Matanuska-Susitna Borough
Septage Handling and Disposal Plan

Prepared for:

Matanuska-Susitna Borough
350 East Dahlia Avenue
Palmer, AK 99645

Prepared by:

HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, AK 99503

April 25, 2007

Table of Contents

List of Tables

List of Figures

Appendices

List of Abbreviations

ADEC............................Alaska Department of Environmental Conservation
ADF&G ....Alaska Department of Fish and Game
ADOT&PF....................Alaska Department of Transportation and Public Facilities
AWWU ....Anchorage Water and Wastewater Utility
BOD ....Biochemical Oxygen Demand
CFU...............................colony forming units
COSA............................Cost of Service Analysis
EPA ....Environmental Protection Agency
FHWA...........................Federal Highway Administration
IRS ....Internal Revenue Service
ISER..............................Institute of Social and Economic Research
KABATA......................Knik Arm Bridge and Toll Authority
lb/d ....pound(s) per day
MOA ....Municipality of Anchorage
MPN/g...........................“most probable number” per gram
MSB ....Matanuska-Susitna Borough
NAS ....National Academies of Science
NPDES..........................National Pollutant Discharge Elimination System
O&M.............................operations and maintenance
PFRP ....process to further reduce pathogens
PSRP ....process to significantly reduce pathogens
RCA ....Regulatory Commission of Alaska
SAS ....Solar Aquatics System
TSS................................Total Suspended Solids
VAR ....vector attraction reduction
VS ....volatile solids
WERF ....Water Environment Research Foundation
WWTP ....wastewater treatment plant

EXECUTIVE SUMMARY

The Matanuska-Susitna Borough (MSB) is the fastest growing community in Alaska and its population is expected to increase from 73,000 to 204,000 in 2030. It is estimated that currently 83% of MSB households use septic tanks and leachfields for sewage treatment. This accounts for 20,000 active septic tanks within the MSB. With population growth, the percentage of septic tank use is likely to remain constant in the MSB because of the plentitude of rural land for large-lot development, and the preference amongst new residents in the MSB towards remaining unconnected to the municipal grid. If this trend continues there will be approximately 56,000 active septic tanks in the MSB in 2030.

Septage is the concentrated sewage that is settled in the bottom of a septic tank while the main liquid component leaches out into the surrounding absorption field. Septage contains 70 percent of the suspended solids, oil, and grease of a household's sewage. Septage must be pumped from a septic tank on a periodic basis depending on sewage production and the size of the septic tank. The recommended rate of pump-out is every 12 to 24 months. In the MSB an estimated 13.6 million gallons of septage is pumped from septic tanks each year and this figure is expected to increase to 38.1 million gallons by 2030.

Septage from MSB is pumped out of septic tanks by septage haulers who transport the waste to Anchorage for disposal. The septage is disposed at a septage facility in Anchorage that is operated by Anchorage Water and Wastewater Utility (AWWU). The average round trip from the outskirts of the MSB is 80 miles and takes about two hours, including the time it takes to dispose of septage at the receiving facility in Anchorage.

The cost of transport and disposal of MSB septage is substantial, at $674,000 per year. This cost is made up of three things: labor for the round trip, the cost of running the septage truck, and the disposal fee paid to AWWU. In the near future the AWWU disposal rate is expected to increase due to a recent Cost of Serve Analysis (COSA) that identified that AWWU has been under-charging haulers. If the rate increase is accepted by the Regulatory Commission of Alaska (RCA), the total transport and disposal cost of septage from the MSB will increase to approximately $825,000 per year. By 2030 the increase in septage production in the MSB will bring the total transport and disposal cost to an estimated $2.3 million. This cost is paid directly by septage haulers, and indirectly by MSB residents with septic tanks, who pay an average of $240 each time their tank is pumped.

Septage haulers have approached MSB representatives requesting that MSB-based disposal options be explored so that they might avoid the commute to Anchorage. The MSB Public Works Department was interested in determining if it were feasible to redirect the cost of transporting and disposing of septage outside the MSB, to the construction and operation of a MSB-based septage facility. HDR Alaska, Inc. was contracted by the MSB Public Works Department to develop a Septage Handling and Disposal Plan that would assess the current septage handling and treatment situation, and develop MSB-based alternatives for the design horizon of 2030.

In consultation with the MSB Public Works Department, four different septage handling and disposal options were selected for evaluation:

1. Keep existing haul practices
2. Install septage consolidation facility and bulk haul to Anchorage
3. Construct co-treatment facility with the City of Palmer
4. Construct regional septage disposal facility

Table ES-1, included at the end of this section, provides a comparison of the advantages and disadvantages of all four options as well as the order of magnitude capital costs, the estimated annual operation and management costs, and the annual capital and operation and management costs that the MSB would pay over a 20-year payoff period. All costs are shown in 2007 dollars and would need to be adjusted for inflation in the future.

It is recommended that two options be further explored; constructing a co-treatment facility with the City of Palmer, and constructing an independent regional septage facility. Both options make the MSB independent of the Municipality of Anchorage (MOA) for septage disposal which may be advantageous in the future. The opportunity currently exists to plan for a new co-treatment facility with the City of Palmer as they seek to upgrade their facility by 2011 to meet more stringent limits in their discharge permit. The feasibility of this option depends on a number of factors including whether the City of Palmer is interested in a joint venture with the MSB. Both the City of Palmer and the MSB could benefit from cost sharing a new treatment facility, and if the septage inflow stream were stored and metered into the sewage stream when sewage flows dropped, such as at night time, the capacity of infrastructure would be better utilized. Ultimate discharge of effluent would be to the Matanuska River, and would require an increase to the City of Palmer's existing permit.

Constructing a regional septage facility would offer the MSB independent ownership and management. Possible treatment options include conventional treatment with a lagoon system, or the newer technology of a Solar Aquatics System that can produce tertiary-treated effluent, and would lessen discharge permit restrictions. MSB-owned land at the Central Landfill Site could be used for a regional septage facility. Ultimate discharge would be available at this site through discharge to constructed wetlands and percolation cell. An appropriate discharge permit would need to be acquired from the Alaska Department of Environmental Conservation (ADEC).

The costs of these alternatives are comparable to the current cost of transporting and disposing of septage in Anchorage. The MSB will be eligible for state and federal loans such as the Clean Water Fund that lends for a maximum of 20 years with an interest rate of 1.5%. To allow comparison of the cost of existing haul practices to the recommended options, a simple analysis of the cost to septage haulers was made. The combined transport and disposal cost for one round-trip for an average sized septage hauling truck of 3,000 gallons will be $174 once the AWWU rate increase comes into affect. In comparison to this figure, the estimated capital costs of Option 3 and Option 4 could be paid off in 20 years, including annual operation and management costs, if septage haulers paid $151 and $166 respectively for each load of septage that was disposed at the regional facilities. This analysis, although basic and not taking into account potential grants or funding, illustrates the feasibility of a MSB-based septage treatment and disposal facility.

Table ES-1. Alternative Matrix

Alternative		Advantages	Disadvantages	Order of Magnitude Capital	Costs Estimated Annual O&M	Annual capital and O&M
Option 1	Keep existing haul practices	• No capital and O&M costs to MSB • No environmental impact on the MSB • No additional land use • No EPA/ADEC regulations • No additional loading on existing WWTP	• Reliance on MOA and less ability to adapt to changes in the regulatory environment • Travel time expenditure • Cost inefficiency • Environmental impact of primary treated effluent	$0	$0	$0
Option 2	Install septage consolidation facility and volume haul to Anchorage	• Cost efficient hauling • Minimizes septage hauler travel time • Increase in MSB Employment • Relatively small amount of land required for transfer station • Project phasing would minimize upfront capital costs	• Reliance on MOA and less able to adapt to changes in regulatory environment • Capital, O&M and labor costs • Management of the facility • Land use and odor/aesthetic issues • Environmental impact of primary treated effluent	$5,252,000	$1,018,000	$1,281,000
Option 3	Construct co-treatment facility with the City of Palmer	• MSB not dependent on MOA • Increase in MSB Employment • Composting could produce marketable biosolids product • Current opportunity exists to design new co-treatment facility with City of Palmer • Existing discharge permit and equipment utilized • Cost shared by more than one revenue stream • Secondary-treated effluent • Mutual treatment benefits of co-treatment	• Cooperation with Palmer City Council could be administratively difficult • Capital and O&M costs • Sludge disposal • Additional land use • Feasibility dependent on being able to compete with AWWU	$19,665,000	$445,000	$714,000*
Option 4	Construct an independent regional septage facility	• MSB not dependent on MOA or local councils • Increase in MSB Employment • Composting could produce marketable biosolids product • Options for treatment • Secondary-treated effluent with the potential to produce tertiary-treated effluent	• Capital and O&M costs • Sludge and effluent final disposal responsibility • Land use and odor/aesthetic issues • Need for permitting and regulations • Feasibility dependent on being able to compete with AWWU • Management of the facility	SAS: $10,427,000 Conventional: $8,016,000	$264,000 $386,000	$785,000 $787,000

* This figure is dependent on the cost being shared by another revenue stream, as discussed in Section 6.5.8.

1.0 BACKGROUND AND PROBLEM STATEMENT

In recent years, the Matanuska-Susitna Borough (MSB) has become one of the fastest growing communities in the state. This is largely due to the lower cost housing, the rural lifestyle, and a reasonable commute to Anchorage for employment and services.

With MSB growth many new homes are being constructed with on-site septic systems. Proper maintenance of on-site septic systems requires pumping of the system's septic tank every 12 to 24 months. The pumped liquid and solids, called septage, need proper disposal to avoid health hazards, groundwater contamination, and odor problems. A plan is needed to collect and safely dispose of this material.

Septage can be described as concentrated sewage. Septage has average biochemical oxygen demand (BOD) levels 32 times that of domestic sewage, and total suspended solids (TSS) levels that are 68 times that of domestic sewage[1]. BOD is a measure of the amount of organic material in the septage and TSS is a measure of the septage solids concentration. Because of this high concentration, septage cannot be discharged directly into local sewage treatment systems. Highly concentrated septage would overwhelm the sewage treatment systems, resulting in the discharge of poorly treated effluent and violation of the plant's discharge permit stipulations.

In the early 1980s septage handling was addressed by the State of Alaska for the MSB, resulting in a septage disposal system being constructed in the Houston area. This system worked for a short time, but developed operational problems that resulted in closure of the system in the 1990s. With no septage disposal facility within the MSB, all septage is currently hauled to Anchorage and disposed at an Anchorage Water and Wastewater Utility (AWWU) receiving station at Turpin Street. The large volume of sewage already in the Anchorage system dilutes the septage to concentrations that do not adversely affect the operation of the Anchorage wastewater treatment plant.

While septage disposal into the Anchorage sewer system addresses treatment requirements, some MSB based septage haulers question its economics, pointing out that driving time between the MSB and Turpin Street results in a significant portion of the cost for septage management. This 'windshield' time reduces the number of septic tanks that can be pumped in a day and increases fuel consumption, vehicle maintenance, and other costs. There has also been concern over the announcement of the potential 141% increase in discharge fee at AWWU that would further increase costs. In general there is an interest amongst local septage haulers in a local disposal facility that would save haulers the current round trip commute time.

While the technology exists to treat the septage within the MSB, other major septage handling issues include the regulatory, economic, and policy aspects. An alternative septage facility within the MSB would need to be competitive with the cost of hauling and disposal in Anchorage. The purpose of this document is to provide information about the current septage handling and disposal practices and possible alternatives from which policy makers can make informed decisions for the future management of septage. The design horizon for this study is 2030.

[1] EPA Handbook for Septage Treatment and Disposal (1984)

Information from this report was gathered from a number of sources including interviews with septage haulers servicing the MSB, ADEC, and local sewage and water authorities, as well as reviews of the following reports, *Knik Arm Bridge Development* (HDR), *Mat-Su Long-Range Transportation Plan* (HDR), and *Mat-Su Stormwater and Wastewater Analysis* (HDR – in draft stage). A full list of references is included in the bibliography.

2.0 DESIGN CRITERIA

This section presents population and septage production data for the MSB, details of the current handling and disposal of septage, and the existing and future regulatory requirements from now until 2030.

2.1 Design population and demographics

The MSB encompasses 25,260 square miles with 90% of the MSB's residents living in the southern portion of the MSB in a corridor between the communities of Willow and Sutton[2] (Figure 1). Three communities are incorporated or have political boundaries within the MSB – Wasilla, Palmer, and Houston. The incorporated communities have represented a slowly declining fraction of MSB population over the past 20 years[3].

This study will use the figure for current (2005) population of 72,700 provided by the Institute of Social and Economic Research (ISER) at the University of Alaska, Anchorage. This figure is confirmed by the State Demographer 2005 estimation that is within 2% of the ISER figure, at 74,041. Thus, the number of households in the MSB is calculated as 22,700, based on the average household having 3.2 persons (ISER).

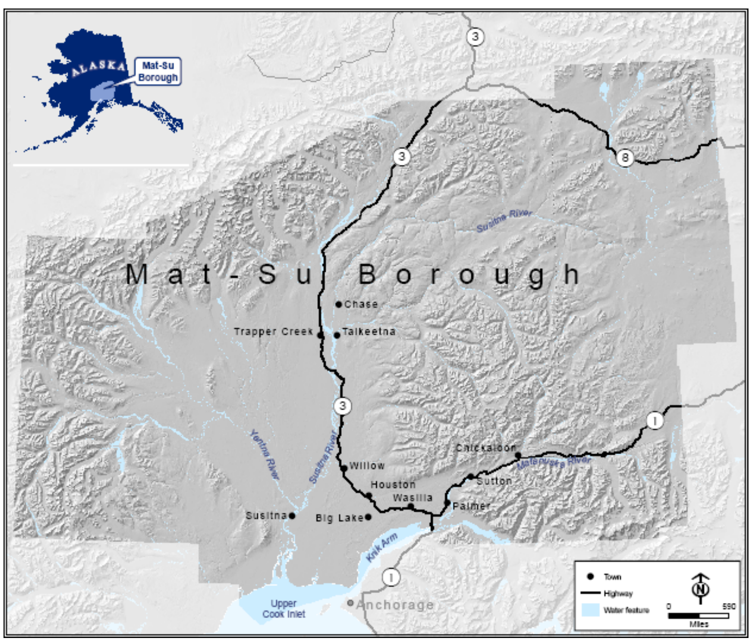


Figure 1 Map of the Mat-Su Borough

[2] Alaska Department of Labor and Workforce Development (ADOL). January 2003. Alaska Economic Trends. The Matanuska-Susitna Borough.
[3] HDR for the MSB Long-Range Transportation Plan

2.1.1 Population growth

The MSB has been Alaska's fastest growing region for the last two decades. Growth is expected to continue in the MSB along a similar projection as the last thirty years. If the Knik Arm Bridge is built there will be accelerated population growth as the southwest region is developed. Figure 2 depicts the population growth trend for the past three decades and the future two decades with, and without, the Knik Arm Bridge. The historical data comes from the Alaska Department of Labor and Workforce Development, and population projections are those developed by ISER for the Knik Arm Bridge and Toll Authority (KABATA), the Federal Highway Administration (FHWA), and the Alaska Department of Transportation & Public Facilities (ADOT&PF). Table 1 provides a summary of the projected population figures.

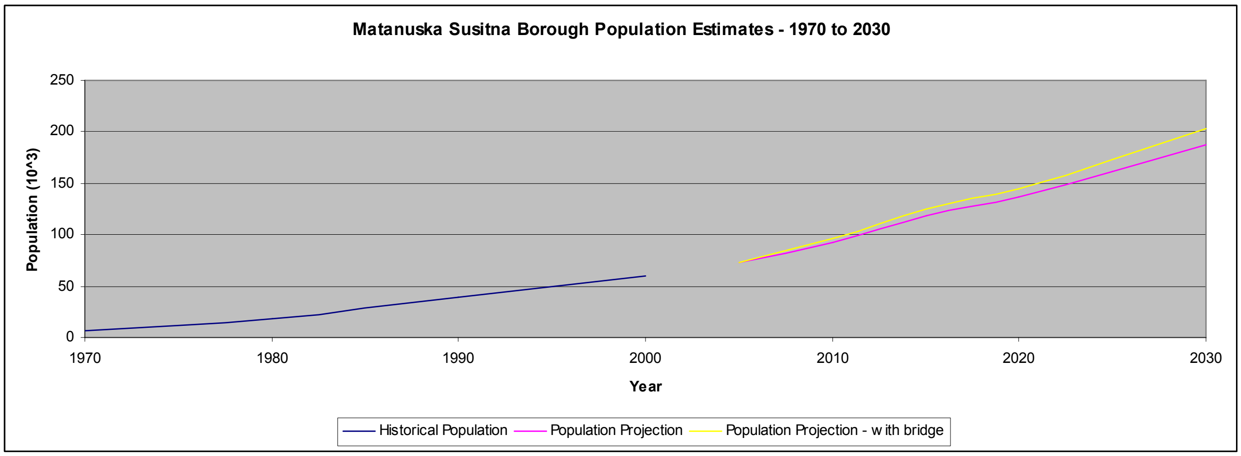


Figure 2: MSB population estimates - 1970 - 2030

Table 1: ISER population projections for the MSB

Projected Population in the MSB (1,000)			
	No Bridge	**Bridge**	**Difference**
2005	72.7	72.7	0
2010	92.08	96.04	3.96
2015	118.99	124.56	5.57
2020	136.86	144.43	7.57
2025	161.87	173.505	11.635
2030	187.53	203.755	16.225

Source: Institute of Social and Economic Research, University of Alaska Anchorage, 2005.

This plan uses future population and employment forecasts based on projections by ISER. ISER developed population estimates for the entire MSB with and without a Knik Arm Crossing for the years 2025 and 2030. The projections made by ISER are based on a number of economic growth assumptions. The methods used to develop the projections, therefore, contain an element of uncertainty about the future. If the MSB's future population and employment in a given year differ by a great amount (10%-20%) from the forecast used for this plan, then the MSB should consider updating the septage handling and disposal plan[4].

For the purposes of this study it is assumed that the Knik Arm Bridge will be built. By using the larger population figure, and with the assumption that growth continues, this study will provide a septage plan for a population of 203,755, a figure that will either be reached in 2030 if the bridge is built or at a later date if the bridge is not built.

[4] Analysis of the sensitivity of the population figure made by HDR for the MSB Long-Range Transportation Plan

3.0 EXISTING CONDITIONS

3.1 MSB WWTP serviced area

There are three operating wastewater treatment plants (WWTP) within the MSB, located in Talkeetna, Palmer, and Wasilla. The number of connections to these sewer systems in the MSB is 2,750[5], including residential and commercial types. In Wasilla 33% of connections are commercial[6]. Assuming that Palmer and Talkeetna also have 33% commercial connections, the total figure for residential sewer connections in the MSB is 1,854. This information is summarized in Table 2. Wasilla is currently operating under a discharge permit that expired in 2001.

Table 2: Serviced Areas in the MSB

WWTP	Number of connections served	Average flow (gpd)	Flow capacity (gpd)	Discharge permit limit (gpd)
Wasilla	660	400,000	1,000,000	400,000[7]
Palmer	1,875[8]	483,000[9]	750,000	950,000
Talkeetna	125[10]	70,000	100,000	180,000
Total	**2,750**[5]	**920,000**	**1,850,000**	**1,530,000**

3.2 Current septage disposal

The MSB did have a septage disposal facility operating in 1980s in Houston. It was funded by the ADEC and designed in 1983 by CRW for a population of 33,060, and a yearly design flow of 2,500,000 gallons of septage[11]. The facility was comprised of a receiving station, storage tank, screenings disposal area, a control building, two primary lagoons, two secondary lagoons, two leaching lagoons, a sludge drying bed, and three monitoring wells. Operation began in 1986 and ended on February 20, 1990. The facility was undersized and the volume of septage received exceeded what the facility could process. In 1991, nearby groundwater wells reported unacceptable levels of pollutants that contaminated the surrounding area and caused the closure of an adjacent fish hatchery that remains closed today. Over the lifespan of the project, revenue decreased as septage haulers chose to use the Anchorage septage facility because it was cheaper (Table 3). Evidently the disposal cost at Huston was set too high to compete with AWWU. Today, all septage is transported to Anchorage for disposal.

[5] Figure from interviews with the operators of the WWTPs and Public Works Departments
[6] This figure is from Wasilla's billing system.
[7] Wasilla's discharge permit expired in 2001 and has not yet been reissued (2006)
[8] Calculated by assuming 3.2 people per household, from the given figure of 6,000 capita served by system
[9] This figure includes 33,000 gpd from the Palmer hospital that will be connected to Palmer WWTP by the end of 2006.
[10] Calculated by assuming 3.2 people per household, from the given figure of 400 capita served by system
[11] Appendix 3 shows the complete system design criteria.

Table 3: Houston septage facility yearly revenue and expense

Year	Revenues	Expenses
1986	$102,045	$110,121
1987	$63,522	$108,220
1988	$55,415	$96,921
1989	$64,628	$134,471
1990	$33,947	$77,364

AWWU accepts septage at two receiving stations in the city of Anchorage, at King Street and at Turpin Street. The Turpin Street facility is in the north of the city and it is assumed that haulers coming from the MSB on the Glenn Highway would use this facility to avoid the difficulties of crossing town. There are no operating septage disposal facilities currently in the MSB.

