P N D
ENGINEERS, INC.

May 15, 2020 PND 192080.01

Mr. Karl Hagerman
Utility Director, Petersburg Borough
P.O. Box 329
11 S. Nordic Drive
Petersburg, Alaska 99833

Re: Pump Station No. 4 Force Main
Design Study Report

Dear Mr. Hagerman,

PND Engineers, Inc. (PND) and Stephl Engineering LLC (Stephl) are pleased to provide this Design Study Report for the Pump Station No. 4 (PS4) Force Main project. The purpose of this study is to evaluate replacement and rehabilitation options for the deteriorating PS4 force main pipe, and potentially the pump station itself, near Hungry Point. This report includes project background information, summary of a site visit performed by the design team, discussion of the methodology used to conduct the study, and a presentation of potential repair and replacement alternatives.

Project Background

PS4 is the second largest pump station in Petersburg's wastewater collection system. The existing force main was installed in the 1970's, is approximately 1,000 feet long, and is constructed of 10-inch diameter iron pipe (records are conflicting as to whether the pipe is cast iron or ductile iron). The force main originates at PS4, approximately 400 feet southwest of Hungry Point on North Nordic Drive. Sewage is pumped northeast to Hungry Point where it turns and travels southeast to the discharge manhole approximately 600 feet southeast of Hungry Point. The force main runs parallel to a gravity main; the gravity main passes through five manholes (including the discharge manhole) between PS4 and the discharge manhole. As-built drawings indicate that the force main lies within the chamber of each manhole however it appears to actually be cast into the concrete manhole bases.

A significant portion of the force main lies at a depth that is tidally influenced, and the saltwater environment has resulted in significant corrosion and pipe failures. A section of pipe near the manhole at Hungry Point was replaced in 2014 after the pipe failed at this location due to corrosion.

PND and Stephl were retained to perform a scoping and design study on replacement and rehabilitation options for the force main. The design team visited the site on November 12-13, 2019 and investigated the pump station, manholes, and general project area. Pump cycle times were noted and flows were visually observed and roughly measured to estimate flow volume and velocity, and system pressure. Subsequent to the site visit, peak flow values for one- and two-pump operations were provided by the Borough.

Information collected was used to evaluate two trenchless rehabilitation alternatives and one conventional trenching (open cut) replacement alternative for consideration by the Borough. These alternatives are discussed in detail in the next section.

Replacement/Rehabilitation Alternatives

Conventional Open-Cut Replacement

The conventional open-cut full pipe replacement option involves installing a new force main pipe from PS4 to the discharge manhole. The existing pipe would be cut and capped near PS4 and the discharge manhole. It will then be filled with a cement slurry and abandoned in place. The new force main would roughly follow an offset alignment of the existing force main, albeit at considerably shallower depth than the existing force main for

most of its length (see attached Sheet 1, Alternative 1: Open Cut Replacement). The new pipe would likely be 10-inch C900 Polyvinyl Chloride (PVC) SDR 21. PVC can be installed in shorter sections more quickly and with a smaller footprint than high-density polyethylene (HDPE) pipe. The pipe material is inherently resistant to corrosion and most industry literature suggests a design life of 100 years or more. The design life for PVC pipe in cyclically-pressurized systems (such as sewer force mains) can sometimes be less than that of non-pressurized or constant pressure systems due to fatigue. SDR 21 PVC pipe was evaluated in accordance with AWWA based on number of cycles (the pumps reportedly cycle approximately every 5 minutes), operating pressure (approximately 30 psi) and design life (50 years). The analysis shows that SDR 21 PVC has significantly more "available" cycles to fatigue failure than anticipated cycles during the design life, indicating a design life in excess of 50 years.

The only permit anticipated for an open-cut replacement, prior to construction, is an Alaska Department of Environmental Conservation (ADEC) Approval to Construct. An Approval to Operate from ADEC must be obtained after construction.

The open-cut replacement option lends itself favorably to local contractors in that there are several general contractors in Petersburg capable of performing the work. Further, there is no need for sewage bypass pumping because the existing force main can remain in service while the new force main is installed. Connecting the new force main to Pump Station 4 and the discharge manhole can occur during a period of minimal flow (at night, likely in a single night shift) with a pump truck on standby in case the wet well fills during the connection work.

The most significant drawback to the open-cut replacement option following the existing force main alignment is the disturbance to Nordic Drive and Sandy Beach Road. Trenching operations will require the removal and patching of a swath of pavement for the entire length of the project. During design, consideration will be given to this factor by minimizing the trench width, but road patches generally reduce the surfacing's service life. The existing asphalt surface is in fair condition. Given its current 15-year age the surfacing likely has 5-10 years of life before a comprehensive rehabilitation or replacement is considered. The patch necessary to complete the open cut replacement may shorten that timeframe.

Open-cut construction sequencing is anticipated as follows:

- Set up traffic control measures within project limits.
- Commence with saw-cutting, trenching, pipe installation and backfill operations between tie-in locations (Pump Station 4 and the discharge manhole). Historical information suggests that the excavation will occur entirely in fill material placed during the original road construction. It is assumed that all excavated material will be suitable for backfill and the only waste material will be that displaced by the pipe and new bedding. During working hours, single lane closures would be permitted. Both lanes will be required to be open after working hours, thus the contractor would need to backfill the entire length of pipe installed except for the daily termination points which could be covered by a steel plate.
- After the majority of new pipe has been installed, it will be pressure-tested.
- Connect the new leg to PS4 and the discharge manhole. This could be performed in a single night shift when flows are at a minimum and the pumps can be shut off. A pump truck should be on standby to drain the wet well if it fills up during tie-in work.
- Fill the existing iron force main with a cement slurry, cap the ends and abandon the pipe in place.
- Backfill tie-in locations and commence concrete surface repairs, maintaining one lane of traffic during working hours and two lanes outside of working hours. Concrete surface repairs were selected because there is not currently an asphalt plant in Petersburg and paving contractors have indicated that there is no paving work forecast for Petersburg in 2020.

