently 75 people, and the city has an operating water and wastewater system, though it is not in good condition and needs critical improvements. The problem with obtaining those necessary improvements is that there are a number of communities in rural Alaska that have no piped water and sewer, so they will always be ahead St. George in funding priority with State of Alaska Village Safe Water capital funding, as well as Federal Indian Health Service (IHS) funding.

The best way to obtain funding for improvements would be by direct appropriation through the Alaska State Legislature. Since this is not assured, it is imperative that the City of St. George operate the existing system to ensure the best success of the outfall until funding from whatever source can be obtained for a new outfall.

RECOMMENDATIONS

It is important to pump out and dispose of the sludge in the septic tank once a year to prevent sludge and debris from moving down the outfall pipe and jamming the pipe. There is not much that can be done to repair the break in the outfall pipe that is underwater. In the winter months, it is important that a steady flow be maintained in the wastewater piping and septic tank to keep heat going down the outfall line to prevent freeze ups. This will have to be done to keep the system running until a source of funding is obtained to install a new underground outfall line.