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LINN SANITARY DISTRICT

# Town of Geneva/[redacted]

## Facilities Planning Report

## October 2007

Draft

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Town of Geneva/Town of Linn
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## EXECUTIVE SUMMARY

The proposed study area encompasses portions of the Towns of Linn and Geneva located in Walworth County in southeastern Wisconsin. Specifically, it is composed of 540 acres of the Town of Linn on Geneva Lake's north shore and 2,185 acres of the Town of Geneva on Lake Como's south shore. The current population of the study area is approximately 3,109 during the recreationally active spring and summer seasons. This population is projected to increase to 4,499 by the year 2027.

Wastewater treatment and disposal is currently provided by on-site systems. The Towns have experienced continuing problems with failing septic systems in specific areas characterized by small lot sizes, poorly drained soils, steep slopes and high groundwater conditions. Continued reliance on the existing on-site systems within these problem areas will result in additional septic system failures, degradation of groundwater quality and deterioration of water quality in Geneva Lake and Lake Como.

This report evaluates alternatives to continued reliance upon the on-site systems.

The following alternatives were selected for inclusion in our cost-effectiveness analysis:

**Alternative I** – Continued use of on-site systems.

**Alternative IIA** – Treatment at the WalCoMet Wastewater Treatment Plant (WWTP) via the existing Interlaken Resort force main.

**Alternative IIB** – Treatment at the WalCoMet WWTP via construction of a new force main in the Interlaken Resort easement.

**Alternative IIC** – Treatment at the WalCoMet WWTP via construction of a new gravity/force main along Highway 50 to the Geneva National Sanitary District Lift Station No. 1.

Our opinion of probable costs for each alternative, when applied on a planning area wide basis, is summarized as follows:

| **Wastewater Collection and Treatment Alternatives** | **Alternative I - Individual Holding Tanks** | **Alternative IIA - Use of LS13** | **Alternative IIB - Use of Interlaken Easement** | **Alternative IIC - Use of Highway 50** |
|---|---|---|---|---|
| Construction Cost | $5,190,100 | $7,032,800 | $18,283,700 | $18,132,600 |
| Offsite Costs | $0 | $1,954,500 | $1,954,500 | $1,954,500 |
| Present Worth of Salvage Value | ($660,200) | ($866,000) | ($2,283,200) | ($2,258,000) |
| Present Worth of O&M | $16,770,400 | $18,906,700 | $5,568,900 | $5,542,200 |
| Total Present Worth Cost | $21,300,300 | $27,028,000 | $23,523,900 | $23,371,300 |
| Number of Homes | 660 | 716 | 759 | 759 |
| Present Worth Cost per Home | $32,300 | $37,800 | $31,000 | $30,800 |

Alternative I addresses wastewater treatment and disposal needs on an individual house-by-house basis. The Towns should adopt and enforce a rigorous inspection and maintenance program. Dwelling units that are determined to have failing and/or non-compliant systems would be forced to install the necessary improvements at the expense of the individual property owners. The total probable costs presented above represent maximum costs, assuming that all of the existing on-site systems are replaced with holding tanks. Households having compliant systems would incur no additional cost.

Should a system-wide approach be implemented, the total cost for the improvements would be shared by all residents who were connected to the system. The construction of the improvements would be financed through low-interest loans from the Wisconsin Department of Natural Resources (WDNR) Clean Water Fund, special assessments and connection fees.

To illustrate the impact on the typical user, the anticipated cost per connection under Alternative IIC would be approximately as follows:

| | |
|---|---|
| Private Property Costs | $1,800 |
| Connection Charge | $2,600 |
| Annual Assessment | $1,600 |
| Quarterly O & M Costs | $ 150 |

The up-front cost to the typical user would be approximately $4,400 with an annual cost of about $2,190 over the 20-year loan repayment period.

***Recommendations*** - Septic systems, like all engineered products, have a limited useful lifetime. The question is not *if* a septic system will need replacement but *when.* Failure for structural reasons (such as broken tanks or laterals) can be easily (but not cheaply) fixed by replacing the broken parts. Failure due to absorption field exhaustion has only one fix – replacement of the field. This fix is only feasible if there is adequate suitable land in which to locate a reserve drainfield. Without adequate land, the homeowner is faced with the decision to either install an advanced treatment system (such as an aerobic treatment unit) or a holding tank. This is the situation many homeowners in the study area will one day be facing (or have already faced) due to small lot sizes and inadequate soil conditions. In light of the ages and conditions of the existing on-site systems, the costs of available replacement systems, and the environmental sensitivity of the study area, we recommend the Towns consider Alternative IIC outlined in this report. This alternative provides for the transport of wastewater produced in the study area to the WalCoMet WWTP for ultimate treatment and disposal.

# 1. INTRODUCTION

## 1.1 Study Purpose and Scope

The purposes of a facilities planning report are to evaluate the current wastewater collection and disposal facilities in the facility planning area and to determine if the existing facilities have sufficient capacity to meet the current and future needs of the area. If the existing facilities do not have adequate capacity, alternative facilities to meet the needs must be identified and compared. The most cost-effective alternative must be determined and described. The environmental impacts of the alternatives must also be compared during the evaluation process.

A facilities plan report consists of six major tasks. They are described below.

***Assessment of Current Situation*** - The existing conditions in the facility planning area are evaluated, including the performance of the existing, on-site sewage collection, treatment and disposal systems.

***Infiltration and Inflow Analysis*** - An infiltration/inflow analysis must typically be performed as part of the facilities planning efforts, to determine whether excessive infiltration/inflow exists in the existing wastewater collection systems. Excessive infiltration/inflow is defined as that which is less costly to find and remove (through sewer system rehabilitation) than to continue to transport and treat. If the economic comparison determines that excessive infiltration/inflow exists, a follow-up sanitary sewer system evaluation survey is required.

