TUNUNAK WATER AND SEWER

Preliminary Engineering Report

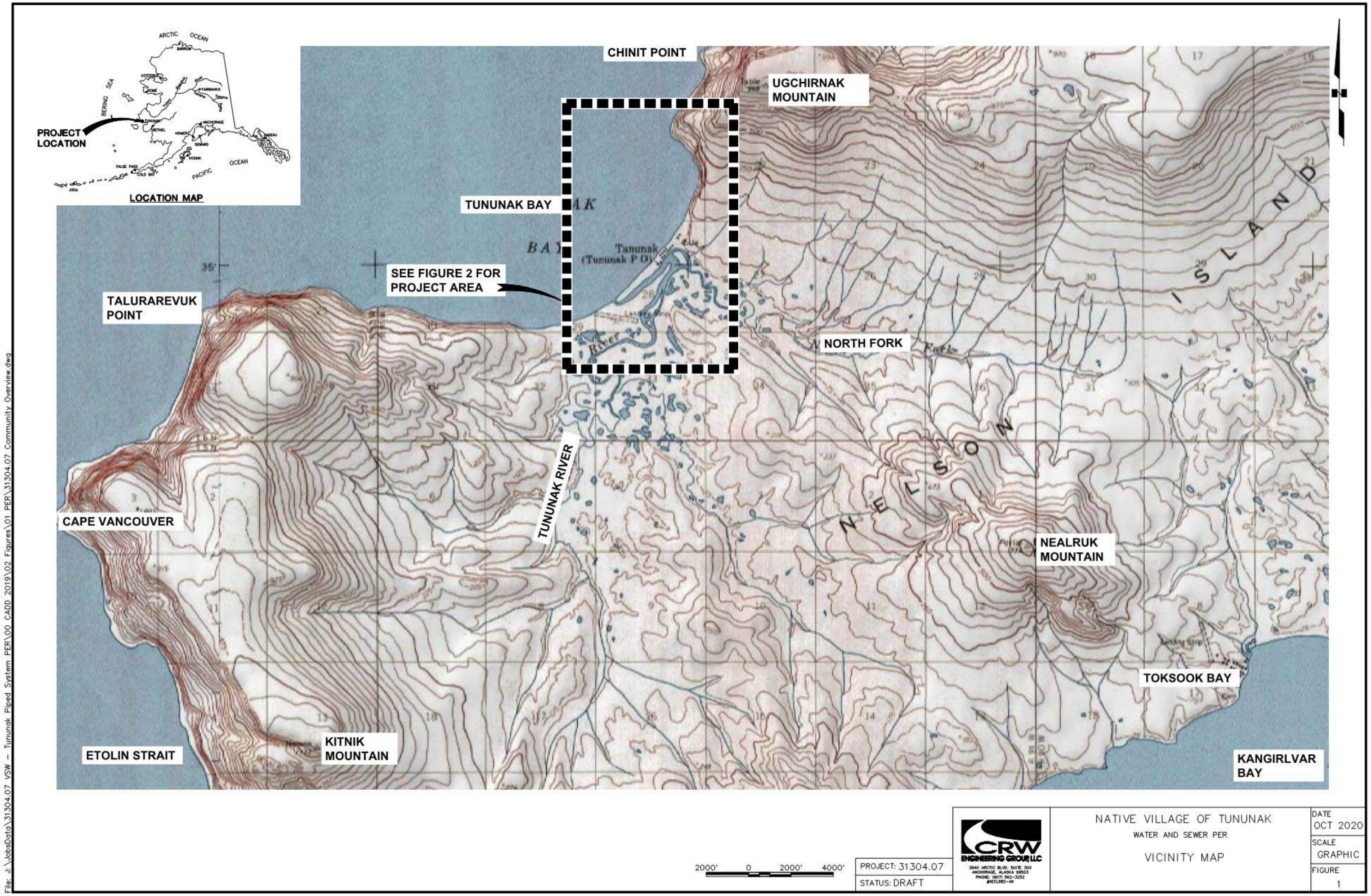
December 2020

PROJECT PLANNING

- The Village Safe Water (VSW) program, in coordination with the Native Village of Tununak (NVT), retained CRW Engineering Group, LLC (CRW) to provide engineering planning services for a piped water and sewer system to serve the community.

School Water Treatment Plant

and Watering Point



CHINIT POINT
UGCHIRNAK MOUNTAIN
PROJECT LOCATION
LOCATION MAP
TUNUNAK BAY
SEE FIGURE 2 FOR PROJECT AREA
TALURAREVUK POINT
NORTH FORK
NELSON ISLAND
TUNUNAK RIVER
CAPE VANCOUVER
NEALRUK MOUNTAIN
TOKSOOK BAY
ETOLIN STRAIT
KITNIK MOUNTAIN
KANGIRLVAR BAY
2000' 0 2000' 4000'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
VICINITY MAP
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
1

- The community water system currently consists of: a surface water sources (Unnamed Creek), a 4,000-foot long raw water transmission line (the segment between Unnamed Creek and Muskox Creek is abandoned), a water treatment plant/washeteria (WTP/W), a 50,000-gallon water storage tank (WST) and an abandoned community watering point water distribution system.
- The water treatment plant does not produce drinking water that meets regulatory requirements and as a result the community gets the majority of their water from the school watering point which is fed from a shallow well.
- Wastewater systems include a septic system that serves the flush-tank-haul systems and the WTP/W, and a membrane bioreactor (MBR) at the school.

