Village of Lake Isabella

Wastewater Management Concepts

(A Peer Review)

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Prepared by

Stephens Consulting Services, P.C.
ENGINEERING • PLANNING
1549 Haslett Road, P.O. Box 708, Haslett, Michigan 48840
Phone (517) 339-8692 Fax (517) 339-6330

And

SCS Systems, L.L.C.
ONSITE WASTEWATER SYSTEM PRODUCTS & SERVICES
1549 Haslett Road, P.O. Box 708, Haslett, Michigan 48840
Phone (517) 339-8692 Fax (517) 339-6330

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Introduction

In early 2009, the Village of Lake Isabella retained Rowe Professional Services Company (Rowe) to study the feasibility of the construction of a public sewer system using “cluster” collection and treatment systems to serve portions of the Village --- primarily those existing properties in Lake Isabella North and South and development east of the those subdivisions and the lake. At the same time, the Village decided to eventually retain the services of a third-party consultant to provide a peer review of Rowe’s study and report.

Following a selection process, the combined companies of Stephens Consulting Services, P.C. and SCS Systems, LLC were retained to provide the peer review. This report has been prepared to summarize the results of that review.

It should also be noted that some additional assignments were added to the final RFP issued by the Village. These additional tasks beyond the scope of comments on the Rowe study are included in this report.

General Structure of this Report and Evaluation

As requested by the Village, this report will generally consist of three primary sections as follows:

1. A review and comment on the report prepared in 2009 by Rowe Professional Services Company for the Village entitled “On-Site Septage Collection and Treatment Feasibility Study”.
2. A comparison of the results of this study with the suggested option of serving the southern and eastern portions of the Village with a traditional gravity sewer system.
3. A discussion of alternative technologies, management concepts and potential funding mechanisms.

REVIEW AND EVALUATION OF ROWE’S STUDY

Definition of Terms

First, it is important to define some of the terms we will use in this report and commentary, since they will differ a bit from the terms used by Rowe in their report. In general, the following are some specific terms listed below along with their industry-recognized definitions:

> **Septage –** Liquid and/or solid material removed from a septic tank or other pretreatment device, cesspool, portable toilet, marine sanitation device, or similar domestic wastewater treatment works that receives only domestic wastewater. (Rowe appears to use this term interchangeably with “gray water” and occasionally with “septic tank effluent” throughout

the report; but they are not the same. Septage is the term normally used for the solids removed from a septic tank by a septic tank pumping and cleaning company when providing that service for a homeowner or business on a periodic, but infrequent, basis.)

Septic Tank Effluent – Partially treated sewage that is discharged from a septic tank. (Rowe calls this "septage")

Septic Tank Effluent Pump (STEP) – Collection system that uses septic tanks and pumping systems.

Domestic Wastewater – Type of wastewater normally discharged from or similar to that discharged from plumbing fixtures, appliances, and devices including, but not limited to toilets, urinals, bath, laundry, dishwashing, garbage disposal and household cleaning wastes.

Greywater – Water captured from sinks, showers, baths, spa baths, clothes washing machines, laundry tubs, and dishwashers. It does not include water from toilets or urinals, which is referred to as blackwater. (Rowe uses this term interchangeably with "septic tank effluent" and "septage" throughout their report; but they are not the same.)

Blackwater – Portion of the wastewater stream that originates from toilets and urinals. Some states also include the kitchen sink waste as blackwater.

Drainfield – Final treatment and dispersal component that is designed to include soil-based treatment of effluent. "Soil absorption system" is sometimes used as a similar name for the soil treatment component.

Comments on Introduction:

Near the bottom of Page 1 of the Rowe study, discussion of a 1999 study by Rowe discusses a "phasing strategy". In that discussion, the possibility is suggested that one approach would be to construct a STEP system as an interim measure to serve vacant properties in the Village in a cluster(s) fashion, with later replacement with traditional gravity sewers as the density of development increases. Mention is made of the discharge of collected septic tank effluent to cluster drainfields ("community septic fields"). This is mentioned in a more lengthy narrative on the history of engineering studies that have been conducted for the Lake Isabella area in the past.

While the current Rowe report does not discuss this option in any detail, it is worthy of some brief discussion in light of our charge to compare the cluster system options discussed by Rowe in their current study with a traditional gravity system for the area east of the lake.

One of the major benefits of a pressure sewer collection system is that the lines are smaller in diameter and can be installed with trenchless technologies. A gravity sewer system must be constructed with open trenches by its very nature, and must be constructed with larger pipes (with the exceptions of required transmission mains following lift stations) laid to grade at minimum slopes that are different for different pipe sizes. In a pressure collection system it is rare to have pipe sizes larger than 4" to 6" in diameter; while in a gravity collection system the minimum pipe size for the collection lines is normally 8" in diameter. Gravity lines must slope at minimum grades to the treatment works, or to collection points in the system where a pumping station lifts the wastewater back up to a higher elevation; while pressure collection lines can follow the natural grade up and down over hills.

Considering these basic differences in concepts, I believe you can understand how these two options are not very compatible. In fact, they are polar opposite in design principle. Therefore, implementing a master plan that calls for the installation of the pressure sewer design concept, with the later replacement by a traditional gravity sewer system would be difficult, at best. It would be very difficult to develop a master plan up-front that would lend itself to such an approach without a significant amount of extra cost and community disruption along the way. Such a concept just does not make sense. And, considering the difficulties in doing so, we see no advantage in the Village actively pursuing such a hybrid option.

It is, however, a valid decision to compare the two options of pressure sewer versus a gravity sewer system at the onset. Certainly, both options are proven concepts and worthy of consideration. Both will be discussed later in this report. There remains the possibility that different portions of the Village could be served by different design concepts --- both in collection and in treatment --- but it would be difficult to identify the advantages of beginning with one concept and changing to the other at some later date.

As part of a much larger regional sewer study for the Isabella County Board of Public Works, Wilcox Professional Services, LLC, completed a study in 2004 that evaluated the costs for public sewer service to the Village of Lake Isabella as well as the neighboring communities of Beal City, Weidman and the Coldwater Lake area. While other methods were mentioned, traditional gravity sewers, with pumping stations where necessary, was the only collection method given serious consideration. Furthermore, only traditional centralized treatment concepts were evaluated. The collection system considered in the Wilcox study was to serve all of the homes in the entire Village; so the results of that study need to be adapted a bit when considering the limited service area now under consideration.

General Comments on the Rowe Study

A meeting was held at the Mt. Pleasant office of Rowe Professional Services on November 6th, 2009. In attendance were John Tanner, P.E. and Steven Clark of Rowe, Tim Wolff of Lake Isabella, and Larry Stephens, P.E. of Stephens Consulting Services. Prior to the meeting a list of appropriate questions were prepared to serve as an agenda for the discussion. The list of questions, with answers shown in red, is included as **Appendix "A"** in the back of this report. These questions and the answers provided provide an insight into the background behind this current Rowe Study and report.

Over all, the concept of using a STEP (Septic Tank Effluent Pump) collection system with low-pressure, small-diameter collection lines is a good concept. It is a method we have found flexible and very cost effective on numerous other projects. The proposed use of 1,500 gallon tanks at each site, equipped with Orenco Systems pump vaults and controls, has been a design that we have found to be of excellent quality and easily maintainable. It is not necessarily the lowest priced product for the purpose, but does offer good value and top quality, in our opinion.

Solids need to be removed from the wastewater somewhere, and STEP system designs provide for the removal of larger solids on each lot, rather than creating those facilities at the treatment site. In this way the solids do not need to be handled in the collection system, and the system capacity for handling solids increases as homes come on line --- avoiding the need to pre-construct solids treatment facilities at the treatment site. Furthermore, the simplicity of a septic tank provides the most cost-effective means to digest and reduce the volume of a substantial portion of the solids in wastewater.

While the concepts are valid, some of the details of what is used as the basis for the cost estimates for collection and treatment components are lacking from the Rowe report. During our meeting on November 6th, Rowe verbally furnished some of the details to fill the gaps. Here are some of the details as furnished by Rowe:

1. The STEP collection estimates included in the Rowe study are based upon:

    - The installation of one 1,500 gallon septic tank on each lot with an Orenco Systems pump vault and high-head pump and controls.
    - Unit pricing for pipe and appurtances was based upon figures given by local contractors, and treatment costs were based upon conversations with Orenco Systems.
    - A STEP tank and pump package was included for both vacant and occupied parcels to provide a total-cost comparison with other collection methods, even though the cost of the STEP installation would not be encountered for vacant parcels until the home is built.

2. Treatment system cost estimates in the Rowe study are based upon:

    - Cluster system effluent treatment by means of recirculating geotextile backed-bed filters (Advantex®) prior to discharge of the treated effluent to community drainfields.
    - Community drainfield sizing was based upon published MDEQ criteria.
    - Cost estimates for community drainfields was based upon the installation of just the primary field initially, even though the study seems to indicate the installation of both the primary and "reserve" fields would need to be constructed up front.
    - Cost estimates for all systems have included both phosphorus and nitrogen reduction facilities, regardless of size.

Comments of a General Nature on Cost Estimates

It is important to realize that engineers' cost estimates at this stage (pre-design) of a project are very subjective in nature. Because of that, the tendency is to be very conservative in picking numbers before any design has been prepared and before any actual bids can be solicited. This project will involve the installation of several miles of pipe and associated structures, so the "price per foot" used to prepare estimates is critical.

Unit Prices Used

Having said that, actual bids for two recent projects we have designed and helped communities bid indicate per-foot costs for pressure collection sewer pipe as follows:

	Narrow Lake – Bid in 2006 [1]	Leach & Middle Lakes – Bid in 2009 [2]
2" Pipe	$11.94 / ft.	$8.83 / ft.
3" Pipe	$13.20 / ft.	$10.55 / ft.
4" Pipe	$15.91 / ft.	$12.39 / ft.
6" Pipe	$18.38 / ft.	N/A
8" Pipe	N/A	N/A
STEP Tank & Pump Installation	$8,812 each [3]	$10,978 each [3]

Notes:

[1] Narrow Lake unit prices shown here are the average of the installed prices received from 2 bidders.

[2] Leach & Middle Lake unit prices shown here are the average of the prices received from 6 bidders.

[3] It needs to be noted that these prices were for the installation of the STEP tank, pumps and controls on existing developed properties. They include abandonment of the existing onsite facilities and restoration of the site disturbance, as well as working in sometimes tight quarters.

You will recognize that these actual bid prices in some cases are substantially less than the prices used by Rowe to estimate project costs. These differences will make a significant difference in total project costs, especially when you consider the miles of the various pipe sizes needed.

In the case of the on-lot tanks, pumps and controls necessary to connect a home to the collection system, the Rowe numbers seem to be lower than those we have experienced recently. However, it is not clear what is included in the Rowe estimates. The prices shown above do include all of the new facilities needed to connect a home to the collection system in the street as well as the costs associated with the proper abandonment of the existing on-lot system. With the projects mentioned above, the homeowner normally has very little, if any, additional private expenditures.

Of course, the installation of the on-lot components to connect existing homes would intuitively be more expensive than the connection of a new home being built. Working around existing facilities is always more expensive. So, the installation of the STEP components for a new home during construction should be less.

Allow me to remind you that the numbers shown above are not the lowest bidder's prices. They are the average unit prices of both bidders in the Narrow Lake case, and of the 6 lowest bidders in the Leach & Middle Lakes project.

Pipe Sizes

Based upon our experience with pressure collection systems, it appears that the sizes of the pipes needed for this collection system are oversized. When one designs a pressure collection system, it is as important to ***not oversize*** piping as it is to ***not undersize*** it. Statistically, studies have determined how many STEP pumps will operate at any one time during an average day. EPA has published tables for such data based upon detailed system studies. Oversizing of collection pipes not only costs more, but creates longer periods of time throughout the day when the velocities in the collection lines are very low. Low velocities without the periods of higher use generating higher velocities to scour the pipes can result in an increased need for pipe cleaning and maintenance.
Of course, the hydraulic modeling of the system design has not yet been done (it would normally be part of final system design), so one should not be too critical of the pipe sizes chosen for the preliminary cost estimates. But, for the service area studied, we would not expect to use any pipe larger than 6" in diameter. Rowe has included 6,600 feet of 8" in their cost estimates for the largest service area.

Comments on Collection and Treatment System – Lake Isabella North

The scope of the overall solution for this portion of the Village discussed by Rowe is very confusing, and does not seem to directly address the problem. Reportedly, Lake Isabella North contains a total of 335 lots. Only 128 of these are now developed, leaving 136 vacant and an additional 71 vacant lots that are owned by the Village. Deed restrictions for this plat limit the number of buildable lots to 134 with onsite septic systems. This leaves a potential of only 6 more lots that can be developed without some form of public sewer system. Of course, there may be a discrepancy between what Rowe calls "developed lots" and the actual number of homes in Lake Isabella North. That is unclear; but the deed restrictions do state that***: ". . . a maximum number of 134 lots may place in-site sewage disposal systems."*** Taken literally, this means that only 6 of the remaining 207 undeveloped lots can be built upon with on-lot systems!