Since wastewater treatment within the facility planning area is currently achieved through the use of on-site systems, an infiltration/inflow analysis is not required in the absence of an existing wastewater collection system.

***Assessment of Future Situation*** - The probable situation in the area during the 20-year planning period is assessed. This includes demographic and economic projections and forecasts of flow and waste loads.

***Development and Evaluation of Alternatives*** - Alternatives for wastewater collection and treatment are evaluated based on both the cost and environmental impacts of the proposed facilities.

***Selection of Plan*** - The most cost-effective alternative is identified and selected for implementation.

***Financial Considerations*** - The financial impact on the average system user is determined based upon the expected financing plan for the facilities.

## 1.2 State and Regional Considerations

A facilities planning report is required by the WDNR for all major wastewater collection, conveyance and treatment facilities. The requirements for the facilities planning report are listed in the Wisconsin Administrative Code, Section NR 110.09 for Sewage Treatment Facilities Projects, Section NR 110.10 for Sewage Collection Systems Projects and Section NR 110.11 for Sewage Lift Stations. This report is intended to comply with the WDNR requirements.

One requirement of the WDNR is that all facilities planning report recommendations must be in conformance with the approved area-wide water quality management (WQM) plan. In 1979, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) prepared an area-wide WQM plan. An amendment to this plan will be needed from SEWRPC to implement the recommendations of this planning report for the facility planning area.

## 1.3 Related Studies and Reports

A number of studies have been previously completed within the facility planning area. A brief description and summary of each follows:

***1.3.1 A Regional Water Quality Management Plan for Southeastern Wisconsin - 2000*** - SEWRPC completed a WQM plan detailing the comprehensive study of wastewater treatment in the (Illinois) Fox River basin in 1979. The report noted the pollutant-sensitive nature of inland lakes located in the region and the potential for surface water pollution related to improperly installed or maintained on-site wastewater disposal systems. This report recommended expanding the Lake Geneva wastewater treatment facility to serve existing and planned urban development along the shoreline of Geneva Lake in the Town of Linn and the shoreline of Lake Como in the Town of Geneva. A trunk sewer was proposed to extend from the City of Lake Geneva to the Interlaken Resort along the southern shore of Lake Como. Another trunk sewer was proposed to extend from Williams Bay eastward along the north shore of Geneva Lake servicing parts of the Town of Linn. Neither of these trunk lines have been constructed as of this report.

***1.3.2 Memorandum Report No. 93; A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*** - SEWRPC completed this update extending the previous plan through the year 2010. Revised sanitary service areas do not show any planned service for the majority of the south shore of Lake Como and the north shore of Geneva Lake.

***1.3.3 Geneva Lake Facilities Plan - West Planning Area*** - This facilities planning report was completed by Donohue & Associates in 1981. The report covered the Villages of Fontana, Walworth and Williams Bay, and Sections 4 and 5 of the Town of Linn north of Geneva Lake. South of Geneva Lake, the facility planning area extended from the Village of Fontana east to Black Point. The report recommended conventional gravity sewers for the Camp Sybil/Shore Haven, Academy Estates and Cisco Beach areas; cluster mound systems for the Sunset Hills Subdivision area; and replacement of existing on-site wastewater disposal systems with mound systems in the Maple Hills Subdivision and the remainder of the Linn Sanitary District (District) area. It is worth noting the recommendation to replace existing on-site systems more than twenty-five years ago.

***1.3.4 Environmental Impact Statement Wastewater Treatment Facilities for the Geneva Lake Area*** - The United States Environmental Protection Agency (USEPA) completed an Environmental Impact Statement in 1984 covering both the east and west planning areas of the 1981 facilities planning reports. The USEPA concluded that the 1981 facilities plans did not establish the need to improve the existing on-site wastewater disposal systems in the Linn Sanitary District, and therefore, any sewer extensions into these areas would not be federally funded. The USEPA recommended establishment of management districts for upgrading and operating the existing on-site systems.

***1.3.5 A Water Quality Management Plan for Geneva Lake*** - SEWRPC completed this WQM plan for Geneva Lake in 1985. The plan identified factors affecting lake water quality and made recommendations for WQM measures. The plan recommended the extension of sanitary sewer service to portions of the drainage area directly tributary to the lake, with treatment and discharge at the existing Lake Geneva, Fontana-Walworth Water Pollution Control Commission (FWWPCC), and Walworth County Metropolitan Sewerage District (WalCoMet) WWTPs. The report also recommended the establishment of a management district for the inspection, maintenance and replacement of existing on-site wastewater disposal systems.

***1.3.6 Walworth County Metropolitan Sewerage District Service Area Additions*** **-** Howard, Needles, Tammen & Bergenhoff completed a Facility Plan Amendment for WalCoMet in 1990. The Facility Plan Amendment was prepared to address the immediate and long range impacts to the WalCoMet system. The report also evaluated the cost-effectiveness of adding the Lake Como north shore area to the WalCoMet system. The report recommended that wastewater from the Lake Como area be discharged to the WalCoMet system and that provisions be included within the Geneva National Development to incorporate the future flows from Lake Como.

***1.3.7 Sanitary Sewer Service Area for the City of Lake Geneva and Environs*** **-** SEWRPC amended the boundary of the City of Lake Geneva sewer service area in 1992. A portion of the Linn Sanitary District falls within the boundaries of the Lake Geneva sewer service area, including the area between the City and Robinsons/Trinke Estates Subdivisions.

***1.3.8 Linn Sanitary District Facilities Planning Report & Amendment*** **-** January 2000 initial report prepared by Baxter & Woodman, Inc. with an amendment in 2001. The report recommended the District undertake a public awareness and hearing process to solicit public opinion regarding the future of wastewater collection and treatment. If the District were to receive a public response which endorsed the construction of a centralized collection system, the report recommended use of the existing WalCoMet facility to serve the areas along the north shore of Geneva Lake east of Williams Bay.