3.3 Current septage production

MSB septage production has been estimated using records from AWWU's septage receiving facilities. In 2005, AWWU received an estimated 14.3 million gallons of septage from outside of the MOA[12]. The contributions from the MSB, and the Kenai Peninsula Borough (KPB) were estimated to be 95% and 5%, respectively. According to the ADEC, the KPB contribution is small because the only septage disposed in Anchorage is from a small number of campground restrooms.

Therefore in 2005 an estimated 13.6 million gallons of septage was pumped from septic tanks in the MSB and discharged into the AWWU system. Assuming that the average amount of septage pumped per septic tank in the MSB is the same as in the MOA (1,125 gallons), and 60% of all tanks are pumped each year[13], it is estimated that there are 20,143 active septic tanks within the MSB.

To determine the validity of this estimation, septage production was also calculated using the number of septic tanks in the MSB. The ADEC does not maintain a register of the number of septic tanks within the MSB, and although there is a process of permit acquisition by homeowners for the installation of a septic tank, staff could only guess the number existing in the MSB when asked. In Section 3.1 it was estimated that there are 2,750 sewered households out of the total 22,700 households in the MSB. This leaves approximately 20,865 households with either septic tanks or neither[14] (Table 4). Assuming that of these households, 90% have septic tanks and the remaining have none, it is determined that there are approximately 18,778 septic tanks in the MSB.

[12] Septic Hauler Analysis for 2004 TY ASU COSA
[13] MSB septic haulers report that households within the MSB frequently do not pump their septic tanks at the recommended minimum AMC requirement. Therefore it is assumed only 60% of MSB tanks are pumped each year instead of the 75% of all tanks that was assumed by AWWU for within the MOA.
[14] A number of households, particularly those on larger blocks in more rural areas, have outhouses. Many households with septic tanks also have outhouses as a back-up for when power is out or as preference to septic (according to Wasilla Public Works department).

Table 4: Ratio of household service type

	Households with sewer connection	Households with septic tanks	Households with neither	Total in the MSB
Number	2,750	18,778	2,086	**22,700**
Percentage	8%	83%	9%	**100%**

With 18,778 septic tanks, 12.7 million gallons of septage would be pumped per year[15]. This figure is within 7% of the estimate using AWWU data and it confirms that the AWWU estimate is reasonable. Thus, for the purposes of this study, the figure of 13.6 million gallons of septage pumped annually in the MSB will be used.

3.4 Septage characteristics

The characteristics of septage can vary widely. Factors that affect the physical characteristics of septage are: climate, user habits, septic tank size, design, and pumping frequency, water supply characteristics, piping material, the use of water conservation fixtures, garbage disposals, household chemicals, and water softeners[16]. Within the MSB, haulers say there is a large variation in pumping frequency. A septic tank that has not been pumped for a few years will have nutrient levels far higher than a tank pumped every year.

The septage received at AWWU's facilities has the following average concentrations: 7,138 mg/l TSS and 2,255 mg/l BOD[17]. These concentrations are relatively low in the typical range of septage TSS and BOD (Table 5). Interestingly, the TSS strength increased approximately 15% from 1992 to 2004, whereas BOD has remained relatively steady for the last five years of monthly sampling. The strength of septage discharged into AWWU's trunk sewers is far greater than the domestic wastewater in the trunk; it has roughly 26 times the TSS concentration[18].

[15] Using the same assumptions as earlier - the average amount of septage pumped from a tank is 1,125 gallons, and 60% of all tanks are pumped each year
[16] EPA, "Decentralized systems technology fact sheet – septage treatment/disposal", 1999
[17] These are figures from AWWU data sampling and analysis of hauler septage discharges. Measurements for average liquid waste BOD are based on monthly sampling of the hauler discharges over a 4 hour period each month. Samples are then composited and analyzed for BOD, and the data is averaged for each year.
[18] HDR, ASU Septic Hauler Rate Increase Analysis, 2006.

Table 5: Typical characteristics of septage

		Concentration, mg/L	
Constituent		**Range**	**Typical**
Total solids	TS	5,000 – 100,000	40,000
Suspended solids	TSS	4,000 – 100,000	15,000
Volatile suspended solids	VSS	1,200 – 14,000	7,000
5-day, 20°C BOD	BOD	2,000 – 30,000	6,000
Chemical oxygen demand	COD	5,000 – 80,000	30,000
Total Kjedhal nitrogen	TKN	100-1,600	700
Ammonia	NH_3 as N	100-800	400
Total phosphorus	TP	50-800	250
Heavy metals	-	100-1,000	300

Source: Metcalf and Eddy, 3rd edition.

3.5 Seasonal variations and peak daily loads

During the summer season between May and October, septage haulers drive to Anchorage around three times more than during the quiet season between November to April. Text books (Metcalf and Eddy 1991, EPA 1984) confirm that peak day delivery of up to three times the average number of loads can be expected unless controlled by the municipality. A yearly septage production of 13.6 million gallons of septage gives an annual average production of 37,000 gallons per day, but assuming that summer daily flow is three times the winter flow, summer (peak) flow is calculated as 57,000 gallons per day, and winter flow as 19,000 gallons per day (monthly details shown in Table 15 in Appendix 1). For the purposes of design, peak flows will be taken to be equivalent to summer flows in this report, and ‘summer’ is defined as the months of May through October, and ‘winter’ is the months of November through April.

Total load figures have been calculated by multiplying the appropriate volume by the average concentration. Average BOD loading is 1,053 lb/d at 2,255 mg/l, and average TSS loading is 3,334 lb/d at 7,138 mg/l (details in Table 17 in Appendix 1).

3.6 Cost of septage handling and disposal

HDR contacted seven of the septage hauling companies operating within the MSB to discuss the costs of transport and disposal of septage. Most interviewed were uncomfortable with sharing information about rates and costs due to the competitive nature of their business, however sufficient information was obtained to develop estimates. All costs described in this report are in 2007 dollars.

3.6.1 Transport and disposal costs

This section reviews the cost of transporting and disposing septage under current conditions. This cost would be diverted if septage was treated and disposed within the MSB. Transport and disposal costs are only part of septage haulers’ total costs that include labor costs for time in pumping a customer’s septic tank and associated costs.

Disposal Cost
AWWU charges septage haulers a flat monthly rate for using the Turpin facility. This rate is currently $272.63 per 1,000 gallon of truck capacity. According to AWWU, the average truck size that dumps at their facilities is 2,867 gallons. Therefore the average monthly disposal fee per truck is $782. If the average 2,867 gallon truck visits the facility the standard 33.5 trips/month[19], each disposal costs $23.

Transport Cost
Unlike disposal cost, the relative cost associated with the drive time remains constant for each truck, regardless of the frequency of trips. The trip distance from the MSB to Turpin Street is an average of 80 miles round trip, which takes on average two hours including dumping time. Transport and labor for this drive-time costs $92, using the Internal Revenue Service (IRS) mileage rate of $0.485/mile, and a wage of $26.35/hr including taxes. The IRS mileage rate has been calculated as the cost of running cars or small trucks, and takes into account depreciation, lease payments, registration fees, licenses, gas, insurance, repairs, oil, garage rent, tires, tolls and parking fees. This rate is for a large fleet of small vehicles, and could be an underestimate for running a small fleet of large trucks, which have greater gas, oil, and repair requirements. One of the hauling companies in the MSB estimated the mileage rate for their large truck as $1.16/mile after taking into account tires, fuel, repairs to engine and transmission, insurance, oil, taxes, maintenance and depreciation. With this rate, the total trip cost including labor ($26/hr) was calculated to be $146. Details of these expenses are shown in Appendix 2.

This analysis shows that each round trip to Turpin Street from the MSB costs approximately $92, and could be as much as $142 for large trucks. For this report an average mileage rate of $0.82/mile will be used, giving a transport cost of $119 per trip, including the cost of labor.

Total Transport and Disposal Cost
The total cost to the average hauler for the return trip including septage disposal ($23) and transport ($119) is $142 per trip, or in terms of septage transportation and disposal, 4 cents per gallons of septage disposed[20]. With an estimated 13.6 million gallons/year of septage produced in the MSB, this equates to annual transport and disposal costs of $674,000.

3.6.2 Septic tank pumping charges

In the MSB, customers are charged between 18 and 20 cents/gallon of septage pumped[21]. This is a rate for households inside the urban areas and does not include travel or special cleaning. Some hauling companies charge extra for longer drive times like going out to Big Lake. Table 6 lists the average prices for different sized households. In comparison, customers within the MOA pay less to have their septage pumped, with a flat fee of $105 being charged[22].

[19] AWWU septage disposal facility data
[20] At the average frequency of trips to Turpin of 33.5 trips/month
[21] Average rates developed from interviews with septage haulers.
[22] Used by AWWU for calculations and confirmed by interviews with haulers in the Anchorage.

Table 6: Septage pumping cost to MSB resident

Size of household	Average tank size (gallons)	Cost @ 19c/gallon
3 brm	1000	$190
4 brm (Average size)	1250	$238
5 brm	1500	$285
Duplex	1500-2000	$333

At 19 cents/gallon of septage, with 13.6 million gallons of septage being disposed each year, MSB residents pay approximately $2.6 million a year for the removal of their septage. Of this cost to the resident, the transport and disposal of the volume of septage represents only one part of the total service of having their septic tank pumped, which includes the labor hours of driving to the household, pumping the septic tank, and additional servicing to the tank as required.

3.7 Septage treatment and disposal parameters

Treatment and disposal of domestic septage is governed by the U.S. Code of Federal Regulations (40 CFR) Part 503. The EPA Region 10 manages wastewater treatment and biosolids permitting.

3.7.1 Wastewater discharge requirements

In Alaska, the minimum requirement for wastewater discharge to the surface land or water is secondary treatment, as dictated by the national 1972 Clean Water Act. ADEC document, 18 AAC 72 details the constituent limits associated with secondary treatment of wastewater, as well as parameters for discharge to subsurface and soil absorption systems.

Wastewater discharge permits, known as 401 Certifications, are issued by the EPA. In addition to the minimum requirements for all systems, the ADEC can require additional treatment to protect public health, water systems, or the environment, as determined for site specific conditions. Additional requirements are outlined for individual sites during the plan review and permitting process for the facility.

Discharge requirements of existing MSB WWTPs
As discussed in Section 3.1, the MSB has three existing WWTPs; at Talkeetna, Palmer, and Wasilla. Wasilla WWTP is currently without a valid discharge permit as it expired in 2001. Wasilla WWTP is not functioning adequately and is discharging elevated nitrate levels according to the ADEC. For these reasons will not be considered as a potential septage treatment option in this report. Talkeetna WWTP will not be considered for septage treatment because of its small size and distance from the core area. Palmer WWTP has a discharge permit for 0.95 million gallons per year and according to the operator, has room for development. Therefore, Palmer WWTP will be considered for septage treatment in this report.

A new discharge permit became effective for Palmer WWTP on January 1, 2007 and will expire in 2011. The effluent limitations for discharge into the Matanuska River, with the exception of flow and ammonia as discussed below, are standard secondary treatment requirements for all effluent discharge to surface water. These limits are 30 mg/L (monthly average), 45 mg/L (weekly average) and 60 mg/L (daily maximum) for biochemical oxygen demand and 45 mg/L (monthly average) and 65 mg/L (weekly average) for total suspended solids. Other parameters in the effluent discharge permit are the effluent dilution factor pertaining to the Matanuska River being a designated mixing zone, the number of fecal coliform bacteria allowed in effluent, and monitoring and signage requirements. The complete effluent discharge permit for the Palmer WWTP is included in Appendix 4.

The 2007 permit differs from the previous permit on two accounts. The maximum allowable volume of treated wastewater that can be discharged from the facility increased from 0.75 million gallons to 0.95 million gallons per day. Also, new effluent ammonia limits were introduced that will have a significant impact on future treatment requirements. Both the new average monthly limit (8.7 mg/L) and maximum daily limit (18.5 mg/L) for ammonia are considerably more stringent than the previous permit limits (34 mg/L and 71 mg/L, respectively). New upstream receiving water ammonia data is the main factor that contributed to the more stringent permit limit. This new data, combined with updated river flow, effluent, pH and temperature data collected under the previous permit were used by the ADEC to calculate the new ammonia limits.

Because the Palmer WWTP is currently unable to meet the new ammonia limits the ADEC has granted a waiver from compliance. The condition of this waiver is to follow the schedule of compliance, stating that Palmer WWTP must achieve compliance with ammonia limitations by November 31, 2011. In the interim, effluent ammonia limits from the previous permit (34 mg/L and 71 mg/L) must be met, and until compliance with the new effluent limits are achieved, the permittee must submit an annual Report of Progress each year which outlines the progress made towards reaching the compliance date.

Discharge requirements in Anchorage
The MOA is under the special condition of having been issued a waiver (301(h) waiver) from the EPA for secondary treatment requirements. Cook Inlet is classified as a mixing zone and primary treatment only is required at AWWU's Asplund Treatment Plant before discharge into the receiving water body.

3.7.2 Sludge (biosolids) discharge requirements

Federal requirements

The Clean Water Act Amendments of 1987 required the EPA to develop new regulations pertaining to sewage sludge/biosolids. In February, 1993, EPA published 40 CFR Part 503 (e.g. Part 503). The Part 503 Rule is a complex, risk-based assessment of potential environmental effects of pollutants that may be present in biosolids (USEPA 1995). These guidelines regulate pollutant and pathogen concentrations as well as vector attraction reduction (VAR). The guideline defines biosolids as Class A or Class B, depending on the potential level of pathogens. Class A biosolids must meet strict pathogen standards and can be used with no restrictions, as long as strict pollutant limits are also met. Class B biosolids must meet less stringent pathogen requirements, with application restricted to crops with limited human and animal exposure. Biosolids in both classes must meet vector attraction reduction and pollutant concentration requirements.

Management practices required by the Part 503 regulations include providing buffer zones around wells, surface water, and property boundaries; nutrient management including only applying biosolids at or below agronomic rates; not causing any adverse impact to threatened or endangered species; and not applying biosolids to flooded, frozen, or snow-covered land. This section also includes requirements on monitoring and reporting.

State requirements

State requirements are outlined in ADEC's Solid Waste Management document 18 AAC 60 (2003). Alaskan regulations follow the federal requirements discussed above.

4.0 FUTURE CONDITIONS

4.1 Service Area Growth

It is likely that for many years to come the bulk of the newly constructed residential housing within the MSB will have on-site septic systems. There are two primary reasons for this. Firstly, the coverage of Wasilla's and Palmer's wastewater collection systems is relatively small compared to the developable land base. Extending these collection systems is expensive, and the housing market now does not want to bear those costs. Secondly, there are still many larger land areas outside Wasilla and Palmer suitable for on-site septic systems. These areas will continue to be developed into larger lots, which is what the housing market demands. With this expansion, septage volumes will continue to increase.

For the purposes of this study it is assumed that the ratios of service type for households remains the same as it is currently. Therefore, out of the total households, 8% will have sewer connections, 83% will primarily use septic tanks, and 9% will have neither. Using this assumption the projected number of connections based on population increases in the MSB were calculated and are shown in Table 7.

Table 7: Household service type

Year	Number of households[23] (100%)	Households with sewer connections (8% of households)	Households with septic tanks (83% of households)	Households with neither (9% of households)
2005	22,719	1,854	18,778	2,045
2010	30,013	2,449	24,807	2,701
2015	38,925	3,177	32,173	3,503
2020	54,134	3,684	37,306	4,062
2025	54,220	4,425	44,816	4,880
2030	63,673	5,197	52,629	5,731

4.2 Septage production – design production

Septage production in the MSB has been projected by assuming that the average septage production per person remains constant. Therefore septage production increases linearly with population as shown in Table 8. In this section 'septage production' refers to the septage that is pumped from septic tanks and disposed of each year – that is, from 60% of all septic tanks, of average volume 1250 gallons, within the MSB each year. From these assumptions it is estimated that in 2030 the MSB will dispose of 38.1 million gallons of septage for a population of 203,755 (Table 8).

[23] Number of households was calculated as the population divided by the average number of people in a household, which is 3.2.

Table 8: Projected septage production in the MSB

Year	Population	Annual Septage Production (million gallons)
2005	72,700	13.6
2010	96,040	18.0
2015	124,560	23.3
2020	144,430	27.0
2025	173,505	32.4
2030	203,755	38.1

4.3 Seasonal variations and peak daily loads

A yearly septage production of 38.1 million gallons of septage gives an average production of 104,000 gallons per day. To estimate peak flow, it is assumed that that summer daily flow remains three times the winter flow. In addition, it is assumed that septage can only be received five days a week, or 20 days a month, to ensure that peak flows are accounted for if a future septage receiving facility is not open on the weekends. With these assumptions, 2030 summer (peak) flow is calculated as 238,000 gallons per day, and winter flow as 79,000 gallons per day (monthly details shown in Table 16 in Appendix 1). As noted earlier, for the purposes of design, peak flows will be taken to be equivalent to summer flows in this report.

Total load figures have been calculated by multiplying the appropriate volume by the average concentration. Peak 2030 BOD loading is 2,000 lb/d, and peak TSS loading is 14,000 lb/d (details in Table 17 in Appendix 1).

4.4 Cost of septage handling and disposal – existing haul practices

All costs described in this report are in 2007 dollars.

Disposal Cost
In 2006 AWWU filed a Cost of Service Analysis (COSA) to identify the costs the Utility incurs from each customer class. The results of the COSA indicated that the costs incurred by the Utility to provide service to the septic hauler customer class are greater than the revenue collected. To correct this, an increase of 141% was needed in the septic hauler rate. AWWU then submitted a request to the RCA to implement the 141% rate increase. This request is currently being addressed by the RCA, and for the purposes of this study it will be assumed that this request is granted, and by 2010 the septic hauler disposal rate will increase from $272.63 per 1,000 gallons of truck capacity per month to $647.54 per 1,000 gallons of truck capacity per month.

Drive Cost
For this study it will also be assumed that the costs associated with transporting septage (gasoline, wages, vehicle maintenance), will remain the same as in 2006, which were estimated at $119/trip.

4.4.1 Transport and disposal costs

With the AWWU rate increase the average total trip cost for septage haulers will increase 28%, from $142/trip to $174/trip. This corresponds to an increase from 5 to 6 cents/gallon of septage transported and disposed. With current septage production, the rate increase will bring the annual cost of transport and disposal to $825,000 and by 2030 the estimated annual transport and disposal cost for the MSB's septage is projected to be $2.3 million. Figure 3 shows the estimated annual costs of transport and disposal for the MSB's septage between 2005 and 2030, using the projected septage volumes from Section 4.2.

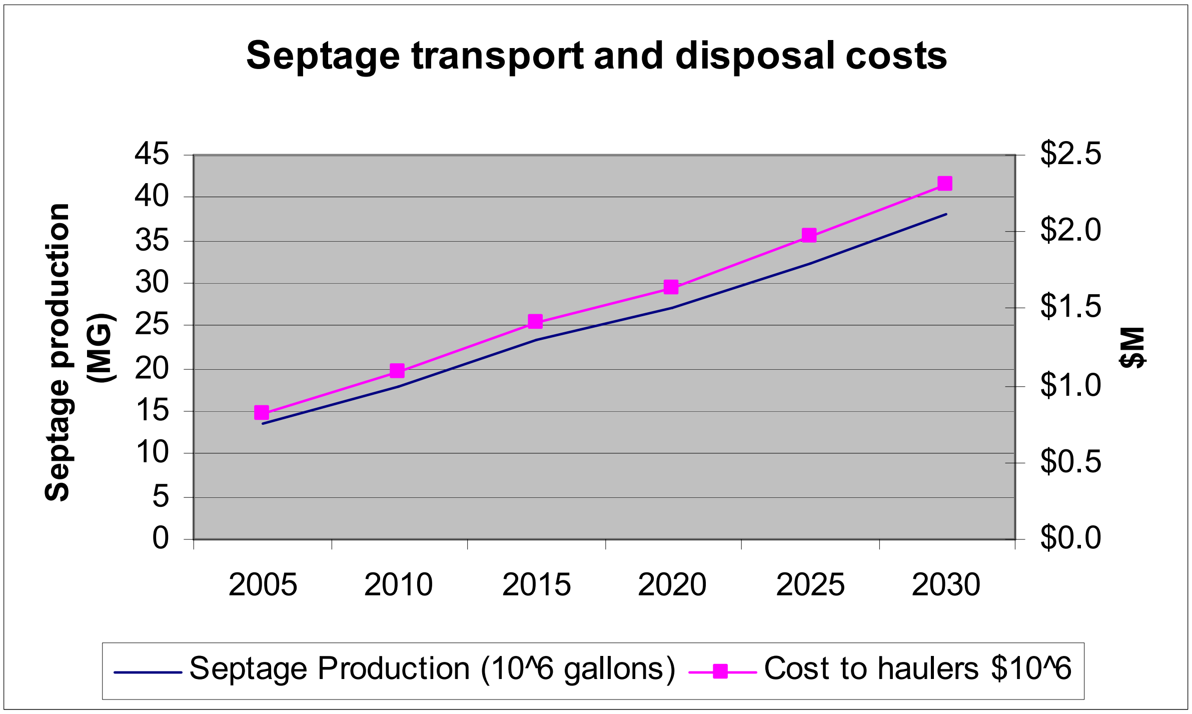


Figure 3: Septage transport and disposal costs

4.4.2 Septic tank pumping charges

With septage haulers attempting to retain their profit margin in the future, it is likely that MSB residents would bear the cost of the COSA price increase.

