ALTERNATIVES MEMORANDUM

DRAFT

TULUKSAK WATER & SEWER FEASIBILITY STUDY

TULUKSAK, ALASKA

By

CRW Engineering Group, LLC

3940 Arctic Blvd. Suite 300

Anchorage, AK 99503

In cooperation with the State of Alaska

Department of Environmental Conservation

Village Safe Water Program

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Introduction

CRW Engineering Group (CRW) in conjunction with the Tuluksak Native Community (TNC) and the State of Alaska Department of Environmental Conservation Village Safe Water Program (VSW) are preparing a feasibility study to evaluate various water and sewer technologies and systems for serving the community. This memorandum is the first step towards developing the feasibility study.

A significant part of the feasibility study effort involves the review of various alternatives to help select technologies and systems best suited for the community of Tuluksak (2011 population 373). This memorandum serves two purposes. The first is to identify and then narrow down the field of possibilities to a smaller group of alternatives that will receive further evaluation in the feasibility study. The selection process for this memorandum is largely qualitative, and relies on inputs from the community and the experience of sanitation professionals who support rural Alaskan communities. The alternatives selected through this memorandum effort will be evaluated in the feasibility study using a more quantitative basis consistent with USDA Rural Development (RD) procedures for Preliminary Engineering Reports (PERs).

The second purpose of this memorandum is to develop the Selection Matrix that will be used in the feasibility study to score and compare the alternatives.

Background

Like many other communities, the Tuluksak Native Community is actively seeking to improve the quality of life for its residents. A significant part of this endeavor is improving the community's sanitation facilities, which includes a combined WTP and washeteria, watering point for self-haul delivery and a honeybucket haul system. The WTP provides potable water for consumption while the washeteria provides a centralized means for households to maintain good hygiene as most residents in Tuluksak do not have plumbing systems in their homes. Many in the community minimize their use of the treated water, preferring instead to use collected rainwater or ice. Currently a wastewater collection and disposal system is being constructed via the VSW force account method. Buried gravity and force main pipe, a lift station and a treatment lagoon are expected to be completed in 2013.

The community's existing WTP/W was designed by the Indian Health Service (IHS) and constructed in the early 1980s. Groundwater is batch-treated for very high levels of iron, manganese and arsenic. The school and a construction camp are directly connected to this facility with pipe water. The existing WTP/W facility is currently in an aged and deteriorating condition. Some equipment is inoperable. Several sections of the floor and subfloor are rotting and have been replaced. The roof reportedly leaks during rain events. Two interior water storage tanks also leak as well.

In the mid-1990s, a feasibility study analyzed options for improving the water and sewer system, and the community selected a piped water and sewer system. In 2005, as part of a phased plan, two groundwater wells were installed approximately 1,200 feet south of the WTP/W in an area called the Utility Core Area. These wells, while both still relatively high in iron, manganese, arsenic, and organics, produce better quality water and in higher quantity than the existing well. The community has affirmed their desire that these new wells be developed and incorporated in the improved water system.

In 2006, water and sewer system alternatives were again evaluated. A piped water and sewer system was recommended and accepted by the community. In subsequent reviews by the funding agencies, the community's capacity for operating and managing these systems was considered. From this assessment, it was determined that additional analysis of alternatives was needed before the funding could be provided for a fully piped system. Accordingly, in January 2013, the community contracted with CRW to perform this additional evaluation.

Development of Alternatives

Alternatives are defined by various combinations of water and sewer options. Options are components of alternatives which are defined by the use of distinct technologies and methods for different parts of a water or sewer system. For example, options for the source of a water system might be the use of groundwater or surface water. These options might combine with a particular method of treatment, say direct filtration, and a method of disinfection, say chlorine solution, to form a particular water alternative.

The alternatives formulated for this memorandum were developed by considering the relative feasibilities of various water and sewer options in Tuluksak. These considerations were largely qualitative, being based on the inputs and experience of rural Alaska sanitation professionals and members of the community, and on engineering judgment. This evaluation does not intend to develop alternatives by process of elimination for all possible options. It instead considers a limited number of options that appear to be reasonably promising for use in Tuluksak.