***1.3.9 City of Lake Geneva Impact Fee Needs Assessment and Feasibility Report -*** A January 2004 study conducted by Ehlers & Associates, Inc. to assess impact fees the City could charge to developers for municipal services. Within the report is a study done by Crispell-Snyder, Inc. on the potential expansion of water and sewer service. A portion of this proposed sewer expansion is into portions of the Town of Geneva (see Appendix A). According to this report, the area would be served by a new 2,200 gpm lift station pumping back to the City's existing collection system for treatment at their wastewater treatment facility. Portions of this proposed expanded sewer service area are also included in the current study.

***1.3.10 Feasibility Study for Use of Interlaken Lift Station and Force Main to Provide Sewer Service to the South Shore of Lake Como -*** An August 2004 letter report by Baxter & Woodman, Inc. to assess the use of the Interlaken Lift Station and force main to provide sanitary sewer service to the residents along Lake Como's south shore. The report concluded that the existing homes and businesses along the south shore of Lake Como could in fact be served by an expanded Interlaken Lift Station without the need to install a parallel force main. A limited number of additional units could also be served by such a system. However, any development beyond a few hundred new units would require a new pump station and force main at considerable cost.

***1.3.11 Sanitary Survey of Lake Como's South Shore* -** A January 2005 sanitary survey conducted by Liesch Environmental Services, Inc. to assess wastewater options for 96 properties located on Lake Como's south shore. The report concluded that 40 percent of the existing properties would not be amenable to using conventional septic systems. This conclusion is based upon incompatible soil types and small lot sizes.

***1.3.12 Wastewater Facility Plan Development for the Lake Como South Shore Cluster System* -** An August 2007 study conducted by Liesch Environmental Services, Inc. in support of this current effort (see Appendix B). This study provides an overview of the current status of on-site treatment systems for the homes located along Lake Como's south shore. The study also provides an option for these homes to be served by a cluster treatment system fed by a low-pressure sewer system, pump station and force main.

# 2. CURRENT CONDITIONS

## 2.1 Introduction

This section provides a broad overview of the facility planning area evaluated for the purposes of this Facilities Planning Report. The location and boundaries of the facility planning area are defined. Existing land use, population, topography and soil conditions are discussed. The current water qualities of Geneva Lake and Lake Como are assessed, and the existing water supply and wastewater treatment and disposal systems are described.

Data on existing septic systems for the Town of Linn portion of the facility planning area was gathered from inspection records from the Linn Sanitary District. Data on existing septic systems for the Town of Geneva portion of the facility planning area was gathered from inspection records from a study conducted by Liesch Environmental for the Town.

## 2.2 Planning Area Description

***2.2.1 Location and Boundaries -*** The facility planning area is located approximately 50 miles southwest of Milwaukee and 60 miles southeast of Madison and is comprised of portions of the unincorporated Walworth County areas of the Towns of Linn and Geneva. The facility planning area boundaries are shown on Figure 1. In general terms, the facility planning area is bordered by Lake Como to the north, Geneva Lake to the south, the Village of Williams Bay to the west, and the City of Lake Geneva to the east.

***2.2.2 Land Use -*** The facility planning area encompasses 540 acres in the Town of Linn and 2,185 acres in the Town of Geneva for a total facility planning area size of 2,725 acres. Current land use consists predominantly of residential development. Residential lot sizes vary widely from 4,000 square feet to 20 acres or more. There is some agricultural usage and a few small commercial establishments scattered across the facility planning area.

Table 1 details the current zoning of property within the facility planning area.