4.5 Septage treatment and disposal parameters

MSB regulations

Regulations for wastewater treatment and discharge in the MSB are expected to remain the same in the years to come, with a minimum of secondary treatment required. Ammonia limitations at the Palmer WWTP, as discussed in Section 3.7.1, are not being met by current treatment methods. The ADEC have issued a waiver on ammonia limits and written a schedule of compliance in the Palmer WWTP discharge permit, ending in 2011 when the ammonia limits must be achieved. Ammonia levels are reduced in the treatment process through nitrification which is the biological oxidation of ammonia nitrogen to nitrates.

Less than 30 percent of total nitrogen is removed by conventional secondary treatment[24] and as removal decreases with temperature it is difficult to achieve in cold climates. The Palmer WWTP is not designed to meet the 2011 ammonia limits and if aerated lagoon treatment were maintained, by 2030 an aeration area in excess of 200 acres would be required to achieve nitrification in the winter season. Obviously this area requirement is unfeasible and as a consequence, more intensive treatment process will be required. Ammonia has successfully been removed in an activated sludge process at other Alaskan WWTPs such as Soldotna WWTP and Eagle River WWTP. Treatment alternatives for ammonia removal are discussed in more detail in Section 5.1.3.

MOA regulations
The MOA is under the special condition of having been issued a waiver (301(h) waiver) from the EPA to the secondary treatment requirements of the 1972 Clean Water Act. If MOA requirements for treatment were raised to secondary or tertiary levels in the future, the cost of this might be reflected in the AWWU septage disposal cost, or if AWWU predicted that it would not be able to obtain sufficient revenue from treating septage to the new elevated level, AWWU might decide not accept septage from outside the MOA. In this situation the MSB would need to seek other disposal options.

When asked, the head of AWWU wastewater treatment said that they see no change in their policy of accepting waste from outside the MOA in the foreseeable future. During the last permit renewal process, Alaska Department of Fish and Game (ADF&G), the ADEC, and the City all agreed that the mixing area for Anchorage's discharge location was not a threat to fish or the environment. The ADEC indicated that AWWU has been doing a good job handling their treatment plant effluent discharge and there was no movement to further tighten discharge requirements.

The NOAA Fisheries Service expected to have the Beluga Whale on its endangered species list by the end of 2006. Once the endangered species status is listed, it is likely that all discharges to Cook Inlet would be reviewed and thus Anchorage's 301(h) waiver could come under closer scrutiny. There is no way of predicting at this point whether the Beluga Whale issue will bring about a retraction of AWWU's 301(h) waiver.

The ADEC stated that if there is an NPDES primacy change and the ADEC takes over the NPDES permitting role from EPA, 301(h) waivers will not be transferred to the ADEC, they would continue to be controlled by EPA.

Future biosolids regulations

It is possible that Class B biosolids may be further restricted in the future due to regulatory changes. At a 2003 Water Environment Research Foundation (WERF) biosolids summit, top industry critics voiced concerns about the adequacy of the Part 503 regulations. However, EPA has reaffirmed its endorsement of biosolids land application in a letter to state biosolids coordinators on October 31, 2003, and will ultimately decide whether Class B biosolids will be

[24] Metcalf and Eddy, Inc., 1991.

further restricted in the future. EPA is currently reviewing the Part 503 regulations and is expected to issue an updated version in the next 2-3 years.

4.6 Operation and management of septage treatment facilities

Larger municipalities have more resources and are more capable of managing the entire septage treatment process of handling, treatment and disposal, while other municipalities often opt to use privately owned facilities that alleviate some of the responsibilities of operating a treatment facility (EPA 1984). The MSB could choose to contract out the management of a septage treatment plant if it wished to alleviate some operating responsibilities.

In conclusion to a two year septage pilot study in Pittsfield, New Hampshire, TTG Environmental Consultants asserted that "building a successful septage operation is primarily a function of the capital costs for improvements, a Town's interest in developing a long-term public-private partnership, and identifying economical outlets for the septage residuals".[25]

4.7 Land availability

To reduce the commute time of haulers, possible facilities / transfer stations need to be located on a site that is both easily accessible and within the central MSB area. Due to odor issues, the site also needs to be an appropriate distance from residential areas. Figure 4 on page 24 shows the parcels owned by the MSB and the city owned WWTP parcels in the central urban area that could be considered for use in the different septage treatment and disposal options.

There are two sites of particular interest. One is the MSB-owned Central Landfill site, located equidistant from Wasilla and Palmer, and the other is the city owned Palmer WWTP site, to the south of Palmer on the Matanuska River. Both sites currently manage waste and have established odor buffer zones, and both sites have potential sludge or effluent discharge options (discussed further in Section 6.0). The sites are already established waste-treatment areas which lessens community resistance to further development as a waste facility area.

The Central landfill site occupies approximately 55 acres within the 620-acre parcel of MSB owned land. The land is undeveloped, and has an established odor buffer zone from residential areas. Being in proximity to the landfill will accommodate potential co-treatment of septage and leachate, or composting.

The Palmer WWTP is situated on two parcels of land that occupy 41 acres. From analysis of aerial photography, the land appears to be about 80% developed. There is residential housing to the north of the site, with housing in close proximity to the fence line. Odor issues must therefore be considered in planning for the development of septage treatment. According to the operator of the Palmer WWTP, the current site has room for development, and they are currently pursuing additional land to extend development potential. Aerial photographs show that there is an undeveloped site on the east that is not MSB land.

---

[25] TTG Environmental Consultants, LLC, "Septage Pilot Study", 2005

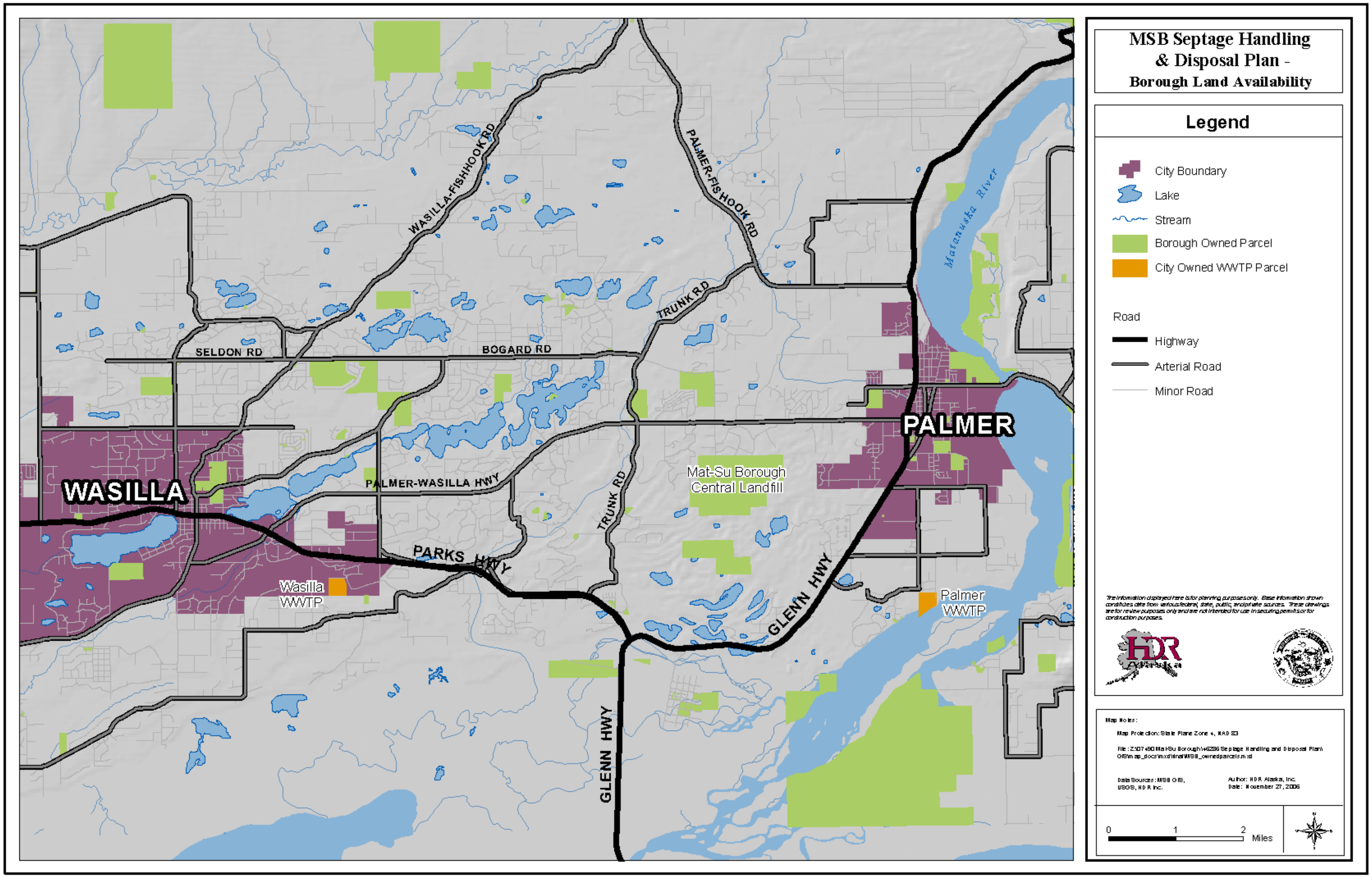


Figure 4 Land Availability Map

4.8 Septage Co-treatment with landfill leachate

Like septage, landfill leachate cannot be treated within the MSB, and it is transported to the AWWU discharge facility in Anchorage. Central Landfill management are seeking to establish a way of dealing with leachate within the MSB and have approached the MSB Public Works Department with the idea to develop a co-treatment facility for leachate and septage, that might be more cost effective than constructing two separate waste facilities with similar functions.

According to the MSB's Solid Waste Division, in 2006, 300,000 gallons of leachate from MSB was hauled to Anchorage for disposal. CH2MHill's 2006 report that states the 2005 average leachate flow rate was less than 2 gpm, a rate that would produce 1.1 million gallons of septage over a year. Therefore, the current rate of leachate production is in the range of 300,000 to 1,100,000 gallons a year.

The design influent leachate flow rate for future and peak leachate flow is estimated to range from 10 to 16 gpm according to CH2MHill's report (2006). A table of the analytical results for volatile and semi-volatile organic compounds found in the MSB landfill leachate is shown in Appendix 7.

One issue with leachate is that unless the landfill is closely regulated, undesirable contaminants, and contaminant sources can be dumped into the landfill and can cause problems further on in the leachate treatment process. Existing wastewater treatment facilities in other parts of the United States typically develop a document that holds the landfill responsible for contamination of the treatment process if it is proven that the problem came from the landfill. A definitive assessment of whether leachate could be co-treated with septage in the MSB was beyond the scope of this study.

5.0 OVERVIEW OF SEPTAGE MANAGEMENT OPTIONS

In this section the various options available for septage management will be assessed for appropriateness in the application of MSB septage. Documentation of cold climate septage treatment is somewhat limited in the published literature and secondary treatment of septage is relatively new in cold climates of North America. Case studies of local septage treatment and cold climate treatment have been used to inform this study wherever possible[26].

5.1.1 Hauling to Anchorage

The EPA's septage handbook (1984) states that although there are little data regarding costs for the transport of septage over long distances, studies investigating the liquid transport of wastewater sludge indicate that truck transport may not be economical for one-way distances of greater than 20 miles. The average one-way distance from the MSB to Anchorage is double this figure, at 43 miles. Because there are currently no regulatory restrictions to the continuation of hauling, the feasibility of this option will ultimately depend on a policy decision by the MSB, and a cost comparison of this option to the other options.

5.1.2 Land Disposal

Land disposal or landfilling of septage without prior removal of the liquid component is not appropriate in the MSB because the volume of septage is too great.

5.1.3 Co-Treatment

Even without the addition of septage, Palmer WWTP requires significant changes to its treatment process in order to meet ammonia removal requirements by 2011 as required by the NPDES effluent discharge permit (see Section 3.7.1 and Section 4.5 for details). The plant's need to upgrade the treatment process by 2011 provides an opportunity for the MSB to join with the City of Palmer to design a treatment plant that would meet the future demands from both wastewater from the City of Palmer, and septage from the MSB. A joint venture might be complicated in terms of financing and administration, but both the MSB and the City of Palmer could benefit from cooperating to solve both problems.

A comparison of the two waste streams is shown in Table 9. This table shows septage concentration estimates after pretreatment. Although the pretreated septage is more concentrated in BOD and ammonia compared to Palmer sewage, the average Palmer sewage load is six times the volume of the peak septage load, and contributes three times the mass of BOD and three times the mass of ammonia. It is possible, with proper storage and flow equalization, for pretreated septage to be metered into the sewage flow at times when sewage flows are reduced, such as at night. Septage flow equalization balances input loadings and best utilizes existing infrastructure.

[26] For example, reports such as the Anderson septage receiving facility design (HDR) were used as references.

Table 9: Comparison of peak season septage and wastewater inflows in 2030

		Summer 2030		Total
		Pretreated Septage	Palmer Sewage	
Flow	gpd	238,165	1,353,696	1,591,860
BOD	mg/L	500	238	738
BOD	lbs/d	993	2,685	3,678
Ammonia	mg/L	50	30	80
Ammonia	lbs/d	99	339	438

The ammonia reduction required to meet the Palmer WWTP 2011 limits could be met with conventional activated sludge treatment that has worked successfully in a number of plants in Alaska, including Eagle River WWTF and Soldotna WWTP.

5.1.4 Pretreatment

Removing septage solids through pretreatment and sending only the liquid portion to a wastewater treatment facility significantly reduces the waste load to the treatment facility because nutrient and solids loading in the liquid portion is 45% to 95% less than raw septage values (EPA 1984, TTG 2005).

Septage Conditioning

Septage has poor dewatering characteristics and needs conditioning prior to dewatering. The conditioning process must fundamentally alter the sludge structure so that the solid and liquid portions are more easily separable. This is typically accomplished through chemical means. The amount of chemical used is based on the load and its characteristics. A combination of lime and ferric chloride has been successfully used, along with certain polymers.

One septage hauler from the Kenai area has been pilot testing polymer conditioning at his septage pretreatment plant. There are two septage haulers in the Kenai and each treat septage and discharge effluent to percolation cells and biosolids to land application. Holland has developed a batch process using polymers to dewater the septage. He claims to have achieved BOD and TSS concentrations in the liquid remaining after pretreatment that are comparable to typical domestic wastewater, with BOD around 200 - 211 mg/L and TSS of 87 – 120 mg/L. If this can be verified, he is achieving a large reduction in BOD and TSS according to other treatment operators[27]. A more conservative figure of 500 mg/l for both BOD and TSS has been used for septage effluent, which was recommended by the manufacturer of the FKC screw press and pretreatment equipment.

Lime stabilization is relatively low in capital cost and is a simple pretreatment technology. The addition of lime creates high pH (>12 for 30min) that inhibits microorganism survival and has been proven to improve septage dewaterability and decrease odors[28]. The two most important

[27] Correspondence with Ed Griffenberg, HDR
[28] EPA, "Handbook for Septage Treatment and Disposal", 1984

criteria for design of a septage lime stabilization facility are lime dosage/pH and mixing/contact time.

Ferric chloride and lime were used successfully in a septage pretreatment study in Pittsfield, New Hampshire[29]. This combination of conditioning chemicals was found not only to settle solids but also provide phosphorus removal and odor control.

The current trend in conditioning is to use polymers, and so for this report it will be assumed that polymers will be used for conditioning.

Solid/liquid separation
A number of mechanical septage dewatering systems are available. The degree of dewatering accomplished is a function of conditioning chemical, admixtures of other sludges, and the dewatering process used. Typically, dewatered septage (sludge cake) has a solids content of approximately 20 to 40 percent[30]. Feasible options for the MSB include using a screw press, and a rotary press.

Standard equipment for dewatering with only polymer includes a sludge feed pump, a polymer system, a control panel, miscellaneous field instrumentation, a conveyor, and a truck/disposal bin.

Table 10 provides vendor supplied data on the potential performance of septage dewatering technologies.

Standard equipment for septage dewatering includes a sludge feed pump, a polymer makeup system, a control panel, miscellaneous field instrumentation, a conveyor, and a truck/disposal bin. A screw press can produce Class A or Class B biosolids, depending on the process and the required product. Biosolids production and management is discussed in Section 5.1.6.

Freeze-thaw treatment

The design for a new Anderson Septage Facility was completed in 2006 and is yet to be built. The facility has two freeze-thaw pretreatment ponds that are used alternately on a 12-month rotation. This technique is not suited for pre-treatment of the MSB's total septage because it requires excessive land area. Freeze-thaw ponds must be shallow enough to allow freezing, and the MSB's septage volume would require two ponds of approximately 23 acres each.

Receiving station
A receiving station must be built at the septage pretreatment site to receive septage from the hauling trucks. The primary functions of a receiving station are the transfer of septage from hauler trucks, preliminary treatment of septage (i.e. screening), and storage and equalization of septage flows. Receiving station design should encourage simple and reliable operation, and

[29] TTG Environmental Consultants, LLC, "Septage Pilot Study", 2005
[30] EPA, Septage Handbook, 1984

have the flexibility to accommodate varying flow and loading conditions[31]. Designs vary but certain design elements in most receiving stations are listed as follows:

Receiving station

- Hard surfaced, truck unloading ramp sloped to a drain to allow ready cleaning of any spillage and washing of the haul tank, connector hoses, and fittings. The ramp drainage must be tributary to treatment facilities and should exclude excessive stormwater.
- A flexible hose fitted with easy connect coupling to provide for direct connection from the haul truck outlet to minimize spillage and help control odors
- Washdown water with ample pressure, hose, and spray nozzle for convenient cleaning of the septage receiving station and haul trucks.[32]
- The receiving station would need to be covered and heated for winter months but still allow excellent ventilation and access for vehicles[33].

Storage/equalization

- An adequate off-line septage receiving tank should be provided. Capability to collect a representative sample of any truck load of waste accepted for discharge at the plant should be provided. The receiving tank should be designed to provide complete draining and cleaning by means of a sloped bottom equipped with a drain sump. The design should give consideration to adequate mixing, for testing, uniformity of septage strength, and chemical addition, if necessary, for treatability and odor control.

Screening and grit removal

- Screening, and grease removal of the septage as appropriate to protect the treatment units.

Pumps and valving

- Pumps provided for handling the septage should be of the nonclogging design and capable of passing 3-inch diameter solids

Valving and piping

- Valving and piping for operational flexibility to allow the control of the flow rate and point of septage discharge to the plant

Safety features – to protect the operational personnel

Staffing

- Laboratory and staffing capability to determine the septage strength and/or toxicity to the treatment processes.

Odor control

[31] EPA, "Handbook for Septage Treatment and Disposal", 1984
[32] Health Research, Inc. Recommended Standards for Wastewater Facilities, 1997.
[33] In Western Canada the problem with cold temperatures has been addressed by constructing underground holding tanks that maintain a warmer temperature. These facilities had no need for special cold weather provisions (HDR internal correspondence).

- Guidelines from Norway and Germany state that septage pretreatment facilities must be located at least 300 feet from the nearest house unless the discharge takes place inside a building and odor reduction equipment is installed[34]. Odors from septage processing in other studies, thought to be a critical component of the pilot study, have proved to be minimal[35].

Composting

Composting of raw septage is not feasible in the MSB because the volume of septage is too large and wet.

5.1.5 Independent Treatment

There are a number of independent treatment options including mechanical treatment systems, passive lagoon systems, and biological treatment (such as Solar Aquatic Systems). Mechanical treatment systems, as opposed to simple lagoon systems or biological treatment, are generally more capital intensive and usually cost more to operate. Such systems are cost effective in areas of significant septic system density (EPA 1984). Lagoons are the most common and among the least expensive independent septage handling alternatives, often requiring the most land. Screening as discussed in Section 5.1.4, would be required prior to septage addition to the lagoons.

The Solar Aquatics System (SAS) is a biological treatment system that treats effluent to advanced secondary and tertiary standards through a series of aerated translucent tanks that host plant communities and aerobic microorganisms. Prior to addition to the tertiary treatment system that is housed within a greenhouse, septage would require pretreatment – mixing, aeration, and clarification. A detailed treatment description from the vendor, Ecological Engineering Group, is included in Appendix 5.

