Hiawatha Beach / Comfort Resort Area

Community Assessment Report

City of Ham Lake, MN

May 31, 2011

Prepared By:

Ellingson Companies

56113 State Highway 56
P.O. Box 68
West Concord, MN 55985
P: 507.527.2294
www.ellingsondrainage.com

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Dated this 31st day of May 2011.

Brent J. Kavitz, P.E.
P.E. Lic. No. 46614
MPCA Advanced Designer Certification No. C8960

Ellingson Companies
56113 State Highway 56
P.O. Box 68
West Concord, MN 55985

Project: **Hiawatha Beach / Comfort Resort Area**
Community Assessment Report
Ham Lake, MN

Table of Contents

1.0 INTRODUCTION

The Hiawatha Beach / Comfort Resort Community Assessment Report project area is located within the City of Ham Lake, Anoka County, Minnesota. The project area is approximately 172.5 acres of residential properties, road right of ways, city owned property, lakes and wetlands.

All parcels within the study area are located within Sections 2 and 3, Township 32N, Range 23W, north of Crosstown Boulevard (CSAH 18). The study area parcels border Mallard Lake, South Coon Lake, and Coon Lake. Both Mallard Lake and South Coon Lake are designated as natural environment lakes and Coon Lake is designated as a general development lake. Various unnamed wetland and low land areas are also located within the project area.

According to the League of Minnesota Cities, the City of Ham Lake has a population of 15,324. Information from City-Data.com shows that the population of the City of Ham Lake has increased 20.1 percent since 2000. Future growth within this area is somewhat limited due to small lot sizes and a lack of room for expansion. The expansion is limited to the 11 vacant lots described below. Within these lots, there is room for cabins or single family homes.

There are undeveloped areas lying outside the study boundary that could potentially be developed or could be used as potential sites for cluster systems. We spoke with the owner of the vacant property located adjacent to Vickers Street and learned that he would not sell the site for installation of a cluster system and would not allow us entry onto the site. The most viable location for a centralized cluster system site remaining is the vacant property located adjacent to the study area and bounded by Vickers Street on the east, CSAH No. 18 on the south, and an extended Hiawatha Beach Drive to the West.

The **objective** of the community assessment is to assess approximately 143 existing onsite septic systems serving seasonal and year round residences. There are approximately 11 vacant lots in the study area that presently have no residential unit on them. A total of 154 properties were evaluated for septic system compliance.

The **goal** of the community assessment is to determine the feasibility of upgrading or replacing non-compliant and failed septic systems. In addition, serve the 11 potential parcels with individual type I-IV Subsurface Soil Treatment Systems (SSTS) to provide compliant wastewater treatment. Four potential sites for cluster mounds to serve as potential treatment solutions within the project area were identified and evaluated as well.

The **purpose** of this initial evaluation is to determine the best wastewater treatment solution for each parcel and to determine if a combination of individual and clustered septic systems or community treatment systems can provide a viable long-term solution to the community's wastewater needs.

Approximately half of the property owners completed a homeowner survey which included information on number of bedrooms, drinking water well information and known status of existing system including size, location, information on soil treatment area, maintenance of tank and treatment area, and other information. The homeowner surveys, the lot by lot PPL tabulation of all the properties, copies of the SSTS permits and property setback requirements were evaluated in completing the CAR Spreadsheet included within this report.

The Community Assessment Report (CAR) is meant to inform the planning and design phase of wastewater infrastructure improvements and provide data to assist in updating the Project Priority List (PPL) for the Minnesota Pollution Control Agency. We have identified all properties within the study area on the CAR Spreadsheet and provided recommended solutions to upgrade or replace non-compliant individual Type I-IV subsurface soil treatment systems.

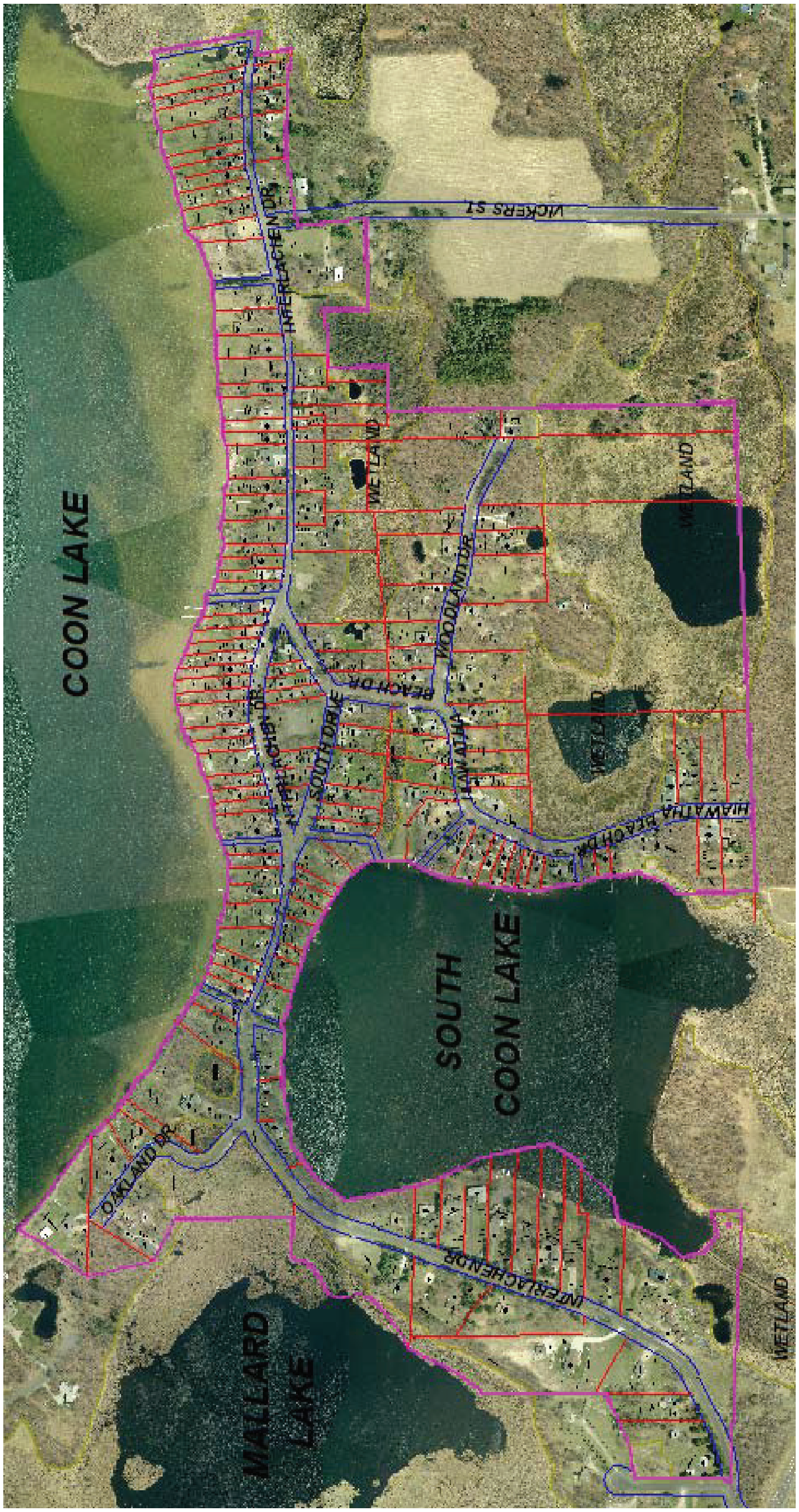
During the fall of 2008, an onsite field investigation was conducted, city building records were reviewed, and questionnaires were sent to residents in order to collect information for the determination of the scoring for the Project Priority List (PPL). This Community Assessment Report was completed utilizing this information and was supplemented with onsite field investigation to establish the locations of existing and proposed facility locations. Step probe borings were conducted at each site to establish the depth of septic field mottling. The data is summarized within the CAR in completing the site evaluation for all properties within the study area.