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**FIGURE 1**

**Facility Planning Area Boundary**

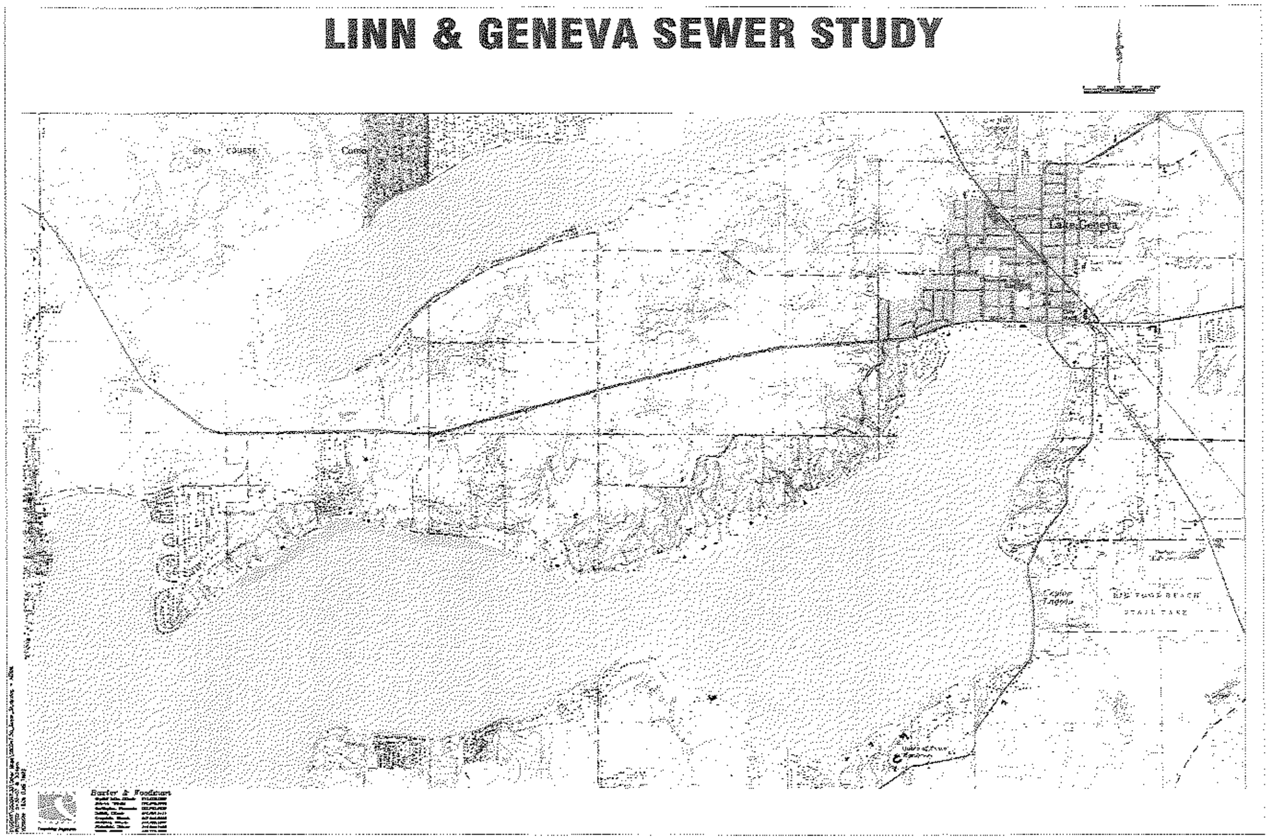

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**TABLE 1**

**Planning Area Current Zoning**

| Zone Code | Zone Title | Acres |
|---|---|---|
| R-1 | Single-Family Residence District (Unsewered) | 1,034 |
| R-2 | Single-Family Residence District (Sewered) | 0.6 |
| R-5 | Planned Residential Development District | 30 |
| R-6 | Planned Mobile Home Park Residence District | 11 |
| C-1 | Lowland Resource Conservation District | 3 |
| C-2 | Upland Resource Conservation District | 487 |
| C-3 | Conservancy-Residential District | 320 |
| C-4 | Lowland Resource Conservation District (Shoreland) | 171 |
| A-2 | Agricultural Land District | 513 |
| A-4 | Agricultural-Related Manufacturing, Warehousing & Marketing District | 2 |
| B-1 | Local Business District | 8 |
| B-2 | General Business District | 28 |
| B-3 | Waterfront Business District | 9 |
| B-4 | Highway Business District | 33 |
| B-5 | Planned Commercial-Recreation Business District | 70 |
| B-6 | Bed & Breakfast District | 2 |
| P-1 | Recreational Park District | 3 |
| P-2 | Institutional Park District | 1 |

***2.2.3 Population*** - The 2000 Census can be broken down by County, Tract, Block Group, and finally, constituent Blocks. When this is done, the facility planning area can be almost completely carved out from the rest of the Towns of Linn and Geneva. Two of the Blocks (5000 and 5014) lie partially outside the facility planning area, however, for the purpose of this report will only add a small factor of safety to the population estimates. Year 2000 Census data placed the population for the facility planning area at 1,364 residents (990 in Geneva and 374 in Linn) in 574 homes. There are, however, a total of 1,164 homes in the facility planning area. Of those homes that were vacant, most (86%) were classified as "seasonal". The average household size for those homes occupied during the Census was

2.43 persons per household for Geneva and 2.24 persons per household for Linn. Applying these same occupancy rates amongst all homes in the facility planning area yields a year 2000 planning area population of 2,755. These figures are summarized in Table 2 below.

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**TABLE 2**

**Facility Planning Area Population Based Upon 2000 Census Figures**

| | Population | Occupied Homes | Occupancy Rate | Total Homes | Estimated Population |
|---|---|---|---|---|---|
| Geneva Portion | 990 | 407 | 2.43 | 770 | 1,873 |
| Linn Portion | 374 | 167 | 2.24 | 394 | 882 |
| Total | 1,364 | 574 | 2.38 | 1,164 | 2,755 |

Source: US Census Bureau

An annual population increase based upon historic trends can be extrapolated from the census figures (see Section 3, subsection 3.3 for methodology). Annual population growth figures for the period 1990 to 2000 for Geneva and Linn are 2.4 percent and 0.24 percent, respectively. Using these annual population increases, an estimate of current population for the facility planning area can be found in Table 3.

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**TABLE 3**

**Facility Planning Area Population Extrapolation**

| | 2000 Population | Annual Growth | 2007 Population |
|---|---|---|---|
| Geneva Portion | 1,873 | 2.4% | 2,212 |
| Linn Portion | 882 | 0.24% | 897 |
| Total | 2,755 | 1.77% | 3,109 |

***2.2.4 Topography and Soil Conditions*** - The topography of the facility planning area is predominantly moderate to steep slopes with some low-lying flat topography along reaches of the lakefronts. 40 percent of the facility planning area has between a 0 to 6 percent slope, 35 percent has between a 6 to 12 percent slope, and 21 percent has between a 12 to 20 percent slope. The balance of the topography consists of wetlands, alluvium and steeply sloped (20 to 30 percent slope), eroded soils. Ground surface elevations range from 864 (lake level) to 1,100 feet above sea level.

Based upon data found in the United States Department of Agriculture Soil Survey, the soils in the facility planning area are generally of the Miami-McHenry association. The predominant soil types within the facility planning area are Miami, Kendall, St. Charles and Pella loams. The Miami soils have moderate limitations where slopes are 6 to 12 percent, and severe limitations for sanitary filter fields on slopes more than 12 percent. The Kendall soils have severe limitations for sanitary filter fields at any slope and the St. Charles soils have moderate limitations, both related to high groundwater. Pella silt loams, likewise, have severe limitations with regards to sanitary filter fields. Appendix C summarizes the suitability of soils in the facility planning area for on-site wastewater disposal systems.