Considerations

Considerations used in the review of options and alternatives are summarized below.

Present Conditions and Continued Usage of Existing Facilities

The integration of new facilities into the community's existing infrastructure will need consideration of the condition and capacity of the existing water and sewer systems.

Newer existing facilities, like the forthcoming wastewater collection and sewage lagoon and recently constructed power plant, are expected to be in sufficient condition and have adequate capacity for serving the new water and sewer systems. In fact, that substantial funding has been dedicated to the design and construction of these facilities will have a significant influence on what types of new systems will be selected to connect to them.

Older existing facilities, like the existing WTP/Washeteria, are expected to either be rehabilitated or reconstructed, if it is considered as an option. The primary reason for considering the re-use of older infrastructure is the potential for lowering project capital costs. If the condition or capacity of an existing facility is inadequate to serve the new facilities, then the potential for cost reductions is diminished.

Siting of New Facilities

The integration of new facilities into the community's existing infrastructure will need to consider where they are located relative to the existing water and sewer systems. Locating new facilities closer to existing facilities will tend to reduce project capital costs and system heating costs. Further, if new facilities can be located in sufficient proximity to the power plant such that waste heat can be recovered, operational costs can be reduced even more.

However, the siting of new facilities closer to users will tend to improve system usage due to increasing or maintaining a higher level of convenience. An example of this would be siting a new WTP/Washeteria at or near the existing facility, which is centrally-located. When system usage is improved, utility revenues tend to increase.

Performance and Reliability of Technologies and Systems

How well new facilities serve the community is greatly influenced by how their technologies and systems perform relative to expectations over their useful lives. New facilities need to accomplish the funding objectives and do so reliably. Because the remote location of Tuluksak can cause difficulties in transporting maintenance personnel and replacement equipment there, the failure of critical systems can result service outages for days, or cause failure of other critical components.

Generally, the more simple and robust a technology is, the more reliable it tends to operate, and the more easily it can be maintained or repaired. An example of this is the operation of a gravity sewer system as compared to a pressure sewer system. However, simple technologies often do not perform as well as more complex technologies. For instance, membrane filtration, which is a relatively complex treatment technology, tends to produce superior water quality relative to granular filtration, which is relatively simpler.

How well a technology is operated and maintained makes a big difference in how well and reliably it performs. Technologies that require simple operational steps and relatively little maintenance tend to perform more reliably over the life of the facilities.

Economics and Community Financial Capacity

New water and sewer facilities need to be affordable for communities to operate and maintain. One of the most common causes of system ineffectiveness, or system failure, is a community's inability to pay for critical components and consumable materials needed to properly operate their facilities.

Generally simpler technologies tend to be more affordable to operate, but often at the expense of best possible performance. More complicated technologies may offer superior results, but may also require extra operator attention and more expensive replacement parts (like specialized, proprietary components) and consumables (like chemicals).

Since the cost of fuel has greatly inflated over the last decade, power-consuming technologies have become a substantial impact on the affordability to operate water and sewer facilities. Systems that feature long piping runs require continuous heating during the winter season and are very expensive to operate. The cost to operate a washeteria is largely affected by the power and heat needed for washers and dryers, and make the use of this facility challenging to sustain financially.

In terms of capital costs, new sanitation facilities also need to be affordable for funding agencies as well. As labor, fuel and material costs continue to rise, and as available sanitation funding dwindles, agencies are becoming less inclined to offer grant money for very large infrastructure projects. Consequently, smaller projects are viewed more favorably for funding, especially those that leverage money from other funding sources or make use of existing facilities to reduce capital costs.