EXISTING FACILITIES

Unnamed Creek Intake

2019 Well


TUNUNAK BAY
SCHOOL WASTEWATER EFFLUENT OUTFALL
SCHOOL WASTEWATER TREATMENT (MBR) PLANT
WTP AND CLNIC SEPTIC SYSTEM
FT&H SEPTIC SYSTEM
ABANDONED WATERING POINT, TYP OF 5
ABANDONED WATERING POINT DISTRIBUTION PIPING
OLD BIA SCHOOL
SCHOOL WTP AND WATERING POINT
SCHOOL WELL
TUNUNAK
RIVER
CLOSED SEWAGE BUNKER, TYP
SCHOOL
UNNAMED CREEK RAW WATER LINE
WATER TREATMENT PLANT/WASHETERIA AND 50,000-GAL WST
CLINIC
PARTIALLY CONSTRUCTED GRAVITY SEWER SYSTEM
UNNAMED CREEK INFILTRATION GALLERY
NEW 2019 WELL
MUSKOX CREEK RAW WATER LINE (ABANDONED)
200' 0 200' 400'
PROJECT: 31304.07
STATUS: DRAFT
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
EXISTING SANITATION FACILITIES
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
6
File: J:\JobsData\31304.07 VSW - Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Townsite Map.dwg

- In 2000, 18 homes were outfitted with flush, tank and haul (FT&H) systems. The water supply system includes an interior 100 gallon fiberglass water storage tank with a water pump and 2-gallon pressure tank mounted on top of the tank. In home fixtures include a kitchen sink, small bathroom sink, and low-volume, pint-flush toilets. Wastewater gravity drains to a 120-gallon sewage holding tank, which is located in an insulated “dog house” on the exterior of each home.
- An additional 18 FT&H units have been installed, however these units utilize an older style system with a vacuum sump. Instead of gravity flow, these units utilize vacuum pressure to transfer the wastewater from the sump to the holding tank.

FT&H System Sewage Tank

EXISTING FLUSH, TANK AND HAUL SYSTEM

- The community of Tununak is actively seeking to improve the public health of the community and meet the essential sanitary needs for its residents. A significant part of that effort is the goal to replace the community's honeybucket system with a more sanitary collection method and to be able to provide residents with an adequate supply of safe, potable water for drinking and washing purposes. The project under consideration would improve health and safety conditions and provide water and sewer service to the majority of homes in the community.

NEED FOR PROJECT

- According to a 2010 survey, almost all residents in Tununak use less than 5 gallons of water per capita per day, with most honeybucket users using 1 to 2 gallons per day. The World Health Organization recommends a minimum of 13 gallons per capita per day for basic needs. Increased water use without improved access to water is not likely to occur. In communities that have transitioned from honeybucket and self-haul water systems to piped water and sewer there's a reduction in gastrointestinal disease of up to 40% (Thomas et al., 2003). Experience has also shown that school attendance rates increase with the installation of in-home plumbing, and school districts have noted that it is easier to recruit and retain teachers in communities with piped water and sewer service.

HEALTH, SANITATION AND SECURITY

- Both above-grade and below-grade configurations were evaluated for the pipe water distribution system.
- Three different configurations of a sewer collection system including a closed haul (decentralized) system were evaluated, including:
- Alternative #1 - Pressure Sewer
- Alternative #2 - Vacuum Sewer
- Alternative #3 - Gravity Sewer
- Additionally, a closed haul (decentralized) system was considered

ALTERNATIVES CONSIDERED

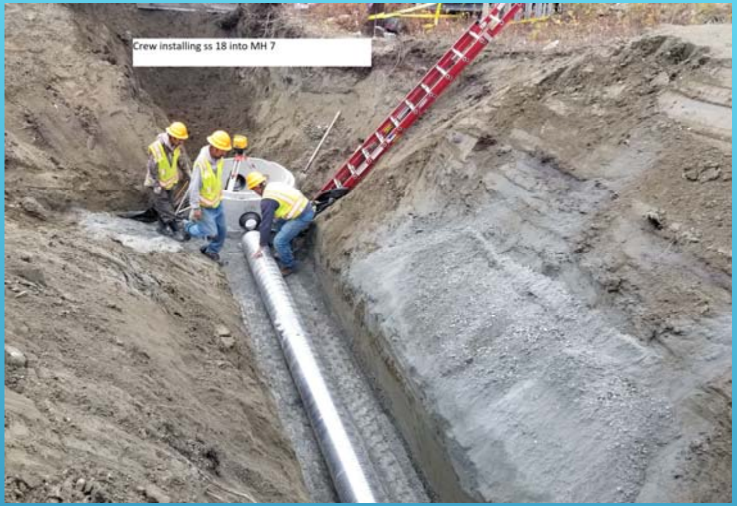
- Two water distribution loops would serve the community: the Hillside Loop, and Old Town Loop. The Hillside Loop would run from the WTP down Allaq Road through the Tununak Subdivision and then back to the WTP. The Old Town Loop would run along the Second and Third Street on the sandspit, providing service to the old townsite area. The water mains would be constructed of 6x15 Arctic pipe with a 6-inch HDPE water line and an aluminum jacket. The above-grade lines in Alternative 1 would be installed within easements and on timber supports.
- The layout and length of the above grade water loops are shown on Figure 9.