***2.2.5 Geneva Lake Water Quality*** - The waters of Geneva Lake cover an area of approximately 5,262 acres, or about 8.2 square miles. The lake drains into the White River, which is tributary to the (Illinois) Fox River. The tributary drainage area is rather small, about 20 square miles. The mean depth of the lake is 61 feet with a maximum depth of approximately 135 feet.

The 2002 Water Quality Study conducted by the United States Geological Survey (USGS) reported the following land uses within the Geneva Lake watershed: agriculture and grassland, 43 percent; forest and wetland, 37 percent; urban, 9 percent; and other uses, 12 percent. Inflow to the lake is predominantly through precipitation (approximately 48 percent) and surface-water inflow (approximately 46 percent). Groundwater inflow accounts for the remaining 6 percent of water inflow.

The USGS 2002 Water Quality Study reported near-surface total phosphorous concentrations ranged between 3 – 16 micrograms per liter (µg/L) and near-surface total nitrogen concentrations ranged between 355 – 1500 µg/L. The ratio of nitrogen to phosphorous (N:P by weight) was always greater than 28:1, indicating phosphorous is the limiting nutrient for controlling algal blooms. Dissolved oxygen concentrations were near saturation during well-mixed periods. Thermal stratification causes nearly all of the oxygen to be consumed at lower depths during the late summer months and into the fall.

The swimming beaches are monitored by the Geneva Lake Environmental Agency. Sampling results from the summer of 2006 recorded 31 instances of E. coli bacteria concentrations exceeding the advisory levels for public beaches (235 cfu/100 ml for one-time sample or 126 cfu/ml for geometric mean of five samples) and five instances of E. coli bacteria concentrations exceeding the beach closing standard (1000 cfu/100 ml). Testing is currently conducted at five locations around the lake: Geneva Beach, Robinson Hillside, Linn Pier, Fontana and Williams Bay. E. coli concentrations have been found in studies to be the most reliable and consistent indicators of risk to human health by gastrointestinal illness through recreational contact.

***2.2.6 Lake Como Water Quality*** - The waters of Lake Como cover an area of approximately 946 acres, or about 1.5 square miles. The lake drains into Como Creek and then joins with the discharge from Geneva Lake in the White River. The tributary drainage area is about 6.3 square miles. The mean depth of the lake is 4.3 feet with a maximum depth of 9 feet. Secchi disk data gathered from 1993 to 1995 indicates only "minor aesthetic problems" for most years. Between April and June 1994 there was degradation in water quality described as "swimming and aesthetic enjoyment of lake slightly impaired because of high algae levels".

***2.2.7 Water Supply*** - The facility planning area has no municipal water supply system. There are a few community wells maintained by property owner associations. In the past, these community water systems had been drained and taken out of service during the winter months. With the increasing full time occupancy of the area, most of these community wells are being abandoned and individual private wells installed for water supply. The average lot size in many of the platted subdivisions is approximately 5,000 square feet, placing private wells and septic systems in close proximity to each other.

***2.2.8 Sewage Treatment and Disposal*** - The majority of the houses in the facility planning area use on-site soil absorption systems for sewage treatment and disposal. The treatment system generally includes a septic tank, which is a buried, watertight receptacle typically constructed of concrete. The tanks are designed to receive wastewater from a home or commercial business. Septic tanks separate the solids from the liquids, store the solids, and discharge partially clarified liquid for further treatment and disposal. Partial decomposition of retained solids occurs within the septic tank through limited anaerobic digestion. Scum and other floatables, including oils, greases and some fecal material, are retained in the tank through the use of baffles.

Septic tanks are typically the first component of an on-site soil wastewater treatment and disposal system. They must be followed by additional treatment and/or disposal units. In most cases, the septic tank effluent is discharged to a soil absorption system where treatment is provided through natural physical, chemical and biological processes within the soil-water matrix. Types of soil absorption systems include the seepage trench, seepage bed, seepage pit, in-ground pressurized distribution system and the mound system.

Seepage trenches are gravel-filled trenches with perforated pipe extending through their length. A trench is typically a shallow, level excavation, 30 inches to 48 inches deep and 12 to 60 inches wide. The bottom is filled with six inches of aggregate over which is laid a single line of perforated distribution piping. Additional aggregate is placed over the pipe and a semi-permeable barrier is installed to prevent the backfill from penetrating the stone. The seepage trench is installed level so that the clarified effluent from the septic tank drips out from all the perforations along its length. Over time, as the liquid spreads over the soil, it induces the growth of a "bio-mat" on the wetted soil. The mat is composed primarily of facultative (aerobic/anaerobic) bacteria. The mat provides a matrix where biological activity takes place and biodegradable materials and some microbes are consumed. In addition, it filters out most pathogens and parasites as it delivers liquid to the soil at a rate usually slower than the soils infiltrative capacity. This results in unsaturated downward flow which provides an aerated environment that enhances the soils ability to capture microbes that may have passed through the mat.

The other soil absorption systems operate in a similar manner with treatment provided by the bio-mat formed in the surrounding soil. Soil absorption systems require little or no attention as long as the systems are not hydraulically overloaded and the wastewater discharged into them is nearly free from solids, greases and oils. This requires that the upstream septic tank be well maintained. Figure 2 depicts a conventional septic tank and in-ground soil absorption system.