Effluent from independent treatment must be discharged according to EPA and ADEC regulations. Discharge options for secondary treated effluent include outfalls, constructed wetlands, and leach fields. If effluent is treated to tertiary standards then discharge options increase, and effluent can be used for irrigation or other reuse applications.

5.1.6 Biosolids management

If MSB septage were treated with chemical conditioning and dewatering, an estimated 9,000 cubic yards of biosolids per year would be produced by 2030, if a similar solid reduction was achieved to the TTG New Hampshire Septage Pilot Study[36]. Biosolids can be treated to Class B

[34] EPA, "Handbook for Septage Treatment and Disposal", 1984
[35] TTG Environmental Consultants, "Septage Pilot Study", 2005
[36] Dewatering produced 125 cubic yards of solids per 600,000 gallons of septage. This was less than what the consultant, GSS, estimated at 25 cubic yards per 100,000 gallons of septage. Assuming that the conditioning and dewatering process chosen for the MSB yielded similar percentage of solids as that in New Hampshire, the amount of solids from the current septage production would be 8,000 to 9,500 cubic yards of solids per year.

or Class A, and the class defines how the biosolids can be applied. Palmer WWTP currently produces Class B biosolids that are applied to the restricted land surface adjacent to the ponds.

Current trends in biosolids management

EPA (1999) provides the most current and wide-ranging look at trends in biosolids management in the US. Figure 5 shows the breakdown of biosolids use/disposal in the US in 1999. Land application and advanced treatment (Class A or similar processing) represent over half of the biosolids use in the US. These biosolids management alternatives are expected to increase to 47 percent and 14 percent of the total biosolids produced in the US, respectively, by 2010 (USEPA 1999).

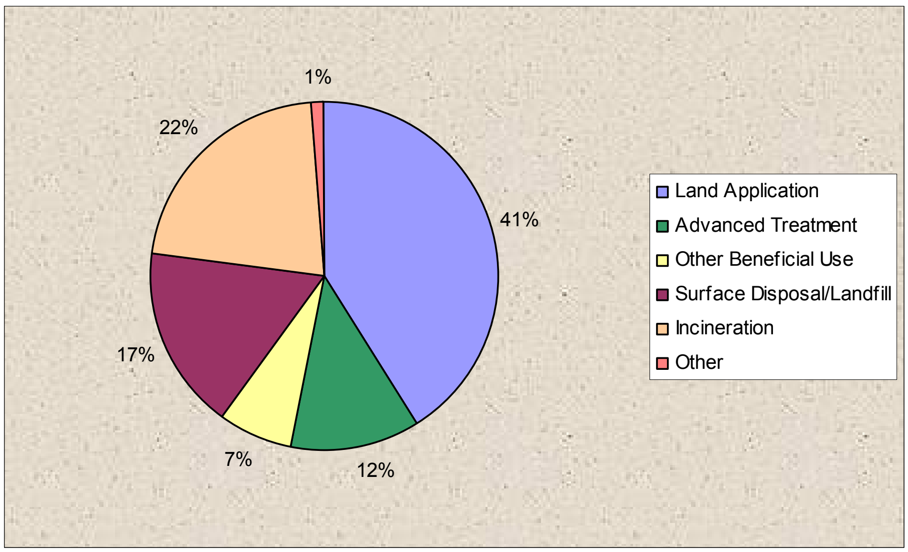


Figure 5: EPA Estimate of Biosolids Use/Disposal in the US in 1998 (USEPA 1999).

Due to increasing public pressure and a recent National Research Council (NRC) report recommending an update of the Part 503 regulations, many wastewater utilities are considering and implementing Class A biosolids technologies.

Producing Class B biosolids

Class B biosolids are the predominant class of biosolids produced in the US (USEPA, 1999). Common treatment technologies, such as aerobic and anaerobic digestion, are used at many municipal wastewater treatment plants to inactivate the vast majority of potential pathogens in sludge. However, the sludge is not considered "pathogen-free," and EPA requires that specific management practices be employed to protect the public. Class B biosolids must also meet the same vector attraction reduction requirements as Class A biosolids.

Class B biosolids must meet one of several pathogen destruction alternatives including the following:

- Meet monitoring requirements for fecal coliform;
- Employ a process to significantly reduce pathogens (PSRP), or;

- Employ a process equivalent to a PSRP.

Monitoring requirements for the first alternative are:
- Seven samples of treated biosolids must be collected and the geometric mean fecal coliform density of the samples must be less than 2 million CFU or MPN per gram of biosolids.

PSRPs include the following:
- Anaerobic digestion between 15 days at 35ºC (95ºF) to 60 days at 20ºC (68ºF)
- Aerobic digestion between 40 days at 20ºC (68ºF) to 60 days at 15ºC (59ºF)
- Air drying for at least 3 months
- Composting – temperature of the sludge must be 40ºC (104ºF) or higher for at least five days. For four hours of that period, the temperature must be 55ºC (131ºF) or higher.
- Lime stabilization – the pH of the sludge must be raised to 12 for at least two hours.

Biosolids treatment must include a method for reducing the attraction of vectors. Alternatives depend on the method of treatment and include 38 percent volatile solids (VS) destruction, a specific oxygen uptake rate of less than 1.5 mg oxygen per hour per gram total solids, and other methods. Meeting the 38% VS destruction criteria for VAR is usually not a problem for an anaerobic digestion process.

Management practices are required to limit public and animal contact after Class B biosolids are applied and to allow natural processes to further inactivate potential pathogens.

Producing Class A biosolids

The application of Class A biosolids, as defined by the US EPA, is not restricted. Consequently, producing Class A biosolids can open many more opportunities for land application or other use than a lesser treatment process. Producing Class A biosolids may provide significant disposal (hauling, application, etc.) cost savings to municipalities depending on the treatment process and the quality of the final product, and can generate revenue in some cases. However, Class A solids treatment technologies generally required increased capital and O&M costs for processing, especially at treatment plants or wherever Class A processing occurs. Producing Class A biosolids can reduce costs associated with acquiring new land application sites.

Class A pathogen reduction requirements include fecal coliforms of less than 1000 MPN/g TS or Salmonella of less than 3 MPN per 4 g TS. Alternatives for meeting Class A pathogen requirements are:
- Thermally treated (must meet specific time-temperature requirements depending on solids concentration)
- High pH-high temperature (lime stabilization followed by air drying)
- Use of a Process to Further Reduce Pathogens (PFRP)
- Process equivalent to PFRP (requires approval of EPA's Pathogen Equivalency Committee)

Thermal treatment

Thermal treatment means that specific time-temperature requirements must be met as specified by the 503 regulations. Thermal treatment can be achieved through composting. Sewage sludge is successfully composted in Fairbanks, producing a marketable product that is sold to gardeners and landscapers in the community at $5 per cubic yard. The product is so highly desired it is sold out each season[37]. If a composting technique were used for solids in the MSB, based on the Fairbanks model, the septage sludge would need to be a minimum of 10 percent solids so that it could be handled. The sludge is mixed with old and new woodchips (three parts woodchips to one part septage solids) and stacked into a 9 foot high compost heap on top of perforated pipes that supply forced air. The EPA requires that the compost achieves temperatures of 104 degrees F. for two weeks to kill pathogens. The compost sits over the wintertime and is screened to remove un-composted woodchips in the spring and then sold to the community.

With approximately 9,000 cubic yards of solids collected in the year, and 27,000 cubic yards of woodchips mixed in, a nine-foot high compost heap would cover an area of 2 acres. Composting might not be an option if the site were at the Palmer WWTP due to land constraints. The combined volume of septage and sewage solids would need to be determined, as well as the future area of the Palmer WWTP, in order to determine the feasibility of composting at this site.

MSB Solid Waste Division is planning to develop a regional composting facility at the Central Landfill. During a meeting with the MSB, the division manager, Greg Goodale, noted the need for more organic material for this venture. If septage sludge were directed towards this venture, it would provide the Solid Waste Division the necessary organic component for composting, and provide a solution to sludge disposal for a septage facility.

PFRP's

PFRPs include composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization. Detailed descriptions of the requirements for these processes can be found in EPA (2003). Pathogen requirements are the same for these processes as the requirements previously mentioned.

High pH-high temperature

A high pH-high temperature process is defined as the three following conditions: elevating the pH to more than 12 for at least 72 hours, maintaining the temperature of the sludge above 52°C for at least 12 hours while the pH is above 12, and air drying to over 50 percent solids after the 72-hour period of elevated pH. One approach to high pH-high temperature treatment is the use of a screw press. Figure 6 on page 36 shows a schematic of the solid/liquid separation process using a screw press that produces Class A biosolids. Such mechanical treatment is less land and labor intensive than composting.

There are two options available when using a screw press to produce Class A biosolids. One option is to add lime and heat to the septage during a typical 8-hour day operation. Auxiliary equipment would include a boiler system, miscellaneous field instrumentation, lime system, lime mixing tanks and pumps, and an upgraded control panel. The cost of this additional equipment is not included in the figure in Table 10.

---

37 Anchorage Daily News, 'Composting thrives in North despite conventional wisdom', September 7, 2006.

The other option is a Class A system that runs continuously 24 hours per day and at slower screw speeds[38] to get the time and temperature required to meet Class A biosolids requirements. The capital cost of this system is similar to that shown in Table 10; however, the extended hours of operation would create higher operation costs than the standard screw press.

Standard equipment for dewatering with only polymer includes a sludge feed pump, a polymer system, a control panel, miscellaneous field instrumentation, a conveyor, and a truck/disposal bin.

Table 10: Mechanical septage dewatering options

Dewatering Technology	Cake solids %	Liquid BOD mg/L	Requirements	Class A biosolids	Cost $
Screw press	35	300 – 700	Indoor housing.	Auxiliary equipment needed.	265,000 ea unit[39] + auxiliary equipment
Screw press	35 – 45 with polymer addition	250 – 800[40]	Rotary screen thickener and a 540 gallon flocculation tank. Indoor housing.	Auxiliary equipment necessary – lime and heat	615,000 for three pieces of equipment + auxiliary equipment

[38] The Class A screw press has 200mm less of screw diameter.
[39] If septage decanted to 15,000 mg/l, one unit should be capable of handling dewatering requirements for current loads, according to Prime Solution vendors.
[40] If grease trap waste added BOD after dewatering is much higher. A combination of septage and grease trap waste will be between 250 – 3,000 mg/L. Grease trap filtrate alone is 2000-3000 mg/L because it adds high dissolved solids that standard dewatering units have no way to capture.

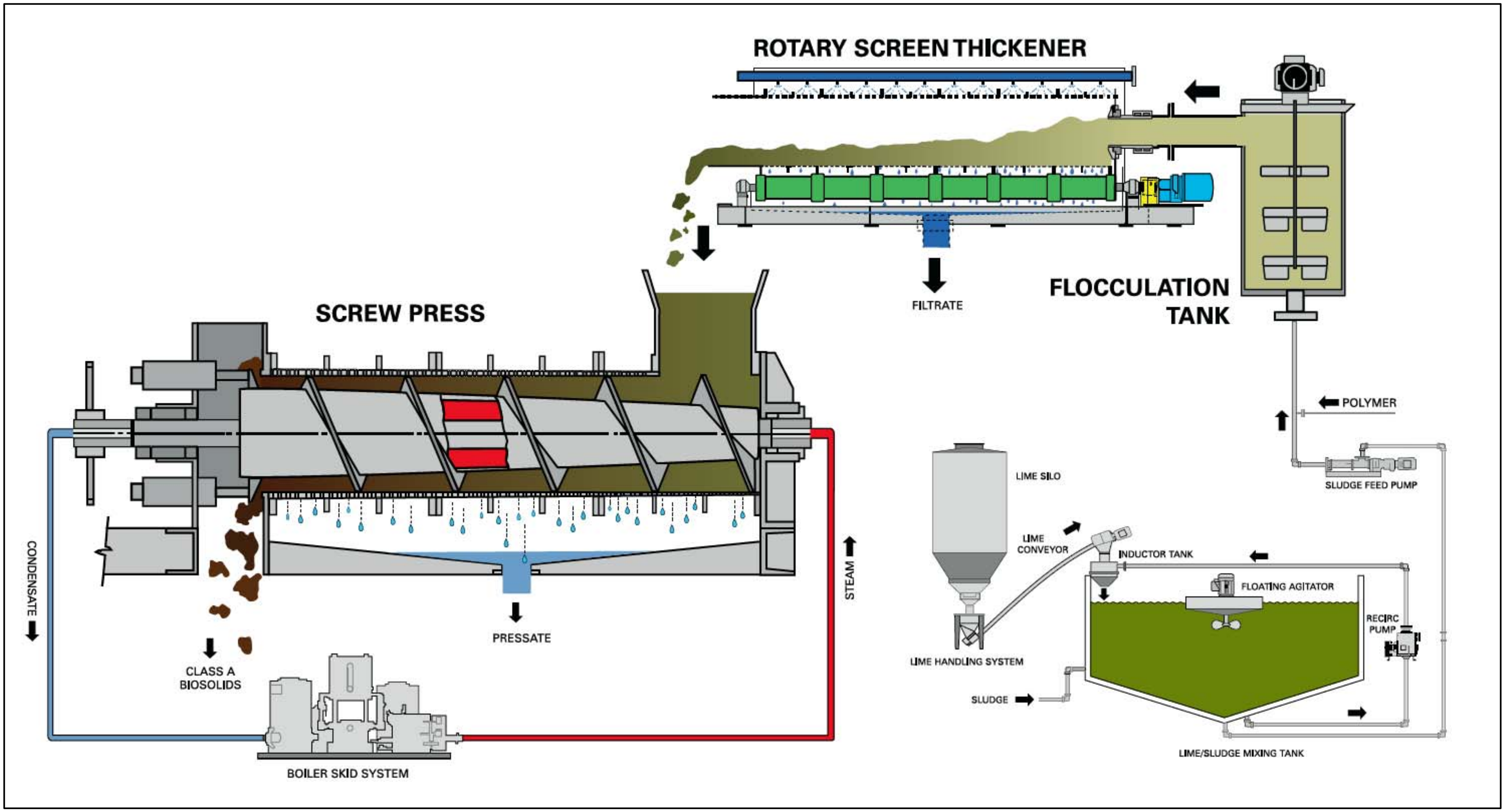


Figure 6: Solid/Liquid separation using a screw press to produce Class A biosolids

5.2 Summary of possible septage treatment options

Figure 7 summarizes the treatment options available to the MSB. Section 6.0 will look at these options in detail.

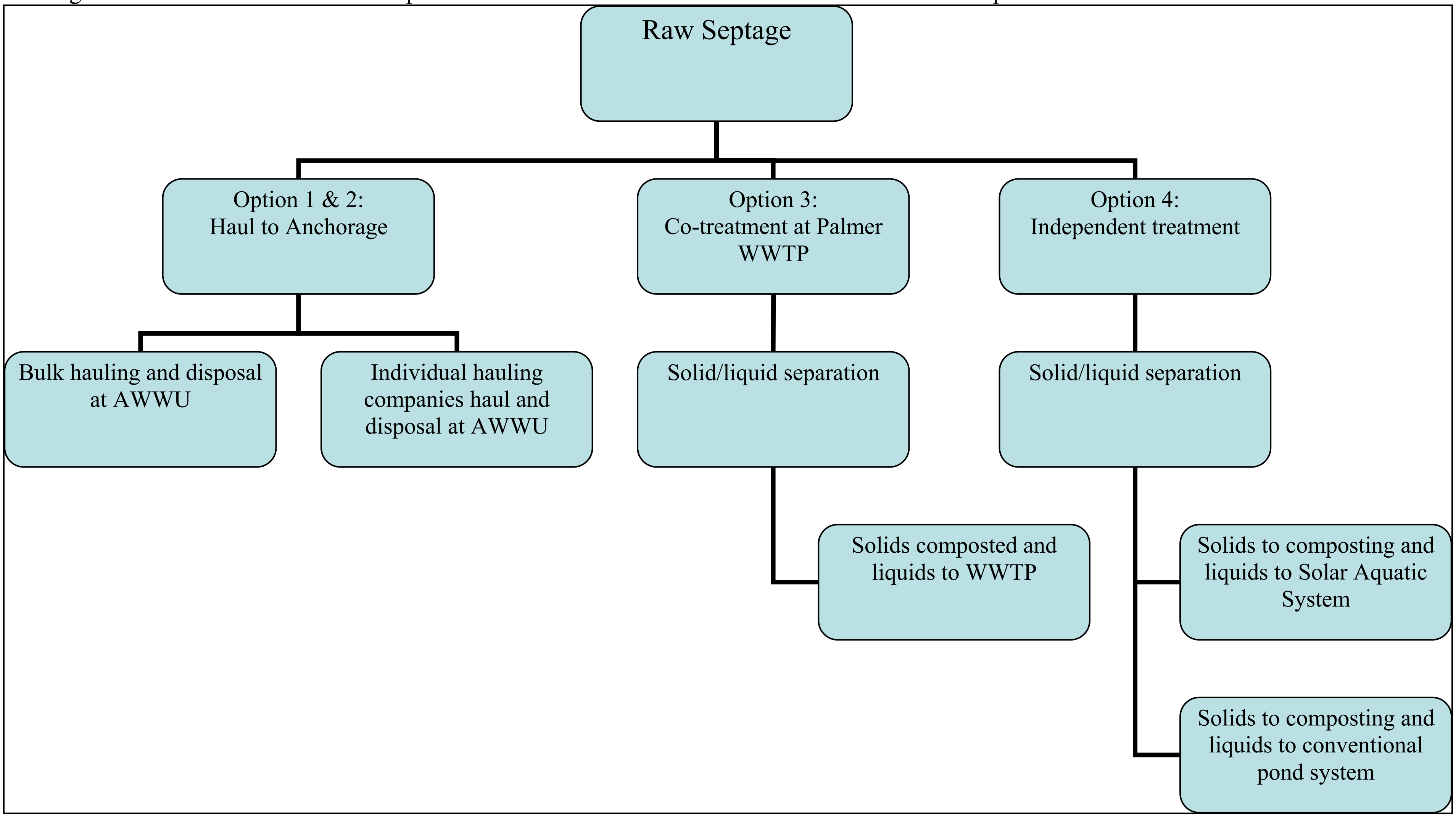


Figure 7: Septage management options

6.0 SPECIFIC TREATMENT AND DISPOSAL OPTIONS

The options discussed in this section were selected in correspondence with the MSB. Each of the alternatives is evaluated for a 23-year planning horizon, to 2030.

- Option 1: Keep existing haul practices
    - Goal: Create a 'do nothing' scenario from which to compare the other options
- Option 2: Install septage consolidation facility and bulk haul to Anchorage
    - Goal: Minimize transport cost
- Option 3: Construct co-treatment facility with the City of Palmer.
    - Goals: Eliminate the cost of transportation of septage to Anchorage and dependence on AWWU for disposal. Coordinate with Palmer WWTP to construct a treatment facility that can meet the future production of septage within the MSB.
- Option 4: Construct regional septage facility
    - Goals: Eliminate cost of transportation of septage to Anchorage and dependence on AWWU for disposal. Construct a regional facility allowing the treatment and disposal of all MSB septage.

6.1 Cost Estimate Development

Sources of cost data used in the development of cost estimates include budget quotations from equipment or material manufacturers, and bid data from similar jobs. All cost estimates developed in this report are based on 2007 dollars, and should be adjusted to account for inflation in the future. The order of magnitude capital cost has been calculated using the following allowances: 20% for design and construction management, 5% for administration and legal fees, 17% for interest and debt charges on bonded finances, and 25% for contingencies. These allowances are commonly used by municipalities assessing projects in the planning stage.

A 25% contingency is added to cover construction unknowns such as soil conditions, season of construction, bidding climate, unforeseen physical conflicts with other utilities, and various incidental costs for labor and materials that are not specifically included in the estimated construction quantities.

The 17% allowance for debt and interest charges includes interest and debt charges as well as costs associated with accounting. If a loan is obtained from the Alaska Clean Water Fund with a contract term of five to 20 years, there will be a finance charge at a rate of one and one-half percent, or 20 percent of the current bond rate, whichever is higher. Although this 1.5% is far lower than the 17% allowance, it may be necessary for the MSB to seek additional loans that may have higher finance charges. Along with accounting costs, whatever finance charges are accrued for the project will be covered by the 17% allowance.

The total yearly capital and O&M cost was calculated by dividing the capital cost by the number of payoff years, and adding the annual O&M cost.

The assumed payoff period for all options is 20 years which is the maximum contract term for Alaska Clean Water Fund loans. This time period is typical for large construction projects, though actual payoff period will depend on individual project financing and phasing. Phasing of projects has not been considered so that the total cost of each option may be easily compared, and to avoid detail that is not necessary at this level of planning.

Order of magnitude capital costs and total yearly costs for each option are included in the following option descriptions, and detailed O&M for each option are shown in Appendix 8.

6.2 Option 1 - Keep existing haul practices

This is the 'no change' option. Septage haulers continue to transport MSB septage to Anchorage for disposal at AWWU Turpin facility throughout the design scope until 2030.