Above grade pipes in Quinhagak

WATER DISTRIBUTION SYSTEM – ALTERNATIVE 1 – ABOVE GRADE


LEGEND:
PROPOSED ABOVE GRADE 6" WATER MAIN
HILLSIDE WATER LOOP (5,800 FEET)
OLD TOWN WATER LOOP (7,500 FEET)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
TUNUNAK BAY
OLD TOWN WATER LOOP
OLD BIA SCHOOL
SCHOOL WELL
TUNUNAK
RIVER
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
WATER DISTRIBUTION BLDG
WATER STORAGE TANK, VOLUME VARIES DEPENDING ON SEWER SYSTEM ALTERNATIVE
HILLSIDE WATER LOOP
NEW 2019 WELL
200' 0 200' 400'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
WATER SYSTEM – ALT 1 – ABOVE GRADE
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
9

- Similar to Alternative 1, two water distribution loops would serve the community: Hillside Loop, and Old Town Loop. The Hillside Loop would run from the WTP down Allaq Road through the Tununak Subdivision and then back to the WTP. The Old Town Loop would run along the Second and Third Street on the sandspit, providing service to the old townsite area. The water mains would be constructed of 6x15 Arctic pipe with a 6-inch HDPE water line and an aluminum jacket. All the mains would be buried 3 to 6 feet deep and generally located in existing road rights-of-way (ROW). The layout and length of the water loops for the different wastewater collection alternatives are shown on Figures 10.



Below grade pipes in Kiana

WATER DISTRIBUTION SYSTEM – ALTERNATIVE 2 – BELOW GRADE


LEGEND:
PROPOSED BELOW GRADE 6" WATER MAIN
HILLSIDE WATER LOOP (4,800 FEET)
OLD TOWN WATER LOOP (7,600 FEET)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
TUNUNAK BAY
OLD BIA SCHOOL
OLD TOWN WATER LOOP
SCHOOL WELL
TUNUNAK
RIVER
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
HILLSIDE WATER LOOP
WATER DISTRIBUTION BLDG
WATER STORAGE TANK, VOLUME VARIES DEPENDING ON SEWER SYSTEM ALTERNATIVE
UNNAMED CREEK INFILTRATION GALLERY
NEW 2019 WELL
200' 0 200' 400'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
WATER SYSTEM – ALT 2 – BELOW GRADE
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
10
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Water System Design.dwg

WASTEWATER COLLECTION – ALTERNATIVE 1 – PRESSURE SEWER

- A pressure sewer system would include: a grinder pump station and glycol circulation pump at each house/business, a service line from each facility, and a network of low-pressure sewer mains along the old town area. Wastewater would generally flow from the west side of the Old Town area to the east. A conceptual layout of the system is shown on Figure 11.