In this most current study by Rowe, the cluster system concept considered service to only 28 of those lots, presumably based upon a conclusion that 28 is the number of unsuitable lots based upon a review of the soil conditions in this plat. **This would leave 173 lots in this plat without any**

solution. It is unclear why Rowe chose 28 as the number of lots for service by the local cluster system.

In planning the type of projects discussed in Rowe's report, particularly from a funding standpoint, one should keep in mind how the project costs are encountered. Projects like this cluster system for Lake Isabella North require three categories of costs:

- The cost of installing the collection pipes and appurtances in the street (collection system costs).
- The cost to build the treatment works at the common treatment site (treatment costs).
- The costs of the STEP equipment that needs to be installed at each home to connect that home into the system (connection costs).

Now consider the timing of these needs:

- The installation of the collection system pipes will need to be done as a part of the initial project investment. Certainly, in the case of the Village of Lake Isabella, these pipes could be installed in phases, but a lot is not served by the system until there is a pipe in the street to serve that lot.
- At the end of that collection pipe, there will need to be treatment works that provide the capacity to treat the number of homes that are on-line. I used this terminology to illustrate the point that many treatment works can be constructed in phases, as needed, rather than fronting the capital costs for capacity that may go unused for long periods of time. Also, many biological treatment processes do not perform as well during those early periods in their life when they are under-loaded. But, this being said, an initial investment in treatment works will be required at the onset of the project.
- However, there will be no need to encounter the costs necessary to connect a home to the system until that home is built and/or ready for connection. In the example of Lake Isabella North, the system is to serve vacant lots, many of which will not be connected for several years. In a 10-year period (1998 to 2007) it is reported by the Village that a total of only 43 homes were built in this subdivision. While this building rate may have been influenced by both the deed restrictions and the economy, it can nevertheless be safely assumed that not all owners of vacant properties would be ready to build instantly upon removal of these barriers. It will take some time for development to occur --- likely decades --- even after a public sewer solution is provided. So, it just makes more sense to defer the costs for actually connecting a new home to the system until the time of the home construction. Of course, any existing homes that initially come on line would encounter that cost immediately.

So, the cost for the construction and implementation of a community wastewater collection and treatment system to serve predominately vacant lots would initially comprise only the installation of the collection pipes and appurtances, and the portion of the treatment works construction that will be needed to serve those homes that are expected to come on line in the near future. The decision as to how much capacity should be built in the first phase should be part of the initial planning and design process. Some components lend themselves more to economy-of-scale considerations than do others. With a pressure collection system like the cluster system studied by Rowe, the cost of on-lot improvements (which also comprise a portion of the primary treatment works in the form of the on-lot septic tank) can and should be postponed until the homes are constructed.

Further comments with regard to this concept and cost of pressure collection and treatment works, cluster systems and other options will be discussed in more detail later in this report. Many of these comments would also apply to the system considered for Lake Isabella North, even though not specifically mentioned here.

With regard to the use of cluster system(s) in Lake Isabella North, more than one system could be considered as it is determined in more detail where the needs are. The fact that the Village owns 71 lots in this subdivision alone presents the potential for multiple cluster systems where they are determined to be appropriate. With the right planning, systems could actually be constructed to serve as little as two homes, or as many as the entire undeveloped portions of this subdivision. For the most part, the choices to be made should be determined by initial and long-term cost issues, after consideration of the environmental and regulatory issues. The long-term goal needs to address the sustainability of the total solution.

Considering the points discussed above, **Appendix "B"** represents what we believe would be the initial cost of a cluster system to serve 28 lots in Lake Isabella North with treatment and dispersal to be placed on 2 or more of the lots that the Village now owns. This estimate has been prepared to provide you with a perspective of the costs from our experience that can be compared directly with that shown in the Rowe report. **This is not to suggest that we feel a cluster system to serve 28 lots is the best approach (please note previous comments on this subject).** Other alternatives will be discussed later in this report.

Comments on Collection and Treatment System – Lake Isabella South, Lake Isabella Golf Estates I, Lake Isabella Golf Estates II, other Unplatted Areas

For simplicity of reference, we shall hereafter refer to this area as the **"Eastern District"** in this report. When referring to this service area as including or not including Lake Isabella Golf Estates I, we shall so state. Otherwise, the term of Eastern District will be used as a generic term for the area south and east of the lake that includes all of these areas.

In discussing potential ways to serve both the residential and commercial portions of the Eastern District, we have been asked to:

- Provide a technical review of Rowe's report with regard user costs and the feasibility of a large scale system to serve the Eastern District.
- Review and offer an opinion on the feasibility and cost for the construction of a large scale collection and treatment system to serve this area (as studied by Rowe) in comparison to a collection system comprised of traditional gravity sewers with necessary lift stations.
- Suggest the optimal means to utilize the Village's "Lagoon Property" for treatment and dispersal of the wastewater.
- Make suggestions of alternative technologies or options that may help reduce costs.

We will first address some comments to the study prepared by Rowe. Comments of a general nature listed above with regard to Lake Isabella North and in general regarding the pressure collection methods and sizing, the use of STEP systems and the construction of treatment works in phases, are all appropriate for this discussion of service to the Eastern District, but will not be repeated here. However, a general discussion of the comparison of pressure sewers versus traditional gravity sewers is appropriate, as well as some comparison of the costs of each.

Basis of Design Used for Sizing of Facilities

The calculation by Rowe of the expected system flow used for the sizing of proposed facilities will result in oversizing of collection and treatment works. The number shown in the Rowe report of 350 gallons per home per day of flow is likely over twice the actual flow experienced at other similar facilities that use pressure collection systems. This is even more evident in communities of second homes. While some argument can be made that regulators will require higher flows per written regulations, a community can usually gain permission to use numbers closer to actual experience. And, as flows are monitored during the early years of operation of systems within the community, the basis of design can be more responsive to actual conditions. Our realistic estimate for the design flow for 646 homes in the Eastern District at Lake Isabella (using a watertight pressure collection system) is around 100,000 gallons per day (GPD). Rowe used 350 GPD per home, resulting in an estimated design flow of 226,000 GPD.

Soil Application Rates with Packed-Bed Filter Effluent

The soil application rate to size proposed drainfields in the Rowe study was 0.5 GPD per square foot. This is a number given to Rowe by MDNRE, or it is number that appears in a document published by MDNRE called the MICHIGAN CRITERIA FOR SUBSURFACE SEWAGE DISPOSAL. This document is referred to in the Part 22 rules (groundwater discharge rules) as a guidance document for the construction of larger septic systems. This document dates back to the 1970's with only minor updates since. MDNRE admits it is out-of-date, and in fact they have begun the process to update/rewrite it. It basically discusses soil application rates for ***septic tank effluent,*** but does not address allowable soil application rates when the septic tank effluent is further treated to higher quality.

This is a significant point when considering the sizing of soil application systems for Lake Isabella. We have found that application rates of 1.0 to 2.5 GPD per square foot can be used for drainfields following packed-bed filters, when applying this treated effluent to permeable soils like those found at Lake Isabella. An even higher application rate of 3.0 GPD per square foot could be used if application is done by means of a flooded open sand bed.

The significance of this is that the estimate sizing of the soil application area used for the cost estimates may be over-estimated by 2 to 5 times the area needed.

COMPARISON OF GRAVITY SEWER
VERSUS A PRESSURE SEWER FOR THE EASTERN DISTRICT

Gravity versus Pressure Sewer

Gravity sewer collection systems are based upon the principal of water flowing downhill. As long as the ground surface slopes in the same direction as the sewer needs to slope to transmit the wastewater in the direction desired, the sewer can be at normal depths --- generally just deep enough to serve the building sewer coming from homes and businesses. But, when the ground surface and sewer do not slope in the same direction, or to the same necessary slope, either the sewer must be installed deeper, or a pumping station must be installed to lift the sewage to higher elevations. Different size gravity sewer pipes require different minimum slopes, with the larger pipes requiring less slope than the smaller. The minimum size public sewer (other than building leads) is usually considered to be 8" in diameter. Pipes need to be installed with uniform fall in straight lines, with access manholes installed at all intersections and changes in grade or direction, and about every 350 to 400 feet for inspection and cleaning purposes.

For the purpose of comparison, we will assume that each type of collection system will serve the entire Eastern District (including Golf Estates I), and will deliver the collected wastewater to the "Lagoon Property" for treatment. In that way, one can compare the costs of each collection method fairly. **Appendix "C"** is an estimate of the cost for a gravity collection system to serve this area. For simplicity sake, we have used the same unit prices used by Wilcox in their 2004 study, adding in the cost of restoration and the installation of the wyes and leads to property lines that would normally be a part of the gravity sewer installation. We do, however, feel like their costs for pipe installation are a bit low.

A low-pressure collection system can be installed using relatively small diameter piping, installed with directional boring methods. The pipe is normally placed just below frost depths --- 5 to 6 feet deep. Surface disturbance is kept to a minimum. Open excavations need only be made where homes are being connected. These "taps" for vacant lots need not be made until the home is under construction. A minimum number of manhole access points need to be installed to accommodate air release fixtures at high points and periodic cleanout access points. **Appendix "D"** is an estimate of the cost for a low-pressure collection system to serve the same area as the gravity system described above would serve. Also shown on Appendix D is the expected cost to serve all of the lots in Lake Isabella North.

Of course, there are differences in the cost for a home to connect to each of these types of collection systems. Here is a description of the connection components for each:

Gravity System - A stub for a lead will be installed at each lot, developed or not, for the connection of that home to the system when it is ready. The stub is normally constructed to the front lot line (road R.O.W.), and marked in some way for future location. When the homeowner is ready to connect, they would be responsible to locate the lead and connect the building sewer to that connection point. If they have an existing onsite system, they would be required to properly abandon that system. The responsibility for the cost of the actual connection is normally determined by the community. The building sewer can normally be connected entirely by gravity if the sewer is installed deep enough in the street to serve the home's plumbing. If not, a small lift pump may be needed to serve plumbing on the lower floor.

Pressure Sewer – If the system is a pressure collection system, homes will require the installation of a STEP tank and pump to connect to the system. There are some additional costs in such connections, but some advantages also. The cost in this type of system will primarily be for the installation of the septic tank, pump and controls. The lead to the street will normally be a small diameter pipe that can be bored or installed with open trench. It would normally be shallower than a gravity lead, so less expensive to install. The pressure main can be live-tapped exactly where and when needed.

We are including in the very back of this report a couple of manufacturer's brochures on the STEP collection concept. These pamphlets will provide some diagrams and pictures of the STEP concept and the components that are used. You will recognize that these were produced by Orenco Systems, Inc., the company that makes many of the products that were used as a basis for both our cost estimates and Rowe's. Hopefully, this literature will be helpful as a reference when you read this report.

In general, a STEP pressure sewer connection is more flexible than a gravity lead in that all of the wastewater is pumped. As such, the distance from the home to the main is not a concern. There is also an advantage of being able to install the tank in the best location in the yard to serve all of the building plumbing.

Other Advantages/Disadvantages/Issues ---

With gravity sewers all of the manhole structures, lift stations and appurtances will need to be constructed with the initial construction for the system to function. The system delivers all of the wastewater, including all of the solids, to the treatment site for treatment. The surface disruption for the installation of gravity sewers is normally significant, requiring significant repair and restoration.

A significant drawback of gravity sewer installations is the infiltration and inflow (I & I) that is unavoidable, even with good construction practices. Better installations reduce I & I to a minimum, but it is impossible to avoid all pipe and manhole leaks. Such breaches in the integrity of the collection system can themselves result in groundwater contamination and/or excess flow to downstream treatment works. This excess water at the treatment end will add to the cost of treatment works in the sizing of components, and in long-term operation and maintenance costs. Pressure sewers require less structures and, by their very nature, do not leak. If a leak develops, it normally becomes visible at the surface and can be promptly recognized and repaired. With a water-tight system, it is only necessary to treat what wastewater is actually generated by users.

Also, many do not recognize the fact that STEP systems have a built-in flow modulating component. Each on-lot tank has some built-in storage as a normal part of the daily pump cycles.

Each individual tank may store from 50 to 100 gallons of flow between pump cycles. This storage means that each STEP pump normally activates only once or twice each day, on the average. The random water use patterns of households, as well as this internal storage, create a dampening effect on peak flow conditions.