On-site construction work would likely take 6-8 weeks to complete.

An itemized cost estimate is provided below, and includes both construction an associated professional service costs for the project:

Construction Costs

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	$40,000	$40,000
2	Abandon Existing Pipe	1	LS	$10,000	$10,000
3	Remove Curb and Gutter	30	LF	$15	$450
4	Remove Sidewalk	15	SY	$15	$225
5	Sawcut & Remove Asphalt	730	SY	$8	$5,840
6	Unusable Excavation	410	CY	$15	$6,150
7	Base Course	125	CY	$50	$6,250
8	install 10-inch PVC Force Main w/ Trenching & Bedding	1090	LF	$130	$141,700
9	Utility Conflict Contingent Work	1	LS	$15,000	$15,000
10	Concrete Sidewalk	15	SY	$100	$1,500
11	Curb and Gutter	30	LF	$50	$1,500
12	Concrete Patch 6"t	730	SY	$150	$109,500
13	Traffic Control	1	LS	$50,000	$50,000
14	SWPPP	1	LS	$10,000	$10,000
15	Construction Surveying	1	LS	$20,000	$20,000

Subtotal Construction Cost Open-Cut Replacement Option	$418,115
Recommended Project Contingency (15%)	$62,717
Total Construction Cost with Contingency (15%)	**$480,832**

Professional Services

Phase 1 Design – Scoping Study	$34,045
Permitting	$5,000
Survey (by Rick G. Braun, L.S.)	$10,000
Final Design (estimated at 10% of construction total)	$48,083
Contract Administration/Construction Inspection (estimated at 10% of construction total)	$48,083
Total Recommended Project Budget	**$626,044**

Trenchless Rehabilitation – Sliplining

Sliplining is described as the insertion of a new pipe into an existing host pipe and grouting the annular space between the existing pipe and the new pipe. This proven trenchless pipe rehabilitation process provides the benefit of a new sewer main, but with the potential limitation of reduced flow capacity due to the smaller cross-sectional area of the new pipe. Continuous sliplining uses a long HDPE pipe that can be butt-fuse welded into segments of any length. The liner pipe is pulled through the existing host pipe starting at an insertion pit and continuing to a receiving pit. Slight deflections in the host pipe can be negotiated with the HDPE liner. Sliplining with a butt-fused pipe would require the excavation of insertion and receiving pits along the host pipe alignment to provide access points for the pipe insertion. The excavations are performed at locations such as bends, fittings, starting and termination points, and low points along the pipe alignment to allow for cleaning and installation.

Figure 1: Sliplining with HDPE pipe

To slipline the existing 10-inch pipe it is recommended that a butt-fused 10-inch SDR (standard dimension ratio) 21 HDPE liner with an outside diameter of 9.05 inches be inserted into the existing CI pipe. The existing 10-inch CI force main host pipe has an inside diameter of 9.95 inches. The 10-inch SDR 21 HDPE pipe has an inside diameter of 8.14 inches. With this size HDPE pipe, the cross-sectional area of the rehabilitated force

main would be reduced by 33 percent compared to the original pipe.

Within access pits and open cut portions of the project the existing force main piping would be replaced with C900 SDR 18 PVC. PVC will allow for direct bolt-up to the HDPE sliplined pipe as long as pipe stiffeners are utilized in construction with the HDPE pipe.

Sliplining will result in significantly reduced pipe cross-sectional area. A preliminary flow analysis was performed as part of this study to evaluate the impact of the smaller pipe on the existing sewer system.

Figure 2: Insertion pit for sliplining with HDPE pipe

The Hazen-Williams Equation was used to model the pressure loss in the project pipe before and after rehabilitation. Flow values used in this preliminary analysis were provided by Petersburg Borough staff.

The sewage flow value used in the analysis was:

- 2,400 gallons per minute (GPM) peak flow for the 10-inch iron pipe with two pumps operating.

The friction loss coefficients used in the flow analysis were:

- C factor = 100 for the existing iron pipe with interior mineralization buildup
- C factor = 140 for the proposed sliplined HDPE pipe

It is estimated that at the current sewage flow rates provided by Petersburg Borough staff, installing the proposed 10-inch HDPE pipes using the sliplining option would result in an overall increase in head loss of approximately 13 psi for the 1,073-foot long force main system. The estimated 13 psi head loss value is large and suggests that the pumps would likely have to be operated substantially differently to achieve a peak flow of 2,400 GPM.

The flow velocity was also checked to verify whether or not it would fall within standard operating ranges. The Environmental Protection Agency (EPA) recommends that sewer force main flows operate between 2 feet per second (fps) and 10 fps. Flow velocity calculations during peak flow conditions indicate that sliplining as described would result in a peak flow velocity of about 14.8 fps, which is outside of the EPA's recommended operational velocities.

Rehabilitating the existing force main by sliplining is **not recommended** for operational reasons, which could have substantial cost implications, and thus no cost estimate was prepared.

Figure 3: Typical CIPP liner access and insertion pit

Trenchless Rehabilitation – Cast-in-Place Pipe (CIPP)

CIPP is a lining system in which a thin flexible tube of fabric is impregnated with resin and expanded by means of internal pressure into position on the inner wall of the host pipe before curing the resin. Curing of the resin usually takes place by one of the following methods: steam, hot water, or ultraviolet light (UV). A CIPP liner can be installed around minor bends and grade breaks without the need for excavation. The CIPP process provides a structural rehabilitation of the host pipe. In this case, the CIPP liner would be designed for the "fully deteriorated" pipe condition. This means that the host

pipe could completely lose its structural strength in the future and the CIPP liner would be a stand-alone pipe. The liner would be sized to account for the site conditions (depth of burial, ovality of the host pipe, operating pressure, traffic loads, etc.). For example, the wall thickness for the CIPP would be approximately 0.3 inches. A 10-inch diameter liner placed within the existing CI pipe would result in a new pipe/liner inside diameter of 9.4 inches.