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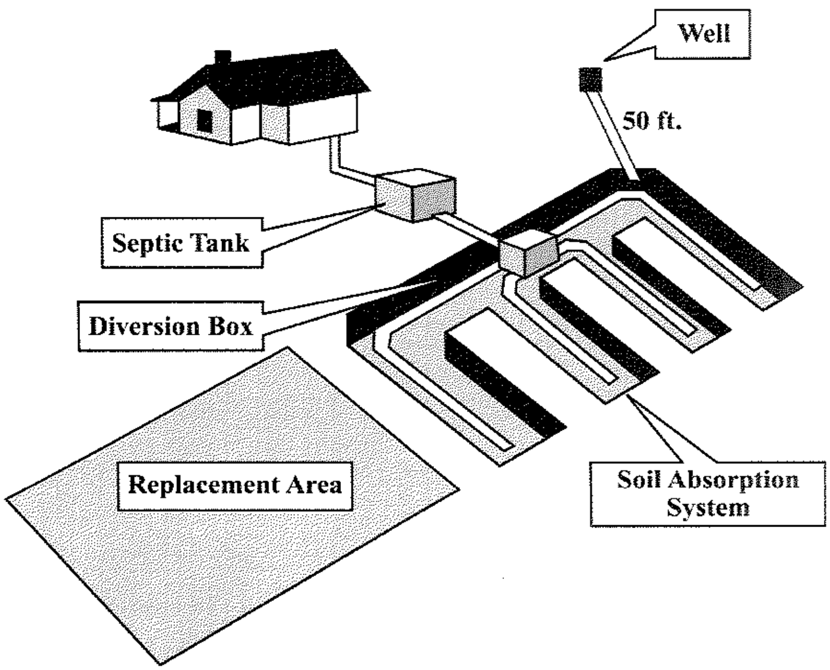
**FIGURE 2**

**Conventional On-Site Wastewater Disposal System**




Absorption fields can fail in two ways: 1) they can fail to absorb the septic tank effluent, or 2) they can fail to treat the effluent by not filtering out parasites and pathogenic organisms. If the absorption field fails, sewage may be discharged to the ground surface or back up into the house. Sewage on the ground surface can be a threat to the health and well being of the residents. A less evident health hazard is associated with the discharge of untreated or partially treated leachate to the groundwater table. As this happens below ground, it is unseen and, therefore, often not viewed as a hazard by the homeowner. If parasites and pathogenic organisms are not filtered out before the liquid enters the groundwater, the untreated waste may affect wells used for drinking water or be discharged to surrounding surface water affecting swimming beaches. Failures of absorption fields can be complex and can be the result of a combination of factors including poor siting, poor design and construction, or hydraulic overloading. The frequency of absorption field failure may range from occasional to continuous.

There are two locations at the edges of the facility planning area which currently have sanitary sewer service. In the eastern part of the facility planning area, the Coachman's Terrace mobile home park is serviced by a 4-inch force main routed along the north side of State Highway 50 to the City of Lake Geneva. The City of Lake Geneva formed their planning boundaries in Community Assistance Planning Report (CAPR) No. 203. CAPR No. 203 was done in 1993 in response to the 1979 WQM Plan. The 2004 Amendment to CAPR No. 203 shows Coachman's Terrace as "existing - served by public sanitary sewer system: 1990". On the western edge of the facility planning area, the Interlaken Resort has a pump station and force main to the Geneva National Sanitary District (GNSD). GNSD, through its own lift station, uses the WalCoMet Sewerage District plant for wastewater treatment. Further, there are overlapping areas of existing planned sanitary sewer service areas and the facility planning area of this facility plan as seen in Figure 3.

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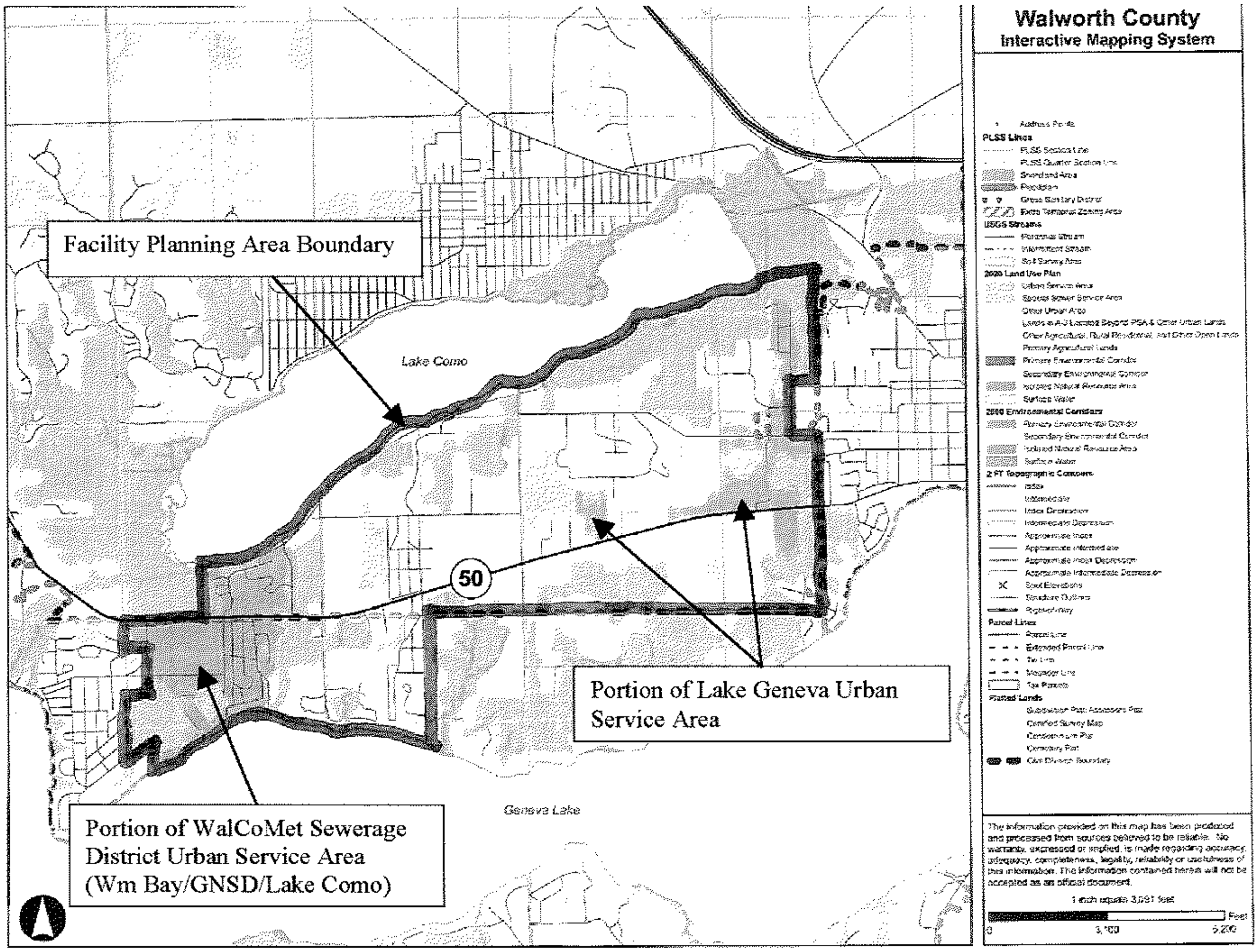
**FIGURE 3**