But, one of the most significant advantages of a STEP collection system over gravity is the removal of solids in the system. And, in the specific case of Lake Isabella, this capacity of solids removal will grow with each new home constructed. Anaerobic solids digestion in the simple septic tank at each home will reduce the volume of solids to be "handled" without the requirement of outside energy. This is the most efficient method of treatment for the majority of the settleable solids in the wastewater. Furthermore, the removal of the solids in each STEP tank eliminates the necessity for the collection system and the treatment system to handle these solids. Any tendency for clogging of the collection system pipes is removed by the settling time and effluent screening that is incorporated in the STEP tank at each lot.

Having said this, it is also important to match the type of collection system with the type of treatment to be used at the treatment site. Some forms of treatment (sand filters and geotextile filters, for example) will require the removal of solids prior to the secondary treatment components; while other treatment means (lagoons, activated sludge processes, etc.) may not need the primary settling component.

Treatment System for use with Gravity System

There are dozens of treatment technologies that have been successfully used for communities such as Lake Isabella, and they all have their advantages and disadvantages, and all have their associated costs. It is beyond the scope of this report to analyze or even discuss all of them. So, we will discuss here what we would suggest as the most practical, based upon our knowledge and experience.

As stated above, if the choice of the community is to use traditional gravity sewers as a collection means, then the downstream treatment works will need to be appropriately compatible. It has been found in numerous small rural communities in Michigan that the most affordable treatment means are lagoon treatment systems --- either facultative lagoons or aerated lagoons. Providing further support for this conclusion is the fact that the Village already has partially constructed lagoons on property owned by the Village. Most lagoons in Michigan are constructed of a size to store the wastewater for a minimum of 6 months, and then discharge it seasonally to a body of surface water. This normally reduces the treated effluent standard because the discharge will not occur during the recreation season or during periods of ice cover on the surface waters. Discharge would normally occur in the spring and/or fall. The water course available at Lake Isabella is the Chippewa River. Apparently no determination has been made at this time as to the performance limits that might be imposed for a discharge to the river. And, we are assuming that the Village would have, or could get, right-of-way access to the river for placement of a discharge outfall.

A proposed treated wastewater effluent discharge to the surface waters of the state will require an NPDES permit from the Michigan Department of Natural Resources and Environment (MDNRE) --- the new combined DNR and DEQ. Such a permit will set the end-of-pipe performance standards for the treatment works. Measuring and monitoring of all discharges will be required during discharge events.

As an alternative, the wastewater could be treated in the lagoons and irrigated on the land during the growing season. This concept will require a groundwater discharge permit from the MDNRE under what is commonly referred to as the Part 22 Rules. There are basically two approaches to land application systems as follows:

1. High-rate application in some form as a means of recharging the groundwater. This method is normally done in the form of open seepage beds or trenches that are intermittently flooded. This type of dispersal of the treated water is normally done at such rates that make maximum use of the hydraulic conductivity of the soil. Further treatment of the wastewater in the soil is minimal due to the high rate of water movement, and further removal of contaminants is minimal. For permits utilizing high-rate infiltration, groundwater quality monitoring will most certainly be required for discharges that will be as large as Lake Isabella will be eventually. The permit for the facility will set standards for the groundwater quality beneath or adjacent to the application area, and several monitoring wells with quarterly groundwater sampling will likely be required. As Rowe has stated in their most recent report, there may be a concern with groundwater migrating from the application site toward the river (in the case of the lagoon property). This concern may be real or imagined, but it probably will affect the monitoring requirements of the permit. The issue will be potential degradation of the quality of the groundwater in any usable potable water aquifer "downstream" of the application site, and/or the quality of any groundwater that may "vent" into the river at some point.

2. The other soil application method for treated effluent is slow-rate irrigation methods that apply the water in the shallow root zone of surface vegetation. This may be done by drip or spray irrigation. The principle of slow-rate application is utilization of the water and remaining nutrients by plants or crops on the surface. This is usually combined with some form of agriculture that involves harvesting plant growth so that nutrients are actually removed from the site on a regular basis. Biological activity in the topsoil and the lower application rates also enhance additional treatment of the effluent as the water is applied. Slow-rate application methods generally result is less concern over groundwater degradation; however it is still likely that some monitoring wells and groundwater sampling and monitoring will be required by regulatory agencies for this size of a project.

Detailed cost estimates for treatment works that would be compatible with a gravity sewer system are beyond the scope of this report. However, estimates for some treatment concepts have been included in previous engineering studies.

Treatment System for use with a STEP Collection System

Since a STEP collection system removes the larger solids at the home sites, the wastewater to be treated at the treatment site is not as strong. Primary settling facilities and sludge digestion equipment are not required. So, the first step in treatment is normally secondary treatment means and very different technologies are normally used. While lagoons can be used, aerated or facultative, it is more common in our experience to treat the wastewater to a high quality before the lagoons, using the ponds for seasonal storage or tertiary treatment only.

When STEP collection systems are used, some type of packed-bed filter has been the treatment concept of choice with many designers today. Packed-bed filters are somewhat passive, fixed film, treatment processes that contain various media types. They are sometimes referred to as "media filters". Various media have been successfully used in such systems, including sand and/or fine gravel, geotextile material, foam cubes, peat, crushed glass, etc. We have had extensive experience with the use of sand/gravel and geotextile filters in our designs in Michigan --- both in the single-pass and recirculating modes. The effluent from properly sized and operated packed-bed filters is normally clear and odorless.

A significant advantage of the use of packed-bed filters is that they can be installed in modules, lending themselves to the construction of a treatment system in phases as the treatment capacity is needed. With the primary solids settling and treatment capacity also growing as homes come on line through the installation of the STEP tanks on each lot, the "treatment" system ***grows with the community.*** From an efficiency perspective, this feature is significant. More on how this might work at Lake Isabella will be discussed later.

Appropriate Use of "Lagoon" Property

The property now owned by the Village for the location of wastewater treatment facilities could be used for most or all of the treatment options suggested above. The soils information currently available indicates that much of the 80 acres is permeable soil, indicating general suitability for a groundwater discharge. Of course, this would be verified by further studies and analysis; but it is more likely that there will be more of a concern over soil treatment capability than permeability. This may lead to a higher treatment standard with regard to nutrient removal in particular. This concern will grow as the system size increases in the future.

The site also seems to be strategically located with regard to the location of wells within the Village, and in proximity to the river should a surface water discharge be sought. The regional groundwater flow is likely toward the river and away from existing wells, at least in the shallow water-table aquifers.

The existing site is sufficient in size to support most feasible alternatives. The partially constructed lagoons could be finished to create a facultative or aerated lagoon system, or could serve as storage facilities for highly treated effluent. Other portions of the site appear suitable for some form of groundwater recharge facilities, pending a confirmation by a soils and groundwater study.

With regard to treatment methods employed today, they can be designed to be odor free. So, isolation from other uses from an odor standpoint does not have to be a concern.

ALTERNATIVE TECHNOLOGIES AND MANAGEMENT CONCEPTS, AND POTENTIAL FUNDING MECHANISMS

Nature of Problem

First of all, I do not believe that the problem has been well understood, or at least described well enough in previous studies --- including the most recent Rowe study. Furthermore, I would speculate that the original reasons for some of the deed restrictions attached to the plats in the Village have been lost over time. So, before we describe additional potential solutions, it may be appropriate to re-describe the problem.

Everyone involves understands that one of the major hurdles at Lake Isabella are the deed restrictions attached to several of the plats. But, the purpose for these restrictions may get lost among other issues. These plats were recorded during a time period when onsite septic systems were considered a “temporary solution” until a “real sewer system” could be built. This philosophy was heavily ***marketed*** by the regulatory community when new development was planned in large chunks, and especially when lot density would eventually be high. The concern was that large numbers of onsite septic systems presented a significant risk of groundwater contamination, and when combined with large numbers of onsite wells would eventually result in well contamination and a public health risk. Adding to that was the concern for the lack of management and oversight that existed at the time with regard to the proper maintenance of onsite systems. One central managed collection and treatment system was considered the ultimate goal!

Many things have changed in the last 20 to 30 years, and these have changed our perspective. We are now realizing that we will never be able to “sewer up” the rural areas of America. At the same time we are looking at our urban experiences and realizing that the concept of piping everything to central sewer systems is an unsustainable infrastructure concept. Bigger systems concentrate environmental degradation at points, and when bigger systems break down or need replacement, big problems with big price tags are the result. At the same time our available resources are stretched very thin as our existing infrastructure grows old.

While all of this has been happening, improvements have been made in decentralized treatment technology, including the development of methods to manage any number of dispersed systems remotely. This permits the construction of multiple onsite or cluster treatment systems that can be managed economically by telemetry and periodic inspections just as well as our central systems. So, decentralized (or dispersed) wastewater treatment has become a viable option as a **sustainable** wastewater treatment infrastructure option of the future.

There are a variety of soil types within the Village of Lake Isabella, but for the most part the soils are permeable. Some exceptions exist, but the recent soil study conducted by Rowe, Isabella County, and the MDNRE has verified that most of the soils are of the type that are usually considered either acceptable for onsite septic systems in their present form, or would be acceptable with some site modifications, or with the use of some form of additional treatment.

Numerous widely-accepted technologies have been developed and applied in the last couple of decades that will either:

- Permit the installation of onsite treatment systems that successfully utilize soil absorption methods on sites without ideal soil conditions; or
- Allow the proper treatment and dispersal of wastewater on sites with much less area available for the soil absorption system.

Such methods and technologies have changed the suitability of onsite systems as a long-term wastewater treatment alternative.

So, yes, I'm sure that there are those problem areas in the Village where the soil conditions do not lend themselves to even the latest treatment and dispersal techniques, but my opinion is that most of Lake Isabella is comprised of suitable soils for either the standard onsite systems or improved treatment methods. Neither the Isabella County Health Department nor the MDNRE have apparently found widespread evidence of existing septic problems in the Village at any higher frequency than that of the county as a whole.

And yes, the concern of groundwater contamination is a valid generic concern for unprotected aquifers; but again, neither of the agencies mentioned above have apparently found any serious levels of well contamination at Lake Isabella, even after 40 or 50 years of experience. Verbally the County Health Department has indicated that only low levels of nitrate (the major contaminant of concern) have ever been found in drinking water at Lake Isabella. And apparently these low levels were found in the most unprotected aquifers. It should be noted that deeper aquifers are available in most areas around Lake Isabella for the construction of new drinking water wells in the future. These deeper aquifers are protected from near-surface sources of contamination by substantial layers of clay overburden.

So, if solutions can address the original concerns that formed the basis for the deed restrictions, and if these solutions will result in a sustainable wastewater infrastructure for the Village of Lake Isabella, the problem can be solved. But, the solution must consist of a cost-effective way or ways to achieve these goals, or it may be another 40 or 50 years before the Village can have a solution in place.

Difficulties with Traditional Funding Concepts

Adding to the difficulties of construction of a sewer system in the Village of Lake Isabella are the restraints of existing funding mechanisms. Most public sewer infrastructure projects are funded in one of two ways:

1. The State of Michigan has a revolving fund (State Revolving Fund – SRF) that makes low interest loans available every year to both large and small communities to fund sewer and water projects on a priority basis. Funds are somewhat limited, so projects are ranked by priority of need on a list at the beginning of the state's fiscal year. These funds are allocated to the most deserving projects with the highest priority until all available funds are gone. Emphasis is placed on correcting existing environmental and public health problems.

2. The United States Department of Agriculture – Rural Development/Community Assistance Program makes both loans and grants available to primarily rural communities for solving water and sewer problems. The grants are available to only the lower income communities, and loans carry more of a market rate interest, unless a community qualifies as a lower income community. However, USDA-RD considers themselves the funding source of "last resort"; and emphasizes the correction of public health and environmental problems.

Both of these funding programs will resist the allocation of public funds to assist new development in an existing community, unless that new development happens to be a small portion of the total project and incidental to the main purpose. One of the more important needs in the Village is service to vacant lots. There also exists reluctance on the part of these agencies to allocate funds to communities of second homes. So, neither of these funding sources seem viable for Lake Isabella.

Traditionally, this leaves only one approach to funding the construction of a sewer system for the Village --- some sort of municipal bond issue with the bonds being paid off by special assessments or revenue from the system. The creation of a special assessment district of properties benefitting from the project would be necessary.

Incidentally, Rowe did discuss the above in their most recent report. We will discuss another non-traditional funding approach below. But, we must first describe the vision of what a "sewer system" for the Village of Lake Isabella might look like.

A New Concept of Wastewater Management

The construction of a traditional wastewater system to serve the residences and businesses in the Village of Lake Isabella faces many obstacles. The circumstances within the Village are very complicated, to say the least! But, I'm sure the Village already knows that. The very fact that several engineering companies over at least 3 decades have tried to find a cost-effective solution to this problem is evidence to this fact. So, if the Village is ever going to have a "public" wastewater infrastructure to serve its citizens in the near future, a non-traditional approach will likely be needed. Please allow me to outline for the Village a very contemporary and probably unique solution that I believe can be successful. Such a solution will require a redefinition of the term "public sewer system" in a futuristic sense.