Complexity of Operation and Community Technical Capacity

The more complex a facility is to operate, the higher is the cost to the community, in terms of increased labor time to attend to the facility, and in terms of training its personnel to understand its processes and properly manage them. Small, remote communities typically do not have access to the resources needed for increasing its technical capacity, nor for retaining well-trained personnel. Frequent employee turnover is very common in rural communities, and operational know-how is usually lost or substantially diminished during the transfer of duties between individuals. In larger or community-wide facilities, complexity cannot be avoided, but when it is reduced, communities benefit in their increased ability to operate them.

Environmental Effects

The extreme cold weather experienced by many rural Alaskan communities often limit the cost effectiveness of various technologies, especially those that relate to water, which is prone to freezing. For example, long runs of pipe that are exposed to cold temperatures over a long time period need to be heated at a higher operational cost to avoid freezing and system shut-down. The sizeable resources typically dedicated to keeping facilities warm cannot be used in other ways that would benefit the operation of water and sewer systems. Technologies and systems that fare better in freezing conditions, with little to no need for heating, serve communities better with more consistent usage and increased reliability.

Community Preferences

Members of the community have local knowledge and insights that are valuable to designing cost-effective and reliable sanitation systems. As users of systems previously designed and constructed, community members can provide input on what methods work well and those that haven't. Very often, locals have critical insights into why certain methods are more or less effective than others that may go unnoticed by designers, and which methods the community may be more inclined to use. Further, as various types of water and sewer systems have undergone a growing history of usage in a local region, community members learn by word-of-mouth which have served neighboring villages well. A critical component of successfully implementing sanitation facilities in any rural community is the increased tendency for people to use it, which, with a good collection performance, thereby increases operating revenues.

Water and Wastewater Options

Several alternatives for improving each water and sewer subsystem are listed below along with their associated pros and cons and the recommendation for further evaluation in the ***Tuluksak Water & Sewer Feasibility Study (FS)***.

Water Source Options

1) Existing well near WTP/Washeteria Bldg

Pros:	Existing, Adjacent to existing facility, Known water quality parameters
Cons:	Shallow, Vulnerable, Poor water quality (difficult to treat), within 200 ft radius of fuel tanks
Include in FS:	Yes, as Do Nothing Alternative

2) Wells drilled at Utility Core (2005 wells)

Pros:	Existing, Better water quality than existing WTP well, preferred by TNC, existing site control
Cons:	Outside of core community area, if connected to existing WTP, would require a longer run of heated raw water line
Include in FS:	Yes

3) Individual wells drilled at each home

Pros:	Homeowner controlled (vs community), does not require community distribution system,
Cons:	Unknown and likely varying water quality, Unknown subsurface contaminants (old sewage bunkers), could be costly, site control likely needed, Water rights
Include in FS:	No

4) New wells drilled closer to WTP/Washeteria Bldg

Pros:	Potential to get better water quality than existing, Raw water line could be shorter, cheaper to operate
Cons:	Unknown water quality, unknown contaminants, site control likely needed, costly to install
Include in FS:	No

5) Rain water collection

Pros:	Homeowner controlled (vs community), Community already prefers, Least expensive O&M, Does not require significant increase in community capacity
Cons:	Limited rainfall may need to be supplemented with haul water, DEC hasn't sanctioned rain water catchments yet, High potential for contamination and may require treatment in the home
Include in FS:	Yes

6) Surface water – Tuluksak River

Pros:	Traditional source of water for the village (CE2, Water Source Study, 2011), Upfront Capital Costs would be lowest
Cons:	Seasonally impacted, (freezing, transitions and varying water quality), Historic concentrations of heavy metals from upstream mining activities, Surface water treatment rules, O&M could be costly
Include in FS:	No

7) Imported water

Pros:	Would not require community treatment system, or distribution system
Cons:	Cost prohibitive
Include in FS:	No

Water Treatment Options

1) Existing direct filtration treatment system (batched water)

Pros:	Existing system
Cons:	Building and treatment system in need of major improvements, Community doesn't like the water, Difficult to treat
Include in FS:	Yes, as Do Nothing Alternative

2) New direct filtration (DF) treatment system (continuous process flow)