CIPP is a special process requiring unique equipment as well as trained and qualified manpower to install. A pressure CIPP liner must be designed to fit this project's conditions. The existing force main operating pressure is approximately 30 psi. It is recommended that the liner specified on this project be built to a pressure rating greater than 60 psi. This would provide a contingency for water hammer events along with operational changes in pumping configuration. During design it is recommended that increasing the wall thickness in the CIPP liner be evaluated as a contingency for possible erosion taking place within the force main.

Figure 4: Pull-in insertion of pressure CIPP liner

Below is a list of CIPP manufacturers and installers that may have interest in this project:

Figure 5: CIPP pressure liner in CI pipe

- **SAERTEX** – SAERTEX offers a sewer force main lining system in the form of a fiberglass reinforced liner. The curing of their liner takes place by UV light or steam methods. SAERTEX states their products are Class IV structural liners with an operating pressure up to 150 psi pressure rating. Construction Unlimited is a certified installer located in Anchorage, Alaska. They have performed work across the state including the communities of Anchorage, Fairbanks, Valdez and Homer. Another SAERTEX installer in the Pacific Northwest is Allied Trenchless. They are located in Chelan, Washington and have performed CIPP work in Anchorage, Alaska.
- **Applied Felts** – Applied Felts manufactures a sewer CIPP lining system called AquaCure PS. AquaCure PS is a fiberglass reinforced polyester felt liner. Applied Felts states their products are Class IV structural liners with an operating pressure rating up to 150 psi. The curing of their liner takes place by water or steam methods. Frawner Corporation, located in Anchorage, is a certified installer of the Applied Felts system. They have performed work across the state of Alaska including Anchorage, Fairbanks, Kodiak and Kake.
- **NORDIPIPE** – NORDIPIPE manufactures a sewer CIPP lining system for pressure situations called NORDIFORCE. Michels Corporation is a licensed installer of the NORDIPIPE system. Michels Corporation is a nationwide contractor with offices in Washington state. The liner can be installed by water or air inversion or pulled in place and inflated. NORDIFORCE can be cured by air, steam, or hot water.

- **Insituform** – Insituform manufactures a sewer CIPP lining system for pressure situations called InsituMain. Their liner is a Class IV structural liner with an operating pressure up to 80 psi. The liner can be installed by water or air inversion, or pulled in place and inflated. InsituMain can be cured by air, steam, or hot water. Insituform services the United States and Canada and has an office in Seattle.
- **RS Technik** – RS Technik manufactures a sewer CIPP lining system called RS CityMain. RS Technik offers a fiberglass reinforced polyester felt liner. RS Technik states their products are Class IV structural liners with an operating pressure of up to 230 psi. The curing of their liner takes place by water or steam methods. RS Technik has an installer located on the West Coast.

Construction sequencing for the CIPP rehabilitation option on this project would consist of the following (please reference the attached drawing Sheet 2, Alternative 2: CIPP Rehabilitation for manhole designations and access pit references):

- Traffic control set up in North Nordic Drive and Sandy Beach Road.
- Excavate access pits at the connection points and valves. Typical maximum runs for CIPP installation are approximately 500 to 750 linear feet. It is estimated that a total of two excavations would be required to install CIPP for this project. The access pits would be approximately 10 feet wide by 20 feet long at the ground surface.
    - An access pit would be excavated immediately outside PS4; piping within this pit would be replaced and would serve as a CIPP insertion point.
    - An access pit would be excavated at manhole MH 2, which would be replaced. The existing manhole and any fittings would be removed. The excavation would serve as a CIPP access pit. After the CIPP is installed a new manhole would be set to encapsulate both the gravity line and the force main at this location. The force main legs would then be mechanically connected.
- Implement flow control on sewer main
    - 12-inch HDPE pipe would be connected to the existing 10-inch force main. Existing pumps would be utilized to bypass sewage flows while rehabilitation work is performed.
- Prior to starting rehabilitation work, the host pipe will be thoroughly cleaned by the construction contractor and inspected with a camera. The purpose is to identify any defects that may restrict the insertion process and confirm that the host pipe is clean and ready for CIPP installation. Minor rocks, debris or defects in the host pipe could affect the lining operation and must be removed before insertion of the liner.
- The CIPP liner is inserted into the existing pipe and may be inverted or winched into place. The resin impregnated lining is cured by circulating hot water or steam, or is cured with UV light. If water curing is completed it could take longer than usual due to the groundwater surrounding the host pipe. Annular space grouting is not necessary, as the CIPP lining will fit tightly against the host pipe and will follow the invert grade of the existing pipe. The finished properties of the CIPP liner are verified through field-sampling procedures and testing. Upon completion of the curing process the liner would be hydrostatically tested for leaks.
- A post-construction CCTV inspection by the contractor will be completed after the CIPP liner is installed. This will be reviewed by the engineer to determine if the work has been completed as required and that the pipe is clean and functioning properly.
- Replace piping within access pits. The force main legs within the access pits will be replaced with 10-inch SDR 21 PVC pipe, which will allow for direct bolt-up to the CIPP-lined force main. Internal end seals will need to be designed to transition from the CIPP lined force main to the PVC piping within the access pits.
- Perform a pressure test of the newly installed CIPP/PVC piping to ensure the installation meets the design specifications.
- Backfill and surface patch all access pits and reopen all lanes in North Nordic Drive and Sandy Beach Road.