By 2030, roughly three times the current volume of septage will be produced. Assuming that truck sizes remain comparable to the current trucks, the frequency of trips to Anchorage would need to double to accommodate this growth in septage production. This would necessitate an equivalent growth in the septage hauling industry. During peak season hauling companies' trucks run full-time with up to four trips a day to the Turpin facility.

To ensure that MSB septage will continue to be accepted by AWWU for the next 24 years it is recommended that the MSB seek an agreement with the MOA that MSB septage will be accepted for the duration of the design scope.

6.2.1 Environmental impacts

Environmental impacts will continue to be the responsibility of the MOA. The MSB septage represents 0.06% of the flow of wastewater to Asplund treatment plant that will be primary treated and ultimately disposed of in Cook Inlet, which is the receiving water body to the outfall from Asplund Treatment Plant.

6.2.2 Land issues

No additional land within the MSB will be affected or occupied by this option as septage will be treated outside the MSB.

6.2.3 Advantages and disadvantages

The advantages of keeping existing haul practices are summarized as follows:

- *No capital and O&M costs to MSB*
  Septage haulers and residents will continue to meet the cost of septage handling and disposal at no additional cost to the MSB.
- *No environmental impact on the MSB*
  Septage from the MSB will impose no environmental impact to the MSB environment as the waste will be discharged within the MOA under AWWU's NPDES permit.
- *No additional land use*

No land will be occupied with treating and handling septage that could be used for other development.

- *No EPA/ADEC regulations*
  No additional permits are required for meeting EPA and ADEC regulations for storing, treating, or discharging septage.
- *No additional loading on existing WWTP*
  Existing WWTPs will grow into their planned capacities from sewered residences in Palmer and Wasilla without additional loading, and will not need to be modified to treat MSB septage.

The disadvantages of keeping existing haul practices are summarized as follows:

- *Reliance on MOA and less able to adapt to changes in regulatory environment*
  The MSB is dependent on the MOA to continue to accept septage from outside of the MOA. If the MOA changes its policy the MSB would then need to seek other handling and disposal options. The timeframe for this might not be convenient for the MSB to find the best solution. The MSB could be forced into choosing a less efficient and economic solution at a time when funding is difficult to obtain.
- *Travel time expenditure*
  Septic haulers would continue to spend the majority of their working hours hauling septage, and their availability to pump septage will continue to be limited by this.
- *Cost efficiency*
  The current cost of transporting septage comprises 87% of the total cost of transport and disposal. If some of this money was redirected from transportation costs and disposal fees, it may be feasible to construct and operate a regional facility.
- *Environmental Impact*
  The liquid remaining from septage will continue to be discharged into Cook Inlet after primary treatment from AWWU's Asplund Treatment Plant. This level of treatment is of concern to some MSB residents although this discharge practice meets the requirements of its permit that was designed to minimize impact to the environment.

6.2.4 Cost estimate for Option 1 – Keep existing haul practices

As discussed in Section 4.3, the estimated annual transport and disposal cost for septage from the MSB using existing haul practices is $2,999,000 in 2030. This cost will be incurred by the hauling companies and will be met by MSB residents who employ the septage haulers. There are no capital or O&M costs for the MSB for Option 1.

6.3 Option 2 - Install septage consolidation facility and volume haul to Turpin Street

In an effort to minimize hauling and disposal costs to the Turpin Street septage disposal facility, this option examines the possibility of constructing a central receiving and holding station in the MSB and bulk hauling septage to Anchorage.

The following elements would be required:

- Bulk hauling truck (large volume that optimizes cost efficiency of transport and discharge but does not exceed maximum vehicle weight allowable by the ADOT&PF)
- Site for transfer station (accessible, large enough, acceptable distance from residential areas)
- Transfer and temporary holding station (capacity to meet peak demand)
- Permit for transfer station

The DOT&PF limit the weight of trucks to 9 tons per axle. The largest sized pump-truck available from Wastequip CUSCO, is the Industrial Vac-130 trailer available in capacities between 5,000-8,500 gallons. This is a trailer with two axles, but with a three axle tractor truck to tow the trailer, there would be a total of 5 axles, allowing for 45 tons of hauling weight. Assuming the rig weighs around 19 tons without septage (14-ton trailer and 5-ton tractor truck), this allows for approximately 26 tons of septage, which is approximately 6,200 gallons.

In peak season (summer), if tankers hauled 17 hours a day (5 am to 10 pm), 6 round-trips would be possible. Thus, two 6,200-gallon trucks would meet current septage production, and four would meet 2030 peak production.

The primary functions of a transfer station are: 1) transfer of septage from hauler trucks, 2) hold septage temporarily until it can be transferred to the tanker, and 3) transfer of septage to tanker. To avoid freezing in the cold months tanks would need to be underground. The holding facility would need storage capacity for up to three days of septage production, to allow for a 3-day weekend when bulk hauling was not operating. For the short duration of peak season, it is likely that hauling would be done 7 days a week, however storage for three days of septage from the MSB should be allowed at the transfer facility for non-working days, as a safety margin, and for MSB haulers to continue to deliver septage to while the bulk hauling trucks are in transit. Storage for three days of peak season production is would require a 170,000-gallon tank for 2005 production, and 476,000-gallon tank for 2030 production. This is the size of tank estimated, and could be reduced should the MSB wish to only hold one or two days of septage.

Only authorized hauler trucks should utilize the facility, since this provides for accurate record keeping of septage volumes handled at the station and prevents system overloading. A card reading system would be required for billing and recordkeeping purposes. The haulers would discharge their septage under pressure (pumping).

6.3.1 Environmental impacts

A permit from the EPA would be required for handling and storage of septage.

Environmental impacts will continue to be the responsibility of the MOA. The MSB septage represents 0.06% of the wastewater flow to Asplund treatment plant that will receive primary treatment and ultimately be disposed to Cook Inlet.

6.3.2 Land issues

It would be beneficial to future planning if the site of the transfer station allowed for future development into a septage treatment facility, should that become necessary. A site for the receiving station is potentially available on the land parcel identified in the future landfill plan[41] for MSB Solid Waste Division. This parcel is shown in Figure 4 Land Availability (Page 24). The site would be central to the MSB's core area and accessible to haulers coming from Palmer and Wasilla directions. The site is distanced from residential areas and it is not close enough to residential areas to pose a threat of odor.

The land required for this option would be approximately 5 acres for the underground storage tank, and to allow access of up to 4 large bulk-septage hauling tankers, and smaller hauling trucks from the MSB. A contingency of 100% has been added to the sum total of 5 acres, to give a 10-acre land requirement for this option.

6.3.3 Advantages and disadvantages

The advantages of installing a septage consolidation facility and volume hauling to Turpin are summarized as follows:

- *Cost efficient hauling*
  Decrease in labor time with less drivers making the commute. Decrease in discharge cost because of the current AWWU pricing structure. Less maintenance costs.
- *Minimizes septage hauler travel time*
  Having larger tankers reduces the number of hours of septage haulers time.
- *Increase in MSB employment*
  Septage bulk hauling will require additional local employment.
- *Relatively small amount of land required for transfer station*
  Compared to Options 3 and 4 this requires a relatively small amount of MSB land for the transfer station.
- *Project phasing would minimize upfront capital costs*
  Although this study calculates total capital cost for 2030 design, it is likely that this option would be phased, with septage storage and transport purchased as required. This would decrease the upfront capital costs to approximately a third of what is shown for capital and O&M costs.

The disadvantages of installing a septage consolidation facility and volume hauling to Turpin are summarized as follows:

- *Reliance on MOA and less able to adapt to changes in regulatory environment*

[41] CH2MHill, "Central Landfill Future Cell Sequencing Plan, Onsite Leachate Treatment Evaluation, and Closure Cost Evaluation", 2006.

The MSB is dependent on the MOA to continue to accept septage from outside of the MOA. If the MOA changes its policy the MSB would then need to seek other handling and disposal options. The timeframe for this might not be convenient for the MSB to find the best solution. The MSB could be forced into choosing a less efficient and economic solution at a time when funding is difficult to obtain.

- *Capital, O&M, and labor costs*

Expenses of buying and maintaining a transfer station and bulk haul equipment as well as well as paying additional staff.

- *Management of the facility*

The septage hauling business is entirely new to the MSB and new management and business skills would be required.

- *Land use and odor/aesthetic issues*

Land would be required for this option, and there could be issues associated with public aversion to being near the transfer station due to the generation of unpleasant odors and the general unaesthetic nature of the facility, however these issues should be minimized by situating the transfer station with the Central Landfill.

- *Environmental Impact*

MSB septage will continue to be discharged into Cook Inlet after primary treatment from AWWU's Asplund Treatment Plant. This level of treatment is of concern to some MSB residents although this discharge practice meets the requirements of its permit that was designed to minimize impact to the environment.

6.3.4 Cost estimate for Option 2 – Bulk haul

Item	Item detail	Quantity	Unit	Unit Price	Total
Land	Land purchase	10	AC	$8,000	$80,000
	Land platting	1	EA	$20,000	$20,000
Tankers	Septage hauling tanker	6	EA	$200,000	$1,280,796
Garage	Garage for tankers[5]	2,000	SF	$150	$300,000
Bulk storage	Storage tank	714,684	Gal	$2	$1,429,368
	5hp pump	1	LS	$25,000	$25,000
	50hp blower	2	EA	$20,000	$40,000
Monitoring	Card-reading system[4]	1	LS	$70,000	$70,000
	Sub-Total				**$3,145,164**

Summary of Costs		
Capital cost bulk hauling		$3,145,164
Design and construction management (20%)	0.2	$629,033
Debt and interest charges (17%)	0.17	$534,678
Administration and legal (5%)	0.05	$157,258
Contingency (25%)	0.25	$786,291
Total Capital Construction Costs:		**$5,252,423**
Payoff period (years)	20	
Capital cost to payoff each year		$262,621
Estimated annual O&M[1]		$1,018,290
Total yearly cost		**$1,280,911**

Transport and Disposal Cost	**Option 1[2]**	**Option 2[3]**
Current septage production (gallons/yr)	13,596,389	
No. of average hauler loads (of 2,867 gallons)	4,742	
Current cost per trip	**$174**	**$270**
Total Yearly Cost	**$824,784**	**$1,280,911**

1. These O&M costs have been calculated on the O&M spreadsheet shown in Appendix 8.
2. These costs assume that the COSA rate increase has occurred.
3. Costs are from the yearly cost of capital payoff (for 20 years) and O&M costs.
4. The Borough recently installed a card-reading system costing $40,000. This cost was increased to account for additional sophistication as required.
5. Garage is sized for holding two tankers with 40 x 50 ft area.

6.4 Option 3 - Construct co-treatment facility with the City of Palmer

In an effort to seek independence from the MOA and avoid hauling septage to Anchorage, this option examines the construction of a regional co-treatment facility for septage and sewage at the Palmer WWTP. For this option, a new mechanical wastewater treatment plant would need to be constructed so that ammonia limits may be met by the City of Palmer. As discussed in Section 5.1.3, Palmer WWTP would require an upgrade to it's treatment process to meet ammonia discharge requirements regardless of whether septage was added to the plant or not. This situation provides an opportunity for the MSB to plan with the City of Palmer for the design of a treatment plant that could meet both sewage and septage loads in the future. This study selected activated sludge as the appropriate process to reduce nitrogen to required discharge levels.

The following elements would be required for Option 3:

- Septage receiving station
- Pretreatment facility
- Activated sludge treatment plant
- UV disinfection
- Solids treatment and disposal
- Discharge permit

Receiving Station
Receiving station design is outlined in Section 5.1.4.

Pretreatment facility
Pretreatment of the raw septage is necessary and as found in Section 5.1.4, the most acceptable for this application is a process of screening, chemical conditioning, mechanical dewatering, and metering the resulting liquid effluent to the WWTP, and sending the solids to further treatment and disposal.

Activated sludge treatment plant and disinfection
The typical treatment train for small (<5mgd) activated sludge treatment is as follows:

- Gravity thickener
- Aeration basin
- Secondary clarifier
- Effluent filter
- Gravity belt thickener

Solids and Effluent disposal

- UV disinfection
- Discharge permit and plan approval
- Solids treatment and disposal using composting (see Section 5.1.6 for more detail)

6.4.1 2030 Design Conditions and Parameters for Option 3

Table 11 shows the design conditions for the co-treatment facility option. These flows and loads have been calculated on the assumption that the new treatment plant is closed on the weekends and as a result, septage is received only 20 days a month.

Table 11: 2030 Design Conditions for Option 3

Septage Flows	Raw Septage	Pre-treated Septage
Winter flow, gpd	79,000	
Summer flow, gpd	238,000	
Total annual flow, gpy	38,000,000	
Summer Septage Loads:		
BOD, mg/l	1,053	500
BOD, lbs/day	2,092	993
TSS, mg/l	7,138	500
TSS, lbs/day	14,178	993
Ammonia-N, mg/l	Unknown	50
Ammonia-N, lbs/day	Unknown	99
Sewage Flows		
Winter flow, gpd		1,354,000
Summer flow, gpd		1,354,000
Total annual flow, gpy		494,000,000
Sewage Loads		
BOD, mg/l		238
BOD, lbs/day		2,685
TSS, mg/l		245
TSS, lbs/day		3,895
Ammonia-N, mg/l		30
Ammonia-N, lbs/day		339
Combined (pretreated septage and sewage)		
Summer flow, gpd		1,592,000
Combined winter flow, gpd		1,433,000
BOD load, lbs/day		3,678
Ammonia-N, lbs/day		438
TSS, lbs/day		4,888

6.4.2 Environmental impacts and permitting

Ultimate discharge of the effluent would be in combination with Palmer wastewater that is discharged to the Matanuska River. The Palmer WWTP discharge permit would be utilized for the discharge of the additional flow from septage; however the volume allowance for this permit would need to be increased. An application to the ADEC would need to be made to acquire approval to increase the volume of wastewater discharge.

Sludge would be treated and/or disposed by one of the methods described in Section 5.1.6. This option has assumed that composting is preferred, because it is the most land and labor intensive, and provides the most conservative cost estimate. If composted under established EPA requirements, Class A biosolids could be sold back to the community.

6.4.3 Land issues

The land requirement for the combined activated sludge treatment plant for sewage and septage requires approximately 1 acre of land for the septage pre-treatment including septage hauling truck access, and another 1 acre for the activated sludge plant. The amount of land required for sludge disposal depends on which the method selected. Composting is the most land-intensive option, and the 2030 volumes of septage would require 2.0 acres of land (estimated in Section 5.1.6). In addition to treatment plant buildings, land will be required for buffer zone, roads and access. 6.0 acres has been allowed for these considerations. A contingency of 100% has been added to the sum total of 10 acres, to give a 20-acre land requirement for this option.

The existing Palmer WWTP is the selected site for this option.

6.4.4 Advantages and disadvantages

The advantages of constructing a co-treatment facility at Palmer WWTP for septage and sewage are as follows:

- *MSB not dependent on MOA*
  The MSB no longer depend on an external party for septage disposal and will therefore have security in planning for the future handling and disposal of septage as production volume increases.
- *Increase in MSB Employment*
  Treating septage within the MSB will require additional local employment.
- *Composting could produce a marketable product*
  The co-treatment facility would produce sludge that could potentially be a useful resource such compost like Golden Heart Utility has successfully done in Fairbanks.
- *Existing facilities utilized*
  Infrastructure from the existing WWTP will be utilized for this option, reducing capital costs of this option. Although Palmer WWTP's equipment inventory is unknown at this point, equipment such as blowers and pumps could be used in the proposed new plant.
- *Existing discharge permit utilized*
  Palmer WWTP's NDPES permit could be augmented as required to cover the total effluent volume.
- *Cost shared by more than one revenue stream*
  The cost of treating septage and sewage would be shared between more than one revenue stream, dividing the burden of paying-off capital costs.
- *Mutual treatment benefits of co-treatment*
  While the high-flow sewage stream dilutes concentrated pre-treated septage, pre-treated septage offers a buffer to the sewage stream which drops off during the night and mid-day.

Septage and sewage inflow streams could be sequenced to maximize equipment utilization 24 hours a day.

The disadvantages of constructing a regional septage pre-treatment and sending treated effluent to an existing WWTP are as follows:

- *Cooperation with City Council*

  This option depends on a policy decision of a local municipal government in accepting MSB septage. Because the cost and management of the treatment plant would be shared, administration between the two government bodies might be more complicated than an independent MSB facility.
- *Capital Costs*

  Capital and O&M costs for a new co-treatment facility are high, even though they would be shared by more than one revenue stream.
- *Sludge disposal*

  Sludge that is separated in the solids removal process will need to be disposed of either in landfill or some other alternative, such as composting.
- *Land use*

  This option would require the development of the Palmer WWTP site, which could be restricted by surrounding residential development.
- *Management of the facility*

  The business of septage pretreatment is entirely new to the MSB, and new management and business skills would be required.
- *Feasibility dependent on being able to compete with AWWU*

  A pricing structure would need to be developed that would be cost competitive with AWWU. Haulers will use whichever facility is less expensive overall to use.

6.4.5 Cost estimate for Option 3 – Co-treatment facility

Item	Item detail	Quantity	Unit	Unit Price	Total
Land	Land purchase	20	AC	$15,000	$300,000
	Land platting	1	LS	$20,000	$20,000
Receiving station[3]	Card-reading system[9]	1	LS	$70,000	$70,000
	Pump station, waste screening and flow equalization	1	LS	$235,385	$235,385
Odor Control	Plant blower 50hp	1	EA	$20,000	$20,000
Septage Pretreatment	Influent screening[3]	1	LS	$175,385	$175,385
	Grit removal[3]	1	LS	$144,615	$144,615
	Screw press[1]	1	EA	$615,000	$615,000
	Auxiliary pretreatment equipment[2]	1	LS	$169,000	$169,000
	Treatment building	5,000	SF	$200	$1,000,000
Treatment	Mechanical treatment - Activated sludge[7]	1,600,000	gpd	$5	$8,000,000
Composting	Sludge moving equipment[4]	1	LS	$200,000	$200,000
	Aeration equipment - 3hp blowers	2	EA	$20,000	$40,000
	HDPE pipe for aeration[5]	2,300	FT	$200	$460,000
	Asphalt surface[6]	16,000	FT	$1	$20,000
Effluent Discharge	UV disinfection[8]	1	LS	$300,000	$300,000
	Discharge permit increase application	50	Hr	$125	$6,250
	Sub-Total				**$11,775,635**

1. This cost from FKC screw press vendor includes 3 main components: the screw press, rotary screen thickener, and flocculation tank.
2. This cost includes sludge feed pump ($14K estimate from Correct Equipment Company), polymer system ($20K), control panel ($95K), miscellaneous field instruments ($10K), conveyor ($30K), and truck/disposal bin.
3. Receiving station, screening, and grit removal costs were developed from the Denali National Park wastewater alternatives analysis study (HDR, 2005).
4. Equipment used by Golden Heart Utilities, at Fairbanks WWTF includes 3/8"trommel screens, case loaders, 12 yd end dumps, conveyor for stacking, feed conveyor.
5. HDPE pipe cost for 4" pipe developed from Denali National Park wastewater alternatives analysis study (HDR, 2005).
6. Cost developed from 2005 MOA bid tabs. Asphalt is $125/ton, and there is 80.7 SF/ton asphalt with 2" thickness.
7. Includes primary clarifier, gravity thickener, aeration basin, secondary clarifier, and effluent filter. Cost was developed from a collection of quotes from vendors, Soldotna WWTP construction costs, and Eagle River and Girdwood WWTF plans prepared by AWWU.
8. Developed from other UV treatment quotes: Soldotna treatment plant was quoted $100K for a 0.6 to 1.0 mgpd flow. Girdwood TP was quoted $450K for 1.0mgd.
9. The Borough recently installed a card-reading system costing $40,000. This cost was increased to account for additional sophistication as required.

Summary of Costs		
Capital cost bulk hauling		$11,775,635
Design and construction management (20%)	0.2	$2,355,127
Debt and interest charges (17%)	0.17	$2,001,858
Administration and legal (5%)	0.05	$588,782
Contingency (25%)	0.25	$2,943,909
Total capital construction costs:		**$19,665,310**
Pay-off period (yrs)	20	
Capital cost to payoff each year		$983,265
Estimated annual O&M[4]		$445,473
Total yearly cost		$1,428,738
Total yearly cost of septage treatment [1]		**$714,369**

Transport and Disposal Cost	**Option 1[2]**	**Option 3[3]**
Current septage production (gallons/yr)	13,596,389	
No. of average hauler loads (of 2867 gallons)	4,742	
Current per trip	**$174**	**$151**
Annual disposal cost	**$824,784**	**$714,369**

1. This cost figure was developed by evenly dividing the total treatment cost between septage and sewage. Even division was assumed because septage contributes 4 times the BOD, but sewage contributes 5 times the flow volume. This yearly cost figure assumes that the new plant cost is shared with another revenue stream.
2. These costs assume that the COSA rate increase has occurred.
3. Costs are from the yearly cost of capital payoff (for 10 years) and O&M costs.
4. These O&M costs have been calculated on the O&M spreadsheet shown in Appendix 8.