Pros:	Similar to existing system, relatively simple operation, Operator and community familiar with DF system and $KMnO_4$ injection, continuous flow yields higher output of treated water relative to batch system
Cons:	System requires backwashing, surge tank and filterable water quality, DF systems have limited organics removal capability
Include in FS:	Yes

3) New conventional filtration (CF) system

Pros:	Suitable for iron and manganese removal, provides larger removal capacity than DF
Cons:	System requires more floor space than DF, more complicated operation relative to DF, CF systems have limited organics removal capability
Include in FS:	Yes

4) New membrane filtration system

Pros:	Small footprint, Produces excellent water
Cons:	Will likely require pre-treatment, Requires significant cleaning and membrane replacing for iron and manganese removal (prone to fouling), Generates highly concentrated process waste, Can require a lot of power, May require higher level of operator certification, Costly to operate and replace membranes
Include in FS:	No

5) New diatomaceous earth filtration system

Pros:	Minimal water use (no backwashing), Easy to operate
Cons:	Requires small raw water NTU, Not suitable for high concentrations of iron and manganese, Typically custom systems
Include in FS:	No

6) Individual treatment systems in each home (including grey water reuse)

Pros:	Least expensive O&M to utility, Doesn't require community-wide treatment and/or distribution system,
Cons:	Varying water quality could make treatment difficult, Requires homeowner education and maintenance, No community oversight or assistance,
Include in FS:	Yes

<u>Water Storage Options</u>

1) Existing interior water storage at WTP/Washeteria Bldg

Pros:	Existing System
Cons:	Suitable for batch system only, Undersized for future, Doesn't have sufficient capacity for emergencies
Include in FS:	Yes, as Do Nothing

2) New interior storage (batched water)

Pros:	Could likely be installed in existing building (with treatment process modifications), Being interior,wouldn't require circ system for heat retention
Cons:	Suitable for batch system only, Undersized for future, Doesn't have sufficient capacity for emergencies (size limited by available space)
Include in FS:	No

3) New exterior storage (batched water)

Pros:	Would provide additional capacity for emergency situations
Cons:	Suitable for batch system only, Undersized for significant future growth, Would require circ system to prevent freezing
Include in FS:	Yes

4) New exterior storage (continuous process flow)

Pros:	Would provide additional capacity for future and for emergency situations,
Cons:	Suitable for continuous process flow system, Larger tanks can cause longer retention times which can impact water quality, Would require circ system to prevent freezing
Include in FS:	Yes

5) Individual water storage tanks for each home (for rain or haul)

Pros:	Least expensive O&M to utility, Allows residents to continue use of rain water with capacity to supplement with haul water
Cons:	Requires homeowner education and responsibility, Community (RMW) assistance limited if at all, tanks will need periodic cleaning.
Include in FS:	Yes

<u>Water Distribution Options</u>

1) Existing self-haul system

Pros:	Existing system
Cons:	Low gray water flows can impact a piped sewer system, Current system requires operator to be onsite to access water, Can be difficult for some homeowners (elders, pregnant women, etc.) to obtain water (as it requires containers and a vehicle to haul), Potential for contamination during hauling and transferring.
Include in FS:	Yes, as Do Nothing Alternative

2) Piped water system

Pros:	Provides best overall sanitation, Improves ease of piped sewer system operation, Preferred by the community
Cons:	Requires significant infrastructure ($$), O&M for heating and power can be costly to homeowner and community, Requires regular (and accountable) user fee collection to operate , Requires higher operator certification
Include in FS:	Yes

3) Improved watering point for self-haul system

Pros:	Minimal O&M required, Doesn't require additional operator cert for distribution, Coin Op mechanism would allow water to be accessed any time
Cons:	Similar to Do Nothing, Can be difficult for some homeowners (elders, pregnant women, etc.) to obtain water (require containers and vehicle), Potential for contamination during hauling and transferring.
Include in FS:	Yes