The Web Soil Survey area of interest, illustrated within the appendix of this report, consists of 715 acres ranging from loamy fine sand to water as indicated on the maps. The topography of the area is very flat with slopes varying from 0% to 4%. The mean annual precipitation is 25 to 34 inches with a frost free period of 120 to 180 days. The depth to the water table is high in most areas but extend down to a depth of greater than 80 inches in others.

According to the Aquifer Assessment on the Web Soil Survey, all areas within the area of interest, excluding the water, are considered to have a sensitive rating. The aquifer assessment is used to predict the aquifer vulnerability and the possible risk of nitrogen impacting the aquifer. The sensitive rating found on the Web Soil Survey indicates a high degree of risk to the aquifer and a more complete assessment shall be completed for systems ranging between 2,500 gallons per day (gpd) and 10,000 gpd.

On June 12, 2009, a memorandum from Thomas Hailey, Senior Engineer at RFC Engineering, summarized questions and concerns from the Sewer Task Force meeting. This memo expanded on wastewater treatment options for the Sewer Task Force and prompted a closer look into the option of individual Type I-IV upgrades or replacements and/or the use of cluster septic systems. A preliminary evaluation was conducted, but no site evaluations were completed as part of this memo. The Community Assessment Report takes into account the site evaluations and breaks down the available options for the project area.

FIGURE 1: Project Area



2.0 EXISTING SYSTEMS STATUS REPORT

Site Parcels & Site Information

The Hiawatha Beach / Comfort Resort Area consists of 143 existing homes placed on various sized lots ranging from 0.15 to 18 acres. Of the 143 existing homes, five were inaccessible due to the inability to obtain approval from the property owners. Very limited information is available for these five properties and some information on the CAR Spreadsheet is assumed or approximated. Within the study area, 154 properties were evaluated for individual septic system compliance and four properties were evaluated for potential Cluster or MSTS site locations. Eleven of the 154 properties were vacant lots which consisted of one or more parcels owned by a single property owner.

Two City owned park areas (3500 Interlachen Dr. NE and 3556 Interlachen Dr. NE) were part of the evaluation process. Potential sites for use within the study area were difficult to find, therefore the City Park sites were included within this study. City owned pathways / water access lots were not evaluated due to layout dimensions, lot-line setbacks and the inability to install a system on the lot.

The CAR Spreadsheet, found in the appendix of this report, lists each of the sites evaluated and the site information relating to the parcel including:

- Property Address
- Parcel Identification Number (PIN)
- Number of Bedrooms within Unit
- Sewer System Flow per Unit (Gallons per Day)
- Existing Individual Subsurface Treatment System (SSTS) Type
- Year SSTS Constructed
- Existing System Compliance
- Other Issues
- Property Notes
- System Alternatives and Approximate Costs
- Well and Well Casing Depths

The CAR Spreadsheet is used as the database for all information collected during and after the field evaluations and was used to determine wastewater treatment options for each of the existing and vacant properties. The color coding in the spreadsheet reflects the compliance status depicted on the Compliance Map.

Drinking Water Sources

There is no publicly owned water system within or in the vicinity of the study area. Drinking water for each of the parcels is from private wells located within each property. Wells were located and well and casing depth information was provided for parcels located within the study area. The wells in the area range from sand point wells as shallow as 22 feet deep to cased wells up to 207 feet deep for wells of know depth.

A site layout map is provided in the appendix for each of the parcels within the study area. The location of the private well with associated 50 and 100 foot setback boundaries are illustrated. A deep cased well (≥50 feet) has setbacks of 50 feet to the septic system absorption area and 50 feet to the septic/holding tank location, where a shallow well (<50 feet) has setbacks of 100 feet to the septic system absorption area and 50 feet to the septic/holding tank location as per Minnesota Department of Health (MDH) guidelines.

One option the area might want to consider is the installation of a community water system. An analysis of the properties and well locations indicates that if a community water system was installed, approximately 41 properties would have additional area available to install a new septic system. The elimination of private wells would allow for non-compliant parcels to have additional area available to make the system compliant. A water system could eliminate the issue of well setbacks but would not address the issue of failing septic systems and the ability to protect ground water. The addition of a community water system could be evaluated in a preliminary engineering report if requested.

3.0 FIELD ASSESSMENT

Assessment Procedures & Information

Site evaluations were conducted between June 21, 2010 and July 31, 2010 by Scott Otting and Brent Kavitz of Ellingson Companies. We worked with Sara Heger and Dan Wheeler from the University of Minnesota on Friday, July 9, 2010 to review procedures and verify soils evaluations for a number of sites.