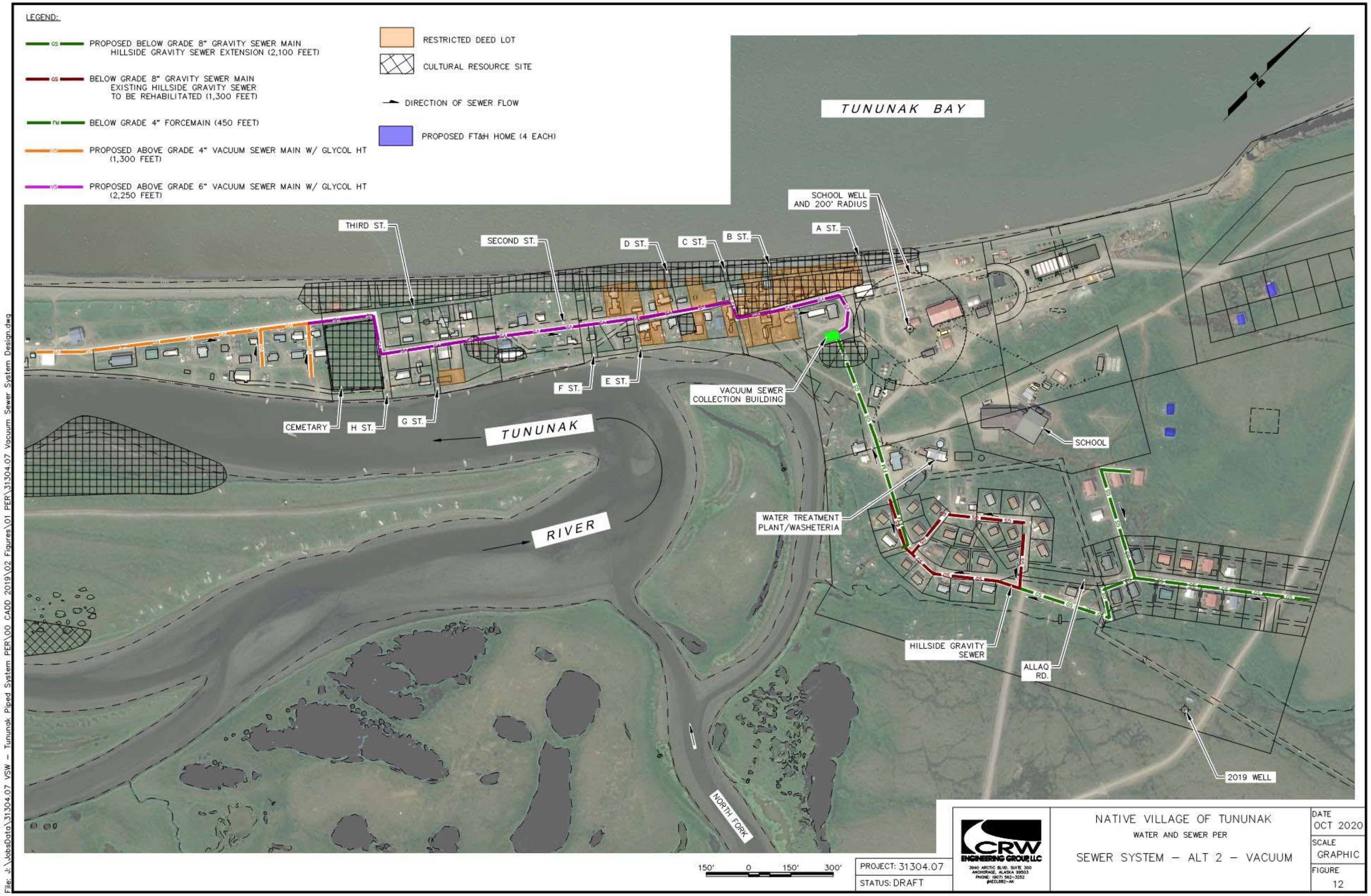
Advantages	**Disadvantages**
• Pressure sewer mains are not grade sensitive so there is a greater tolerance for ground movement. • More flexibility in the routing of mains as the grinder pumps have more head capacity than vacuum pumps. • Sewer mains can be shallow buried to avoid challenging soil and groundwater conditions. • Homeowners pays for the electricity to operate the grinder pump so there is an incentive to conserve water.	• Significantly more expensive to operate and maintain than a vacuum sewer system with vacuum toilets. • Operation of the system requires more than 100 grinder pumps compared to 3 pumps for the vacuum sewer system and 7 pumps for gravity sewer. • Requires more water to operate than a vacuum sewer system. • Increased freeze potential as the mains and services lines are always full of liquid.


LEGEND:
PROPOSED BELOW GRADE 8" GRAVITY SEWER MAIN HILLSIDE GRAVITY SEWER EXTENSION (2,100 FEET)
BELOW GRADE 8" GRAVITY SEWER MAIN EXISTING HILLSIDE GRAVITY SEWER TO BE REHABILITATED (1,300 FEET)
PROPOSED BELOW GRADE 3" OR 4" PRESSURE SEWER MAIN W/ GLYCOL HT (3,500 FEET)
BELOW GRADE 4" FORCEMAIN (450 FEET)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
PROPOSED FT&H HOME (4 EACH)
TUNUNAK BAY
LOW PRESSURE SEWER MAIN
THIRD ST.
SECOND ST.
D ST.
C ST.
B ST.
A ST.
SCHOOL WELL AND 200' RADIUS
F ST.
E ST.
WASTEWATER COLLECTION BUILDING
CEMETARY
H ST.
G ST.
TUNUNAK
RIVER
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
HILLSIDE GRAVITY SEWER EXTENSION
EXISTING PARTIALLY CONSTRUCTED LIFT STATION TO BE REHABILITATED
EXISTING HILLSIDE GRAVITY SEWER TO BE REHABILITATED
ALLAQ RD.
2019 WELL
NORTH FORK
150' 0 150' 300'
PROJECT: 31304.07
STATUS: DRAFT
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
SEWER SYSTEM – ALT 1 – LOW PRESSURE
DATE OCT 2020
SCALE GRAPHIC
FIGURE 11
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Low Pressure Sewer System Design.dwg

WASTEWATER COLLECTION – ALTERNATIVE 2 – VACUUM SEWER

- A vacuum sewer system would consist of: a vacuum toilet and 10-gallon greywater sump in each house/business, a sewer service line from each facility, a network of vacuum sewer mains, and a central vacuum collection station near the BIA school. Wastewater would generally flow from west to east in old town to the community to the central vacuum sewer collection building.