6.5 Option 4 - Construct an independent regional septage facility

In an effort to gain independence from the MOA, avoid hauling septage to Anchorage, invest expenditure on a regional solution to septage management, and not put unforeseen loads on existing WWTP's within the MSB, this option examines the construction of a regional independent septage treatment and disposal facility.

The following elements would be required for this option:

- Site for independent treatment facility
- Receiving station
- Pretreatment facility
- Secondary/tertiary treatment facility
- Effluent discharge location
- Solids treatment and disposal
- Discharge permit

An appropriate site for independent treatment is likely to be adjacent to the MSB landfill site as discussed in Section 4.7 and shown in Figure 4 on page 24. The receiving station and pretreatment facility would have the same requirements that were detailed for Option 3 in Section 1.1.

There are two different septage treatment processes that will be considered for this option that were discussed in Section 5.1.5; conventional treatment that produces secondary-treated effluent, and a proprietary system that produces tertiary-treated effluent. Both processes have identical options for pretreatment which are the same as for the Co-treatment, as discussed in Section 5.1.3.

6.5.1 Solar Aquatic System (SAS)

The septage would be collected and transmitted to the SAS by pump trucks. The pump trucks would dump their load flows directly to the Blending Tank. Blended flows would be mixed and aerated, then pumped to an appropriately-sized primary clarifier that would remove the settled solids and send them to a sludge tank. The clarified effluent would then drain or be pumped to the tertiary treatment system within the greenhouse.

The Solar tanks in the greenhouse are aerated by fine bubble membrane diffusers. Flows are divided between multiple trains of multiple Solar Tanks, a proprietary component of the Solar Aquatics System. Each Solar Tank contains approximately 1,100 gallons of wastewater along with a variety of aquatic plants and individual fine bubble membrane diffusers. Each train is capable of being isolated for maintenance.

Wastewater exiting the Solar Tanks is transmitted by gravity to a secondary clarifier. Sludge is wasted from the secondary clarifier to the Blending Tank as return activated sludge. The supernatant exits the secondary clarifier and passes through a gravity fed sand filter before entering one of two identical anoxic subsurface-flow constructed wetlands. The wetlands provide a root zone-based ecosystem for polishing and de-nitrifying the effluent to tertiary standards.

Each anoxic wetland is 5 feet deep to promote final treatment and polishing in an environment that promotes anaerobic microorganisms and is capable of handling the average daily flow. The treated effluent is then pumped from the wetlands through an enclosure containing an ultraviolet lamp for disinfection prior to dispersal in a surface-water or soil absorption system adjacent to the greenhouse.

An advantage of the SAS is that it is a complete, environmentally friendly package system. A disadvantage of Solar Aquatics Systems is that the technology has not been used in Alaska, although it has been used in Canada. The system would need to be accepted by the EPA and ADEC.

A detailed treatment description and budgetary quotation from the vendor, Ecological Engineering Group, is included in Appendix 5.

6.5.2 Cost estimate for Option 4 - SAS

A preliminary cost range based on an average daily flow of 88,767 gpd of $8 - $10 million was provided by the vendor. In addition, estimated power requirements and labor requirements were supplied by the vendor. Because the vendor provided a capital cost quote that already considered contingency factors, the $10 million quote was taken as already inclusive of the 67% additional allowances such as the cost of design and construction management.

Item	Item detail	Quantity	Unit	Unit Price	Total
Land	Purchase	28	AC	$8,000	$224,000
	Platting	1	LS	$20,000	$20,000
Treatment[1]	Solar Aquatic System	1	LS	$6,000,000	$6,000,000
	Sub-Total				**$6,244,000**

1. Quote from SAS vendor.

Summary of Costs		
Capital Cost bulk hauling		$6,244,000
Design and Construction Management (20%)	0.2	$1,248,800
Debt and Interest Charges (17%)	0.17	$1,061,480
Administration and Legal (5%)	0.05	$312,200
Contingency (25%)	0.25	$1,561,000
Total Capital Construction Costs:		**$10,427,480**
Payoff Period (yr)	20	
Capital cost to payoff each year		$521,374
Estimated Annual O&M[3]		$264,020
Total yearly cost		**$785,394**
Transport and Disposal Cost	**Option 1**[1]	**Option 4**[2]
Current septage production (gallons/yr)	13,596,389	
No. of average hauler loads (2867 gallons)	4,742	
Cost per trip	**$174**	**$166**
Annual disposal cost	**$824,784**	**$785,394**

1. These costs assume that the COSA rate increase has occurred.
2. Costs are from the yearly cost of capital payoff (for 10 years) and O&M costs.
3. These O&M costs have been calculated on the O&M spreadsheet shown in Appendix 8.

6.5.3 Conventional Treatment

This option is to discharge the effluent into a new aerated lagoon. This design is based around the peak BOD and flows based on the fact that this flow and loading will be coming to the plant during the peak months of April through December. The plant will have continuous discharge to a percolation cell or constructed wetland. The following treatment design is for BOD removal only. If nitrification is necessary for the discharge permit (depending on ADEC requirements) then detention time and lagoon size must be increased. The treatment process for nitrification is described in Appendix 6.

6.5.4 2030 Design Conditions and Parameters for Option 4 – Conventional treatment

Table 12 shows the design conditions for an independent conventional treatment facility. These flows and loads have been calculated on the assumption that the new treatment plant is closed on the weekends and as a result, septage is received only 20 days a month.

Table 12: 2030 Design Conditions for Option 4

Septage Flows	**Raw Septage**	**Pre-treated Septage**
Winter flow, gpd	79,000	
Summer flow, gpd	238,000	
Total annual flow, gpy	38,000,000	
Summer Septage Loads:		
BOD, mg/l	1053	500
BOD, lbs/day	2,092	993
TSS, mg/l	7,138	500
TSS, lbs/day	14,178	993
Ammonia-N, mg/l	Unknown	50
Ammonia-N, lbs/day	Unknown	99

Table 13 shows the design requirements for the conventional septage treatment facility and Figure 8 provides a schematic of lagoon configuration for the option.

Table 13: Calculations for 2030 design of conventional septage treatment

Aeration Requirement:	993 lb X 2.25 = 2234 lb/day
Volume Requirement:	2.4 million gallons (12,003 yd^3)
Aeration Area:	0.87 acres
Quiescent pond area	0.87 acres (assume the same as aeration area)
Configurations:	Four ponds: two aeration and two quiescent ponds with room for an additional pond in the future. This additional quiescent pond would be constructed and brought into service and the two original quiescent ponds would be converted to aerated ponds in the future. Aerated ponds can operate in series or parallel configuration (Figure 8).
Additional facilities required:	Screen between septic hauling trucks and lime slurry tank to remove debris. Building for septage screen, lime silo, lime sludge mixing tank, re-circulating pump, sludge feed pump, flocculation tank, rotary drum thickener, polymer system and screw press, odor control system, and storage pad for Class A biosolids.
Discharge	To percolation cell or constructed wetlands.

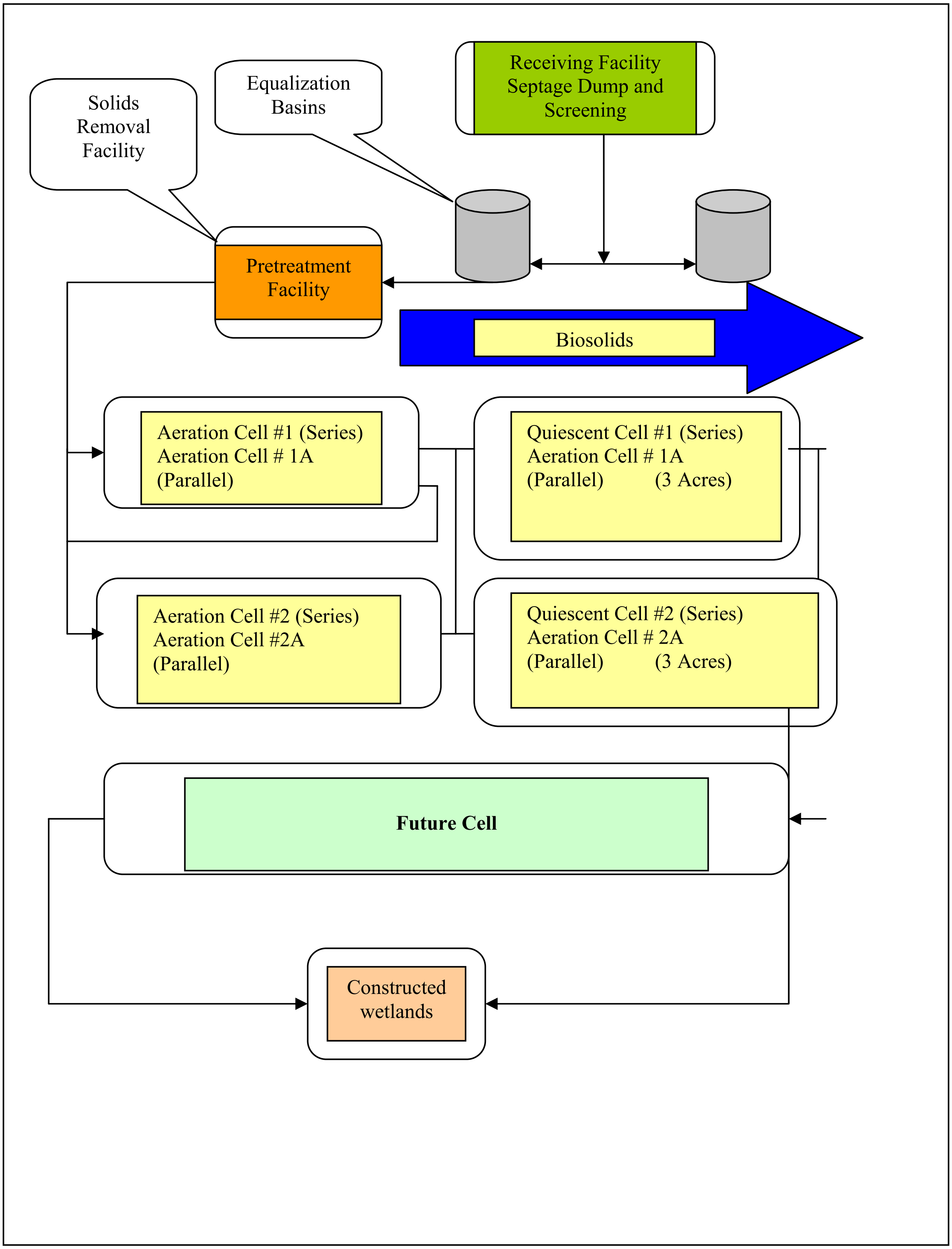


Figure 8: Possible Independent Treatment Lagoon Configuration

Effluent discharge
Effluent would be secondary treated and would be discharged either through a percolation cell or constructed wetland system. If it is assumed that a percolation cell is used, with the projected 2030 flow, approximately 1.0 acres of land would be required. Geotechnical studies would be required to determine the percolation rate of on-site soil, and from this information, the necessary volume of percolation cell would be determined. In addition, four monitoring wells would need to be installed, and an ongoing monitoring program designed, and sampling undertaken according to ADEC regulations. An application to the ADEC would need to be prepared and a plan approval and discharge permit secured.

6.5.5 Environmental impacts

Sludge would be treated and/or disposed by one of the methods described in Section 5.1.6. This option has assumed that composting is preferred, because it is the most land and labor intensive, and provides the most conservative cost estimate.

6.5.6 Land issues

The Central Landfill site was identified for an independent septage facility because of its central location within the MSB, as well as it being an established waste treatment area (discussed in Section 4.7).

The calculated lagoon aeration requirement for pretreated septage is 1.0 acre, and an additional 1.0 acre has been allocated for the two quiescent ponds, giving a total of 2.0 acres for lagoons. This option also requires approximately 2.0 acres of land for roads, the septage pre-treatment building, and septage hauling truck access within and around the pre-treatment building. The amount of land required for sludge disposal depends on which the method selected. Composting is the most land-intensive option, and the 2030 volumes of septage would require 2.0 acres of land (estimated in Section 5.1.6). The estimated area for lined wetland pond is 1.0 acre, and for a wetland percolation cell (unlined) is 1.0 acre, giving a total area for the discharge of treated effluent of 2.0 acres. In addition to treatment plant buildings and lagoon systems, land will be required for buffer zone and access. Six acres has been allowed for these considerations. A contingency of 100% has been added to the sum total of 14 acres, to give a 28-acre land requirement for this option.

6.5.7 Advantages and disadvantages

The advantages of constructing a regional septage facility are as follows:

- *MSB not dependent on MOA or local councils*
  The MSB no longer depend on an external party for septage disposal and will therefore have security in planning for the future handling and disposal of septage as production volume increases.
- *Increase in MSB Employment*
  Treating septage within the MSB will require additional local employment.
- *Options for treatment*

With a new facility the MSB would be able to select technology that is most suited to the MSB's needs and would be able to explore more alternatives that might not have been available when existing WWTP were constructed such as the SAS.

- *Potential to produce tertiary-treated waste*

Facility has the opportunity to produce effluent that exceeds permit conditions that sets an environmental example in the State and may attract funding from other environmental bodies, not just the EPA.

- *Composting could produce a marketable product*

The independent facility would produce sludge that could potentially be a useful resource such compost like Golden Heart Utility has successfully done in Fairbanks.

The disadvantages of constructing a regional septage facility are as follows:

- *High capital and O&M costs*

This option requires high capital costs for treatment facility as well as O&M costs, and staffing.

- *Sludge disposal*

Sludge that is separated in the solids removal process will need to be disposed of either in landfill or some other alternative, such as composting.

- *Land use and odor/aesthetic issues*

A substantial area of land is required for this option. There could be issues associated with public aversion to being near a new facility due to the generation of unpleasant odors and the general unaesthetic nature of the facility; however, these issues should be minimized by situating the facility with the Central Landfill. The site would need to have some pathway or percolation cell available for ultimate discharge of effluent.

- *Permitting and regulations*

A discharge permit must be obtained for ultimate discharge of effluent into the environment. The facility would need to follow all ADEC and EPA regulations and associated monitoring.

- *Feasibility dependent on being able to compete with AWWU*

A pricing structure would need to be developed that would be cost competitive with AWWU. Haulers will use whichever facility is less expensive overall to use.

- *Management of the facility*

The business of septage treatment is entirely new to the MSB, and new management and business skills would be required.

- *Proven Operation of SAS*

The SAS alternative has not been applied in Alaska and so does not have proven operation here.

6.5.8 Cost estimate for Option 4 - Conventional independent treatment

Item	Item detail	Quantity	Unit	Unit Price	Total
Land	Purchase	28	AC	$8,000	$224,000
	Platting	1	LS	$20,000	$20,000
Receiving station[3]	Card-reading system[12]	1	LS	$70,000	$70,000
	Pump station, waste screening, and flow equalization	1	LS	$235,385	$235,385
Odor Control	Plant blower 50hp	1	EA	$20,000	$20,000
Septage Pretreatment	Influent Screening[3]	1	LS	$175,385	$175,385
	Grit removal[3]	1	LS	$144,615	$144,615
	Screw press[1]	1	EA	$615,000	$615,000
	Auxiliary pretreatment equipment[2]	1	LS	$169,000	$169,000
	Treatment building[7]	1,215	SF	$200	$243,056
Lagoon Treatment	Excavation for lagoons	50,767	CY	$3.00	$152,301
	Dike material[10] (onsite)	25,384	CY	$3.00	$76,151
	Dike material[10] (borrowed)	25,384	CY	$8.50	$215,760
	Membrane liner[13]	198,632	SF	$3.50	$695,211
	Gravel drain bed	10,153	CY	$15.00	$152,301
	Aeration equipment - blowers[8]	2	EA	$28,000	$56,000
	Aeration equipment - pipe	11,423	FT	$40	$456,903
Composting	Sludge moving equipment[4]	1	LS	$200,000	$200,000
	Aeration equipment - 3hp blowers	2	EA	$20,000	$40,000
	HDPE pipe for aeration[5]	2,300	FT	$200	$460,000
	Asphalt surface[6]	16,000	SF	$1.25	$20,000
Permitting	Discharge permit plan approval and permit	80	HR	$125	$10,000
Constructed wetlands	UV disinfection[9]	1	LS	$50,000	$50,000
	Geotechnical studies	1	LS	$20,000	$20,000
	Vegetation planting	87	1,000 SF	$350	$30,492
	Dirt work[11]	25,384	CY	$3.00	$76,151
	Membrane liner[11]	43,560	SF	$3.50	$152,460
	Monitoring wells	4	EA	$5,000	$20,000
	Sub-Total				**$4,652,842**

1. This cost from FKC screw press vendor includes 3 main components: the screw press, rotary screen thickener, and flocculation tank.

2. This cost includes sludge feed pump ($14K estimate from Correct Equipment Company), polymer system ($20K), control panel ($95K), miscellaneous field instruments ($10K), conveyor ($30K), and truck/disposal bin.

3. Receiving station, screening, and grit removal costs were developed from the Denali National Park wastewater alternatives analysis study (HDR, 2005).

4. Equipment used by Golden Heart Utilities, at Fairbanks WWTF includes 3/8"trommel screens, case loaders, 12 yd end dumps, conveyor for stacking, feed conveyor.

5. HDPE pipe cost for 4" pipe developed from Denali National Park wastewater alternatives analysis study (HDR, 2005).

6. Cost developed from 2005 MOA bid tabs. Asphalt is $125/ton, and there is 80.7 square feet/ton asphalt with 2-inch thickness.

7. Building to house FKC dewatering equipment (680 SF as shown on FKC layout) and other equipment (535 SF estimated).

8. Quote from the vendor (APSCO) for aeration requirement of 1000 lb/d ($23K) was scaled up to apply for the required 2,200 lb/d.

9. Developed from other UV treatment quotes: Soldotna treatment plant was quoted $100K for a 0.6 to 1.0 mgpd flow. Girdwood TP was quoted $450K for 1.0mgd.

10. It is assumed that 50% of dike material will be borrowed and the other 50% will come from on-site material. The suitability of on-site soil will be found after on-site soil testing has been performed.

11. Assume that constructed wetlands are 1 acre lined and planted pond, and 1 acre unlined and planted percolation area. Therefore requiring dirt work for 2 acres and membrane liner for 1 acre. Wetlands are assumed to be half the depth of the lagoons, therefore half the volume of excavation required.

12. The Borough recently installed a card-reading system costing $40,000. This cost was increased to account for additional sophistication as required.

13. Membrane liner costs were developed from the Anderson WTP upgrade cost estimates (HDR). Sizing is estimated by assuming that area of membrane required is 1.2 x the surface area of the 3 acre, 12-ft deep pond with side slopes of gradient 1 to 3.

Summary of Costs		
Capital Cost bulk hauling		$4,800,170
Design and Construction Management (20%)	0.2	$960,034
Debt and Interest Charges (17%)	0.17	$816,029
Administration and Legal (5%)	0.05	$240,008
Contingency (25%)	0.25	$1,200,042
Total Capital Construction Costs:		**$8,016,284**
Payoff Period (yr)	20	
Capital cost to payoff each year		$400,814
Estimated Annual O&M[3]		$386,154
Total yearly cost		**$786,968**

Transport and Disposal Cost	Option 1[1]	Option 4[2]
Current septage production (gallons/yr)	13,596,389	
No. of average hauler loads (2867 gallons)	4,742	
Cost per trip	**$174**	**$166**
Annual disposal cost	**$824,784**	**$786,968**

1. These costs assume that the COSA rate increase has occurred.
2. Costs are from the yearly cost of capital payoff (for 20 years) and O&M costs.
3. These O&M costs have been calculated on the O&M spreadsheet shown in Appendix 8.

7.0 ALTERNATIVE COMPARISON

A matrix has been developed to help summarize each alternative and is shown in Table 14 on page 65. The advantages and disadvantages for each alternative are listed along with relative order of magnitude capital cost, annual O&M cost estimates, and the combined total yearly cost. The total yearly capital and O&M cost was calculated by dividing the capital cost by the number of payoff years, and adding the O&M cost to it.

7.1 Recommended alternatives

Based on the information developed and assumptions therein, it is recommended that the MSB pursue both Options 3 and 4. Both options make the MSB independent of the Municipality of Anchorage (MOA) for septage disposal. The opportunity currently exists to plan for a new co-treatment facility with the City of Palmer as they seek to upgrade their facility by 2011 to meet more stringent limits in their discharge permit. The feasibility of this option depends on whether the City of Palmer is interested in a joint venture with the MSB. Both the City of Palmer and the MSB could benefit from cost sharing a new treatment facility, and if the septage inflow stream were stored and metered into the sewage stream when sewage flows dropped, such as at night time, the capacity of infrastructure would be better utilized. Ultimate discharge of effluent would be to the Matanuska River, and would require an increase to the City of Palmer's existing permit.

Option 4, to construct a regional septage facility, offers MSB independent ownership and management. There are treatment options available such as conventional treatment with a lagoon system, or the newer technology of a solar aquatics system that can produce tertiary-treated effluent, and would lessen discharge permit restrictions. MSB-owned land at the Central Landfill Site could be used for a regional septage facility. Ultimate discharge would be available at this site through discharge to constructed wetlands and percolation cell. An appropriate discharge permit would need to be acquired from the ADEC. The location of this alternative would also allow for future coordination with landfill operations, and possible combined septage and leachate treatment possibilities.