Appendix "E" is a copy of a paper I have written to describe the concept of "Decentralized Wastewater System Management". In a sentence, it can be a combination of both large and small onsite, cluster and centralized systems, all brought under the umbrella of one responsible agency for the purpose of maintenance and management. It really is not directly related to any particular technology; and it can include public or private ownership of the facilities, or both.

So, step back and look at the entire Village with me for a moment. While doing that, envision with me a ***"public wastewater system"*** serving all of the residents. However, **this system is different!** It does not all have pipes in the street and lots of manholes like a traditional system! Nor does it have a large concrete and steel treatment plant with open aeration tanks and funny looking structures! Furthermore, it does not necessarily have a large pipe going down to the river discharging large quantities of treated wastewater every day! But, **this public sewer system does provide each homeowner with the proper treatment of the wastewater that is discharged from their home in a manner that will protect the public health and the environment.** And, this "sewer system" is managed by a public entity just like the system is at the large urban community nearby. The homeowner does not need to worry about what happens when he flushes the toilet or does the laundry any more than he would if he lived in Mt. Pleasant, for instance. He simply pays his monthly sewer bill, and someone else does the rest. Let me explain what this might look like at Lake Isabella.

Description of a Potential Village "Sewer System"

We understand that Lake Isabella has about 950 homes and a few businesses within the Village. There are also about 2,000, or so, vacant properties within the Village that are expected to eventually yield an additional 700 to 900 homes and businesses. Most of these lots are located in recorded subdivisions.

So, the 950 existing homes may or may not need or desire sewer at this time, and all have existing onsite septic systems. At the current time the maintenance of these onsite systems is left to the homeowners. There is little or no professional oversight of this required maintenance. This is the typical situation throughout Michigan. The homeowners likely have their septic tank pumped either on some pre-determined schedule, or when the toilet backs up. Many of these existing homes are on the west side of the Lake, far from the area under consideration for a sewer system; but some are in the sewer district under consideration.

In some parts of the United States, onsite system management districts have been established to provide professional oversight of onsite systems. This is usually done to protect a common natural resource like Lake Isabella. Experts that have studied these management districts have found that problems with malfunctioning systems have been reduced to less than 1% at any one time. This compares to a failure rate of 20% to 30% of the systems inspected in some counties in Michigan as a part of their point-of-sale inspection programs.

On the other hand, many of the 700 to 900 building sites for future homes are located in subdivisions in the Eastern District that will need a public sewer to permit them to build per deed restrictions and some soil limitations. These are the properties that need a ***"pipe in the street".*** But, when pipes are constructed in the streets, they will also pass existing homes that already have onsite systems, most of which are working properly as far as we know. However, they may someday have problems that require an off-site solution.

Furthermore, some of these future homes may be spread out on vacant lots elsewhere in the Village where pipes are not under consideration at this time, and may be difficult to serve in the future by traditional means. Some of these building sites may be suitable for standard onsite systems, and some may require an improved onsite treatment technology.

So, the vision for a "public sewer system" for Lake Isabella can and should address all of these various needs! Consider that it could include the following elements:

1. The construction of pipes in the streets in the Eastern District and Lake Isabella North.

2. The construction of treatment works in the Eastern District and a cluster system to serve Lake Isabella North, and the expansion of these facilities when additional capacity is needed.

3. The oversight and management of the onsite systems now serving properties in the Eastern District, Lake Isabella North, and the remainder of the Village.

4. The construction of repairs to any onsite system in the Village, if and when needed. This may include the connection of any system to an available sewer in the street, or the construction of a new onsite system.

5. The construction of "sewer service" to any new home constructed in the Village, including those to be hooked to pipes in the street, those that will need an onsite system, or those that may require a small off-site cluster solution.

6. Maintenance and management by the Village of all onsite, cluster and central treatment systems.

Funding of the Village "Sewer System"

Every public sewer system has three major cost components ---1) planning and design, 2) project construction, and 3) long-term operation and maintenance and funding for future repair and replacement of system components. The last expense for funding O & M is normally not implemented until the first home is connected and comes on line. Then the homeowner begins paying a monthly or quarterly "sewer bill" for the duration. This bill can be as low as $20 to $25 per month or as high as $50 per month --- sometimes even higher. **But, consider the possibility** that these sewer fees might begin even before the system is constructed, and be used to pay for the construction of the system, along with other costs of implementing a wastewater management program for the Village of Lake Isabella.

In our experience, most new sewer infrastructure projects like that of Lake Isabella take 3 to 5 years in planning, design, permitting and funding. Two projects we have recently worked on have taken 3 and 4 years respectively from concept to ground breaking. These were SRF Funded projects, so some of this lead time is built into the funding schedule. However, a minimum of two years lead time can be expected to build citizen support for a project, prepare construction plans and specifications, obtain permits, bidding, etc., even if the funding of a project is more expeditious.

So, the primary funding sources for the cost of implementing this wastewater management plan for the Village would be:

1. The immediate implementation of a monthly sewer bill for **all property owners in the Village** (both occupied and vacant) of some initial amount to be determined --- say $45.00 per month, as an example. The monthly revenue from these fees would be placed in a sewer fund to pay sewer related expenses, including design, construction, O & M, and future repairs.

2. Each new home to be connected to the system would pay a lump-sum hookup fee of a set amount --- say $5,000. This money would also go into the sewer fund to pay for expansion of the treatment system when needed.

For this monthly fee, the residents of the Village will receive the following benefits:

1. Those with homes now on septic systems will receive an inspection of their wastewater system by the Village on a suggested schedule of once every 3 years. During the inspection cycle, the septic tank will be inspected for need of pumping, and the existing onsite system will be located and mapped. The inspection will identify the need for risers over the septic tank, and inspection access points in the drainfield. If needed, these will be scheduled and installed at no cost to the homeowner. When the tank needs pumping, the first pumping event will be at the homeowner's expense. After that, the Village will pay for all pumping of tanks when needed. The initial inspections of existing onsite systems will begin upon implementation of the monthly sewer fee system, but will be conducted over the next 3 years to establish a rotation for the long-term management program.

2. If a new drainfield is needed at a home, the Village will commission that repair work. The cost of major repairs will be prorated during the first few years or so of the program, but after that the Village will pay such costs. The details of this provision should be given careful thought and consideration.

3. The Village will undertake the installation of pipes in the streets where needed, and the construction of the first phases of treatment works to serve those collection systems. These treatment works will be expanded in phases as the Village develops and users come on line.

4. The Village will pay the costs to connect new homes to the new collection systems, subject to the established connection fee. When a new home is to be constructed in the Village, the Village will decide, with concurrence from the County Health Department, the best way to serve that home with a sewer system --- connection to a collection pipe, construction of some form of onsite system, or the need for construction of some form of additional off-lot cluster system.

5. The Village will provide the operation and maintenance services for all community, cluster and onsite systems within the Village.

Because of the unique circumstances at Lake Isabella, it is possible to provide this kind of all-encompassing sewer management program cost-effectively. Appendix "F" is a spreadsheet to illustrate a cash-flow scenario that we believe can work. This spreadsheet can be used to evaluate several scenarios by changing the numbers as one desires. The sample calculation in the Appendix uses a monthly sewer fee of $45.00 through the end of 2014, reduced to $30.00 per month thereafter, and a connection fee of $5,000 per home. It assumes the commencement of the monthly sewer fee in the 3rd quarter of 2010, the immediate start of existing system inspections, and allows for about 2 years of design and permitting before the construction of community and cluster systems. It then spreads the construction costs of these larger systems out over the next 3 years. It also assumes that the first home would not be connected to the community systems until the 3rd quarter of 2012, and that 3 homes per quarter would be connected after that. You will recognize that the cash flow in this scenario never leaves the sewer fund balance in the negative beyond the first quarter of projected revenues.

Even though the increased tax revenues are not great, we have also factored those estimates into this cash flow analysis so they will not be forgotten. We also recognize that it is not likely that those funds would go into the sewer fund.

Again, it is the unique set of circumstances at Lake Isabella that make this a possibility. As you can see, sufficient funds can be collected in a "pay-as-you-go" fashion to pay the expenses for a wastewater management program, including the construction of infrastructure that will be needed.

One of the most important principals in a project like this is that it be fair to everyone --- that everyone receives equal value for their investment. With the plan outlined above, both the existing homeowners and the vacant lot owners receive the same general value. The existing homeowner will receive "sewer service" by means of the long-term management of their existing onsite system by the Village, including regular inspections, periodic tank pumping, and system repair and replacement when needed. The vacant lot owner will receive "sewer service" from the Village by means of either connection to a collection system in the street, the construction of a small cluster system to serve them and their neighbors, or the construction of a new on-lot system, as appropriate. This choice will be made at the time the home is built.

Let me point out that the monthly sewer fee can be adjusted from time to time by the Village as needed. When all existing onsite systems are equipped with access risers and inspection ports, the cost of the periodic inspection of these systems should go down dramatically, as inspections can be conducted in much less time. And, of course, once the initial construction expenses of community systems are paid, those costs will also go down.

For your reference, our operations company, SCS Systems, LLC, has provided an estimate of the inspection and onsite system “upgrade” costs. These are included as **Appendix “G”.** Also included is our estimate of the operation and maintenance costs for the initial treatment system to serve the Lake Isabella North and the Eastern District. These costs will grow a bit as additional users come on line, as flows increase, and as treatment works are enlarged.

Of course, it is understood that this type of aggressive wastewater management plan may seem a bit daunting for the Village. It is admittedly unique, and will require a lot of stakeholder input during the planning process. It may even look significantly different than what is described here by the time it is actually ready for implementation. But all good plans must start with a vision.

While there are some real financial advantages to tackling the wastewater infrastructure Village wide, it is recognized that the Village may choose to start with only providing these services in the Eastern District. To that end, we have also projected for your information what this might look like with service to only that area. The second spreadsheet in **Appendix “F”** is a scaled-down version of this concept to serve only the Eastern District; excluding the inspection of any existing onsite systems. Making the numbers work will require a higher initial monthly fee, and may require the construction of the collection and treatment systems be postponed a year or two, unless the Village borrows the capital for the construction costs.

Opportunities for Reclamation and Reuse

We also believe that there are some long term opportunities at Lake Isabella for the reuse of reclaimed wastewater. Initially, it is probably more cost-effective and feasible to simply utilize large drainfields for the return of treated wastewater to the groundwater. However, wastewater quantities will eventually grow to the point that it would make sense to consider reuse.

A typical golf course, like the one in the middle of the Eastern District, utilizes large quantities of water every year for irrigation. Furthermore, they also apply substantial quantities of nitrogen and phosphorus in fertilizer to keep the turf healthy. The Village will have a large quantity of water --- in the form of treated wastewater --- which also contains some phosphorus and nitrogen. And, of course, it will be necessary that the Village manage the fate of these nutrients so they do not cause harm to others or the environment. This presents the perfect opportunity to discuss how this wastewater, containing nutrients, could be used to replace water and fertilizer that is now being purchased and applied at the golf course. In this way the regional demand on source water is diminished, and the nutrient load on groundwater is mitigated.

CONCLUSIONS AND RECOMMENDATIONS

The Village of Lake Isabella and its governmental predecessors have worked for decades now to find ways to construct a public sewer system at Lake Isabella. The development and demonstration of wastewater management concepts, not previously given serious consideration, now make it possible for the Village to implement a unique management program and to do so cost-effectively. The following are some of the important aspects of such a concept:

1. The immediate establishment of a monthly or quarterly sewer fee or assessment.

2. The immediate planning and implementation of a periodic inspection program for all existing onsite systems. The goal of such an effort would be to manage these existing systems in such a way, using professional oversight, to extend their life and protect the public health and environment.

3. Begin the design and permitting of community and/or cluster systems to provide service to those lots where onsite systems are not a suitable option.

4. Construct in phases the collection and treatment systems to serve portions of the Village where onsite systems are not the most appropriate solution.

5. Establish a long-term wastewater management plan for the Village that is sustainable for the distant future.

6. As discussed briefly, there exists a local opportunity for the reuse of treated wastewater. We recommend further thought and consideration of this concept as a long-term dispersal option.

7. It is our opinion that all of this can be done in a timely fashion and paid for by reasonable monthly sewer fees initially collected about 2 years in advance of the commencement of construction activities.

This report has been prepared by the combined resources and knowledge of the staff of both Stephens Consulting Services, P.C. and SCS Systems, LLC. We stand ready to answer any questions or provide any supporting information the Village of Lake Isabella may need with regard to it content. We would also be happy to provide any further assistance the Village may need to further study or implement any of the concepts described here.