**WalCoMet and Lake Geneva Planning Areas**




## 2.3 Sewage Treatment and Disposal Needs

The condition of existing onsite treatment systems within the facility planning area was assessed from inspections conducted by the Towns of Geneva and Linn. Records from the Linn Sanitary District inspection program were used to assess those properties within the facility planning area which are currently within the existing boundaries of the Linn Sanitary District. These areas are primarily the environs around the Knollwood Estates subdivision and the southern half of the Sunset Hills subdivision.

The population concentrations for the Town of Geneva portion of the facility planning area are the properties along the south shore of Lake Como, the northern half of the Sunset Hills subdivision and the Wildwood subdivision. The Town conducted a study of onsite systems for 96 homes along Lake Como's south shore in 2005.

All properties within the facility planning area have some limitations for onsite wastewater treatment based upon small lot sizes, soils types, steep slopes and/or shoreline/floodplain restrictions.

***2.3.1 Town of Linn Portion of Facility Planning Area*** - The population concentrations of the Town of Linn portion of the facility planning area are concentrated in two subdivisions: the Knollwood subdivision area (including Cisco Beach, Sylvan Trail Estates, Ara Glen Estates and Elgin Club) and the southern half of the Sunset Hills subdivision. These properties are typically on lot sizes between one-quarter and one-half acre in size. These smaller lots normally do not provide adequate area for a replacement drainage field if the existing field should fail, forcing homeowners to replace their septic system with a holding tank.

The Linn Sanitary District has an ongoing on-site wastewater treatment system inspection program. As of August 2005, the District had 1,332 inspection records on file. 344 of these inspections are within the Linn portion of the facility planning area. The overwhelming majority of these systems are conventional septic systems (over 72 percent). Locating the septic tanks had a success rate of over 86 percent. Over half of the tanks (55 percent) were reported as being constructed of pre-cast concrete, the balance being formed of brick (2 percent), concrete brick/block (2 percent), steel (8 percent), unknown (20 percent) or other (11 percent). Outward evidence of failed systems has been rare. Less than 1 percent of the soil absorption systems had evidence of liquid and only 1.5 percent showed any signs of surface discharge. Similarly, for the septic tanks, slightly greater than 1 percent showed any signs of leaks or overflows. Contrary to these outward signs of failure are the reported tank component conditions. As can be seen in Table 4, only half of the 344 tanks in the facility planning area were reported as being "Adequate".

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**TABLE 4**

**Septic Tank Physical Conditions**

| Total # of tanks = 344 | Adequate | Broken | Inadequate | Not Applicable | Unable to Determine | Unknown |
|---|---|---|---|---|---|---|
| Tank Baffle Condition | 165 | 3 | 79 | 12 | 25 | 60 |
| Manhole & Riser Condition | 157 | 1 | 114 | 12 | 5 | 55 |
| Condition of Tank | 165 | 0 | 83 | 12 | 28 | 56 |

Further, only 32 percent of those systems inspected had a known or estimated installation date. Of these, the average age is over 30 years old. The National Environmental Services Center (NESC) quotes minimum septic system life expectancy between 20 to 30 years *if* the system is well maintained. Anecdotal inspection evidence indicates root penetration is a significant problem. Of the 296 tanks located, over 30 percent recorded some degree of root penetration. Of these, 25 percent could be classified as "minor penetration", 57 percent as "some penetration", and 18 percent as "substantial penetration". It is reasonable to assume that, in those tanks with root penetration, untreated septage is leaking out of the tanks and potentially polluting the groundwater in the immediate area.

***2.3.2 Town of Geneva Portion of Facility Planning Area*** - The population concentrations of the Town of Geneva portion of the facility planning area are concentrated in three areas: the northern half of the Sunset Hills subdivision, the properties along the south shore of Lake Como and the Wildwood subdivision. Parcels in Sunset Hills and on the lakeshore are typically between one-quarter and one-half acre in size. The Wildwood subdivision has lots around one acre in size.

The Town conducted a study of on-site systems for 96 properties along Lake Como's south shore in 2005. A sanitary survey was conducted as a part of this study. The survey showed that of the 96 properties investigated along South Shore Drive, at least 34 properties (40 percent) would "not allow use of conventional on-site wastewater treatment systems at a cost-effective level of investment, given current use levels, both seasonally and year-round".