Site evaluations were broken into three zones and a reserve week as follows:

Zone 1 - Interlachen Dr. (Coon Lake – lake front properties):
Week 1 – Monday, June 21 to Friday, June 25 between the hours of 8:00 am and 8:00 pm and Saturday, June 26 between 8:00 am and 4:00 pm.

Zone 2 - All remaining properties on Interlachen Dr. & South Drive:
Week 2 – Tuesday, July 6 to Friday, July 9 between the hours of 8:00 am and 8:00 pm and Saturday, July 10 between 8:00 am and 4:00 pm.

Zone 3 - Oakland Dr., Hiawatha Beach Dr. & Woodland Dr. properties:
Week 3 – Monday, July 12 to Friday, July 16 between the hours of 8:00 am and 8:00 pm and Saturday, July 17 between 8:00 am and 4:00 pm.

Reserve week for other properties & misc. work:
Week 4 – Monday, July 26 to Friday, July 30 between the hours of 8:00 am and 8:00 pm and Saturday, July 31 between 8:00 am and 4:00 pm.

All property owners who sent back signed and approved consent forms were contacted via mailed letters to set up a time to meet onsite for the site evaluation process. The property evaluation notes included any additional information that the owner had on their parcel.

At the time of the site evaluation, both GPS mapping and hand drawn mapping was conducted to illustrate all physical features of each property including:

- House location
- Garage location
- Driveway location and type
- Landscaping
- Fence lines
- Trees
- Well locations and setbacks
- Approximate lot lines and right of way lines
- Roadway
- Wetlands
- Lake shoreline setbacks
- Existing septic systems and lines
- Soil boring locations

A partial inventory of all tanks, sizes, and locations was taken at the time of the site evaluation process. A more complete assessment of the tanks will be conducted at a later date and an amended report with the results of the assessment will be submitted to the City.

The final field assessment was conducted to evaluate setbacks associated with wells, buildings, property lines, public right of ways, lakes and wetlands to determine if enough alternate area was available for a SSTS. The possible system types available for construction within the project area are:

- Type I – Trenches, Beds, At-grades, Mounds, and Gray-water systems
- Type II – Privies, Holding Tanks, and Type I systems used with modifications for floodplains
- Type III – Previously "Other" Systems – Type I systems that can vary from non-soil standards, use registered distribution media products, and rely on the soil to provide treatment
- Type IV – Performance Systems – Advanced treatment systems registered for use in MN, coupled with subsurface soils dispersal per code specifications (maximum loading rates, use of pressure distribution, timed dosing, reduced soil separation)
- Type V – Performance systems that protect public health, protect groundwater, protect surface water, custom designed – "engineered" systems
- Cluster Type I-IV – Multiple sites grouped together into one common system. Flows up to 5,000 gpd
- Mid-sized Soil Treatment System (MSTS) – Mainly follows Type IV SSTS requirements. Flows from 5,000 to 10,000 gpd

If the assessment determined that area was available for an alternate system location, a soil boring was taken in a location were the absorption area would possibly be placed. If no alternate area was available for a new system, then soil borings were not taken. Septic system drain field soil borings were conducted to verify the actual soil separation between the drain field rock bed to the limiting condition in the original soil. Soil Boring logs taken on individual parcels are included within the property evaluation notes section of the appendix.

Assessment Findings

Table 1 provides a breakdown of the 158 sites evaluated. As indicated below, 24 sites were found to be compliant, 119 were found to be non-compliant, and there were 15 vacant lots. A wide range of SSTS systems exist from trenches and mounds to cesspools, outhouses, and holding tanks as listed in the table below:

TABLE 1: Existing SSTS Types & Compliance Status

SSTS Type	Quantity	Compliant	Non-Compliant
Trench	82	5	77
Mound	26	17	9
Bed	18	1	17
Cesspool	6	0	6
Outhouse	3	0	3
Holding Tank	4	1	3
Straight Pipe onto Surface (ITPHS)	1	0	1
Systems that could not be located	3	0	3
No Existing System (Vacant Lots)	15	-	-
Totals	**158**	**24**	**119**

According to Minnesota Rules Chapter 7080 an existing system is considered compliant if:

- It is not an imminent threat to public health or safety (ITPHS)
- It is not failing to protect groundwater (FTPG)
- It meets its monitoring and mitigation plan/operating permit (if required)

Minnesota Rules Chapter 7080 states a system that is an ITPHS is a system with a discharge of sewage or sewage effluent to the ground surface, tile drainage systems, ditches, or storm water drains or directly to surface water; systems that cause a reoccurring sewage backup into a dwelling; or sewage tanks with unsecured, damaged, or weak maintenance hole covers or weak lids. Only one site in the project area was found to be an ITPHS. The cabin located at 3561 Interlachen Dr. NE had a surface drain out into the back yard area.

A system that is failing to protect groundwater (FTPG) is defined as a seepage pit, cesspool, drywell, leaching pit or other pit; a system with less than the required vertical separation distances; and a system that is no longer in use and is not abandoned. Of the 119 non-compliant systems, 118 were considered to be FTPG.

Five of the evaluated systems were considered to be "Experimental or Other" systems and were considered non-compliant based on FTPG. These systems may be compliant based on reduced soil separation and the use of pre-treatment devices. No additional information was found on the status of the operating permit and/or variance of these systems.

The septic tank assessment, which will be available as an amendment to this report, could alter the results of the compliance status. If a system's drain field is considered to be non-compliant, there is still a chance that the septic tank or pump tank is compliant and may be used for the alternate system proposed to reduce future construction costs.

4.0 IDENTIFICATION OF DECENTRALIZED SOLUTIONS

Septic System Solutions

Available space for alternate system locations seems to be the main concern for the project area because of dense housing, lake and wetland setbacks, and private well locations. Many different options are available for the area. As illustrated on the layout maps, a majority of the properties are limited due to various setback issues.

Table 2 summarizes the most cost effective option available for the 130 properties that are either vacant or are non-compliant. The four possible cluster sites and the 24 compliant sites were not included in the calculation below. Vacant, buildable lots were assessed and were also included in table below and distributed as shown.