Larry D. Stephens, P.E., President
Stephens Consulting Services, P.C.

Michael T. Stephens, Managing Member
SCS Systems, LLC

NOTE: Comments in red are a summary of answers to the various questions provided by Rowe staff during a meeting in Rowe's office on November 6, 2009. These responses are summarized from the notes and the memory of Larry Stephens, P.E. Any discrepancies or corrections should be brought to the attention of the author immediately.

Wastewater Treatment Feasibility Study
by
Rowe Professional Services Company

Village of Lake Isabella

Meeting date: November 6, 2009
Meeting place: Offices of Rowe Professional Services Company, Mt. Pleasant, MI
Attendance: G. John Tanner, P.E., Rowe Professional Services Company
Steven M. Clark, Rowe Professional Services Company
Tim Wolff, Village Manager, Village of Lake Isabella, MI
Larry D. Stephens, P.E., Stephens Consulting Services, P.C.

General questions:

1. Do you have any kind of topographic mapping of the Village?
Just used USGS --- no other topography available.

2. Where is the "Eagle Point" Area?
Eagle Point is the small, unplatted area, between Lake Isabella South and Golf Lake Est. #2.

3. What do you have with regard to well records for the areas of concern? Is there any documentation of well contamination in the Village? None. Where? Do you have water sample results? No.

4. Do you have copies of the "plat deed restrictions" regarding onsite systems and wells?
Village should have these, and will furnish them.

5. Do you have reports of malfunctioning onsite systems at existing homes? None.

6. Do you have the Wolverine (1988) or Wilcox (2004) engineering studies available?
A copy of the Wilcox report is furnished --- the location of the Wolverine study is unknown.

7. Is a copy of the earlier Rowe study (1999 "Master Plan") available?
A copy of the 1999 Rowe Master Plan is furnished.

With regard to the collection system concepts:

1. What type of S.T.E.P. tank design was used as the basis for determining the costs included in the report? Were screened pump vaults included? Did the cost estimates assume the use of high-head turbine, grinder or centrifugal pumps?
   The STEP tank design used for the Rowe study is the typical Orenco pump vault design in either a single tank or a two-tank option, with a high-head turbine pump. Price estimating was based upon one tank.

2. Was a collection system model used for sizing the pipelines? Or, would that be done later? What basis did you used to size the pressure sewers?
   An internally developed spreadsheet was used to size the collection lines. Rowe indicated that "Cleansing velocity would be adequate with only one pump operating at a time."

3. Were H.D.P.E. tanks considered? What size of tank did you find would be required?
   H.D.P.E. tanks were not given serious consideration, but the tank type selection was somewhat considered to be beyond the extent of this study. The tank size suggested was 1,500 gallons.

4. Has Rowe designed a S.T.E.P. collection system before? Where and when? What did that one look like?
   John Tanner, the P.E. that worked on this study for Rowe, has worked on the design of another STEP collection system(s) for a previous employer, Progressive Engineering. The system served the Wamplers Lake area of Lenawee County. The treatment system was a lagoon system with surface water discharge. He also worked on a project in Denton, MI. The collection system there was a combination of STEP systems and gravity collection.

5. Where did you find the unit prices you used in preparing the cost estimates?
   Unit prices used for cost estimates were based upon conversations with local contractors and Orenco Systems, Inc. (the manufacturer of the STEP pump packages).

6. Why did you include the cost of the on-lot S.T.E.P. equipment for vacant lots in your cost estimates?
   The STEP equipment was added to vacant parcels in cost estimates in an attempt to develop an ultimate cost number for comparison purposes.

With regard to the treatment systems discussed in the study:

1. Where were the community drainfield sites to be located that were used for the cost estimates?
   Village has the information on the potential location of community drainfield sites.

2. What type of treatment works were considered for these cost projections, and what is the basis for the anticipated costs?
   The treatment works were geotextile, packed-bed filter units (Advantex®), made by Orenco Systems, Inc. The cost of added components for phosphorus removal was also added per OSI recommendations.

3. Did you consider treatment systems that can be installed in a modular fashion for lower costs when only a few users are connected, and then easily expanded as new users come on line? Yes.

4. You state more than once that:

   "The treatment costs assume typical treated effluent levels of nitrogen and phosphorus for a groundwater discharge. If higher levels of treatment are necessary, costs per REU will be approximately $500 to $700 more."

   What are the "typical effluent levels" you have assumed? And, what is the basis for the additional costs projections stated?
   Typical treatment levels were based upon information from OSI on the normal performance of Advantex® treatment systems. The additional costs for phosphorus removal facilities were based upon numbers furnished by OSI.

5. It sounds like the report includes costs for the construction of the second "reserve" drainfield up front? Is that correct?
   Rowe is uncertain if the costs of construction of the "reserve" system were included in the cost projections.

6. Where did you obtain the design soil application rate for the soil absorption system part of the treatment works? Is this application rate based upon highly treated effluent? Or septic tank effluent?
   Soil application rates were based upon the standards of MDEQ. Drip irrigation was considered as the method of application for treated wastewater.

7. You list BOD and Total Suspended Solids, along with Nitrogen and Phosphorus, as parameters that will need to be monitored at treatment works, and say that there will likely be performance limits set by MDEQ in the Groundwater Discharge Permit for these parameters. What is the basis for that statement? What size system?
   Rowe could not provide an answer to this question.

8. You have used a design flow of 350 GPD per REU (or, typical household) for your calculations. Is this an accurate flow figure for a S.T.E.P. collection system in your opinion? What has been your experience on past projects like this?
   This flow number is based upon MDEQ information. Rowe recognizes that this number is higher than the flows that will actually be generated.

9. Have you designed other systems using remote system monitoring and management? Do you participate in actively monitoring any of them? What is the basis for your estimate of $5.00 per month for the cost of this service? Could you suggest some of the advantages of remote monitoring?
   Rowe believes that this estimate on the costs for remote monitoring comes from information provided by Milan Engineered Systems, the Michigan distributor for OSI equipment.

With regard to the operation and maintenance cost estimates listed:

1. You suggest an O & M cost for a cluster system to be in the range of $15 to $25 per home per month. What does this include? Where does this number come from? Does in include monitoring and service of the S.T.E.P. pumps and appurtances on each lot? Does it include money to be set aside for repair and replacement of system components as needed in the future? It apparently does not include the periodic pumping of tanks, right?
   The cost for O & M for similar cluster systems is based upon information provided by OSI. This estimate DOES INCLUDE the periodic pumping of the STEP tanks.

2. Does the O & M estimate include such things as electrical power costs, lawn mowing and snow plowing at the treatment site, insurance, permit fees, etc.
   No details such as this were used in the preparation of O & M costs. They are simply based upon historical numbers for other similar facilities.

3. In the options discussed on Pages 21 & 22 it is stated a couple of times under "Cons" that:

   > "***Until the overall system has an adequate number of users/connections, some additional maintenance would likely be required.***"

   What do you mean by this statement, and what is the basis for that conclusion?
   Rowe says that this is probably not an accurate statement, and should not have been included in this report.

With regard to system funding options:

1. What is the approximate total of funds already on hand to begin a project like this?
   There is approximately $120,000 left in the Village sewer fund. No mechanism is currently in place to fund the construction and operation of a public system.

2. What financing options were explored --- other than the couple mentioned?
   Special assessments are thought to be the only feasible way to finance such a project.

3. What specific process was used to change the plat restrictions on the two plats in the Village?
   Village will provide additional information on this. But, the process is still ongoing, without final resolution at this time.

With regard to options that were apparently not considered:

1. Was the concept of recycle and reuse of the wastewater for other beneficial purposes ever considered or explored? No.

2. Was the possibility of irrigating the golf course with the highly treated wastewater ever considered? In what way? No. The golf course now gets its irrigation from the lake via an interconnection to one of its ponds on the course.

3. Was any consideration given to the possibility of a surface water discharge to the river? Yes, it was discussed. But, the Village has a desire to do something more environmentally friendly than just discharge to the river.

And finally:

1. What is meant by the concluding remark:

   "Since the Village of Lake Isabella has established protection of the lake and environment as primary goals, they do not want to create a problem, by attempting to resolve one."
   See answer to #3 above.

2. What are the professional recommendations of Rowe Professional Services as to the course of action for the Village in this matter? Which of the alternatives studied --- both now and in the past --- should the Village pursue?
   The candid opinion of Rowe (not included in the report) is that the most feasible solution is probably the construction of some form of lagoon system, with a surface water discharge to the river.

Appendix B

Cost Comparison for Lake Isabella North Cluster System

Item Description	Quantity		Rowe		Stephens		
STEP Systems	Each		$4,500		$11,000		A
2" Force Main	2800	Foot	$20	$56,000	$8.83	$24,728	B
2.5" Force Main	2700	Foot	$23	$62,100	$10.55	$28,481	C
Collection System Structures	5	Each	$2,500	$12,500	$2,000	$10,000	D
Treatment Equipment	1	Lump Sum	$235,000	$235,000	$225,000	$225,000	E
Disposal Equipment	1	Lump Sum	$50,000	$50,000	NA	NA	
Hydrogeological	1	Lump Sum	$40,000	$40,000	$40,000	$40,000	
Engineering (15%)				$96,000		$96,000	
Contingency (10%)				$58,200		$58,200	
			TOTAL *	$609,800	TOTAL*	$482,409	

A: Average of 8 bids in 2009, $6,800 to $15,300 - Bid includes abandonment of existing septic system, restoration, and installation of all equipment including STEP lead, curbstop, and connection to the force main.

B: Average of 7 bids in 2009 ranging from $6.00 to $10.67

C: Average of 7 bids **(for 3" pipe)** in 2009 ranging from $6.60 to $15.00

D: Approximate based on an evaluation of 6 low bids in 2009

E: Construction costs for a turnkey treatment system constructed in 2005 including soil absorption field and maintenance building.

* These totals do not include the cost of the S.T.E.P. connections that will be required when each home is connected; and estimated costs for engineering and contingencies were kept the same for comparison purposes.

Appendix C

Estimated Costs to Construct Gravity Sewer for Eastern District

PHASE I - Lake Isabella South , Golf Estates II, Eagle Point, West Coldwater Business

Item	Quantity	Unit Price	Total Price
8" Sanitary Sewer	24,607	$55.00	$1,353,385.00
12" Sanitary Sewer	6,964	$60.00	$417,840.00
15" Sanitary Sewer	1,225	$65.00	$79,625.00
4' Dia. Manhole	109	$2,000.00	$218,000.00
6" Dia. Forcemain	2,368	$23.00	$54,464.00
8" Dia. Forcemain	5,445	$25.50	$138,847.50
Medium Pump Station	3	$100,000.00	$300,000.00
Lateral Connections	531	$1,000.00	$531,000.00
		Grand Total	$3,093,161.50
		Lots	531
		Cost/Lot	$5,825.16

PHASE II - Golf Estates I (213 lots), East Coldwater Business (8 lots), Unified Brands (1 lot), and Light Industrial (1 lot)

Item	Quantity	Unit Price	Total Price
8" Sanitary Sewer	14,486	$55.00	$796,730.00
12" Sanitary Sewer	0	$60.00	$0.00
15" Sanitary Sewer	2,536	$65.00	$164,840.00
4' Dia. Manhole	57	$2,000.00	$114,000.00
6" Dia. Forcemain	0	$23.00	$0.00
8" Dia. Forcemain	0	$25.50	$0.00
Medium Pump Station	0	$100,000.00	$0.00
Lateral Connections	222	$1,000.00	$222,000.00
		Grand Total	$1,297,570.00
		Lots	222
		Cost/Lot	$5,844.91

Note: These estimates are based upon quantities calculated by Stephens Consulting Services and on unit prices used by Wilcox in their 2004 study. An estimated price was added for the installation of wyes and leads to the property lines because that cost was not included in the Wilcox study. The Wilcox cost for restoration is included in the unit prices.