A preliminary flow analysis was not completed for CIPP. Experience suggests that any flow restriction resulting from the marginally-reduced cross-sectional area of the rehabilitated force main will be offset by its increased

wall smoothness. Rehabilitation may actually result in slightly increased flow capacity.

Lane closures will be necessary to upgrade the existing force main. Construction would be staged to allow one lane of traffic to be operated during construction.

The composite liner and epoxy-based resin CIPP lining systems are highly resistant to corrosion, as is the PVC pipe that would replace the existing force main in the access pits.

The following permits would be obtained during design and prior to construction:

- ADEC Approval to Construct
- Excavation Dewatering General Permit (USACE Nationwide Permit)

An Approval to Operate from ADEC will be required after construction.

Typical lead times on CIPP materials is eight weeks. It is estimated that construction work at the site would take 5 weeks to complete. CIPP installation requires a specialized contractor not currently in Petersburg, although there are installers located in Alaska and the Pacific Northwest.

Below is an itemized cost estimate for the CIPP rehabilitation option, including associated professional services:

Construction Costs

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	$75,000	$75,000
2	Removal of Pavement	50	SY	$15	$750
3	Removal of Curb and Gutter	50	LF	$15	$750
4	Remove Sidewalk	15	SY	$10	$150
5	Remove and Replace MH	1	EA	$25,000	$25,000
6	Bedding	50	LF	$55	$2,750
7	Unusable Excavation	150	CY	$15	$2,250
8	Trench Excavation and Backfill	150	CY	$50	$7,500
9	Remove and Replace 10-inch CI line with 10-inch PVC	40	LF	$500	$20,000
10	Pipe Cleaning and Preparation for CIPP	1	LS	$50,000	$50,000
11	Pre-CCTV and Post-CCTV	1,073	LF	$20	$21,460
12	CIPP 10-inch CI Pipe	1,073	LF	$200	$214,600
13	CIPP Point Repairs	3	EA	$4,000	$12,000
14	Curb and Gutter	50	LF	$50	$2,500
15	Concrete Sidewalk	15	SY	$100	$1,500
16	Concrete Patch	100	SY	$150	$15,000
17	Utility Conflict Contingent Work (water main support)	1	LS	$15,000	$15,000
18	Traffic Control	1	LS	$50,000	$50,000
19	SWPPP	1	LS	$10,000	$10,000
20	Construction Surveying	1	LS	$10,000	$10,000

Subtotal Construction Cost CIPP Option	$536,210
Recommended Project Contingency (15%)	$80,432
Total Construction Cost with Contingency (15%)	**$616,642**

Professional Services

Phase 1 Design – Scoping Study	$34,045
Permitting	$7,000
Survey (by Rick G. Braun, L.S.)	$5,000
Final Design (estimated at 10% of construction total)	$61,664
Contract Administration/Construction Inspection (estimated at 10% of construction total)	$61,664
Total Recommended Project Budget	**$786,015**

System Replacement: New Pump Station and Alternate Force Main Alignment

The Petersburg Borough intends to replace Pump Station No. 4 in the near future. This presents an opportunity to combine the force main and pump station replacements, and pursue an alternate less-impactful force main alignment. The alternate alignment is presented in the attached Sheet 3, Alternative 1A: Pump Station and Force Main Replacement. The new force main would largely route through the undeveloped right-of-way south of the residences on Hungry Point, and the new pump station would be installed behind the existing pump station. The new pump station and force main configuration would roughly be as follows:

- A new manhole would be installed in front of the existing pump station; the manhole will intercept and re-direct the existing gravity pipe to a more favorable alignment for connecting to the new lift station.
- The gravity line will extend from this new manhole, through the existing wet well (to be decommissioned), to its discharge point at the new pump station wet well behind the existing pump station.
- The new force main will be routed through the existing rights-of-way south of the Hungry Point residences, to a local high point southwest of the existing discharge manhole.
- At this high point, a new discharge manhole equipped with an air relief valve would be installed.
- The sewer main would transition to gravity downstream of the air relief valve, and connect to the existing discharge manhole. Several intermediate manholes may be required in the gravity line to accommodate grade breaks. The downstream end of the new gravity main may need board insulation; the existing gravity main exiting the existing discharge manhole is relatively shallow, and matching inverts may prevent 5 feet of cover over the new pipe.
- The existing wet and dry wells and force main would be decommissioned and left in place. The emergency backup generator would remain and connect to the new pump station.

The new force main downstream of the new lift station would consist of fused HDPE which, like PVC, is inherently resistant to corrosion and has a suggested a design life of 100 years or more. The gravity extension upstream of the new lift station, and the gravity component at the downstream end of the new main, could be either PVC or HDPE (we have assumed PVC is preferred). The new pump station would be a triplex submersible-pump type station similar to other recently-installed pump stations in Petersburg.

Pursuing this alternative has several advantages. The most significant is the minimization of disturbance to Nordic Drive and Sandy Beach Road. This reduces costly surface patching which will also contribute to accelerated deterioration of the pavement surface. Local general contractors are capable of constructing this combined replacement option, as it will be similar to other recent lift station replacement projects. Bypass pumping is likely necessary, but should be minimal and only needed during final connection work. Lastly, the existing pump station could remain in operation during the majority of construction.

Permitting efforts for the combined pump station/force main replacement option will likely be more substantial than other replacement options. A portion of the undeveloped right-of-way is mapped as a wetland area according to the National Wetlands Inventory. This may trigger agency consultation with the United States Army Corps of Engineers (USACE) and others, unless a wetlands delineation shows that these areas are not jurisdictional. An ADEC Approval to Construct and Approval to Operate will also be required.