TABLE 2: SSTS Alternatives

SSTS Type	Description	Quantity
I	Trench	9 (2 on Vacant Lots)
I	Mound	26 (3 on Vacant Lots)
II	Holding Tank	56 (3 on Vacant Lots)
III	Mound	18 (3 on Vacant Lots)
IV	Add Advanced Treatment	21

Refer to the wastewater maps for locations of proposed alternate system locations.

Out of the remaining 130 septic system locations, 53 properties have space available for a Type-I or III trench/bed or mound type SSTS's. A majority of these properties are larger lots where setback issues are not a problem. Sizes of systems were determined using Minnesota Rules 7080 February 2008 edition. Type I trench and mound systems were designed in areas that could accommodate the areas needed for treatment of wastewater. Type III mounds were designed in areas with disturbed soils or compacted soils, and areas with less than 12 inches to the mottled soil layer. A Type III mound system would require a management plan requiring monitoring such as visual observation and flow measurement.

Another option available is to construct a Type IV or V system to sites with additional space available such as a box mound with reduced soil separation and advanced treatment. Further investigations into sites may require smaller areas be utilized for treatment. Reduced soil separation or engineered systems may reduce the size of the soil treatment area to better fit the lot. These types of systems will also require a management plan requiring monitoring and flow measurements.

There are 21 sites within the project area that have the option to add advanced treatment to their current system to put the system into compliance. Adding the advanced treatment components would reclassify the system as a Type IV system. These systems were found to have soil separations of between 12 and 36 inches and have no additional area available for the construction of a new system. There are two treatment levels for advanced treatment, Treatment Level A and B. Treatment Level A options would be utilized in systems that have soil separation of 12 to 17 inches and Treatment Level B options would be utilized in systems that have soil separation of 18 to 36 inches. Refer to page 17 for a discussion of costs associated with this option.

The remaining 56 properties do not have available space for a new SSTS or have less than 12 inches of vertical separation. A Type II holding tank is the next SSTS option available for these properties. Most of these properties are limited on available space as illustrated in the layout maps. Holding tanks do not take up much area but should be located near the roadways for better access. Audible or visual alarms are required in the tanks to notify the owner when pumping is required. If holding tanks are neglected or not pumped when needed, the overflow of septic waste can cause an ITPHS and FTPG.

The sharing of a single treatment system between two or more properties may be a problematic option for property owners. Generally, shared systems are not advised because parties involved have to be in total agreement for shared systems to be constructed and managed effectively. Written agreements between each property owner should be required for shared systems. Issues related with shared systems include; lot line variances, easements, maintenance/pumping costs, etc. Considering the minimal land available on properties that currently could install a new system, not many options are available to share systems between property owners that do not have land available. Increasing the flow into each system respectfully increases the size of the system, thus available land is much harder to come by. For purposes of complexity of system construction, maintenance, easements, and land purchases, shared system options were not feasible and therefore removed from further consideration.

5.0 REGULATORY REQUIREMENTS

Treated wastewater must be discharged either to the underlying soil or to a surface water (river, stream, or lake). An appropriate method of dispersal is highly influenced by the regulatory requirements that apply.

A wastewater treatment system serving over 10,000 gpd, owned by a single entity, and discharging treated effluent to the soil must comply with MPCA's Large Subsurface Treatment Systems (LSTS) guidelines. LSTS rules apply to individual sewage treatment systems as well as cluster systems if all systems within one-half mile have a combined flow of greater than 10,000 gpd. If separate cluster systems under 10,000 gpd are used and are separated by at least a half mile from each other, the systems can be permitted by the County and would not require a state permit.

Effluent limits for Subsurface Dispersal are stated in Table 3 below.

TABLE 3: Effluent Limits for Subsurface Dispersal

Subsurface or Characteristics	Limits for Subsurface Dispersal
Carbonaceous Biochemical Oxygen Demand (CBOD5)	125 mg/L
Total Suspended Solids (TSS)	60 mg/L
Total Nitrogen (includes ammonia, nitrates, and nitrates.)	10 mg/L
Phosphorous	None
Fecal Coliform	None

Total Nitrogen is the only effluent limit for subsurface dispersal. The lack of effluent limit criteria makes this type of dispersal very attractive. Costs associated with operation and maintenance of a facility and ongoing conformance to effluent limit requirements are greatly reduced.

Nitrogen reduction is achieved by the use of advanced pretreatment devices that minimize the release of nitrogen to the environment. To handle the nitrogen concerns effectively, each site in this study, with a design flow of greater than 2,500 gpd, is designed to include some sort of advanced treatment device such as an aerobic treatment unit (ATU) or media filter. Other advantages of pretreatment devices include cleaner wastewater flowing through disturbed or compacted soils, environmentally sensitive areas, areas with shallow bedrock, aquifer recharge areas and wellhead protection areas.

Surface discharges are classified as either 'controlled' or 'continuous'. Controlled discharges are those from stabilization ponds that retain wastewater in the facility for a minimum of 180 days before discharging in the spring and fall. Continuous discharges occur from other types of wastewater treatment facilities that are designed to discharge the same volume of water that is received by the facility each day. Generally, treated wastewater limits determined by the Minnesota Pollution Control Agency (MPCA) are more stringent for controlled discharges because the potential impacts on the receiving water can be greater.

The following effluent limits would apply for surface water discharge.

TABLE 4: Effluent Limits for Surface Discharge

Substance or Characteristic	Limits for Continuous Discharge	Limits for Controlled Discharge
Carbonaceous Biochemical Oxygen Demand (CBOD5)	15 mg/L	30 mg/L
Total Suspended Solids (TSS)	30 mg/L	45 mg/L
Phosphorous Management Plan (PMP)	Must submit PMP every 5 years (1)	Must submit PMP every 5 years (1)
Fecal Coliform	200 Organisms/100 mL	200 Organisms/100 mL
Ammonia-N	None	None
pH Range	6.0 to 9.0 Standard Units	6.0 to 9.0 Standard Units

(1) The MPCA requires all point sources to monitor phosphorous and develop a strategy for reducing phosphorous inputs.

The limits for continuous discharge for an effluent are the most stringent. Approval of a continuous discharge or controlled discharge permit for Ham Lake would require the approval of the MPCA and could be problematic to obtain due to the City's close proximity to Met Council Wastewater Facilities.