Appendix D

Cost Estimates for Collection System Pipes in Lake Isabella North and the Eastern District

1/22/2010

Lake Isabella North					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	13938	$8.83	$123,092.45		
3" Force Main	3397	$10.55	$35,833.50		
4" Force Main	0	$12.39	$0.00		
6" Force Main	0	$14.20	$0.00		
Force Main Structures	37	$2,000.00	$74,000.00		
Misc. Mobilization costs	1	$65,000.00	$65,000.00		
Total Lots Served by Collection System	335	Total Cost	$297,925.95	Cost/Lot	$889.33
S.T.E.P. Connection Costs	EACH	$11,000.00			

Golf Estates II					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	11123	$8.83	$98,231.98		
3" Force Main	918	$10.55	$9,683.59		
4" Force Main	7613	$12.39	$94,357.70		
6" Force Main	2561	$14.20	$36,366.20		
Force Main Structures	33	$2,000.00	$66,000.00		
Misc. Mobilization costs	1	$65,000.00	$65,000.00		
Total Lots Served by Collection System	326	Total Cost	$369,639.47	Cost/Lot	$1,133.86
S.T.E.P. Connection Costs	EACH	$11,000.00			

Lake Isabella South, Eagle Point					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	7532	$8.83	$66,518.32		
3" Force Main	2878	$10.55	$30,358.79		
4" Force Main	0	$12.39	$0.00		
6" Force Main	0	$14.20	$0.00		
Force Main Structures	20	$2,000.00	$40,000.00		
Misc. Mobilization costs	1	$35,000.00	$35,000.00		
Total Lots Served by Collection System	180	Total Cost	$171,877.11	Cost/Lot	$954.87
S.T.E.P. Connection Costs	EACH	$11,000.00			

Golf Estates I (112 lots as evaluated by Rowe)					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	5784	$8.83	$51,080.98		
3" Force Main	3229	$10.55	$34,061.34		
4" Force Main	2250	$12.39	$27,887.14		
6" Force Main	0	$14.20	$0.00		
Force Main Structures	13	$2,000.00	$26,000.00		
Misc. Mobilization costs	1	$23,000.00	$23,000.00		
Total Lots Served by Collection System	112	Total Cost	$162,029.46	Cost/Lot	$1,446.69
S.T.E.P. Connection Costs	EACH	$11,000.00			

Golf Estates I (112 lots as evaluated by Rowe), West Coldwater Business (26 lots), and others (74 lots)					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	9137	$8.83	$80,692.76		
3" Force Main	3229	$10.55	$34,061.34		
4" Force Main	2250	$12.39	$27,887.14		
6" Force Main	0	$14.20	$0.00		
Force Main Structures	22	$2,000.00	$44,000.00		
Misc. Mobilization costs	1	$45,000.00	$45,000.00		
Total Lots Served by Collection System	212	Total Cost	$231,641.24	Cost/Lot	$1,092.65
S.T.E.P. Connection Costs	EACH	$11,000.00			

West Coldwater Business (26 lots), and others (74 lots)					
ITEM	**QUANTITY**	**COST/UNIT**	**TOTAL**		
2" Force Main	3353	$8.83	$29,611.78		
3" Force Main	1	$10.55	$10.55		
4" Force Main	0	$12.39	$0.00		
6" Force Main	0	$14.20	$0.00		
Force Main Structures	9	$2,000.00	$18,000.00		
Misc. Mobilization costs	1	$23,000.00	$23,000.00		
Total Lots Served by Collection System	100	Total Cost	$70,622.33	Cost/Lot	$706.22
S.T.E.P. Connection Costs	EACH	$11,000.00			

Note: These unit prices should include restoration. They are based upon actual bids for two similar projects. Engineering and contingencies have not been included in these numbers.

Stephens Consulting Services, P.C.
ENGINEERING • PLANNING
1549 Haslett Road, P.O. Box 708, Haslett, Michigan 48840
Phone (517) 339-8692 Fax (517) 339-6330

DOES YOUR COMMUNITY NEED A "SEWER" SYSTEM ?

Background

About one-fourth of the population of the United States live in rural areas outside the reach of existing wastewater collection and treatment systems. These homes and businesses rely upon some form of on-lot septic system. Many of these existing facilities were designed and installed with an expectation that their community would be served by public sewers before they had to worry about replacing their septic system, and many are nearing the end of their useful life. Counties that have now implemented time-of-sale inspection programs are sometimes finding 20% or more of the septic systems they inspect to be malfunctioning in some way.

This paper is designed to provide members of such communities a description of the options that may be available for local decision-makers to consider when addressing their wastewater infrastructure needs. It is also intended to suggest some of the steps that will help evaluate which options might be appropriate and feasible for the community to consider.

Keep in mind, most of the on-lot systems in use today were installed using the simplest of designs and management methods developed over 50 years ago. Both the technology of small scale wastewater treatment and the management methods for smaller systems have improved dramatically over the last quarter of a century.

Traditional Approach

Since the invention of the water-flush toilet, the traditional approach to meet our wastewater treatment needs has most often been either a large municipal collection and treatment system, or an on-lot septic system serving each individual home and business. The publicly owned system is usually accompanied by government control with full-time professionally trained employees whose job it is to operate and maintain the system. The scattered on-lot systems are typically installed to meet the provisions of a county or state code, but the maintenance of the system is left in the hands of the untrained homeowner. Efforts have been made to educate homeowners, but it is an insurmountable task when you consider the changeover that occurs in typical home ownership, and the resources that would be necessary to do the task well. So, the on-lot system has been considered the second choice option to be used until public sewer becomes available.

This traditional paradigm has resulted in the construction of literally hundreds of thousands of miles of public and private sewers and thousands of treatment facilities across the country. Many of these sewer systems and treatment facilities are now aging and in need of major repair and upgrades. Tremendous amounts of public resources are being invested in such efforts. This leaves very little of our funds to address the wastewater needs of rural and yet unsewered communities.

Furthermore, many decision-makers are waking up to the fact that the continual expansion of our large "centralized" sewer collection and treatment systems is not the most cost-efficient and sustainable way to provide our wastewater infrastructure needs of the future. Many of our large urban areas are now piping great quantities of potable water great distances, treating it to a very high quality, and then using it ***once.*** And, much of this high-quality water is being used for non-potable purposes, such as flushing toilets or watering landscaping. After use, this "waste" water is then piped and often pumped great distances to be treated again and typically discharged to our rivers and streams. In this typical approach, large quantities of energy are used just to move water from place to place. In locations where water is a premium, this wasteful process is also creating surface and groundwater shortages.

Because of this significantly inefficient process, those with a vision for the future are looking at dispersed wastewater treatment concepts as the ***first choice*** of the future. Individual, on-lot and small cluster (or "satellite") treatment systems are being considered as a permanent part of our wastewater treatment infrastructure.

Development of Technology

Wastewater treatment is a matter of assembling any number of treatment components in an appropriate "system" that, when properly managed, will treat a given wastewater to achieve a specified performance standard. This performance standard may vary from place to place depending upon where the treated water goes and what it will be used for. For instance, if the water is discharged back into the ground to be further filtered and treated by the soil, finally ending up as a part of the subsurface groundwater resources, it will need to be treated to a different standard than if it were discharged to a river.

Over the last couple of decades manufacturers and researchers have developed and refined products and processes for smaller treatment works that, when properly managed, will achieve as good or better results than the best performing public treatment facilities. Some of these are processes that have been downsized from the traditional larger treatment facilities; and many are processes that depart from traditional means, but lend themselves well to the smaller flow systems. These technologies, when properly applied, allow the treatment of wastewater to occur closer to the point of origin, thus avoiding the expenses of moving the wastewater great distances for treatment to occur.

As long ago as 1997, the U.S. Environmental Protection Agency reported to the U.S. Congress that: "Properly managed decentralized wastewater systems can provide the treatment necessary to protect public health and meet water quality standards just as well as centralized systems." One of the key phrases in this statement is "properly managed". Management programs are and should be developed to provide the necessary oversight to assure that any system or systems are designed, installed and operated in the manner necessary to achieve the intended performance.

Dispersed Wastewater Treatment as an Infrastructure

The concept of "decentralizing" our wastewater treatment is somewhat of a misnomer. In fact, we will call it "dispersed wastewater treatment", as some like to refer to it. However, the use of either of these terms somewhat implies an either/or choice. This should not be the case in actual application. In fact, the wise choice is to carefully evaluate all of the options open to any community. In doing so, one would consider the whole range of choices that may be feasible.

As an example, a rural community with failing on-lot septic systems may be near another community that has an existing public wastewater treatment system. In general, the following options may be considered as a part of the initial preliminary engineering study:

1. Improved on-lot systems combined with the formation of some form of management entity to provide oversight of the individual treatment system performance. The management entity that is formed should not only provide for the proper maintenance of the newly repaired systems, but could also assure that existing systems that are now working would be properly maintained to minimize future problems. Considering this option will require a very careful community-wide inventory of the condition of existing on-lot systems, lot sizes, and soil conditions.

2. One or more small collection and treatments systems serving clusters of homes and/or businesses. This type of an approach may be necessary or desirable when site conditions prevent the construction of individual on-lot systems. If one or more off-lot sites can be identified that are suitable for a small treatment system to serve a group of homes, this choice may be preferred.

3. A smaller localized central treatment system or systems. This option is very similar to both the clustering option and the larger connection to an existing public system, but differs in the number of customers served.

4. And of course, connection to an existing public system nearby. Our existing central public systems will always have a place in our wastewater infrastructure, and this may be the best and most economical solution in some cases.

A careful review of the above options should give you the message that there is a whole range of options for many communities. Beyond that, for any given community, some combination of the above options may be the best choice. The choices are not technology-limited. But, whatever the choice, a management program must be put in place so that the solution(s) work and the communities investment is protected.

When considering the best and most cost-effective solution for any community, the local decision-makers should consider both the initial construction costs and the long-term operation and maintenance costs. Many of the smaller and simpler technologies require less operator attention, therefore reducing labor costs, and may consume less energy.

Retaining a Consultant

If a person is to have dental work done, he or she would hire a dentist --- a specialist in teeth and gums. If one is having heart surgery, the normal person would look for a heart surgeon. And, if I were having back surgery, I would look for a doctor or surgeon that is a specialist in that task. Likewise, if you want an engineering consultant to do a comprehensive job of evaluating this entire array of options for your community's wastewater infrastructure needs, you should look for an engineering company that has experience in the application of the various options and choices available. Officials of various agencies call this the "Qualifications-Based" selection process. In other words, communities should look for the most qualified consultants, rather than the one that might offer the lowest price, or even the one that has the largest staff. Here are some things to consider.

On the issue of price, you should keep in mind that there are always multiple ways to solve problems. Even though the engineering investment is a significant one, you will be paying the engineering company a small percentage of the project cost to design a system that will cost much, much more than that design fee. A choice here and there during the project design can result in significant differences between project designs that perform comparably.

Traditionally, many engineering companies provided their services as a percentage of project cost. Such engineering contracts are actually a disincentive for the engineer to go out of his way to save the community money by considering less costly alternatives. And, many times these alternative choices are not the easy path. To acquire the permits from regulators, non-traditional means often require more investigation, meetings, and other effort than the more traditional approaches.

The type of dispersed wastewater treatment means and methods discussed above are rarely taught in colleges and universities. It is unusual to find an engineering company --- even a large company --- that has on its staff any professionals that are trained in the application of the various dispersed wastewater treatment technologies available today. This is unfortunate, but it does mean that the size of the engineering firm has no direct relationship to their qualifications in this area of expertise. Furthermore, the larger the firm the more likely you will have the younger staff-level engineers working on your project, rather than the more experienced firm principals. And, even those that are the more experienced principals were likely trained in the 1960's and 1970's when even less on dispersed wastewater treatment was being taught.

If your desire is to have the entire range of dispersed wastewater treatment options evaluated, we encourage a qualifications-based selection process by your community. But beyond that, we suggest that communities look deep into the background of the experience a firm may claim to have to see if their track record verifies that they have the experience to meet your needs. We encourage communities to place significantly more weight upon experience than on price or size.

Contact Information

Should you wish to discuss how our firm might be able to assist your community, please get in touch with us.

Stephens Consulting Services, P.C.
1549 Haslett Road
P.O. Box 708
Haslett, Michigan 48840
Phone: (517) 339-8692
Email: scscons@yahoo.com

This document prepared by Larry D. Stephens, P.E., President, Stephens Consulting Services, P.C., and a member of SCS Systems, LLC, at the same address and phone number.