Aerial imagery indicates that private improvements exist in the right-of-way immediately behind the existing pump station. This will need to be addressed prior to beginning construction.

Pump station and force main construction sequencing is anticipated as follows:

- Set up traffic control measures within project limits.
- Clear, grub and construct equipment access routes to the force main alignment in undeveloped areas. De-construct existing pump station roof as necessary to facilitate equipment access behind the pump station; backup generator enclosure and roof shall not be disturbed.
- Install new force main, gravity main and manholes in the undeveloped right-of-way, to the existing

discharge manhole on Sandy Beach Road.

- Install new pump station and controls to the point where the system will be fully operational once connected to the upstream gravity line. This may require excavation shoring so as to not disturb the existing pump station and adjacent private properties.
- Plug the existing gravity main at the manhole immediately upstream of the pump station. Install new manhole and re-routed gravity line in front of the existing pump station and through the existing wet well, to the new pump station wet well. Once the section of pipe through the wet well has been installed and the penetration sealed, bypass pumping may commence if necessary. Wastewater can be pumped from the manhole approximately 150 feet northeast of the pump station, to the existing wet well where it will continue to be pushed through the existing force main.
- Complete connections in the upstream gravity main, and from the gravity main to the new pump station.
- Activate the new pump station, unplug the existing gravity main, and cease bypass pumping. The new pump station and force main are now in operation.
- Perform surface repairs including limited curb and sidewalk replacement near lift station, and at discharge point on Sandy Beach Road.
- Decommission the existing pump station wells.

On-site construction work would likely take approximately three or four months. Some items associated with the new pump station may have long lead times, on the order of several months. A significant portion of the work can be completed without having these long lead time items on hand.

The cost estimate for this option was prepared with several earthwork and wetland surface reparation assumptions, as the subgrade conditions and wetland extents are largely unknown. The assumptions are as follows:

- Excavated material in developed areas will be acceptable for trench backfill
- Organic peat subgrade exists to an average depth of 8 feet below the existing ground surface in undeveloped areas. All organic subgrade in the trench section below the pipe and 2 feet above the top of pipe bedding will be removed and replaced with imported foundation and trench backfill.
- Spreading a 2-foot thick surface layer of salvaged organic subgrade, and the salvaged vegetative mat, will satisfy USACE in terms of wetland restoration.

The following is an itemized cost estimate for replacing Pump Station No. 4 and installing a new force main along the alternate alignment. The estimate includes construction costs, professional service fees, and material costs for owner-provided equipment as has been typical on past pump station projects.

Construction Costs

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	$80,000	$80,000
2	Dewatering	1	LS	$10,000	$10,000
3	Clearing, Grubbing, Tree Removal	1	LS	$50,000	$50,000
4	Demolition and Disposal	1	LS	$50,000	$50,000
5	Decommission Exist Lift Station	1	LS	$15,000	$15,000
6	Abandon Existing Pipe	1	LS	$10,000	$10,000
7	Remove Curb and Gutter	20	LF	$15	$300
8	Remove Sidewalk	20	SY	$15	$300
9	Remove Asphalt	20	SY	$8	$160
10	Salvage and Replace Organic Overburden	300	CY	$30	$9,000
11	Construct Temp Access Road and Remove	1	LS	$50,000	$50,000
12	Unusable Excavation	900	CY	$20	$18,000
13	Base Course	100	CY	$50	$5,000
14	Trench Backfill	275	CY	$45	$12,375
15	Foundation Backfill	200	CY	$45	$9,000
16	Excavation Shoring	1	LS	$30,000	$30,000
17	Geotextile Separation	1600	SY	$7	$11,200
18	Install Sanitary Sewer Manhole	2	EA	$12,000	$24,000
19	Install Sanitary Sewer Manhole w/ Air Relief Valve	1	EA	$15,000	$15,000
20	Install 8-inch PVC Gravity Sewer	45	LF	$120	$5,400
21	Install 10-inch PVC Gravity Sewer	250	LF	$125	$31,250
22	Install 10-inch HDPE Force Main	900	LF	$130	$117,000
23	Board Insulation	15	EA	$50	$750
24	Utility Conflict Work	1	LS	$15,000	$15,000
25	Concrete Sidewalk	15	SY	$100	$1,500
26	Curb and Gutter	30	LF	$50	$1,500
27	Concrete Patch 6"t	20	SY	$150	$3,000
28	Lift Station Slab	1	LS	$12,000	$12,000
29	Furnish and Install Wet Well	1	EA	$100,000	$100,000
30	Furnish and Install Valve Vault	1	EA	$70,000	$70,000
31	Bypass Pumping	1	LS	$10,000	$10,000
32	Install Owner-Provided Equipment	1	LS	$25,000	$25,000
33	Traffic Control	1	LS	$20,000	$20,000
34	SWPPP	1	LS	$10,000	$10,000
35	Construction Surveying	1	LS	$30,000	$30,000
36	Landscaping	1	LS	$10,000	$10,000
37	Electrical and Controls	1	LS	$75,000	$75,000
38	Pumps, Equipment and Controls (Borough-Provided)				$120,000
	Subtotal Construction Cost Pump Station and Force Main Replacement				$1,053,735
	Recommended Project Contingency (15%)				$158,060
	Total Construction Cost with Contingency (15%)				**$1,211,795**

Professional Services

Phase 1 Design – Scoping Study	$34,045
Permitting	$10,000
Survey (by Rick G. Braun, L.S.)	$12,000
Final Design (estimated at 10% of construction total)	$121,180
Contract Administration/Construction Inspection (estimated at 10% of construction total)	$121,180
Total Recommended Project Budget	**$1,510,199**

Summary of Alternatives

Below is a summary of benefits and drawbacks of the pipe rehabilitation and replacement Alternatives 1 and 2 discussed herein. Sliplining is excluded from this summary because it is not recommended for consideration. Alternative 1A is not included in this comparison because it is dependent on pump station replacement, an element not required for Alternatives 1 and 2. It should be noted that pump station replacement can be incorporated into Alternatives 1 and 2, if either of those force main replacement/rehabilitation options are preferred.