The costs of these two alternatives are comparable to the current cost of transporting and disposing of septage in Anchorage. The MSB will be eligible for state and federal loans such as the Clean Water Fund that lends for a maximum of 20 years with an interest rate of 1.5%. To make a comparison of the cost of existing haul practices and the recommended options, a simple analysis of the cost to septage haulers was made. The combined transport and disposal cost for one round-trip for an average sized septage hauling truck of 3,000 gallons will be $174 once the AWWU rate increase comes into affect. In comparison to this figure, it is estimated that the capital costs of Option 3 and Option 4 could be paid off in 20 years, including annual operation and management costs, if septage haulers paid $151 and $166, respectively for each load of septage that was disposed at the regional facilities. This analysis, although basic, and not taking into account potential grants, illustrates the feasibility of a MSB-based septage treatment and disposal facility.

Table 14: Alternative Matrix

	Alternative	Advantages	Disadvantages	Order of Magnitude Capital	Costs Estimated Annual O&M	Annual capital and O&M
Option 1	Keep existing haul practices	• No capital and O&M costs to MSB • No environmental impact on the MSB • No additional land use • No EPA/ADEC regulations • No additional loading on existing WWTP	• Reliance on MOA and less ability to adapt to changes in the regulatory environment • Travel time expenditure • Cost inefficiency • Environmental impact of primary treated effluent	$0	$0	$0
Option 2	Install septage consolidation facility and volume haul to Anchorage	• Cost efficient hauling • Minimizes septage hauler travel time • Increase in MSB Employment • Relatively small amount of land required for transfer station • Project phasing would minimize upfront capital costs	• Reliance on MOA and less able to adapt to changes in regulatory environment • Capital, O&M and labor costs • Management of the facility • Land use and odor/aesthetic issues • Environmental impact of primary treated effluent	$5,252,000	$1,018,000	$1,281,000
Option 3	Construct co-treatment facility with the City of Palmer	• MSB not dependent on MOA • Increase in MSB Employment • Composting could produce marketable biosolids product • Current opportunity exists to design new co-treatment facility with City of Palmer • Existing discharge permit and equipment utilized • Cost shared by more than one revenue stream • Secondary-treated effluent • Mutual treatment benefits of co-treatment	• Cooperation with Palmer City Council could be administratively difficult • Capital and O&M costs • Sludge disposal • Additional land use • Feasibility dependent on being able to compete with AWWU	$19,665,000	$445,000	$714,000*
Option 4	Construct an independent regional septage facility	• MSB not dependent on MOA or local councils • Increase in MSB Employment • Composting could produce marketable biosolids product • Options for treatment • Secondary-treated effluent with the potential to produce tertiary-treated effluent	• Capital and O&M costs • Sludge and effluent final disposal responsibility • Land use and odor/aesthetic issues • Need for permitting and regulations • Feasibility dependent on being able to compete with AWWU • Management of the facility	SAS: $10,427,000	$264,000	$785,000
				Conventional: $8,016,000	$386,000	$787,000

* This figure is dependent on the cost being shared by another revenue stream, as discussed in Section 6.5.8.

8.0 POTENTIAL FUNDING SOURCES

8.1 Grants for Sanitation Projects

8.1.1 Community Development Block Grant Program (CDBG)

The U.S. Department of Housing and Urban Development (HUD) and the Alaska Department of Community and Economic Development (DCED, formerly DCRA) manage this grant program to provide financial resources to communities for public facilities design and construction, and planning activities. Specific project activities may include water and sewer facilities construction, landfill construction, acquisition of property, relocation and demolition, and rehabilitation of structures. Community development and planning activities that address health and safety needs are the priority for funding. Municipal governments (except Anchorage) are eligible for this program. The applicant must show that at least 51% of the persons who benefit from a funded project are low and moderate-income persons. The CDBG applications are distributed to eligible municipalities in September or October. Applications must be submitted around December or January (details in application) and awards are made the following spring.

Contact
Jo Cooper, Block Grant Administrator
Department of Community and Economic Development
209 Forty Mile Ave.
Fairbanks, AK 99701-3110
Phone: (907) 452-4468 Fax: (907)451-7251
E-mail: Jcooper@ComRegAf.state.ak.us
http://www.comregaf.state.ak.us/mradcdbg.html
http://www.hud.gov/progdesc/cdbg-st.html

8.1.2 Public Works and Development Facilities Program

The U.S. Department of Commerce Economic Development Administration (EDA) manages this grant program to assist in the creation of public facilities needed to initiate and encourage permanent jobs in the private sector in areas where economic growth is lagging behind the rest of the country. Grants from $200,000 to $2,000,000 are awarded to tribal governments, cities, municipalities, boroughs, and public or private nonprofit organizations in an area experiencing economic distress. Funds can be used for water and wastewater treatment systems, access roads to industrial parks or sites, port improvements, and tourism projects.

Contact
Bernhard E. Richert Jr.
Economic Development Representative
550 W. 7th Ave Suite 1700
Anchorage, AK 99501
Phone: (907) 271-2272 Fax: (907) 271-2274
E-mail: brichert@doc.gov
http://www.doc.gov/eda

8.1.3 Water Quality Cooperative Agreements

The EPA funds this program to support the creation of unique and new approaches to meeting combined sewer outflows, sludge, and pretreatment requirements. Project grants are $25,000 to $500,000 and a match is encouraged. Tribes, nonprofit institutions, state water pollution control agencies and local public agencies, among others, are eligible for the funds. Proposal forms are available on the Internet.

Contact
Steve Torok, Senior Alaska EPA Representative
410 Willoughby Ave. Suite 100
Juneau, AK 99801
Phone: (907) 586-7658 Fax: (907) 586-7015
E-mail: torok.steve@epamail.epa.gov
http://www.epa.gov/OWOW/watershed/wacademy/fundppc.html
http://www.epa.gov/OWM/finan.htm

8.2 Loans for Sanitation Projects

8.2.1 Alaska Clean Water Fund

The EPA and ADEC provide low-interest loans to municipalities for financing wastewater and solid waste projects. The loans support planning, design, and construction of publicly owned wastewater treatment facilities, sewer collection systems, or rehabilitation costs, studies of nonpoint source pollution, estuary management, protection of groundwater, and combined sewer control measures. Questionnaires are mailed to eligible communities in February and are due by mid-March.

Contact
Terriann Lowell
Alaska Department of Environmental Conservation
Division of Facilities Construction and Operation
410 Willoughby Ave. Suite 102
Juneau, AK 99801-1795
Phone: (907) 465-5146 Fax: (907) 465-5177
E-mail: Tlowell@envircon.state.ak.us
http://www.state.ak.us/dec/dfco/dec_dfco.htm

8.2.2 Alaska Municipal Bond Bank Authority (AMBBA)

State of Alaska Department of Revenue makes loans to Alaskan municipalities to assist with financing capital projects. The funding can be used for any capital project. The applicant must complete an application for a loan by contacting the AMBBA contact below.

Contact

Deven Mitchell, Acting Executive Director
Alaska Municipal Bond Bank Authority
PO Box 110405
Juneau, AK 99811-0405
Phone: (907) 465-2388 Fax: (907) 465-2902
E-mail: ambba@revenue.state.ak.us
http://www.revenue.state.ak.us/treasury/ambba/ambba.htm

8.2.3 Municipal Loan Program

The ADEC provides loans and engineering assistance to public and certain privately owned utility systems for drinking water and wastewater projects. The low-interest loans assist in securing or matching federal grant funds. Along with the loan, the project is assigned an engineer to assist with project planning, budgeting, design, construction, and addressing regulatory issues.

Contact
Dan Garner, Program Manager
Department of Environmental Conservation
Division of Facility Construction and Operation
Municipal Grants and Loans Unit
410 Willoughby Avenue, Suite 303
Juneau, AK 99801
Telephone: (907) 465-5144
Fax Number: (907) 465-5177
Email Address: dan_garner@envircon.state.ak.us
http://www.state.ak.us/local/akpages/ENV.CONSERV/dfco/dec_mlns.htm
http://www.state.ak.us/local/akpages/ENV.CONSERV/dfco/dec_mlns.htm#SUCCESS

8.3 Grants for Sanitation Planning

8.3.1 Alaska Science and Technology Foundation Grants

The Alaska Science and Technology Foundation provides grants for the study and planning of innovative sewage and water treatment technology projects (as well as other projects). The research projects must result in direct and significant benefits to the State of Alaska.

Contact
Alaska Science and Technology Foundation
4500 Diplomacy Drive, Suite 515
Anchorage, Alaska 99508-5918
1-907-272-4333/telephone
1-907-274-6228/fax
info@astf.org

8.4 Training and Technical Assistance Funding Sources

8.4.1 Operator Training and Certification Program

The ADEC has developed training programs to certify operators of community water and sewerage systems. The program provides classroom and onsite training and technical assistance, maintains a library of training videos, textbooks and reference materials, provides correspondence courses for operator advancement, plans, coordinates, and develops statewide training and provides a forum for operator concerns through the Governor's Water/Wastewater Works Advisory Board. The ADEC should be contacted for additional information.

Contact
Ken Smith, Certification Officer
Department of Environmental Conservation
410 Willoughby Ave. Suite 105
Juneau, AK 99801-1795
Phone: (907) 465-5140 Fax: (907) 465-5177
E-mail: ksmith@envircon.state.ak.us
http://www.state.ak.us/dec/dfco/dec_dfco.htm#Operations

9.0 REFERENCES

Alaska Department of Labor and Workforce Development (ADOL). January 2003. Alaska Economic Trends. The Matanuska-Susitna Borough.

Anchorage Daily News, Composting thrives in North despite conventional wisdom, Thursday, September 7, 2006

CH2MHill, "Central landfill future cell sequencing plan, Onsite leachate treatment evaluation, and closure cost evaluation", 2006.

EPA, "Decentralized systems technology fact sheet – septage treatment/disposal", 1999

EPA, Handbook - Septage Treatment and Disposal, U.S. EPA Report No. 625/6-84-009, October 1984

EPA, City of Palmer NPDES Permit, Permit No. AK-002249-7.

Health Research Inc., "Recommended standards for wastewater facilities", 1997

Mat-Su Long-Range Transportation Plan (HDR) 2006.

Metcalf and Eddy, Inc., Wastewater Engineering Treatment, Disposal, and Reuse, Third Edition, Irwin/McGraw-Hill, New York, 1991.

Septic Hauler Analysis for 2004 TY ASU COSA

TTG Environmental Consultants, "Septage Pilot Study", 2005

Spinosa, L., and Vesilind, P.A., Sludge into Biosolids: Processing, Disposal, Utilization, IWA Publishing, 2001.

APPENDIX 1 SEPTAGE PRODUCTION VOLUME CALCULATIONS

AWWU estimated the annual volume of septage from outside of the MOA by subtracting the volume of MOA septage from the total septage received at the two receiving facilities. Because AWWU does not meter the septage intake, the volume of MOA septage had to be estimated using the following assumptions:

The volume from the MOA was found using the following figures;
Assumptions:

- Number of septic tanks in Anchorage (data from MOA On-Site services),
- the average amount of septage pumped from a tank (data from MOA On-Site services)

Given:

- Number of septic tanks in the MOA pumped per year (assumed that 75% of all tanks pumped each year. MOA On-Site services estimated 50% are pumped annually and AMC require septic tanks to be pumped every two years at a minimum)

Because the volume of septage from MOA was calculated using the number of septic tanks within the MOA, it can be used to accurately estimate the volume of septage from outside the MOA, independent of which hauling company delivered the septage to the facility, and whether they were an Anchorage or a MSB-based company.

Table 15: 2007 Seasonal Daily Septage Flows

Delivery Days	20

By modifying the Delivery Days Cell and Monthly Weighting Cells different daily averages can be obtained. These numbers will link throughout the spreadsheet.

2007 Maximum Flow Calculation (Winter)		
Month		Max Flow
January, February, March, April		28,333
November, December.		28,333
Winter Flow		28,333

2007 Maximum Flow Calculation (Summer)		
Month		Max Flow
May to October		85,000
Summer Flow		85,000

Table 16: 2030 Septage Flows (gallons)

Delivery Days	**20**

By modifying the Delivery Days Cell and Monthly Weighting Cells different daily averages can be obtained. These numbers will link throughout the spreadsheet. The model looks at the maximum daily average for summer and winter months.

2030 Maximum Flow Calculation (Winter)		
Month		**Max Flow**
January, February, March, April		79,388
November, December		79,388
Winter Flow		79,388
2030 Maximum Flow Calculation (Summer)		
Month		**Max Flow**
May to October		238,165
Summer Flow		238,165

Table 17: Seasonal Flows and loading for 2007 and 2020

Flows & Loading						
			2007	**2007**	**2030**	**2030**
			Winter	**Summer**	**Winter**	**Summer**
Septage Load						
	Flow	gpd	28,333	85,000	79,388	238,165
	BOD	mg/L	1053	1053	1053	1053
	BOD	lbs/day	249	746	697	2092
	TSS	mg/L	7138	7138	7138	7138
	TSS	lbs/day	1687	5060	4726	14178
Pretreated Septage Load						
	Flow	gpd	28,333	85,000	79,388	238,165
	BOD	mg/L	500	500	500	500
	BOD	lbs/day	118	354	331	993
	Ammonia	mg/L	50	50	50	50
	Ammonia	lbs/day	12	35	33	99
	O2	lbs/day	172	517	483	1450
Palmer Sewage Load						
	Flow	gpd	483,000	483,000	1,353,696	1,353,696
	BOD	mg/L	230	245	226	238
	BOD	lbs/day	926	988	2,551	2,685
	Ammonia	mg/L	30	30	30	30
	Ammonia	lbs/day	121	121	339	339
Palmer Load + Septage Load						
	Flow	gpd	511,333	568,000	1,433,084	1,591,860
	BOD	mg/L	245	284	241	277
	BOD	lbs/day	1,044	1,342	2,882	3,678
	Ammonia	mg/L	31	33	31	33
	Ammonia	lbs/day	133	156	372	438
	O2	lbs/day	1654	2061	4593	5693

Table 18: Lagoon sizing for Option 3 and Option 4

Aerated, Partially Mixed Lagoon Sizing Comparison						
			BOD Removal Only		BOD + Nitrif.	
Condition	Year	Season	HDT	Size	HDT	Size
			days	Acres	days	Acres
Option 4: Septage Filtrate Only						
1	2007	Winter	20.0	0.13	361	2.3
2	2007	Summer	16.1	0.31	546	11
3	2020	Winter	20.0	0.26	361	4.6
4	2020	Summer	16.1	0.62	546	21
Option 3: Palmer Flow plus Septage Filtrate						
5	2007	Winter	14.8	2.5	265	45
6	2007	Summer	12.7	2.3	477	88
7	2020	Winter	14.5	7.3	264	135
8	2020	Summer	12.3	6.5	474	266

APPENDIX 2 HAULER EXPENSES

Table 19: Hauler expenses

ITEM	**COST**
Tires	$8,000 per 55,000 miles
Fuel	4.6 miles per gal @ $2.93 per gal
Oil	Oil and filter $121.00 per change
Tanker maintenance and dep	$3,000 per yr @36,000 miles
Truck maintenance and dep	$8000 per year @ 36,000 miles
Engine life	$22,000 per 500,000 mile overhaul
transmission	$10,000 per 500,000 mile overhaul
Labor	$20.00/hr
Taxes	
Social security	6%
Medicare	1%
Unemployment	3%
401-K	4%
Workman's compensation	15%
Insurance	$3500 @ 609 loads

APPENDIX 3 HOUSTON SEPTAGE DISPOSAL FACILITY - SYSTEM DESIGN CRITERIA (1993)

Population Served	33,060
Design Flows	
Yearly	2,500,000 Gallons
Peak month	350,000 Gallons
Peak day	25,000 Gallons
Influent Characteristics	
BOD (mg/l)	7,500 mg/l
BOD (lbs/yr)	156,000 lbs
Suspended solids (mg/l)	15,000 mg/l
Suspended solids (lbs/yr)	312,000 lbs
Treatment System Design	
Storage tankage capacity	46,000 Gallons
Pump station capacity	200 GPM ea (2 pumps)
Time to pump receiving tank	4 Hours
Screens	2 Screens at 200 GPM ea (0.10” Screen)
Primary lagoons	700,000 Gallons
Secondary lagoons	1,000,000 Gallons
Total lagoon capacity	1,700.000 Gallons
Detention	8 Months
BOD loading	0.03 lbs/1000 cf/day
Suspended solids loading	0.07 lbs/1000 cf/day
Aeration	
Storage tank (25cfm/1000cf)	170 cfm
Treatment lagoons (2.0lbs/O_2/1.0lb.BOD	690 cfm
Percolation beds	2 Acres
Yearly Disposal Time (1 gal/sf/day)	30 Days
Pumping requirements during disposal	7 Hours/Day
Sludge drying beds	0.5 Acres
Loading rate	10 lbs/sf/year

APPENDIX 4 CITY OF PALMER WWTP NPDES PERMIT – FACILITY INFORMATION

General Information	
NPDES ID Number:	AK-002249-7
Mailing Address:	231 West Evergreen Ave. Palmer, Alaska 99645
Facility Background:	The facility was originally issued an NPDES permit in March 1976 that included secondary treatment requirements. The current permit became effective on October 30, 2000, and has been administratively extended since October 31, 2005. The renewal application was received on September 15, 2005.
Collection System Information	
Service Area:	City of Palmer (6,000) and adjacent areas of Matanuska-Susitna Borough (3,000)
Service Area Population:	9,000
Collection System Type:	100% separate sanitary sewer
Facility Information	
Type of Facility:	Publicly Owned Treatment Works (POTW)
Treatment Train:	Bar screen, metering flume, two aeration lagoons, aerated polishing pond, and UV disinfection
Flow:	Design flow is 0.95 mgd. Long-term average flow is 0.57 mgd.
Discharge Frequency:	Year round
Outfall Location:	latitude 61°E 33' 30" N; longitude 149°E 06' 20" W
Receiving Water Information	
Receiving Water:	Matanuska River
Watershed:	Matanuska (HUC 19020402)
Beneficial Uses:	By default, the Matanuska river is protected for all beneficial uses.
Impairments:	None
Low Flow	20% of 7Q10 = 46.4 mgd, 20% 30B3 = 55.3 mgd (USGS Palmer gauge)
Additional Notes	
BOD_5 / TSS Limits	Principle treatment process is not a trickling filter or a waste stabilization pond, therefore, secondary treatment limits required. Facility previously qualified for reduced percent removal rates for TSS based upon low influent concentrations, but effective treatment process no longer requires this.

Source: EPA fact sheet for Palmer wastewater treatment plant NPDES, 2006

APPENDIX 5 SOLAR AQUATIC SYSTEM QUOTE

Ecological Engineering Group, Inc.

Ecological Engineers and Designers

where Life informs design®

500 Boston Post Road
P.O. Box 415
Weston, MA 02493-0003 USA
Phone: 978.369.9440
Fax: 978 369 2484
staff@ecological-engineering.com
www.ecological-engineering.com

11/24/2006

Dear Ms. O'Mullane;

Regarding an estimated cost for a Solar Aquatic System (SAS) to treat MSB septage, we can offer the following preliminary information:

First the disclaimer – as you know, septage composition varies widely and so the first engineering task must be to fully characterize the influent to the treatment plant. We can only develop accurate process and cost details from a Preliminary Engineering Report (PER), for which we would be pleased to provide a proposal. Absent that information we can only offer generalizations at this time

For the treatment of septage, which has 20-30 times more solids than sewage, substantial additional solids processing is integrated into the Solar Aquatic System prior to the greenhouse. This includes blending/storage capacity (typically in an in-ground concrete tank with mixing and aeration,) of approximately 10 days average flow followed by a primary clarifier. Primary effluent then flows to the greenhouse and is biologically treated to tertiary quality standards for discharge. Storage and dewatering of sludge is also a major additional requirement for septage treatment.

As we previously discussed, the PER could include a recommendation for employing a methane digester to consume filtered solids from the septage (and other landfill wastes?) to produce some percentage of the energy needed to power the facility.

In response to your recent question regarding scaling: SAS are highly compatible with a multi-step development plan – another advantage of SAS over conventional treatment systems The units are modular and capacity can be increased or decreased quickly and efficiently. We would be very interested in discussing the MSB's interest in building the facility in stages.

Design Flow:

Your year 2025 projection for septage volume is 32,400,000 gallons per year or 88,767 gallons per day (gpd)

Process Description:
The septage flows would be collected from a combination of commercial and residential septic tanks and holding tanks.