Lake Isabella Cash Flow Analysis

Monthly Sewer Charge = $45.00 per month through 2014

Monthly Sewer Charge = $30.00 per month after 2014

New Home Tap Fee = $5,000

Number of Properties in District = 1,750

Average SEV for a New Home = $100,000

Lake Isabella Cash Flow Analysis

Frequency of Home Inspection = * See note below

Est. Cost for Initial Home Inspection = $200.00

Est. Cost for Future Home Inspection = $105.00

Est. Cost for a Onsite System Upgrade = $800.00

Est. cost of Septic Tank Pumping = $250.00

Est. O & M Costs for Central and Cluster Systems = $1,000.00 per month

		Income Analysis						Sewer System Expenses													
Quarter	Year	Income in Period from Sewer Fees	No. of New Homes on Line	Total New Homes Built	Tap Fees	Tax Revenue from 1 mil	Accumulated Income	Planning & Design	Construction of New Sewers	Construction of New Treatment Facilities	* Number of Ex. System Inspections	Cost of System Inspections	Number of Onsite System Upgrades **	Costs of System Upgrades	Number of Septic Tank Pumpouts	*** Septic Tank Pumping Costs	Cost Assistance for System Hookups	Onsite System Repair Costs	Estimated O & M for Central Treatment	Total Expenses for Period	Sewer Fund Balance Remaining
1st Qtr.	2010	$0	0	0	$0	$0	$0													$0	$0
2nd Qtr.	"	$0	0	0	$0	$0	$0	$10,000												$10,000	-$10,000
3rd Qtr.	"	$236,250	0	0	$0	$0	$236,250	$10,000			50	$10,000								$20,000	$206,250
4th Qtr.	"	$236,250	0	0	$0	$0	$472,500	$25,000												$25,000	$417,500
1st Qtr.	2011	$236,250	0	0	$0	$0	$708,750	$50,000										$5,000		$55,000	$598,750
2nd Qtr.	"	$236,250	0	0	$0	$0	$945,000	$50,000			100	$20,000						$5,000		$75,000	$760,000
3rd Qtr.	"	$236,250	0	0	$0	$0	$1,181,250	$10,000			150	$30,000						$5,000		$45,000	$951,250
4th Qtr.	"	$236,250	0	0	$0	$0	$1,417,500	$10,000			50	$10,000						$5,000		$25,000	$1,162,500
1st Qtr.	2012	$236,250	0	0	$0	$0	$1,653,750	$10,000										$5,000		$15,000	$1,383,750
2nd Qtr.	"	$236,250	0	0	$0	$0	$1,890,000	$20,000	$200,000	$345,000	100	$20,000	100	$80,000				$5,000		$670,000	$950,000
3rd Qtr.	"	$236,250	3	3	$15,000	$75	$2,141,325	$20,000	$225,000	$230,000	150	$30,000	100	$80,000			$18,000	$5,000		$608,000	$593,325
4th Qtr.	"	$236,250	3	6	$15,000	$150	$2,392,725	$10,000			50	$10,000					$18,000	$5,000	$3,000	$46,000	$798,725
1st Qtr.	2013	$236,250	3	9	$15,000	$225	$2,644,200	$10,000									$18,000	$5,000	$3,000	$36,000	$1,014,200
2nd Qtr.	"	$236,250	3	12	$15,000	$300	$2,895,750	$10,000	$200,000	$200,000	100	$20,000	100	$80,000			$18,000	$5,000	$3,000	$536,000	$729,750
3rd Qtr.	"	$236,250	3	15	$15,000	$375	$3,147,375	$25,000	$200,000	$281,000	150	$30,000	100	$80,000			$18,000	$5,000	$3,000	$642,000	$339,375
4th Qtr.	"	$236,250	3	18	$15,000	$450	$3,399,075	$10,000			50	$10,000					$18,000	$5,000	$3,000	$46,000	$545,075
1st Qtr.	2014	$236,250	3	21	$15,000	$525	$3,650,850	$10,000									$18,000	$5,000	$3,000	$36,000	$760,850
2nd Qtr.	"	$236,250	3	24	$15,000	$600	$3,902,700	$15,000	$143,000		150	$15,750	100	$80,000			$18,000	$5,000	$3,000	$279,750	$732,950
3rd Qtr.	"	$236,250	3	27	$15,000	$675	$4,154,625	$15,000			170	$17,850	100	$80,000			$18,000	$5,000	$3,000	$138,850	$846,025
4th Qtr.	"	$236,250	3	30	$15,000	$750	$4,406,625	$10,000									$18,000	$5,000	$3,000	$36,000	$1,062,025
1st Qtr.	2015	$157,500	3	33	$15,000	$825	$4,579,950	$10,000									$18,000	$5,000	$3,000	$36,000	$1,199,350
2nd Qtr.	"	$157,500	3	36	$15,000	$900	$4,753,350	$10,000	$100,000		150	$15,750	100	$80,000	100	$25,000	$18,000	$5,000	$3,000	$256,750	$1,116,000
3rd Qtr.	"	$157,500	3	39	$15,000	$975	$4,926,825	$10,000	$167,000		170	$17,850	100	$80,000	100	$25,000	$18,000	$5,000	$3,000	$325,850	$963,625
4th Qtr.	"	$157,500	3	42	$15,000	$1,050	$5,100,375										$18,000	$5,000	$3,000	$26,000	$1,111,175
1st Qtr.	2016	$157,500	3	45	$15,000	$1,125	$5,274,000										$18,000	$5,000	$3,000	$26,000	$1,258,800
2nd Qtr.	"	$157,500	3	48	$15,000	$1,200	$5,447,700				150	$15,750	100	$80,000	100	$25,000	$18,000	$5,000	$3,000	$146,750	$1,285,750
3rd Qtr.	"	$157,500	3	51	$15,000	$1,275	$5,621,475				170	$17,850	50	$40,000	100	$25,000	$18,000	$5,000	$3,000	$108,850	$1,350,675
4th Qtr.	"	$157,500	3	54	$15,000	$1,350	$5,795,325										$18,000	$5,000	$3,000	$26,000	$1,498,525
1st Qtr.	2017	$157,500	3	57	$15,000	$1,425	$5,969,250										$18,000	$5,000	$3,000	$26,000	$1,646,450
2nd Qtr.	"	$157,500	3	60	$15,000	$1,500	$6,143,250				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$1,753,700
3rd Qtr.	"	$157,500	3	63	$15,000	$1,575	$6,317,325				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$1,858,925
4th Qtr.	"	$157,500	3	66	$15,000	$1,650	$6,491,475										$18,000	$5,000	$3,000	$26,000	$2,007,075
1st Qtr.	2018	$157,500	3	69	$15,000	$1,725	$6,665,700										$18,000	$5,000	$3,000	$26,000	$2,155,300
2nd Qtr.	"	$157,500	3	72	$15,000	$1,800	$6,840,000				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$2,262,850
3rd Qtr.	"	$157,500	3	75	$15,000	$1,875	$7,014,375				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$2,368,375
4th Qtr.	"	$157,500	3	78	$15,000	$1,950	$7,188,825										$18,000	$5,000	$3,000	$26,000	$2,516,825
1st Qtr.	2019	$157,500	3	81	$15,000	$2,025	$7,363,350										$18,000	$5,000	$3,000	$26,000	$2,665,350
2nd Qtr.	"	$157,500	3	84	$15,000	$2,100	$7,537,950			$50,000	150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$116,750	$2,723,200
3rd Qtr.	"	$157,500	3	87	$15,000	$2,175	$7,712,625				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$2,829,025
4th Qtr.	"	$157,500	3	90	$15,000	$2,250	$7,887,375										$18,000	$5,000	$3,000	$26,000	$2,977,775 ****
1st Qtr.	2020	$157,500	3	93	$15,000	$2,325	$8,062,200										$18,000	$5,000	$3,000	$26,000	$3,126,600
2nd Qtr.	"	$157,500	3	96	$15,000	$2,400	$8,237,100				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$3,234,750
3rd Qtr.	"	$157,500	3	99	$15,000	$2,475	$8,412,075				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$3,340,875
4th Qtr.	"	$157,500	3	102	$15,000	$2,550	$8,587,125										$18,000	$5,000	$3,000	$26,000	$3,489,925
1st Qtr.	2021	$157,500	3	105	$15,000	$2,625	$8,762,250										$18,000	$5,000	$3,000	$26,000	$3,639,050
2nd Qtr.	"	$157,500	3	108	$15,000	$2,700	$8,937,450				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$3,747,500
3rd Qtr.	"	$157,500	3	111	$15,000	$2,775	$9,112,725				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$3,853,925
4th Qtr.	"	$157,500	3	114	$15,000	$2,850	$9,288,075			$50,000							$18,000	$5,000	$3,000	$76,000	$3,953,275
1st Qtr.	2022	$157,500	3	117	$15,000	$2,925	$9,463,500										$18,000	$5,000	$3,000	$26,000	$4,102,700
2nd Qtr.	"	$157,500	3	120	$15,000	$3,000	$9,639,000				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$4,211,450
3rd Qtr.	"	$157,500	3	123	$15,000	$3,075	$9,814,575				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$4,318,175
4th Qtr.	"	$157,500	3	126	$15,000	$3,150	$9,990,225										$18,000	$5,000	$3,000	$26,000	$4,467,825
1st Qtr.	2023	$157,500	3	129	$15,000	$3,225	$10,165,950										$18,000	$5,000	$3,000	$26,000	$4,617,550
2nd Qtr.	"	$157,500	3	132	$15,000	$3,300	$10,341,750				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$4,726,600
3rd Qtr.	"	$157,500	3	135	$15,000	$3,375	$10,517,625				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$4,833,625
4th Qtr.	"	$157,500	3	138	$15,000	$3,450	$10,693,575										$18,000	$5,000	$3,000	$26,000	$4,983,575
1st Qtr.	2024	$157,500	3	141	$15,000	$3,525	$10,869,600										$18,000	$5,000	$3,000	$26,000	$5,133,600
2nd Qtr.	"	$157,500	3	144	$15,000	$3,600	$11,045,700			$50,000	150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$116,750	$5,192,950
3rd Qtr.	"	$157,500	3	147	$15,000	$3,675	$11,221,875				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$5,300,275
4th Qtr.	"	$157,500	3	150	$15,000	$3,750	$11,398,125										$18,000	$5,000	$3,000	$26,000	$5,450,525
1st Qtr.	2025	$157,500	3	153	$15,000	$3,825	$11,574,450										$18,000	$5,000	$3,000	$26,000	$5,600,850
2nd Qtr.	"	$157,500	3	156	$15,000	$3,900	$11,750,850				150	$15,750			100	$25,000	$18,000	$5,000	$3,000	$66,750	$5,710,500
3rd Qtr.	"	$157,500	3	159	$15,000	$3,975	$11,927,325				170	$17,850			100	$25,000	$18,000	$5,000	$3,000	$68,850	$5,818,125
4th Qtr.	"	$157,500	3	162	$15,000	$4,050	$12,103,875										$18,000	$5,000	$3,000	$26,000	$5,968,675
		$11,182,500	162		$810,000	$111,375	**$12,103,875**	$360,000	$1,235,000	$1,206,000	4,790	$593,200	950	$760,000	2,200	$550,000	$972,000	$300,000	$159,000	**$6,135,200**	**$5,968,675**

*** Number of home system inspections is based upon an inspection frequency of once every 3 years for existing onsite systems, once every two years for new STEP systems that come on line, and once a year for new "engineered" onsite systems.**

**** Onsite system upgrades consist of the installation of risers to grade on the septic tanks and the installation of inspection ports in the drainfields. These improvements will dramatically reduce the time necessary for future onsite system inspections.**

***** Cost of tank pumping is based upon an estimate of the need to pump every septic tank on the average of once every 6 years. The first pumping required for existing systems will be at the cost of the homeowner.**