Parameter		Open-Cut Replacement		CIPP
Total Cost	✓	$626,044		$786,015
Construction Expertise	✓	Can be performed by local contractors		Requires specialized non-local contractor
Impacts During Construction		Significant – extensive periods of lane closures (6-8 weeks on-site construction)	✓	Significant, but less so than open-cut (5 weeks on-site construction)
Impacts After Construction		Potentially significant – extensive surface patching may reduce remaining service life of road	✓	Minimal – limited surface patching not expected to significantly impact service life of road
Design Life	✓	>50 years		50 years

✓ = Advantageous

If the driving factors in selecting a preferred alternative are immediate force main replacement and short-term cost, then the open-cut replacement option (Alternative 1) is clearly more favorable. However, we strongly recommend considering impacts to the road surfacing resulting from the open-cut installation. Ride comfort will be reduced for vehicles traveling through the project limits due to extensive surface patching. The surface patching will also likely diminish the remaining service life of the road, leading to significant future pavement rehabilitation or replacement costs sooner than if the CIPP option (Alternative 2) were pursued. The existing pavement is now 15 years old and will need replacement within the next 5-10 years regardless of which option is selected. If the primary driving factor is immediate force main replacement only, CIPP becomes more alluring. If the existing force main is not in need of immediate replacement and PS4 is to be replaced in the near future, Alternative 1A presents considerable benefit although at the greatest cost.

Closing

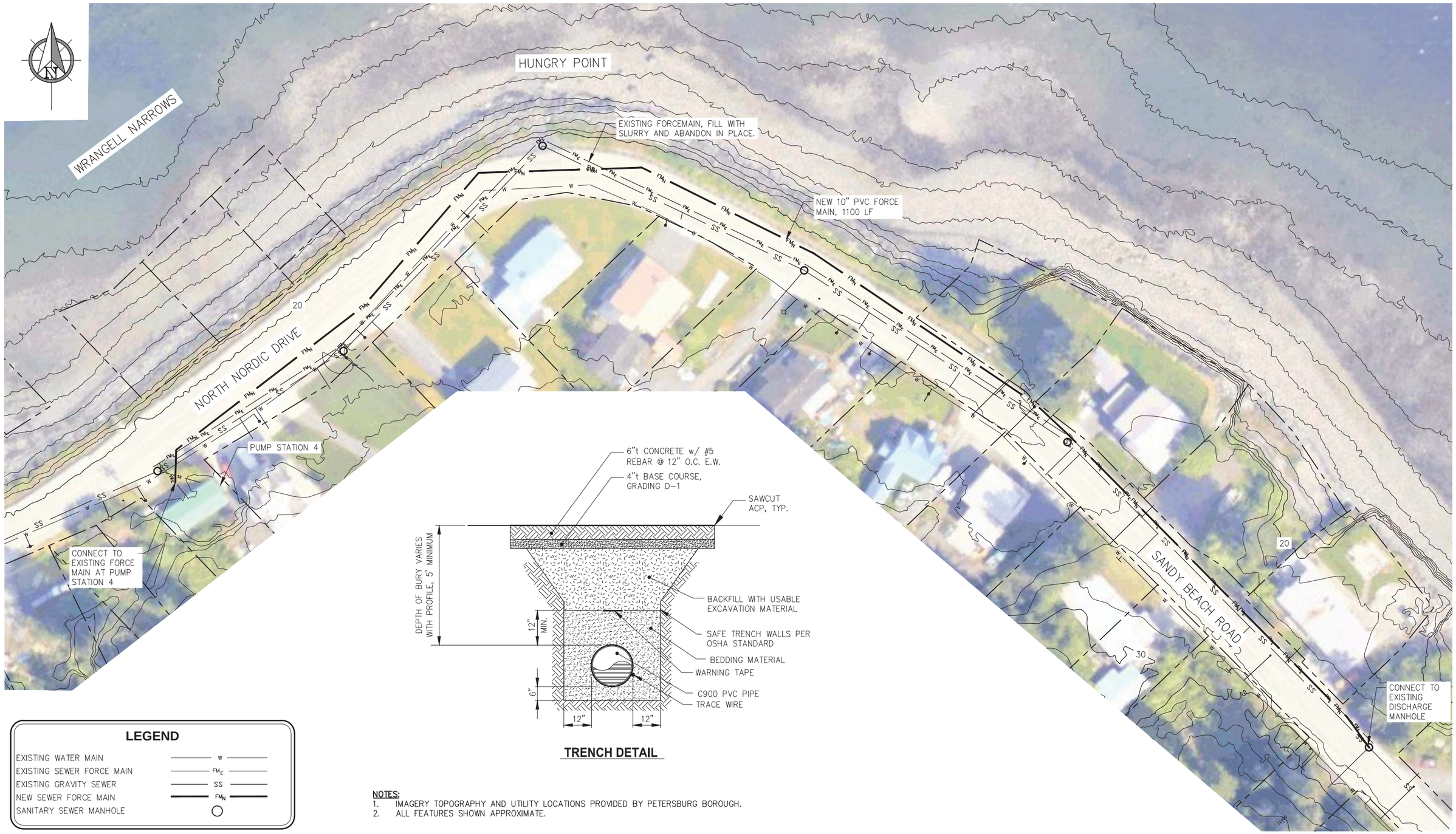
PND and Stephl appreciate the opportunity to provide this Design Study Report for your consideration. Please review at your earliest convenience – we are available via teleconference to discuss this study in greater detail with you if necessary. We look forward to potentially assisting the Petersburg Borough with this project in the near future.