Advantages	Disadvantages
* Lowest capital costs. * Low O&M cost. * Requires the least amount of water when vacuum toilets are utilized. * The vacuum station equipment is above grade making it cleaner and easier to work on than submersible sewage pumps in a wet well.	* The sewer mains and service lines are grade sensitive so there is less tolerance for ground movement. * The vacuum pumps are expensive to replace ($12K versus $5k for a typical submersible sewage pump).
* There are fewer pumps to operate and maintain. * Sewer mains can be shallow buried to avoid challenging soil and groundwater conditions. * Reduced freeze potential as the sewer mains and services lines are typically less than half full.	* Unreported vacuum leaks or faulty valves can greatly increase the electrical cost for the utility. * The vacuum toilets and greywater sumps are noisy when discharged.


LEGEND:
PROPOSED BELOW GRADE 8" GRAVITY SEWER MAIN HILLSIDE GRAVITY SEWER EXTENSION (2,100 FEET)
BELOW GRADE 8" GRAVITY SEWER MAIN EXISTING HILLSIDE GRAVITY SEWER TO BE REHABILITATED (1,300 FEET)
BELOW GRADE 4" FORCEMAIN (450 FEET)
PROPOSED ABOVE GRADE 4" VACUUM SEWER MAIN W/ GLYCOL HT (1,300 FEET)
PROPOSED ABOVE GRADE 6" VACUUM SEWER MAIN W/ GLYCOL HT (2,250 FEET)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
PROPOSED FT&H HOME (4 EACH)
TUNUNAK BAY
SCHOOL WELL AND 200' RADIUS
THIRD ST.
SECOND ST.
D ST.
C ST.
B ST.
A ST.
VACUUM SEWER COLLECTION BUILDING
F ST.
E ST.
CEMETARY
H ST.
G ST.
TUNUNAK
RIVER
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
HILLSIDE GRAVITY SEWER
ALLAQ RD.
2019 WELL
NORTH FORK
150' 0 150' 300'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
SEWER SYSTEM – ALT 2 – VACUUM
DATE OCT 2020
SCALE GRAPHIC
FIGURE 12

WASTEWATER COLLECTION – ALTERNATIVE 3 – GRAVITY SEWER

- A gravity sewer system would consist of a service line from each facility, a network of gravity sewer mains, five lift stations and a terminal lift station. Wastewater would generally flow from the extremities of the community to a nearby lift station and then to the terminal lift station. Five lift stations would serve the older portion of the community along the sand spit and a terminal lift station would pump wastewater to the selected wastewater treatment alternative location (lagoon, septic system or MBR plant). A conceptual layout of the system is shown on Figure 13.