4) Community-run haul system

Pros:	Less expensive capital cost than piped system, Improves sanitation from current conditions,
Cons:	Requires infrastructure (haul garage and vehicles)($$), Requires regular (and accountable) user collection fee to operate, less water usage for sanitation relative to piped system.
Include in FS:	Yes

5) Individual well-based distribution systems (wells, treatment and piping)

Pros:	No system O&M required, Doesn't require user collection fees to operate,
Cons:	Requires homeowner education and maintenance, Requires treatable well water, water rights and cost effective in-house treatment system, Limited to no community (RMW) support
Include in FS:	No (Unless individual wells are considered)

6) Individual rain/haul- based distribution systems (catchment, storage, treatment and piping)

Pros:	No system O&M required, Doesn't require user collection fees to operate, Traditional practice, Community prefers taste of rain water
Cons:	If used in conjunction with piped sewer system, would require additional heat add (water, heat tape or other) to keep pipes from freezing, Require homeowner education and maintenance, Requires in-home disinfection system to treat rain water
Include in FS:	Yes (Unless rain catchment systems are not considered)

7) Satellite watering points

Pros:	Less O&M required than fully piped system, Easier for community residents to obtain water (especially elders, children and pregnant women),
Cons:	Could be costly to keep from freezing, Would still require regular user fees to keep operable Doesn't address community's dislike of treated water, Potential for contamination during hauling and transferring.
Include in FS:	No

Sewer System

Wastewater Collection

1) Existing honey bucket self-haul to community hoppers

Pros:	Existing system
Cons:	Does not improve sanitation, Homeowners still directly handling waste, Not preferred by the community
Include in FS:	Yes, as a Do Nothing Alternative

2) New honey bucket haul system

Pros:	Similar to existing system, wouldn't require significant capital investment
Cons:	Does not improve sanitation, Homeowners still directly handling waste, Not preferred by the community
Include in FS:	No

3) Buried piped sewer system (gravity and force main)

Pros:	Improves sanitation, Already designed and partially constructed, Gravity lines are generally cost effective for piped systems, Soils in TLT suitable for buried lines, Preferred by community, Removes waste handling by residents and operators
Cons:	Low flows (if not on piped water) require a source of flushing to help prevent freezing,
Include in FS:	Yes

4) Above ground piped system (pressure sewer)

Pros:	Improves sanitation, Would be able to utilize sewage lagoon and force main, Not reliant on gravity/grade requirements, Disturbs less ground (no excavation) than buried system, Removes waste handling by residents and operators, Not limited by low flows (if not on piped water)
Cons:	Expensive to purchase and install, Higher community and homeowner O&M, Requires glycol heat trace to prevent freezing, Creates corralling effect
Include in FS:	No

5) Community-run haul system

Pros:	Cheaper capital cost than piped system, Improves sanitation from current conditions,
Cons:	Requires infrastructure (haul garage and vehicles)($$), Requires regular (and accountable) user collection fee to operate, Requires specialty plumbing equipment
Include in FS:	Yes

6) Compost toilets

Pros:	No community system O&M, Environmentally friendly, Innovative, Eliminates honey buckets
Cons:	Requires homeowner education and continuous maintenance, Requires heat and mixing, Generates a waste product that needs to be disposed, Replacement parts can be expensive, Minimal success rate in rural Alaska, Little to no community oversight and/or assistance, Very unpleasant when not operating correctly.
Include in FS:	No

7) Incinerator toilets

Pros:	No community system O&M, Environmentally friendly, Innovative, Eliminates honey buckets
Cons:	Requires homeowner education and maintenance, High energy needs, Generates a waste product that needs to be disposed, Replacement parts can be expensive, Little to no community oversight and/or assistance, obnoxious odors when not well vented.
Include in FS:	No

8) Individual septic systems

Pros:	No community system O&M, Doesn't require specialty plumbing fixtures (can work with off the shelf plumbing) , Eliminates honey buckets, lagoon available for sludge disposal.
Cons:	Not suitable for areas prone to spring flooding, Not suitable for dense housing areas, Require regular pumping,
Include in FS:	No