Sincerely,

PND Engineers, Inc. | Juneau Office

Sean Sjostedt, P.E.
Project Manager

Enclosures: Concept Drawings



TRENCH DETAIL

LEGEND

- EXISTING WATER MAIN — W
- EXISTING SEWER FORCE MAIN — FM_E
- EXISTING GRAVITY SEWER — SS
- NEW SEWER FORCE MAIN — FM_N
- SANITARY SEWER MANHOLE

NOTES:
1. IMAGERY TOPOGRAPHY AND UTILITY LOCATIONS PROVIDED BY PETERSBURG BOROUGH.
2. ALL FEATURES SHOWN APPROXIMATE.

PETERSBURG ALASKA

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

PND ENGINEERS, INC.
9360 Glacier Highway Suite 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

DESIGN: ____ CHECKED: ____
DRAWN: ____ APPROVED: ____
SCALE: NTS

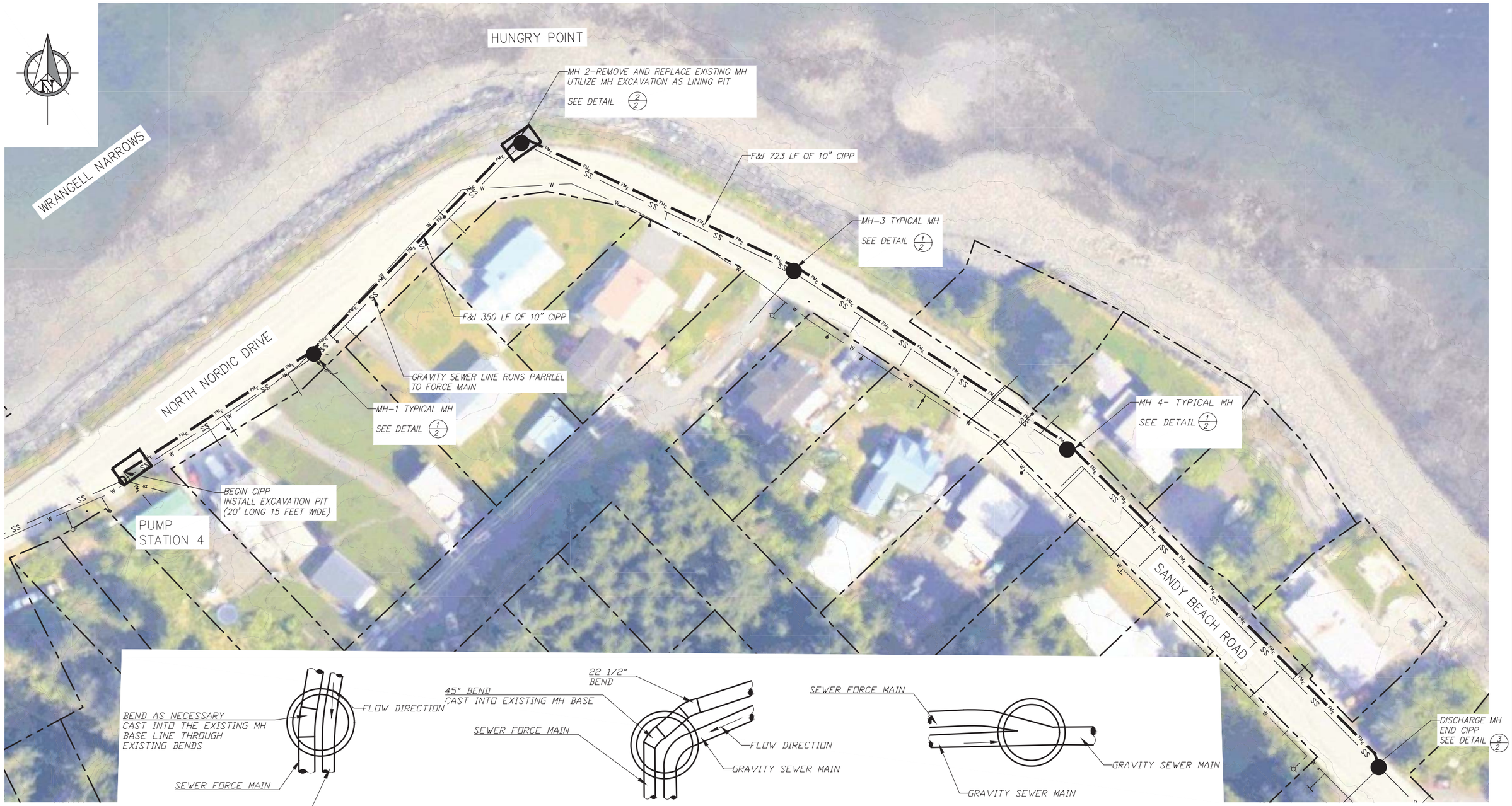
CONCEPT DESIGN REVIEW
DATE: 1/20/20

PETERSBURG BOROUGH
PUMP STATION 4
FORCE MAIN REPLACEMENT

SHEET TITLE:
ALTERNATIVE 1:
OPEN CUT REPLACEMENT

PND PROJECT #: 192080

1



1/2 TYPICAL MH
NTS

2/2 MH EXCAVATION
NTS

3/2 DISCHARGE MH
NTS

WATER — W —
FORCE MAIN — FM_E —
SEWER — SS —

NOTES:
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CONCEPT DESIGN REVIEW
DATE: 1/20/20