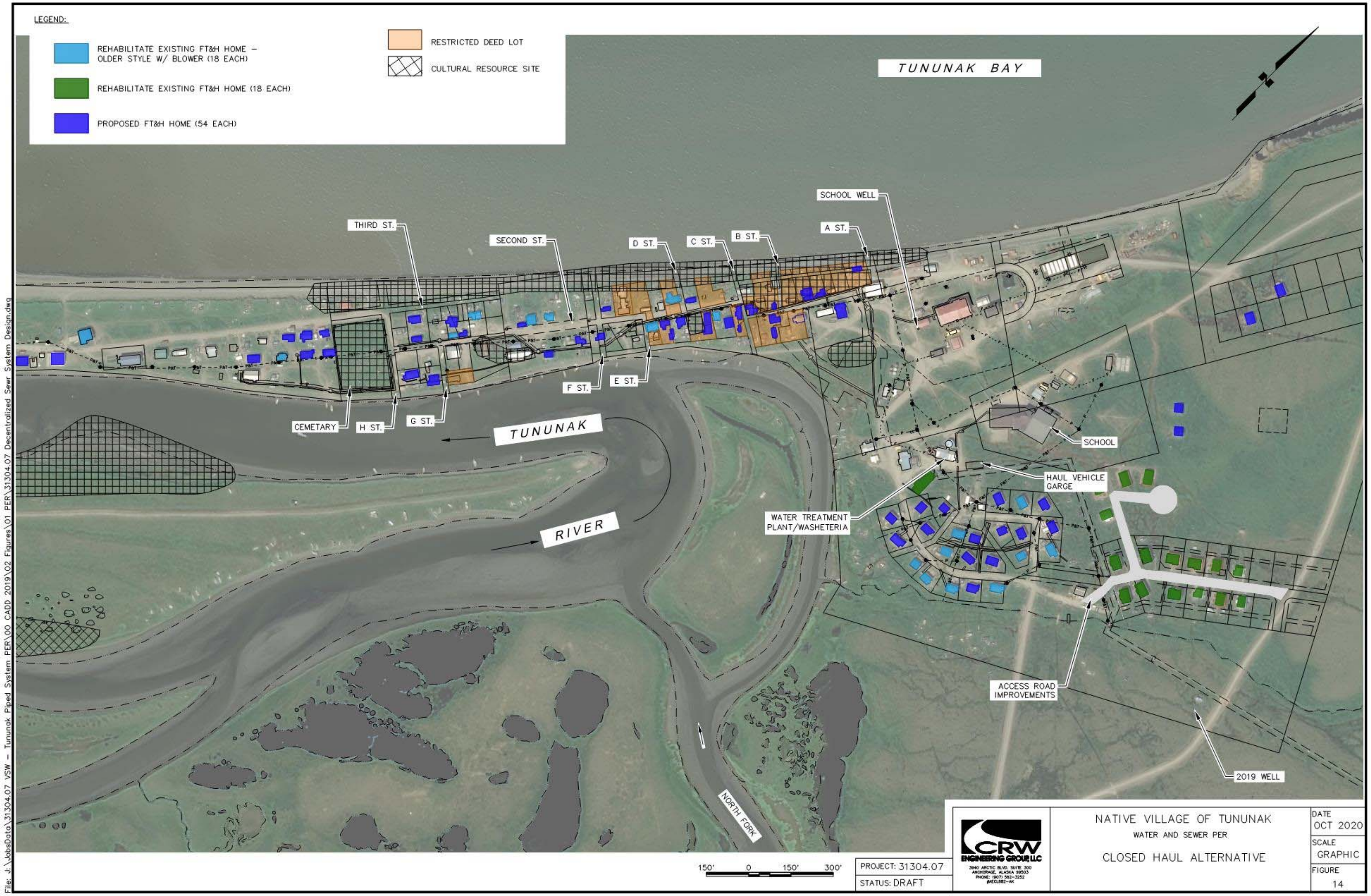
Advantages	**Disadvantages**
• The entire community would be on the same type of sewer system. • Simplest system for the homeowner to operate and maintain. • No specialty or custom components to repair or replace. • Lowest freeze potential as the sewer mains and services lines are typically near empty.	• More expensive to construct and operate than a vacuum sewer system with vacuum toilets. • Requires more water than a vacuum sewer system. • The sewer mains and service lines are grade sensitive so there is less tolerance for ground movement than with a pressure sewer system. • The flat topography and challenging subsurface conditions requires multiple lift stations for a relatively small service area.


LEGEND:
PROPOSED BELOW GRADE 8" GRAVITY SEWER MAIN
HILLSIDE GRAVITY SEWER EXTENSION (2,100 FEET)
OLD TOWN GRAVITY SEWER (3,550 FEET)
PROPOSED LIFT STATION (5 EACH + TERMINAL LIFT STATION)
BELOW GRADE 8" GRAVITY SEWER MAIN
EXISTING HILLSIDE GRAVITY SEWER
TO BE REHABILITATED (1,300 FEET)
BELOW GRADE 4" FORCEMAIN (450 FEET)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
PROPOSED FT&H HOME (4 EACH)
TUNUNAK BAY
SCHOOL WELL
LOWER TOWN GRAVITY SEWER
LIFT STATION NO. 1
LIFT STATION NO. 2
THIRD ST.
SECOND ST.
LIFT STATION NO. 3
LIFT STATION NO. 4
D ST.
C ST.
B ST.
A ST.
LIFT STATION NO. 5
F ST.
E ST.
CEMETARY
H ST.
G ST.
TANUNAK
RIVER
TERMINAL LIFT STATION
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
HILLSIDE GRAVITY SEWER EXTENSION
HILLSIDE LIFT STATION
EXISTING HILLSIDE GRAVITY SEWER TO BE REHABILITATED
ALLAQ RD.
NORTH FORK
2019 WELL
150' 0 150' 300'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
SEWER SYSTEM – ALT 3 – GRAVITY
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
13
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Gravity Sewer System Design.dwg

CLOSED HAUL SYSTEM

- This alternative would consist of individual water and sewer systems for each residence. A haul system is the recommended system for this alternative, as the soils in Tununak on the Hillside and the extremely small lot size and tight spacing of homes throughout the community do not allow for on-site disposal of wastewater which would be necessary with conventional septic systems, or PASS systems. Figure 14 shows the project layout.

Advantages	**Disadvantages**
• Pay-as-you-go service.	• Lowest level of service.
• Lowest capital cost alternative.	• Highest O&M cost.
• Minimal impact to wetlands.	• Once a home is served with a decentralized system it is typically not eligible for future service from a piped system.