Wastewater Treatment Options

1) Existing honey bucket dump

Pros:	Existing facility
Cons:	Not permitted, Does not improve sanitation in the community,
Include in FS:	Yes, as Do Nothing Alternative

2) Improved honey bucket dump

Pros:	Similar to existing facility, existing process
Cons:	Not likely to be permitted , Site control would likely be needed, low capacity.
Include in FS:	No

3) Sewage lagoon (already under construction)

Pros:	Already designed and under construction, Can be permitted, Provides most cost effective wastewater treatment,
Cons:	Requires use of force main pump, Requires closure and monitoring, high capital cost, can produce obnoxious odors in certain weather conditions
Include in FS:	Yes

4) Quanics trickling filter system

Pros:	Above ground insulated unit has been used successfully in Alaska, Removes the need to handle raw sewage, Can be installed below grade, Doesn't require specialty plumbing fixtures in the home
Cons:	Expensive, Would require regular and routine maintenance, Requires use of circ pumps and power, Would need to be heated to prevent freezing in pipes,
Include in FS:	Yes

5) Wastewater treatment plant (settling basin, clarifiers, aerators)

Pros:	Treats wastewater to highest quality (reuse levels)
Cons:	Highest Capital Cost, Requires high level operator certification, Highest O&M
Include in FS:	No

Subsystem Alternatives to be included in FS

Based on a review of the pros and cons of each of the above listed alternatives, the following are recommended for further evaluation and comparison in the Tuluksak Water & Sewer Feasibility Study:

Water Source

- Existing well near WTP/Washeteria Bldg
- Wells drilled at Utility Core (2005 wells)
- Rain water collection

Water Treatment

- Existing treatment system (batch water)
- New direct filtration (DF) treatment system
- New conventional filtration (CF) system
- Individual treatment systems in each home (including grey water reuse)

Water Storage

- Existing interior water storage at WTP/Washeteria Bldg
- New exterior storage (batched water)
- New exterior storage (piped water)
- Individual water storage tanks for each home (for rain or haul)

Water Distribution

- Existing self-haul system
- Piped water system
- Improved watering point for self-haul system
- Community-run haul system
- Individual rain/haul- based distribution systems (catchment, storage, treatment and piping)

Wastewater Collection

- Existing honey bucket self-haul to community hoppers
- Buried piped sewer system (gravity and force main)
- Community-run haul system

Wastewater Treatment

- Existing honey bucket dump
- Sewage lagoon (already under construction)
- Quanics trickling filter system

Alternative Systems

While looked at individually in the previous section, the majority of the improvements ultimately have to work in concert with each other as primary water and sewer systems. For instance, the smaller exterior water storage tank for a batched water process might be the least expensive of the water storage tank alternatives; however this tank would not provide the volume needed in a piped water distribution system. For this reason, the above alternatives have been grouped together in alternative systems that are listed below.

Alternative 1 – Do Nothing Alternative

This alternative includes the Do Nothing option for each water and sewer subsystem. This is required in all RD Preliminary Engineering Reports (PER) as a way to express the cost of the existing unimproved systems.

Alternative 2 – Piped Water & Sewer System

This alternative is the community-wide piped water and sewer system. In addition to the piped water distribution and gravity/force main wastewater collection, this alternative requires a DF or CF treatment system, a large exterior water storage tank, residential plumbing improvements and the use of the sewage lagoon already under construction.

Alternative 3 – Self-Haul/Rainwater Catchments Water & Piped Sewer

This alternative requires CF or DF treatment, an exterior water storage tank for batched water, an improved watering point for self-haul, buried piped sewer system (with flushing for low flows), residential plumbing improvements including rainwater catchments and a tank for storing hauled water, and the use of the sewage lagoon already under construction.