If the City owns a wastewater treatment facility that is permitted by the state, and a collection system, the operator in charge of both systems must be licensed as a wastewater operator and can operate both systems. If the City owns only the collection system and pumps sewage to another location, the operator must be certified as an S-D (minimum) collection systems operator. An S-D collection system operator is required for systems serving a population of less than 1,500 people.

The collection system operator will maintain the sewers, schedule cleaning and inspections, keep records on maintenance activities, respond to sewage backups and alarm conditions, and monitor conformance to City and State Statutes relative to wastewater conveyance.

6.0 ALTERNATIVES CONSIDERED

There are three components that need to be evaluated when considering alternatives for long-term wastewater infrastructure:

1. Collection System: The means in which the wastewater is conveyed from the home to the wastewater treatment facility
2. Wastewater Treatment: The removal of pathogens and nutrients in primary and secondary wastewater treatment processes
3. Effluent Disposal (Dispersal): Final distribution of treated effluent to surface waters, the ground surface, or subsurface soils

With most Individual Soil Treatment Systems, the treatment and effluent dispersal components occur with the same infrastructure. The septic tank provides for primary treatment of the wastewater by allowing the removal of solids from the waste stream. The drain field removes pathogens and viruses while dispersing the wastewater effluent.

Collection System Methods

There are four collection system methods available to convey wastewater to cluster or regional treatment sites:

1. Grinder Pump with Small Diameter Forcemain
2. Septic Tank Effluent Pump (STEP) with Small Diameter Forcemain
3. Septic Tank Effluent Gravity System (STEG)
4. Gravity Raw Effluent Collection

Methods 1 and 2 above employ a type of low-pressure sewer collection utilizing a progressive cavity grinder pump located in an underground two foot diameter polyethylene wet well basin located near the house. It grinds the sewage into a slurry and pumps it through very small diameter pipes made of high density polyethylene (HDPE).

The pipe is heat-fused making a completely watertight sewer system with very little opportunity for groundwater or rain water to enter the system. Small diameter forcemains can be directional bored which reduce restoration costs. The progressive cavity pumps tend to have longer life than centrifugal grinder pumps and can be used in various terrains where centrifugal pumps may have difficulties.

The pressure sewer Methods 1 and 2 employ similar technologies with the primary difference being that the septic tank remains in service for the Method 2 STEP system. Onsite solids retention with a STEP system requires less capital cost at the treatment site as solids are removed at the individual on-site septic tank. In cases where the property does not have a compliant septic tank, new tanks would need to be installed. In addition, under Method 1 Grinder Pumps, the septic tank is abandoned and wastewater is conveyed by use of the grinder pump and small diameter pipe networks to the wastewater treatment facility. Under the Method 2 Step System, the individual tanks would stay in service and would need periodic pumping. The viability of using existing septic tanks for solids collection is dependent on the condition of the tank and the methodology to manage SSTS systems as discussed later in this section.

Methods 3 and 4 employ a conventional gravity sewer for conveyance of wastewater flow from the home. Minimum pipe diameters of eight inches are used with a minimum bury below frost depth, typically eight feet. Piping materials are usually Polyvinyl Chloride (PVC). The pipes are installed with uniform gradients sufficient to create a self-cleansing velocity of two feet per second or greater. When gravity flow cannot be maintained due to topography and depth, lift stations are employed to ‘lift’ the flow to a higher elevation to again flow by gravity. Waste water from homes may need to be ‘lifted’ to the gravity system by the use of grinder pumps. Manholes are provided to permit inspection, monitoring, and cleaning; and are located at changes in gradient, direction, and at intervals of 400 feet.

Under the Method 3, Septic Tank Effluent Gravity System (STEG), the individual tanks would stay in service and would need periodic pumping. Under Method 4 Gravity Raw Effluent Collection, the septic tank is abandoned and wastewater is pumped by use of the grinder pump to the cluster system for treatment. Because of the topography of the area and costs associated with restoration and installing larger diameter gravity sewer and lift stations, the gravity sewer Methods 3 and 4 above are removed from further consideration. We recommend that only Methods 1 and 2 be utilized for collection.

Wastewater Treatment Options

The purpose of this initial evaluation is to determine the best wastewater treatment solution for each parcel and to determine if a combination of individual and clustered septic systems or community treatment systems can provide a viable long-term solution to the community’s wastewater needs. The four wastewater treatment options considered are described below:

> Option 1 – Subsurface Soil Treatment System (SSTS): Leave all compliant systems as they are and install the most cost effective individual system to all noncompliant systems. For example, install Type I or III systems in sites that have sufficient land available for a new onsite system; add Type IV advanced treatment components to existing systems to get the reduction of soil separation; and install Type II holding tanks for seasonal residences and residences with setback issues for the remaining properties. This option would not require the construction of a wastewater collection system.
>
> Option 2 – Combination of SSTS and Cluster or MSTS sites: Same as Option 1 with the exception that cluster sites would be constructed within the Project Area to benefit the most restrictive properties for example, all properties with holding tanks as the only option. This option would require the construction of a wastewater collection system.
>
> Option 3 – Regionalization to East Bethel: Utilize the wastewater treatment facilities capacity available from Met Council or a neighboring community. This option would require the construction of a wastewater collection system.

Option 4 – Centralized Collection and Treatment: Construct a centralized wastewater treatment facility within Ham Lake. This option would include effluent dispersal considerations and the construction of a wastewater collection system.

Option 1 – Managed Subsurface Soil Treatment System (SSTS)

A managed SSTS Program utilizing the best available onsite technologies and management can be effective in protecting public health and environment. The discussion of this alternative assumes that the City of Ham Lake would assist property owners with SSTS upgrades and in doing so take some financial and operational responsibility. The discussion of assisting property owners should be brought up at a future Task Force meeting. The City would oversee management of the system with employees or through subcontracts for financial and operational services.

As stated in Section 4, there are a total of 56 properties are non compliant and do not have available space for a new SSTS or enough soil separation to add advanced treatment to make compliant. The type of SSTS recommended to bring the system under conformance is influenced by ongoing operation and maintenance costs in addition to the initial capital cost for the upgrade.