****** At the projected building rate, the first expansion of the treatment works will be necessary in about 2020.**

Appendix F

Eastern District Only

Lake Isabella Cash Flow Analysis

Monthly Sewer Charge = $60.00 per month through 2014

Monthly Sewer Charge = $30.00 per month after 2014

New Home Tap Fee = $5,000

Number of Properties in District = 646

Average SEV for a New Home = $100,000

Lake Isabella Cash Flow Analysis

Frequency of Home Inspection = * See note below

Est. Cost for Initial Home Inspection = N/A

Est. Cost for Future Home Inspection = N/A

Est. Cost for a Onsite System Upgrade = N/A

Est. cost of Septic Tank Pumping = N/A

Est. O & M Costs for Central and Cluster Systems = $1,000.00 per month

		Income Analysis							Sewer System Expenses													
Quarter	Year	Income in Period from Sewer Fees	No. of New Homes on Line	Total New Homes Built	Tap Fees	Tax Revenue from 1 mil	Income per Period	Accumulated Income	Planning & Design	Construction of New Sewers	Construction of New Treatment Facilities	* Number of Ex. System Inspections	Cost of System Inspections	Number of Onsite System Upgrades **	Costs of System Upgrades	Number of Septic Tank Pumpouts	*** Septic Tank Pumping Costs	Cost Assistance for System Hookups	Onsite System Repair Costs	Estimated O & M for Central Treatment	Total Expenses for Period	Sewer Fund Balance Remaining
1st Qtr.	2010	$0	0	0	$0	$0	$0	$0													$0	$0
2nd Qtr.	"	$0	0	0	$0	$0	$0	$0	$10,000												$10,000	-$10,000
3rd Qtr.	"	$116,280	0	0	$0	$0	$116,280	$116,280	$10,000												$10,000	$96,280
4th Qtr.	"	$116,280	0	0	$0	$0	$116,280	$232,560	$10,000												$10,000	$202,560
1st Qtr.	2011	$116,280	0	0	$0	$0	$116,280	$348,840	$50,000												$50,000	$268,840
2nd Qtr.	"	$116,280	0	0	$0	$0	$116,280	$465,120	$50,000												$50,000	$335,120
3rd Qtr.	"	$116,280	0	0	$0	$0	$116,280	$581,400	$30,000												$30,000	$421,400
4th Qtr.	"	$116,280	0	0	$0	$0	$116,280	$697,680	$30,000												$30,000	$507,680
1st Qtr.	2012	$116,280	0	0	$0	$0	$116,280	$813,960	$30,000												$30,000	$593,960
2nd Qtr.	"	$116,280	0	0	$0	$0	$116,280	$930,240	$20,000	$200,000	$345,000										$565,000	$145,240
3rd Qtr.	"	$116,280	3	3	$15,000	$75	$131,355	$1,061,595	$20,000	$225,000	$230,000							$18,000		$3,000	$496,000	-$219,405
4th Qtr.	"	$116,280	3	6	$15,000	$150	$131,430	$1,193,025	$25,000									$18,000		$3,000	$46,000	-$133,975
1st Qtr.	2013	$116,280	3	9	$15,000	$225	$131,505	$1,324,530	$25,000									$18,000		$3,000	$46,000	-$48,470
2nd Qtr.	"	$116,280	3	12	$15,000	$300	$131,580	$1,456,110	$10,000	$200,000								$18,000		$3,000	$231,000	-$147,890
3rd Qtr.	"	$116,280	3	15	$15,000	$375	$131,655	$1,587,765	$10,000									$18,000		$3,000	$31,000	-$47,235
4th Qtr.	"	$116,280	3	18	$15,000	$450	$131,730	$1,719,495										$18,000		$3,000	$21,000	$63,495
1st Qtr.	2014	$116,280	3	21	$15,000	$525	$131,805	$1,851,300										$18,000		$3,000	$21,000	$174,300
2nd Qtr.	"	$116,280	3	24	$15,000	$600	$131,880	$1,983,180										$18,000		$3,000	$21,000	$285,180
3rd Qtr.	"	$116,280	3	27	$15,000	$675	$131,955	$2,115,135										$18,000		$3,000	$21,000	$396,135
4th Qtr.	"	$116,280	3	30	$15,000	$750	$132,030	$2,247,165										$18,000		$3,000	$21,000	$507,165
1st Qtr.	2015	$58,140	3	33	$15,000	$825	$73,965	$2,321,130										$18,000		$3,000	$21,000	$560,130
2nd Qtr.	"	$58,140	3	36	$15,000	$900	$74,040	$2,395,170										$18,000		$3,000	$21,000	$613,170
3rd Qtr.	"	$58,140	3	39	$15,000	$975	$74,115	$2,469,285										$18,000		$3,000	$21,000	$666,285
4th Qtr.	"	$58,140	3	42	$15,000	$1,050	$74,190	$2,543,475										$18,000		$3,000	$21,000	$719,475
1st Qtr.	2016	$58,140	3	45	$15,000	$1,125	$74,265	$2,617,740										$18,000		$3,000	$21,000	$772,740
2nd Qtr.	"	$58,140	3	48	$15,000	$1,200	$74,340	$2,692,080										$18,000		$3,000	$21,000	$826,080
3rd Qtr.	"	$58,140	3	51	$15,000	$1,275	$74,415	$2,766,495										$18,000		$3,000	$21,000	$879,495
4th Qtr.	"	$58,140	3	54	$15,000	$1,350	$74,490	$2,840,985										$18,000		$3,000	$21,000	$932,985
1st Qtr.	2017	$58,140	3	57	$15,000	$1,425	$74,565	$2,915,550										$18,000		$3,000	$21,000	$986,550
2nd Qtr.	"	$58,140	3	60	$15,000	$1,500	$74,640	$2,990,190										$18,000		$3,000	$21,000	$1,040,190
3rd Qtr.	"	$58,140	3	63	$15,000	$1,575	$74,715	$3,064,905										$18,000		$3,000	$21,000	$1,093,905
4th Qtr.	"	$58,140	3	66	$15,000	$1,650	$74,790	$3,139,695										$18,000		$3,000	$21,000	$1,147,695
1st Qtr.	2018	$58,140	3	69	$15,000	$1,725	$74,865	$3,214,560										$18,000		$3,000	$21,000	$1,201,560
2nd Qtr.	"	$58,140	3	72	$15,000	$1,800	$74,940	$3,289,500										$18,000		$3,000	$21,000	$1,255,500
3rd Qtr.	"	$58,140	3	75	$15,000	$1,875	$75,015	$3,364,515										$18,000		$3,000	$21,000	$1,309,515
4th Qtr.	"	$58,140	3	78	$15,000	$1,950	$75,090	$3,439,605										$18,000		$3,000	$21,000	$1,363,605
1st Qtr.	2019	$58,140	3	81	$15,000	$2,025	$75,165	$3,514,770										$18,000		$3,000	$21,000	$1,417,770
2nd Qtr.	"	$58,140	3	84	$15,000	$2,100	$75,240	$3,590,010			$50,000							$18,000		$3,000	$71,000	$1,422,010
3rd Qtr.	"	$58,140	3	87	$15,000	$2,175	$75,315	$3,665,325										$18,000		$3,000	$21,000	$1,476,325
4th Qtr.	"	$58,140	3	90	$15,000	$2,250	$75,390	$3,740,715										$18,000		$3,000	$21,000	$1,530,715 ****
1st Qtr.	2020	$58,140	3	93	$15,000	$2,325	$75,465	$3,816,180										$18,000		$3,000	$21,000	$1,585,180
2nd Qtr.	"	$58,140	3	96	$15,000	$2,400	$75,540	$3,891,720										$18,000		$3,000	$21,000	$1,639,720
3rd Qtr.	"	$58,140	3	99	$15,000	$2,475	$75,615	$3,967,335										$18,000		$3,000	$21,000	$1,694,335
4th Qtr.	"	$58,140	3	102	$15,000	$2,550	$75,690	$4,043,025										$18,000		$3,000	$21,000	$1,749,025
1st Qtr.	2021	$58,140	3	105	$15,000	$2,625	$75,765	$4,118,790										$18,000		$3,000	$21,000	$1,803,790
2nd Qtr.	"	$58,140	3	108	$15,000	$2,700	$75,840	$4,194,630										$18,000		$3,000	$21,000	$1,858,630
3rd Qtr.	"	$58,140	3	111	$15,000	$2,775	$75,915	$4,270,545										$18,000		$3,000	$21,000	$1,913,545
4th Qtr.	"	$58,140	3	114	$15,000	$2,850	$75,990	$4,346,535			$50,000							$18,000		$3,000	$71,000	$1,918,535
1st Qtr.	2022	$58,140	3	117	$15,000	$2,925	$76,065	$4,422,600										$18,000		$3,000	$21,000	$1,973,600
2nd Qtr.	"	$58,140	3	120	$15,000	$3,000	$76,140	$4,498,740										$18,000		$3,000	$21,000	$2,028,740
3rd Qtr.	"	$58,140	3	123	$15,000	$3,075	$76,215	$4,574,955										$18,000		$3,000	$21,000	$2,083,955
4th Qtr.	"	$58,140	3	126	$15,000	$3,150	$76,290	$4,651,245										$18,000		$3,000	$21,000	$2,139,245
1st Qtr.	2023	$58,140	3	129	$15,000	$3,225	$76,365	$4,727,610										$18,000		$3,000	$21,000	$2,194,610
2nd Qtr.	"	$58,140	3	132	$15,000	$3,300	$76,440	$4,804,050										$18,000		$3,000	$21,000	$2,250,050
3rd Qtr.	"	$58,140	3	135	$15,000	$3,375	$76,515	$4,880,565										$18,000		$3,000	$21,000	$2,305,565
4th Qtr.	"	$58,140	3	138	$15,000	$3,450	$76,590	$4,957,155										$18,000		$3,000	$21,000	$2,361,155
1st Qtr.	2024	$58,140	3	141	$15,000	$3,525	$76,665	$5,033,820										$18,000		$3,000	$21,000	$2,416,820
2nd Qtr.	"	$58,140	3	144	$15,000	$3,600	$76,740	$5,110,560			$50,000							$18,000		$3,000	$71,000	$2,422,560
3rd Qtr.	"	$58,140	3	147	$15,000	$3,675	$76,815	$5,187,375										$18,000		$3,000	$21,000	$2,478,375
4th Qtr.	"	$58,140	3	150	$15,000	$3,750	$76,890	$5,264,265										$18,000		$3,000	$21,000	$2,534,265
1st Qtr.	2025	$58,140	3	153	$15,000	$3,825	$76,965	$5,341,230										$18,000		$3,000	$21,000	$2,590,230
2nd Qtr.	"	$58,140	3	156	$15,000	$3,900	$77,040	$5,418,270										$18,000		$3,000	$21,000	$2,646,270
3rd Qtr.	"	$58,140	3	159	$15,000	$3,975	$77,115	$5,495,385										$18,000		$3,000	$21,000	$2,702,385
4th Qtr.	"	$58,140	3	162	$15,000	$4,050	$77,190	$5,572,575										$18,000		$3,000	$21,000	$2,758,575
		$4,651,200	162		$810,000	$111,375	**$5,572,575**	**$5,572,575**	$330,000	$625,000	$725,000	0	$0	0	$0	0	$0	$972,000	$0	$162,000	**$2,814,000**	**$2,758,575**

*** Number of home system inspections is based upon an inspection frequency of once every 3 years for existing onsite systems, once every two years for new STEP systems that come on line, and once a year for new "engineered" onsite systems.**

**** Onsite system upgrades consist of the installation of risers to grade on the septic tanks and the installation of inspection ports in the drainfields. These improvements will dramatically reduce the time necessary for future onsite system inspections.**

***** Cost of tank pumping is based upon an estimate of the need to pump every septic tank on the average of once every 6 years. The first pumping required for existing systems will be at the cost of the homeowner.**

****** At the projected building rate, the first expansion of the treatment works will be necessary in about 2020.**

SCS SYSTEMS LLC

ONSITE WASTEWATER SYSTEM SERVICES & PRODUCTS

1549 Haslett Rd | P.O. Box 708 | Haslett, MI 48840 | P 517.339.8692 | F 517.339.6330

February 15, 2010

LAKE ISABELLA ONSITE SEPTIC SYSTEM INSPECTION PROGRAM

SCOPE:

For the purposes of this estimate, we assumed a total of 900 homes to be inspected at an interval of every 3 years. We would anticipate scheduling 300 homes per year to accomplish this task at the prescribed interval. Not knowing whether or not local qualified inspectors will be available, we have assumed program costs as if we were performing the inspections based from our Haslett office location. As such, travel time and expenses have been included to reflect this cost.

INITIAL INSPECTIONS:

Each septic system inspected for the very first time involves additional tasks to be performed that will not necessarily be repeated again. This includes obtaining copies of existing permits and as-built locations from the local health department, locating and verifying the components on each site, and mapping the components with precise measurements from fixed reference points for ease of future inspections.

Each tank will also need to be excavated down to the tank openings for inspection. Because there are no uniform standards for where these access lids are located, each tank may be different and involve additional time to find the access opening.

FUTURE INSPECTIONS:

Once proper location of components are made, each tank has been equipped with access risers to grade, and observation ports have been installed in the drainfield, the amount of time required to inspect each site is drastically reduced.

COSTS:

Initial Inspections (estimated at 10 sites completed per day)

- Document research & review – performed prior to site visit
- Onsite location & mapping
- Tank excavation, drainfield borings, and report
- Travel costs - $25/site

Total Estimated Cost: $175.00 per site

Future Inspections (estimated at 20 sites completed per day)

- Onsite location, inspection, and report
- Travel costs - $15/site

Total Estimated Cost: $90.00 per site

FACTORS INFLUENCING COST FLUCTUATIONS:

Many site factors and variables will directly influence the cost of this inspection program. Sites with very accurate permit and as-built information may decrease the time involved in location and mapping. Sites with access risers to grade or shallower than 18" below grade may also reduce time onsite. Deep tanks and drainfields, incomplete permit information, and other site obstructions may increase costs. Any additional regulatory restrictions or requirements may also increase costs.

SYSTEM UPGRADES

All onsite septic systems should be retrofitted with access risers and lids over both the inlet and outlet ends of the tank. Tanks without outlet filters should have a filter installed. In addition, each drainfield should also be equipped with observation ports installed down to the infiltrative surface.

The following estimates are for the installation of these two system upgrades. These costs are estimated on an assumed depth of 2' to the tank and drainfield components.

Tank Upgrades (two access risers, two lids, one effluent filter)

- Materials - $350
- Labor - $350
- Effluent Filter - $25

Drainfield Upgrades (two inspection ports, two valve boxes)

- Materials - $25
- Labor - $50

Total Estimated Cost: $800.00 per site