PETERSBURG BOROUGH
PUMP STATION 4
FORCE MAIN REPLACEMENT

SHEET TITLE:
ALTERNATIVE 2: CIPP REHABILITATION

PND PROJECT #: 192080

2

LEGEND

EXISTING WATER MAIN	W
EXISTING SEWER FORCE MAIN	FM_E
EXISTING GRAVITY SEWER	SS
NEW GRAVITY SEWER	SS
NEW SEWER FORCE MAIN	FM_N
SANITARY SEWER MANHOLE	○

NOTES:
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PETERSBURG ALASKA

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Juneau, Alaska 99801
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Fax: 907-586-2099
www.pndengineers.com

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SCALE: NTS

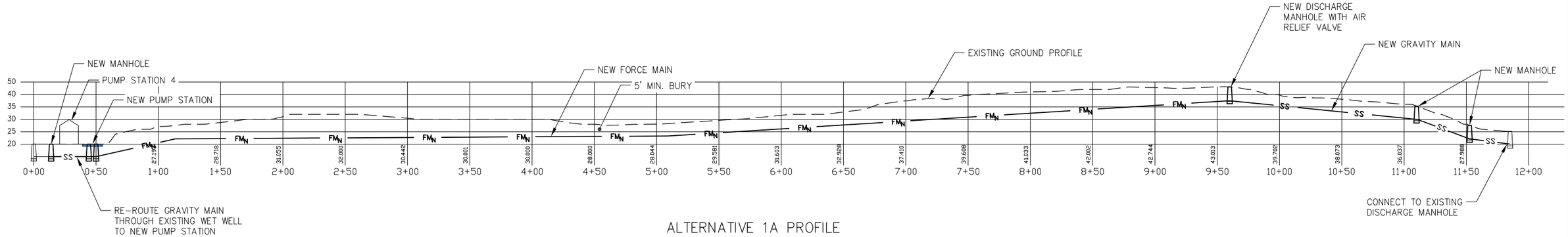
CONCEPT DESIGN REVIEW
DATE: 5/15/20

PETERSBURG BOROUGH PUMP STATION 4 FORCE MAIN REPLACEMENT

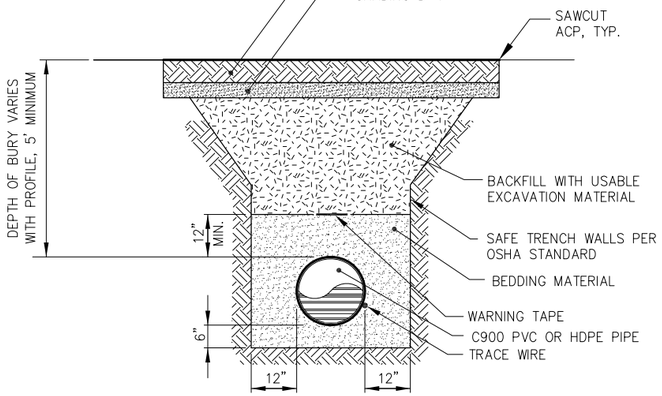
SHEET TITLE: **ALTERNATIVE 1A: PUMP STATION AND FORCE MAIN REPLACEMENT**

PND PROJECT #: 192080 C.A.N. NO.: AECC250

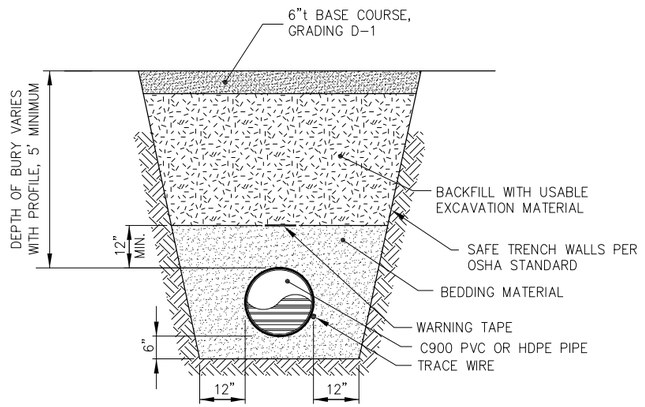
3



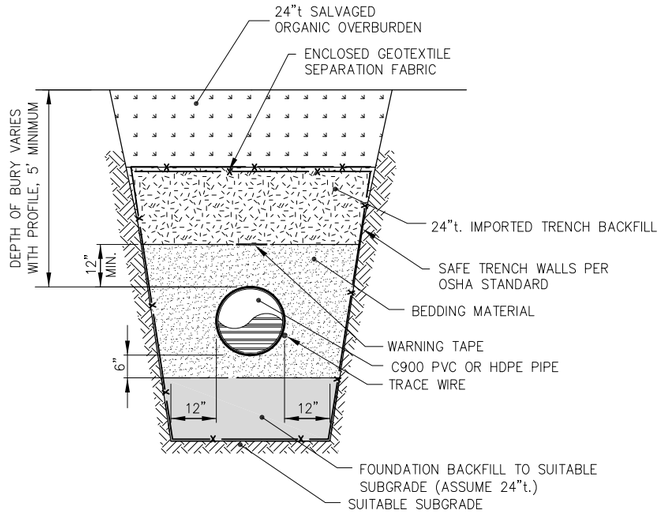
ALTERNATIVE 1A PROFILE



TRENCH SECTION IN PAVED AREAS



TRENCH SECTION IN DEVELOPED AREAS



TRENCH SECTION IN UNDEVELOPED AREAS

PETERSBURG ALASKA

REVISIONS

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SCALE:

CONCEPT DESIGN REVIEW
DATE: 5/15/20

PETERSBURG BOROUGH
PUMP STATION 4
FORCE MAIN REPLACEMENT

SHEET TITLE: **ALTERNATIVE 1A: FORCE MAIN PROFILE AND TYPICAL SECTIONS**

PND PROJECT #: 192080 C.A.N. NO.: AECC250