Current sites that do not have additional area available for the construction of a new system nor have the ability to add advanced treatment to make the system compliant total 56 properties and the only option is a holding tank. Holding tanks are needed on small lots, lots with high groundwater, lots with setback restraints and/or lots with multiple structures with little usable land. These lot constraints make the installation of any system that discharges to the soil not available. Holding tanks are typically only permitted where no other system type is feasible. A managed SSTS program would be needed to for oversight of pumping frequency for assurance that tanks are emptied in an approved manner.

A disadvantage of a holding tank is the ongoing expense of pumping the tank. A full time residence of two to three people will use approximately 4,000 gallons of water per month. A 2000 gallon holding tank pumped every two weeks at a cost of approximately $250 per pumping results in an annual pumping cost of $6,500.

A total of 21 properties could upgrade to a Type IV or V SSTS at much lower operation and maintenance cost of $560 per system per year but have a larger initial cost of approximately $10,000 to $14,000 based on number of bedrooms in each home. Cost estimates were determined utilizing performance treatment Level A (refer to page 12 for the discussion on treatment levels). Treatment Level A products available for use in these systems are listed on the MPCA's Registered Products List which include aerobic treatment units, media filters, and disinfection units. A Service Provider would be required to maintain the system as per Minnesota Rules Chapter 7080. Service Providers are trained on SSTS technologies and have the knowledge to operate and maintain Type IV and V systems that provide alternative treatment other than a conventional subsurface drain field or mound.

SSTS Advantages:

- Capital costs based on need - residents pay for treatment based on their own needs
- There is an economy of scale for ongoing operation and maintenance

Disadvantages:

- High operation and maintenance expenses for full-time residents on holding tanks
- Holding tanks pose practical limitations on use and development of a property

Option 2 – Combination of SSTS's and Cluster/MSTS Systems

A series of homes connected to a decentralized wastewater treatment system is commonly referred to as a cluster system. Cluster system ownership, operation, and maintenance occur through private ownership, a sewer district, or through the municipality. For the purposes of this report, the assumption is made that the cluster system would fall under the ownership of the City of Ham Lake. Private ownership is an option but presents challenges related to land ownership, easements, and fee collection.

In this analysis of this alternative, the project area has been divided into four service areas. These service areas in addition to possible cluster system sites are illustrated on the Cluster Site Map in the Appendix. Cluster sites are possibly available on four properties within the project area. Two of the sites are existing City owned park areas that should be considered as a possible option. The other two sites are privately owned wooded lots on Woodland Dr. Table 6 highlights the number of wastewater generating parcels per service area and the estimated daily flow.

TABLE 5: Cluster & MSTS Sites (Within Project Area)

Service Area	Site Location	System Type	Design Flow (gpd)	No. of Connections
1	3500 Interlachen Dr. NE	Mound	6,182	22
2	3556 Interlachen Dr. NE	Mound	2,880	7
3	Woodland Dr. (North Lot)	Mound	5,556	16
4	Woodland Dr. (South Lot)	Mound	3,527	10
		Totals	**18,145**	**55**

(See Section 7 for costs related to these options)

The design flow for each service area is estimated using a formula specified in Minnesota Rules, Part 7081.0120. This flow is calculated based on the number of bedrooms for each of the residences and the total number of wastewater generating parcels in the service area. Design flows shown include additions for infiltration and inflow into a collection system as well as allowed reductions in the estimation of daily flows due to the number of properties connected to a cluster treatment system. Flow determinations for each service area can be found in the appendix.

Design flow impacts permitting of any wastewater alternative. Greater flows result in higher levels of treatment for permitting resulting in higher costs to the Subsurface Sewage Treatment

System (SSTS) design, construction, operation and maintenance of the system as greater restrictions on treatment of effluent is required.

State rules require some cluster SSTS to employ additional “pre-treatment” methods prior to effluent dispersal. Cluster systems under 5,000 gallons per day are the least restrictive using Minnesota Rules Chapter 7081. Cluster systems between 5,000 and 10,000 gpd are considered to be a Midsize Subsurface Treatment System (MSTS) and is more restrictive using Minnesota Rules Chapter 7080-7083. Flows over 10,000 gpd are the most restrictive with permitting through the Minnesota Pollution Control Agency State Disposal System (SDS) Permit.

The combination of all four service areas equates to a total design flow of 18,145 gpd, all within a radius of a half mile. If the system was to be owned by the City of Ham Lake, a MPCA SDS Permit would be required along with the most restrictive requirements as stated above. Reducing the number of connections to each treatment site would reduce the design flow and the need for the state permit as well as reducing the sizes of the treatment systems. If each service area was limited by half the connections as stated above, the City would not be required to apply for a state permit, thus reducing costs and other associated items. In this scenario, construction costs per service area would be reduced and properties would be connected on a first come first serve basis.

Another scenario the City may want to explore is setting up separate subordinate sewer districts for each service area. Separating the ownership of the collection and treatment systems would eliminate the need for the SDS Permit and each service area would be able to accommodate all connections as shown on the Cluster Site Map in the appendix. This option may present challenges related to land ownership, easements, and fee collection as stated previously.

The 56 properties with holding tanks were considered for treatment with the clustering option.. The Cluster and MSTS sites above will accommodate 55 of the 56 properties with holding tanks. It was determined to be non-cost effective to extend the collection system 1300 feet to the remaining property and that property will need to remain on a holding tank or share a treatment system with an adjoining property.

The City Park located at 3500 Interlachen Dr. is listed as Cluster Site #1 and would serve the properties with a holding tank option located in Service Area #1 as shown on the Cluster Site Map in the Appendix. The park area has the potential for a mound MSTS. More detailed assessments would need to be completed prior to placing a system in this location due to the existing paved areas. Also an aquifer assessment would need to be conducted since the system is greater than 5,000 gallons per day.

The City Park located at 3556 Interlachen Dr. is listed as Cluster Site #2 and would serve the properties with a holding tank option located in Service Area #2 as shown on the Cluster Site Map in the Appendix. The play area would have to be removed and a Type III mound cluster system would be placed on the disturbed ground. More detailed assessments would need to be completed prior to placing a system in this location due to the existing playground area.

The wooded vacant lot located on the north side of Woodland Dr. is listed as Cluster Site #3 and would serve the properties with a holding tank option located in Service Area #3 as shown on the Cluster Site Map in the Appendix. This lot will accommodate a mound MSTS. The wooded vacant lot located on the south side of Woodland Dr. is listed as Cluster Site #4 and would service the properties located in Service Area #4. This lot will accommodate a Type I mound cluster system. These lots are privately owned and would have to be purchased by the City.