LEGEND:
REHABILITATE EXISTING FT&H HOME – OLDER STYLE W/ BLOWER (18 EACH)
REHABILITATE EXISTING FT&H HOME (18 EACH)
PROPOSED FT&H HOME (54 EACH)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
TUNUNAK BAY
SCHOOL WELL
A ST.
B ST.
C ST.
D ST.
SECOND ST.
THIRD ST.
F ST.
E ST.
CEMETARY
H ST.
G ST.
TUNUNAK
RIVER
SCHOOL
HAUL VEHICLE GARGE
WATER TREATMENT PLANT/WASHETERIA
ACCESS ROAD IMPROVEMENTS
2019 WELL
NORTH FORK
150' 0 150' 300'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
CLOSED HAUL ALTERNATIVE
DATE OCT 2020
SCALE GRAPHIC
FIGURE 14
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Decentralized Sewr System Design.dwg

WASTEWATER TREATMENT – ALTERNATIVE 1 - LAGOON

- A new two-cell facultative lagoon would be constructed at the old airport site, to the south of town. The cells would be lined. The lagoon would be designed for discharge to the Tununak River.
- This alternative would also require construction of a 5,500-foot force main from the community. The approximate layout of the lagoon and force main alignment are shown on Figure 15.

Advantages

- Lowest O&M cost.
- Simple operational requirements, with training required for discharge sampling and permitting.
- Less reliance on technology for treatment compared with MBR plant.
- Low energy requirements since system is designed to operate with gravity flow

Disadvantages

- Located in an area of know cultural resources
- If lagoon effluent discharge is not monitored, could result in degradation of the Tununak River water quality
- Sludge accumulation is generally higher in cold climates due to reduced microbial activity
- Near current airport
- Within 1,000 ft of nearby water bodies
- Requires large area of land

LEGEND:
PROPOSED BELOW GRADE HILLSIDE 8" GRAVITY SEWER, SEE FIGURES 11, 12 & 13
PROPOSED BELOW GRADE SEWER (GRAVITY, VACUUM OR LOW PRESSURE, SEE FIGURES 11, 12 & 13)
PROPOSED BELOW GRADE 4" FORCEMAIN (5,500 LF)
PROPOSED LAGOON EFFLUENT LINE (500 LF)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
TUNUNAK BAY
SCHOOL WELL AND 200' RADIUS
OLD AIRPORT BRIDGE
FORCEMAIN TO LAGOON
OLD AIRPORT
TUNUNAK
RIVER
WASTEWATER PUMP STATION
SCHOOL
WATER TREATMENT PLANT/WASHETERIA
NEW 2019 WELL AND 200' WELL RADIUS
HILLSIDE GRAVITY SEWER
NORTH FORK
MUSKOX CREEK
ATV TRAIL TO TOKSOOK BAY
LAGOON EFFLUENT DISCHARGE LINE
APPROX 2,000'
ALT 1 & ALT 3 – GRAVITY AND LOW PRESSURE SEWER 7.5 ACRE WASTEWATER LAGOON (SHOWN)
ALT 2 – VACUUM SEWER 5.1 ACRE WASTEWATER LAGOON
ALT 4 – CLOSED HAUL 1.3 ACRE WASTEWATER LAGOON
AIRPORT
AIRPORT BRIDGE
250' 0 250' 500'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP, LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
WW TREATMENT – ALT 1 – LAGOON
DATE OCT 2020
SCALE GRAPHIC
FIGURE 15
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Lagoon Design.dwg

- The typical configuration for an onsite disposal systems consists of a septic tank followed by a soil absorption (leach) field. Solids settle to the bottom of the septic tank as sludge and lightweight material (scum) including grease and fats rise to the top. Internal baffles help to capture scum and sludge within the tank, allowing clarified liquid (effluent) to flow from the tank into the soil absorption system. Sludge and scum are periodically pumped from the tank through access manways.

Advantages

- Low O&M cost. Low energy requirements since system is designed to operate with gravity flow
- Smaller footprint compared to a lagoon.
- Less reliance on technology for treatment compared with MBR plant.

Disadvantages

- If sludge and scum are not periodically removed, adversely affects treatment

WASTEWATER TREATMENT – ALTERNATIVE 2 – SEPTIC SYSTEM

LEGEND:
GS PROPOSED BELOW GRADE 8" GRAVITY SEWER (400 LF)
FM PROPOSED BELOW GRADE 4" FORCEMAIN (750 LF)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
TABLE 1
ALT 1 & ALT 3 – GRAVITY AND LOW PRESSURE SEWER
ABSORPTION FIELD – 43,000 SF (SHOWN)
SEPTIC TANKS – (2) 15,000-GALLON (SHOWN)
ALT 2 – VACUUM SEWER
ABSORPTION FIELD – 30,000 SF
SEPTIC TANKS – (2) 10,000-GALLON
ALT 4 – CLOSED HAUL
ABSORPTION FIELD – 8,000 SF
SEPTIC TANKS – (1) 6,000-GALLON
TUNUNAK BAY
COMMUNITY FUEL TANK FARM
SCHOOL MBR OUTFALL
SCHOOL WELL 200 FT RADIUS
SCHOOL MBR PLANT
OLD TOWN SEWER, SEE FIGURES 11, 12 & 13
COMMUNITY ABSORPTION FIELD, SEE TABLE 1
BIA SCHOOL
SCHOOL WELL, WTP AND WATERING POINT
REMOVE EXISTING SEPTIC TANKS AND ABSORPTION FIELD
SCHOOL FUEL TANK FARM
SEPTIC TANKS SEE TABLE 1
SCHOOL SEWER SERVICE BYPASS TO ALLOW FOR FLOW TO SEPTIC SYSTEM OR MBR PLANT
SCHOOL SEWER SERVICE
TUNUNAK RIVER
SCHOOL
HILLSIDE SEWER, SEE FIGURES 11, 12 & 13
50' 0 50' 100'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
WW TREATMENT – ALT 2 – SEPTIC
DATE
OCT 2020
SCALE
GRAPHIC
FIGURE
16
File: J:\JobsData\31304.07 VSW – Tununak Piped System PER\00 CADD 2019\02 Figures\01 PER\31304.07 Septic System Design.dwg