Alternative 4 – Self-Haul/Rainwater Catchments & Quanics Septic Systems

This alternative requires CF or DF treatment, an exterior water storage tank for batched water, an improved watering point for self-haul, residential plumbing improvements including rainwater catchments and a tank for storing hauled water and, individual or where feasible, cluster Quanics septic systems. This option does not use the sewage lagoon and force main currently under construction.

Alternative 5 – Community-Wide Haul System (Truck or ATV)

This alternative requires CF or DF treatment, an exterior water storage tank for batched water, an improved watering point for truck haul, residential plumbing improvements including water and sewer haul tanks, and the use of the sewage lagoon. In addition to haul vehicles, a community wide haul system would require the construction of a haul garage to store equipment and vehicles.

Selection Matrix

The Selection Matrix will be used in the FS to score and compare the system alternatives. In this section we have proposed the criteria to be used in the Selection Matrix and the weights to be assigned to each parameter.

The weights are the measure of the relative importance of the criteria and are to be assigned to each of the criteria on a scale of 1 to 3 with 3 being very important. (For example, a criteria like "Operation & Maintenance Cost" which directly relates to the cost impact to the homeowners for the system being proposed, is very important and would therefore be assigned a weight of 3.)

A rating of 1 to 5, with 5 being excellent, is then applied to each alternative relative to the criteria begin considered. (For instance when considering the criteria of "Capital Costs," a piped system alternative would likely rate poorly and be given a score of 1, since that alternative is assumed to have the highest capital costs.) Brief descriptions of the proposed criteria and suggested weights are provided below. Final criteria and weights will be decided jointly by the community and VSW with input by CRW. Ratings will be applied during the FS process, when the details of the alternatives evaluations have been determined and can be compared.

<u>Criteria & Weights</u>

Operator Requirements - How crucial is it that the systems being proposed meet the existing abilities of the local operators? Will the system require a higher level of certification and training? **Proposed weight: 1**

Environmental Impacts - Will the improvements impact floodplains, wetlands endangered species? Will they have the potential to discharge untreated wastewater or allow a contaminant into the water supply? Impact a subsistence area? **Proposed Weight: 3**

Land Requirements/Site Control - Will the improvements require site control or additional land? **Proposed Weight: 1**

Constructability/Construction Challenges - Will the improvements require specialty equipment or require seasonal construction? Are there unique challenges associated with the construction of a particular alternative? **Proposed Weight: 2**

Capital Costs - Will the Capital Costs be excessive and limit the likelihood that the final recommended alternative can even be funded? **Proposed Weight: 3**

O&M Costs - Will the O&M costs be significant and require a high customer fee to cover the costs of the system? Will rates exceed the target 5% of median household income in the community? **Proposed Weight: 3**

Reliability - Will the system provide regular, safe, and continuous sanitation service? Is it dependent on weather, outside sources or other utilities to function as intended? **Proposed Weight – 3**

Community Impacts - Will the systems require community-wide training or significant changes in how the utilities are currently being operated and maintained? Will the systems require significant changes in existing community capacity? Will the systems be able to utilize existing facilities? **Proposed Weight - 3**

Future Needs - Does the alternative provide for future growth? Or can the system be easily modified to account for future growth? **Proposed Weight - 1**

Community Preference – Is the alternative preferred by the community? **Proposed Weight - 2**

The following table lists the proposed criteria and associated weights in an example Selection Matrix.

Selection Matrix						
Criteria	**Weight**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Operator Requirements	1					
Environmental Impacts	3					
Land Requirements/Site Control	1					
Constructability/ Construction Challenges	2	**To be completed as part of the Feasibility Study.**				
Capital Costs	3					
O&M Costs	3					
Reliability	3					
Community Impacts	3					
Future Needs	1					
Community Preference	2					
Total Score						

Key:

1. Weight factor - based on a scale of 1 to 3, where 1 = somewhat important, 2 = important, and 3 = very important
2. R – Rating - based on a scale of 1 to 5, where 1 = poor, 2 = below average, 3 = average, 4 = good, 5 = excellent.

END