Combination of Individual and Cluster SSTS Advantages:

- Potential for low interest loans for collection and treatment system construction
- Elimination of holding tanks reduces O&M costs
- Dispersal of treated effluent away from surface waters
- Allows for more usable land on individual lots
- Parcel owners with conforming systems are allowed to stay on individual SSTS

Disadvantages

- Obtaining land for cluster systems in close proximity to area residents could be problematic
- More City involvement required for project development
- The facility would require a certified operator to operate, maintain, and submit records to the MPCA
- LSTS classification

Option 3 – Regionalization to East Bethel

This option incorporates a centralized approach by providing sewer collection and treatment service to all dwellings within the project area. Wastewater flows would be conveyed to the City of East Bethel where adequate treatment capacity exists.

The City of Ham Lake has indicated to us that the City is not interested in pursuing this option at this time due to high capital costs associated with wastewater conveyance and ongoing operation and maintenance costs associated with conveyance and treatment. This Option is therefore removed from further consideration.

Regionalization to East Bethel Advantages

- Potential for low interest loans for collection system construction
- Ability to Expand for future development
- Ongoing System Operation and Maintenance in place
- Dispersal of treated effluent away from surface waters
- Allows for more usable land on individual lots

Disadvantages

- Loss of control of wastewater system to East Bethel
- High Capital Cost for Conveyance System
- High Operation and Maintenance Costs
- City involvement required for project development

Option 4 – Centralized Treatment

There are a number of wastewater centralized treatment options available for consideration. For purposes of this report we have limited our evaluation of treatment alternatives to the three listed below:

1. Cluster Mounds
2. Re-circulating Gravel Filter
3. Pre-Manufactured Package Mechanical Facility

Cluster Mound Systems

The design of a soil-based system requires information about the type of soils to be treating the wastewater, including the rate which the soil can receive and percolate water. Based on soils evaluation in the area, the potential sites for treatment would be granular in nature and conducive for a subsurface discharge of wastewater effluent. Percolation testing and soil evaluation at the sites is needed in order to determine the appropriate size of the mound treatment system.

Potential sites for treatment are illustrated on the Cluster Site Map in the Appendix. Based on the information gathered in evaluating individual sites to the north of the possible treatment site areas, we estimate that the mound system will be able to treat a design flow of 34,849 gpd (35,000 gpd for design purposes). The design flow was determined based on the existing conditions. No adjustment has been made to allow for an increase in flow due to additions or remodeling of homes or cabins. The required area for the series of mounds is approximately 100,000 square feet (2.3 acres) and with the septic tanks and control building, the entire facility can fit within approximately five to six acres. Refer to the flow determination and design worksheets in the appendix for all design calculations and parameters.

The wastewater must be pretreated to remove large solids and scum prior to flowing through the mound systems. This is done in a series of settling tanks or high volume septic tanks. MPCA rules require four days of retention time in the septic tanks if the type of sewage collection system is a grinder pump low-pressure system, and three days if it is a conventional gravity system. This report will assume a grinder pump low-pressure system for the cost estimate.

Advantages of Cluster Mound Systems

- Properly installed systems result in no odors or noise
- The system is favorable for phasing in the event of the need for additional capacity
- Low operation and maintenance requirements - moderate number of pieces of operating equipment

Disadvantages

- Larger land area requirements relative to mechanical means
- LSTS classification

Re-circulating Gravel Filter

The Re-circulating Gravel Filter (RGF) media filter is a fixed film process in which the wastewater is distributed over the media. Bacteria present in the wastewater attach themselves to the surface area of the media and as more wastewater passes over the media, the bacterial extract nutrients, organic matter, and pathogens by utilizing the dissolved oxygen of the filtrate. Oxygen is readily available within the filter and promotes biological activity.

Potential sites for treatment are illustrated on the Cluster Site Map in the Appendix. The total required area for a media filter is approximately 10,217 square feet, but for operations purposes, and to allow at least one cell to rest at all times (rotating between cells), the total area required is approximately 65,340 square feet (1.5 acres).

The wastewater must be pretreated to remove large solids and scum prior to flowing through the gravel filter media. This is done in a series of settling tanks or high volume septic tanks. MPCA rules require four days of retention time in the septic tanks if the type of sewage collection system is a grinder pump low-pressure system, and three days if it is a conventional gravity system. This report will assume a grinder pump low-pressure system for the cost estimate.

Advantages of RGF's

- RGF's are favorable aesthetically with low odors and noise
- The system is favorable for phasing in the event of the need for additional capacity

Disadvantages

- The facility would require a certified operator to operate, maintain, and submit records to the MPCA
- LSTS classification

Package Plant

A package wastewater treatment facility consists of one or more pre-fabricated units that can be installed as a package, rather than constructing the units on site. There are several types of package wastewater treatment facilities available, from a complex treatment system like a Sequencing Batch Reactor, to a much simpler Fixed Activated Sludge Treatment (FAST) System. For the service study area considered, the simpler FAST system is a good mechanical plant alternative as the operator does not need as advanced licensing or training as with a complex system.

The FAST system works similarly to the Re-circulating Gravel Filter, with a few notable exceptions. Bacteria attach themselves to the surface of the plastic insert inside a large tank placed below ground (similar to a septic tank). Air is blown in at the same time to keep the process aerobic.

After some time, bacteria on the plastic media grow into a thick mass, and slough off of the plastic to the bottom of the tank as sludge. The tank must be pumped periodically to remove the sludge, just as the septic tanks at the front of the system do. Other operational activities include power for the pumps and blowers and periodic maintenance of that equipment as well as the control panel. The operation of the FAST facility is similar to the Re-circulating Gravel Filter facility but the footprint of the plant is smaller as the treatment takes place within a few tanks.

Discharge from this system can be either to a surface water or subsurface. If the design flow is over 10,000 gallons per day, and the discharge is subsurface, nitrogen removal will be required, increasing the number of units, the complexity, and the cost of the system. For this report the discharge will be assumed to be subsurface – same as for the Re-circulating Gravel Filter and Cluster Mound alternatives.