WASTEWATER TREATMENT – ALTERNATIVE 3 – WASTEWATER TREATMENT PLANT

- Under this alternative a membrane bioreactor (MBR) package plant similar to what is used at the school would treat wastewater to secondary standards (Figure 17). The treatment process is described below.
- Influent wastewater first passes through a fine drum screen to remove particulate matter. Screened wastewater then enters the anoxic tank. In the anoxic tank influent wastewater comes in contact with return activated sludge. Nitrogen and phosphorous removal processes also occur in the anoxic zone. Treatment continues in the aeration tank

Advantages:

- Highest level of wastewater treatment
- Smaller overall footprint than a lagoon or septic system.

Disadvantages:

- High capital and O&M costs.
- Will require additional operator training and certification
- Unlike a passive facultative lagoon or septic system, the MBR treatment system requires frequent monitoring by the operator. If the system fails or is bypassed, it could results in discharges of raw sewage directly into Tununak Bay.
- A permanent outfall at Tununak Bay could be subject to damage from storm surge or ice during the winter.

LEGEND:
PROPOSED BELOW GRADE HILLSIDE 8" GRAVITY SEWER SEE FIGURES 11, 12 & 13
PROPOSED BELOW GRADE SEWER (GRAVITY, VACUUM OR LOW PRESSURE, SEE FIGURES 11, 12 & 13)
PROPOSED BELOW GRADE 4" MBR EFFLUENT FORCEMAIN (1,300 LF)
RESTRICTED DEED LOT
CULTURAL RESOURCE SITE
DIRECTION OF SEWER FLOW
TUNUNAK BAY
COMMUNITY MBR OUTFALL
SCHOOL MBR OUTFALL
COMMUNITY FUEL TANK FARM
SCHOOL WELL 200 FT RADIUS
OLD TOWN SEWER, SEE FIGURES 11, 12 & 13
SCHOOL MBR PLANT
BIA SCHOOL
SCHOOL WELL, WTP AND WATERING POINT
SCHOOL FUEL TANK FARM
COMMUNITY WASTEWATER COLLECTION BUILDING AND MBR PLANT
SCHOOL SEWER SERVICE
TUNUNAK RIVER
SCHOOL
HILLSIDE SEWER, SEE FIGURES 11, 12 & 13
50' 0 50' 100'
PROJECT: 31304.07
STATUS: DRAFT
CRW ENGINEERING GROUP LLC
NATIVE VILLAGE OF TUNUNAK
WATER AND SEWER PER
WW TREATMENT – ALT 3 – MBR PLANT
DATE OCT 2020
SCALE GRAPHIC
FIGURE 17

Water Distribution System Alternative	Capital Cost	O&M Cost	20-Year Salvage Value	NPV
Alternative 1 – Above Grade Water System	$23,180,000	$143,500	$11,190,000	$15,420,000
Alternative 2 – Below Grade Water System	$18,410,000	$133,800	$8,810,000	$12,710,000

Sewer Collection System Alternative	Capital Cost	O&M Cost	20-Year Salvage Value	NPV
Alternative 1 – Pressure Sewer System	$27,160,000	$65,300	$11,220,000	$17,860,000
Alternative 2 – Vacuum Sewer System	$22,900,000	$51,100	$9,370,000	$15,070,000
Alternative 3 – Gravity Sewer System	$24,160,000	$40,100	$9,790,000	$15,720,000

Closed Haul vs. Piped System (Lowest NPV)	Capital Cost	O&M Cost	20-Year Salvage Value	NPV
Closed Haul	$21,180,000	$292,200	$2,440,000	$24,550,000
Alternative 2 – Below Grade Water System Alternative 2 – Vacuum Sewer System	$41,310,000	$184,900	$18,180,000	$27,770,000

Wastewater Treatment System Alternative	Capital Cost	O&M Cost		NPV
Alternative 1 – Lagoon	$5,970,000	$2,400	$0	$6,020,000
Alternative 2 – Community Septic System	$1,220,000	$20,300	$0	$1,610,000
Alternative 3 – Membrane Bioreactor (MBR) Plant	$7,530,000	$77,500	$0	$9,030,000

LIFE CYCLE COST

- Water Distribution System
  - Below-grade water system
- Sewer Collection System
  - Below-grade gravity sewer
- Wastewater Treatment System
  - Community septic system

RECOMMENDATIONS