Process stages:

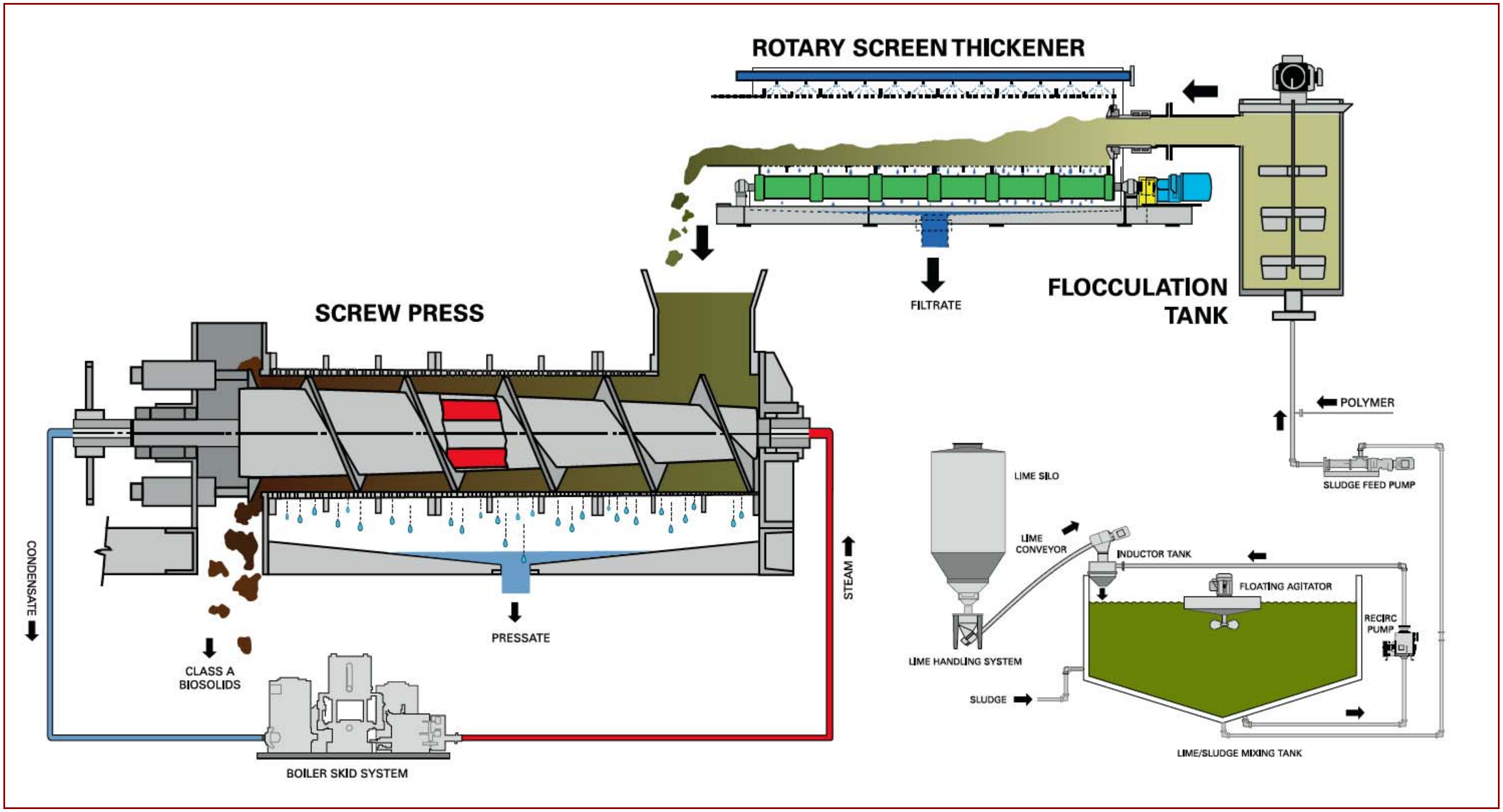
1. The septage would be collected and transmitted to the SAS by pump trucks. The pump trucks would dump their load flows directly to the Blending Tank.
2. Blended flows would be mixed and aerated, then pumped to an appropriately-sized primary clarifier that would remove the settled solids and send them to a sludge tank. The clarified effluent would then drain or be pumped to the tertiary treatment system within the greenhouse.
3. The Solar tanks in the greenhouse are aerated by fine bubble membrane diffuser. Flows are divided between multiple trains of multiple Solar Tanks, a proprietary component of the Solar Aquatics System. Each Solar Tank contains approximately 1100 gallons of wastewater along with a variety of aquatic plants and individual fine bubble membrane diffusers. Each train is capable of being isolated for maintenance.
4. Wastewater exiting the Solar Tanks is transmitted by gravity to a secondary clarifier. Sludge is wasted from the secondary clarifier to the Blending Tank as Return Activated Sludge.
5. The supernatant exits the secondary clarifier and passes through a gravity fed sand filter before entering one of two identical anoxic subsurface-flow constructed wetlands. The wetlands provide a root zone-based ecosystem for polishing and de-nitrifying the effluent to tertiary standards.
6. Each anoxic wetland is 5 feet deep to promote final treatment and polishing in an environment that promotes anaerobic microorganisms and is capable of handling the average daily flow.
7. The treated effluent is then pumped from the wetlands through an enclosure containing an ultraviolet lamp for disinfection prior to dispersal in a surface-water or soil absorption system adjacent to the greenhouse.

Capital and Engineering Costs:
Although it is premature to give specific estimates we can offer a preliminary range based on an average daily flow of 88,767 gpd. We anticipate these costs to range from $8 - $10 million.

Thank you very much for your interest. We look forward to speaking with you about the MSB project in more detail at your convenience.

Gershon Cohen, Ph.D.
Project Development Representative
Ecological Engineering Group
Box 956 Hanes, Alaska, 99827
Phone (907) 766-3005 gershon@aptalaska.net

APPENDIX 6 TREATMENT WITH NITRIFICATION



Additional facilities required

- Screen between septic hauling trucks and lime slurry tank to remove debris similar to Lakeside septage treatment system
- Building for septage screen, lime silo, lime sludge mixing tank, recirc. pump, sludge feed pump, floc. tank, rotary drum thickener,
- Polymer system and screw press. Odor control system needed also.
- Storage pad for Class A biosolids.

Table 20: Lagoon sizing for BOD removal and nitrification

BOD Removal + Nitrification					Lagoon Sizing				BOD + Nitrification
Condition	Year	Season	Flow	HDT	Volume	Volume	Area	Area	
			gpd	days	gallons	cu. ft.	sq. ft.	acres	
Septage Filtrate Only									
1	2007	Winter	18,889	360.8	6,815,840	911,209	101,245	2.3	
2	2007	Summer	56,667	545.7	30,921,341	4,133,869	459,319	10.5	
3	2020	Winter	37,516	360.8	13,537,144	1,809,779	201,087	4.6	
4	2020	Summer	112,547	545.7	61,413,802	8,210,401	912,267	20.9	
Palmer Flow plus Septage Filtrate									
5	2007	Winter	501,889	265.1	133,068,551	17,789,913	1,976,657	45.4	
6	2007	Summer	539,767	476.7	257,310,003	34,399,733	3,822,193	87.7	
7	2020	Winter	1,500,000	263.6	395,388,881	52,859,476	5,873,275	134.8	
8	2020	Summer	1,648,012	473.6	780,464,196	104,340,133	11,593,348	266.1	

APPENDIX 7 MSB CENTRAL LANDFILL ANALYTICAL RESULTS AND PARAMETERS

Matanuska-Susitna Borough - Department of Public Works
Anchorage Water & Wastewater Utility Industrial Pretreatment Program
Central Landfill Leachate

Parameter	Arsenic	Beryllium	BOD	Cadmium	Chromium	Copper	Cyanide	Lead	Mercury	Nickel	Oil & Grease	pH
STORET	1002	1012	310	1027	1034	1042	720	1051	71900	1067	3582	406
Permit Limit	3.7 mg/L	14.5 mg/L	NA	0.69 mg/L	2.77 mg/L	3.38 mg/L	1.7 mg/L	0.69 mg/L	0.2 mg/L	3.88 mg/L	NA	>5.0, <12.5
7/22/2004	ND	-	108	ND	0.0176	0.0398	ND	0.00434	ND	0.0378	ND	7.15
8/6/2004	ND	-	291	ND	0.00518	ND	0.0059	ND	ND	0.0130	ND	6.49
9/28/2004	ND	-	4.19	ND	ND	0.00831	ND	0.00122	ND	0.00264	ND	7.99
3/21/2005	ND	ND	742	ND	0.00253	0.00779	ND	0.000672	0.000318~	0.0209	4.21	6.60
6/27/2005	ND	ND	1,120	ND	0.0176	0.0272	ND	0.00326	ND	0.0309	11.1	6.51
9/27/2005	ND	ND	119	ND	0.00146	0.00289	ND	0.000477	ND	0.00310	ND	6.81
12/15/2005	ND	ND	7.03	ND	0.00239	0.0116	ND**	0.00129	ND	0.0143	ND	7.50
3/23/2006	ND	ND	9,640	0.00204	0.0622	0.00585	ND	0.00103	ND	0.283	158	6.20
6/21/2006	0.00260 J	ND	8.50	ND	0.00250	0.00811	ND	0.00155	ND	0.00462	1.70 J	7.25
9/21/2006	0.0261	ND	15,400	0.00120	0.161	0.0283	0.0050	0.00660	ND	0.286	249	6.19
12/12/2006	0.00380 J	ND	4,710	0.000335 J	0.0188	0.0286	0.0070	0.00176	ND	0.0741	56.0	7.22

KEY	Description
<	Less than
>	Greater than
*	Total Aromatic Hydrocarbon (TAH) result is sum of benzene (78124), toluene (78131), ethylbenzene (34371), & xylenes (81551) concentration results
~	Follow-up sampling event conducted on May 16, 2005
**	Sample collected on December 16, 2005
-	Sample not analyzed for this parameter
mg/L	Milligrams per liter
NA	Not Applicable
ND	Not Detected
0.00260 J	Analyte detected, but at a concentration less than the detection limit

Matanuska-Susitna Borough - Department of Public Works
Central Landfill Leachate
Volatile & Semi Volatile Organic Compound Analytical Results

Parameter	7/22/2004	8/6/2004	9/28/2004	3/21/2005	6/27/2005	9/27/2005	12/15/2005	3/23/2006	6/21/2006	9/21/2006	12/12/2006
Acetophenone* - µg/L	ND	ND	ND	ND	ND	ND	ND	ND	3.77 J	ND	ND
Acetone - µg/L	ND	232	ND	61.9	3,890	140	ND	5,910	12.0	3,300 J	10,100
Benzene - µg/L	ND	27.3	ND	1.21	13.4	ND	ND	8.70	ND	ND	19.4
bis(2-Ethylhexyl)phthalate* - µg/L	ND	ND	ND	ND	ND	ND	13	ND	ND	ND	ND
Benzoic acid* - µg/L	ND	ND	ND	ND	ND	ND	ND	11,000	ND	ND	ND
2-Butanone (MEK) - µg/L	ND	199	ND	107	9,360	199	ND	9,630	5.55 J	6,610	16,100
Carbon disulfide -µg/L	ND	10.2	ND	ND	ND	ND	ND	ND	ND	ND	1.99 J
Chloroethane - µg/L	ND	ND	ND	ND	5.10	ND	ND	ND	ND	ND	6.52
Chloroform - µg/L	ND	2.47	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane - µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.11
1,1-Dichloroethane - µg/L	ND	3.43	ND	ND	7.37	ND	ND	11.1	ND	ND	22.9
1,2-Dichloroethane - µg/L	ND	1.82	ND	ND	1.98	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene - µg/L	1.58	19.8	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane - µg/L	ND	17.4	ND	1.16	27.9	ND	ND	ND	ND	ND	9.10
Ethylbenzene - µg/L	ND	12.1	ND	3.17	10.7	ND	ND	ND	ND	ND	11.9
2-Hexanone - µg/L	ND	ND	ND	ND	55.0	ND	ND	ND	ND	ND	1,860
3&4-Methylphenol (p&m-Cresol)* - µg/L	ND	ND	ND	ND	ND	ND	ND	15,000	ND	8,800	1,500
4-Methyl-2-pentanone (MIBK) - µg/L	ND	140	ND	ND	143	ND	ND	266	ND	ND	ND
Methyl-t-butyl ether - µg/L	ND	ND	ND	ND	17.7	ND	ND	ND	ND	ND	9.89
Methylene chloride - µg/L	5.31	494	ND	ND	ND	ND	ND	177	ND	715 J	519
N-Nitrosodimethylamine* - µg/L	ND	ND	ND	ND	140	ND	ND	ND	ND	ND	ND
Phenol* - µg/L	ND	ND	ND	ND	ND	ND	ND	1,600	ND	830 J	250
Tetrachloroethene - µg/L	ND	7.45	ND	2.05	6.14	ND	ND	ND	ND	ND	ND
Toluene - µg/L	ND	256	ND	27.0	164	2.72	1.96	59.7	2.97	310 J	255 J
1,1,1-Trichloroethane - µg/L	ND	45.4	ND	ND	12.2	ND	ND	12.0	ND	ND	7.28
Trichloroethene - µg/L	ND	1.56	ND	ND	4.38	ND	ND	ND	ND	ND	5.90
Trichlorofluoromethane - µg/L	ND	118	ND	4.82	27.3	ND	ND	18.1	ND	ND	7.86
Xylenes, total - µg/L	ND	56.2	ND	8.42	ND	ND	ND	ND	ND	ND	51.7

KEY	Description
*	Semi Volatile Organic Compound
µg/L	Micrograms per liter
ND	Not Detected
5.55 J	Analyte detected, but at a concentration less than the detection limit

APPENDIX 8 OPERATIONS AND MAINTENANCE COSTS

O&M Costs for Option 2 Bulk Hauling

Lookup Table	Quantity	Unit	Quantity	Unit
Power	0.098534	kwh		
Power facility charge	18.05	$/month		
Power demand charge	4.68	$/kW		
Depth of tank	20	feet head		
2030 annual flow	38,106,357	gallons		
Blower	50	hp	37.29	kW
Pump	5	hp	3.73	kW
Distance of round-trip to Turpin	80	miles		

Item	Quantity	Unit	Unit Price	Total
Transfer station operation costs	1	Annual	$1,000	$1,000
Labor (driver)[2]	12,480	Hr	$28	$426,317
Labor (Transfer station operation)	2,080	Hr	$28	$71,053
Labor (Maintenance of fleet)	1,040	Hr	$28	$35,526
Power (pumps)	4,662	kWh	$0.10	$459
Power (blower)[4]	87,600	kWh	$0.10	$8,632
Power facility charge	217	$/month	$18.05	$46,916
Power demand charge	41	$/kWh	$4.68	$192
Facility maintenance	1	LS	$5,000.00	$5,000
Truck fuel and maintenance[3]	491,695	miles	$0.82	$403,190
AWWU discharge fee[1]	6	Annual	$1,562	$10,006
Miscellaneous supplies	1	LS	$10,000	$10,000
Total O&M				**$1,018,290**

1. Trucks charged $21/1,000 gallon truck capacity per month. Therefore, for the 6,200 gallon tankers this is $1,560 per year.

2 It is assumed that peak season (17hrs/day) and off-season wages will average out to a full time job - 2080 hours/year for 6 drivers.

3 Truck fuel and maintenance figures were developed from the average cost estimates from bulk haulers in the MSB, ($1.16/mile) and IRS reimbursement rate, ($0.485/mile).

Includes tires, fuel, oil, maintenance, engine life, transmission

4. Blower is operated 20% of the time, 365 days a year.

Option 3 Co-treatment at Palmer WWTP O&M Costs

Lookup Table	Quantity	Unit	Quantity	Unit
Power	0.098534	kwh		
Power facility charge	13.37	$/month		
Power demand charge	4.68	$/kW		
Depth of tank	20	feet head		
2030 annual flow	38,106,357	gallons		
Pretreatment blower	50	HP	37.29	kW
composting blower (2 @ 3hp)	6	HP	4.47	kW
Sludge feed pump	10	HP	7.46	kW
Mechanical treatment - Aeration[6]	240	HP	178.97	kW
Nalco dose[4]	2	mg Nalco/L water		
Nalco cost	4	$/lb		

Item	Item detail	Quantity	Unit	Unit Price	Total
Maintenance	Plant annual maintenance	1	Annual LS	$10,000	$10,000
Chemicals	Conditioning polymer[4]	1,589.04	lb	$5	$7,882
Labor	Labor - plant operator[1]	6,000	Hr	$31	$225,968
Plant power	Sludge feed pump	13,065	kWh	$0.10	$1,287
	Plant blower[5]	65,323	kWh	$0.10	$6,437
	Aeration power	313,552	kWh	$0.10	$30,896
	Facility charge	12	Month	$13.37	$160
	Demand charge	49	kWh	$4.68	$230
Compost Operation	Woodchips[3]	27,000	CY	$2	$54,000
	Labor - operations[2]	2,880	Hr	$25	$87,840
	Power[5] (aeration blower)	7,839	kWh	$0.10	$772
Monitoring	Sampling and testing	1	LS	$10,000	$10,000
	Miscellaneous supplies	1	LS	$10,000	$10,000
	Total O&M				**$445,473**

1. An estimated 3 fulltime operators will be needed for the plant. MSB treatment plant operator wage from MSB.
2. Winter employment of one operator, 4 hrs per day for 8 months, Summer employment of 2 operators for 8 hour days, for 4 months.
3. Woodchips in Fairbanks are sold to the wastewater facility at $10.50/CY. They were originally free, and then this charge was made.
4. Nalco is a polymer used to treat water in the pelican water supply project (HDR) and has been applied here at a dose of 5mg/l.
5. Blower is operated 20% of the time, 365 days a year.
6. This HP value was developed from a 2006 quote for a 0.3mgd activated sludge design plant in CA requiring 30 HP. I have scaled this up 6 times to match the volume, and another 2 times for contingency with colder climate (Total = 8 x 30).

Option 4 Independent Treatment
Conventional Treatment O&M Costs

Lookup Table	Quantity	Unit	Quantity	Unit
Power	0.098534	kwh		
Power facility charge	13.37	$/month		
Power demand charge	4.68	$/kW		
2030 annual flow	38,106,357	gallons		
Plant blower	50	hp	37.29	kW
composting blower (2 @ 3hp)	6	hp	4.47	kW
Sludge feed pump	10	hp	7.46	kW
Aeration blower	75	hp	55.93	kW
Nalco dose[4]	2	mg Nalco/L water		
Nalco cost	4	$/lb		

	Item	Quantity	Unit	Unit Price	Total
Plant Maintenance	Plant annual maintenance	1	Annual LS	$10,000	$10,000
	Labor - plant operator[1]	3,000	Hr	$31	$112,984
Chemicals	Conditioning polymer[4]	360	Ton	$25	$8,986
Plant Power	Sludge feed pump	13,065	kWh	$0.10	$1,287
	Plant blower[5]	65,323	kWh	$0.10	$6,437
	Facility charge	160	$/month	$13.37	$2,145
	Demand charge	105	$/kWh	$4.68	$492
	Power (two 75 hp aeration blowers)[6]	979,850	kWh	$0.10	$96,549
Composting	Woodchips[3]	27,000	CY	$2	$54,000
	Labor - operations[2]	2,880	Hr	$25	$72,000
	Power[7] (blower)	12,934	kWh	$0.10	$1,274
Monitoring	Sampling and testing	1	LS	$10,000	$10,000
	Miscellaneous supplies	1	LS	$10,000	$10,000
	Total O&M				**$386,154**

1. An estimated 1.5 fulltime operators will be needed for the plant. MSB treatment plant operator wage from MSB.
2. Winter employment of one operator, 4 hrs per day for 8 months, Summer employment of 2 operators for 8 hour days, for 4 months.
3. Woodchips in Fairbanks are sold to the wastewater facility at $10.50/CY. They were originally free, and then this charge was made.
4. Nalco is a polymer used to treat water in the pelican water supply project (HDR) and has been applied here at a dose of 5mg/l.
5. Plant blower is operated 20% of the time, 365 days a year.
6. Two aeration blowers to run 24 hr/day, 365 days a year.
7. Blower is operated 30% of the time, 365 days a year (assuming 30 min cycles, 10 min on, 20 min off, with two 3hp engines).

Option 4 Independent Treatment
SAS O&M Costs

Lookup Table	Quantity	Unit	Quantity	Unit
Power	0.098534	kwh		
Power facility charge	13.37	$/month		
Power demand charge	4.68	$/kW		
2030 annual flow	38,106,357	gallons		
Plant power	100000	kWh/month	138.89	kW

	Item	Quantity	Unit	Unit Price	Total
Plant Maintenance	Plant annual maintenance	1	Annual LS	$10,000	$10,000
	Labor - plant operator[1]	3,000	Hr	$31	$112,984
Plant Power	Plant power[5]	1,200,000	kWh	$0.10	$118,241
	Facility charge	160	$/month	$13.37	$2,145
	Demand charge	139	$/kWh	$4.68	$650
Monitoring	Sampling and testing	1	LS	$10,000	$10,000
	Miscellaneous supplies	1	LS	$10,000	$10,000
	Total O&M				**$264,020**

1. An estimated 1.5 fulltime operators will be needed for the plant. MSB treatment plant operator wage from MSB.
2. SAS power requirement estimate from vendor.