Advantages of Package Plants

- Fast units are favorable aesthetically with low odors and noise
- The facility is simple in operation, takes up a small footprint, and is effective in treating domestic wastewater

Disadvantages

- Higher operation and maintenance requirements with visits required daily due to the number of pieces of operating equipment
- The facility would require a certified operator to operate, maintain, and submit records to the MPCA
- LSTS Classification

Effluent Disposal (Dispersal) Options

Effluent limits for Surface Discharge and Subsurface Discharge of treated wastewater effluent are discussed in Section 5 – Regulatory Requirements and we have presented a number of wastewater treatment options in this Section 6 – Alternatives Considered. Only Option 4 – Centralized Collection and Treatment discuss options presented that involve the need for surface or subsurface dispersal of wastewater effluent.

The package plant system above would require a high level of operation and maintenance and requires the employment of a certified operator. In addition, The City would be required to meet stringent effluent requirements for discharge to surface water. For the purposes of this report, only the cluster mounds and re-circulating gravel filters will be considered further for centralized treatment alternatives as the most viable for this application.

7.0 COST COMPARISON OF ALTERNATIVES

Collection System

The following table is a summarized capital costs for two of the collection system methods discussed in Section 6. Estimated Costs include construction, contingencies, land cost, engineering, legal and administrative costs associated with each of the methods considered. The determination of costs is provided in the appendices.

TABLE 6: Collection System Present Worth Cost

Alternative	Total Capital Cost	Annual O&M Cost	Present Worth Cost
Method 1 – Grinder Pump with Small Dia. Forcemain	$2,564,197	$26,900	$2,571,544
Method 2 – STEP with Small Dia. Forcemain	$2,812,389	$37,200	$2,573,756

Determination of Capital Cost

The following table is a summarized capital costs for each of the alternatives discussed in Section 6. Estimated Costs include construction, contingencies, land cost, engineering, legal and administrative costs associated with each of the alternatives considered. The determination of costs is provided in the appendices.

TABLE 7: Capital Costs

Alternative	Collection System Cost	Treatment Facilities Cost	Total Capital Cost
Individual Treatment System (SSTS)	$0	$1,077,250	$1,077,250
Combination of SSTS and Cluster Systems	$997,980	$2,418,759	$3,416,739
Centralized Treatment with Cluster Mounds	$2,564,197	$2,013,620	$4,577,817
Centralized Treatment with Re-circulating Gravel Filter	$2,564,197	$1,660,716	$4,224,913

The most cost effective alternative based on total capital cost is the Individual Treatment System (SSTS) option at $1,077,250. The major factor contributing to the low cost of this alternative is the fact that there is no collection system cost. The other three options have a considerable cost jump due to the cost of the collection system needed.

Determination of Present Worth Cost

Present worth is a method of annualizing capital and operating costs to put different types of projects on the same cost basis. If one alternative is of higher capital cost than a second alternative, but it annual operating costs are lower, the determination of the present worth cost allows for an objective comparison of the alternatives and may show that the first alternative is actually more cost effective. We have assumed an interest rate of 5 percent and a 20-year payback period in determining the present worth of each alternative in the following tables.

TABLE 8: Present Worth Costs

Alternative	Total Capital Cost	Annual O&M Cost	Present Worth Cost
Individual Treatment System (SSTS)	$1,077,250	$241,500	$3,952,838
Combination of SSTS and Cluster Systems	$3,416,739	$98,443	$4,048,620
Centralized Treatment with Cluster Mounds	$4,577,817	$145,693	$5,403,879
Centralized Treatment with Re-circulating Gravel Filter	$4,224,913	$107,128	$5,112,475

The continued use of Individual Treatment Systems is more cost effective than centralized treatment. The operation and maintenance cost for the second alternative is lower that the first as individual holding tanks would be eliminated thus reducing the annual pumping cost considerably.

The O&M projections for the Combination of SSTS and Cluster System alternative equates to $98,443 per year or about $53 per month per connection (154 connections). The average O&M cost per resident for the Individual Treatment System (SSTS) alternative is higher by a multitude of 2.5.

A breakdown of present worth costs per connection is shown below:

TABLE 9: Present Worth Cost/Connection

Alternative	Present Worth Cost	No. of Connections	Present Worth Cost per Connection
Individual Treatment System (SSTS)	$3,952,838	130*	$30,407
Combination of SSTS and Cluster Systems	$4,048,620	130*	$31,143
Centralized Treatment with Cluster Mounds	$5,403,879	154	$35,090
Centralized Treatment with Re-circulating Gravel Filter	$5,112,475	154	$33,198

* The 24 compliant systems are not included within this number.

The Individual Treatment System Alternative has the lowest present worth cost of $30,407 per connection.

8.0 CONCLUSION AND RECOMMENDATIONS

The City of Ham Lake and the Hiawatha Beach / Comfort Resort Area poses some interesting challenges as it moves forward through the various implementation steps to solving its wastewater issues. This report provides an evaluation of upgrading or replacing non-compliant and failed septic systems. A summary of our conclusions and recommendations follows:

- A total of 119 out of 143 (83 percent) of the evaluated SSTS sites are in non-compliance.
- One system (<1%) is an Imminent Threat to Public Health and Safety due to a surface discharge.
- A total of 30 out of 119 (25 percent) of the existing or potential building sites can install a Type I trench or mound system.
- A total of 15 out of 119 (13 percent) of the existing or potential building sites can install a Type III mound system.
- A total of 21 out of 119 (18 percent) of the existing sites can upgrade the existing system with advanced treatment options to put the system into compliance
- At total of 53 out of 119 (44 percent) of the SSTS upgrades would require a holding tank as the only feasible option.
- The continued use of Subsurface Treatment System (SSTS) alternatives is more cost effective than Centralized Treatment Alternatives.
- Cluster sites can be constructed to remove residents from holding tanks for four service areas which are based on geography and current SSTS compliance status.
- A low pressure sewer system is recommended for wastewater collection.
- A preliminary engineering report (PER) is only needed if the City chooses to pursue a centralized treatment alternative.
- Use findings in this report to update cost information on the MPCA Project Priority List.
- The Individual Treatment System Alternative provides the best long term value in terms of present worth cost per connection.
- Two alternative Cluster/MSTS sites will need to be found if the use of City Park Property is prohibited.