***2.3.3 Summary of Sanitary Disposal Needs*** - The data from the previously cited investigations shows the heavily developed portions of the facility planning area are not well suited for traditional onsite treatment due to poor soils, steep slopes and small lot sizes. Further, some of the homes are located in the floodway and the flood fringe, requiring any new tank construction to be watertight. In some cases, the proximity of septic systems to water wells creates a liability homeowners should seek to eliminate. Additionally, many of the residences in the facility planning area have septic systems reaching the end of their useful life on lots without adequate room for drain field replacement. For homes on larger lot sizes (like the ones in Wildwood which are one acre and larger), conventional onsite systems may be a reasonable alternative if other offsetting negatives (i.e. soil suitability) can be reduced.

# 3. FUTURE CONDITIONS

## 3.1 Introduction

Current and projected wastewater treatment and disposal needs are critical concerns of the facilities planning process. This section describes the planning considerations which determine how wastewater flows have been projected for this Facilities Planning Report. Planning considerations discussed include land use, population projections, per capita wastewater flows and effluent quality requirements for various types of wastewater treatment.

Section NR 110.09 of the Wisconsin Administrative Code requires that facilities planning efforts address wastewater treatment and disposal needs within the facility planning area for a 20-year period. Accordingly, this report addresses population projections and density assumptions within the facility planning area through the year 2027.

## 3.2 Land Use

The 2020 Land Use Plan for the facility planning area is shown on Figure 4. Primary environmental corridors can be found in the facility planning area, concentrated along the eastern half of the south shore of Lake Como and stretching in a north-south direction on the eastern edge of the Interlaken Resort and Knollwood subdivision. Smaller isolated natural resource areas are scattered throughout the facility planning area.

Planned land uses are evenly divided between "other urban area", "other agricultural/rural residential" and "primary environmental corridor". Parts of the western section of the facility planning area have been planned as urban service areas to include the Interlaken Resort and Knollwood subdivision.

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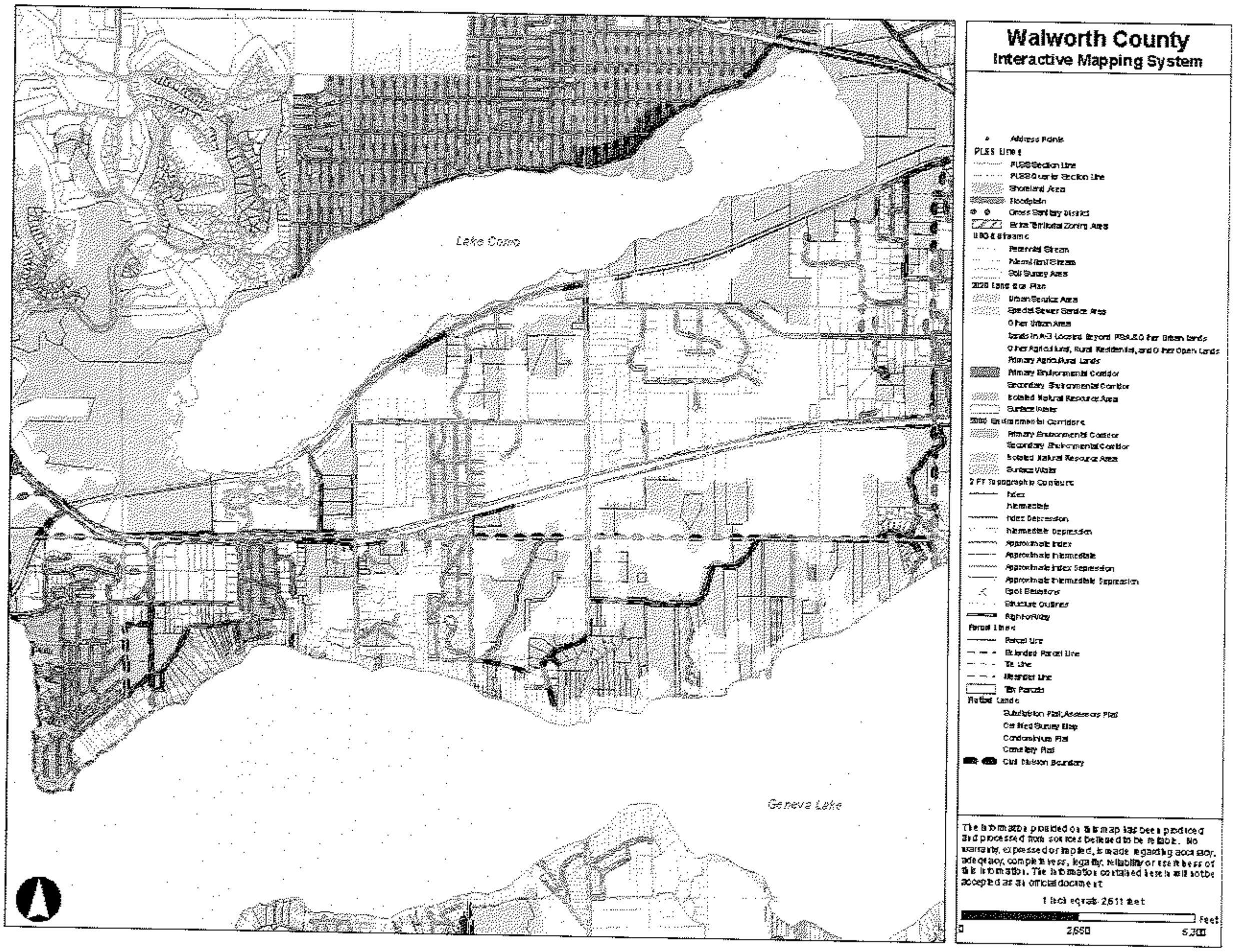
**FIGURE 4**

**Walworth County 2020 Land Use Plan**




Also, it is worthwhile noting that the Village of Williams Bay has an extraterritorial zoning area extending into the facility planning area, ending at the eastern edge of the Knollwood subdivision (see Figure 7).

## 3.3 Population Projections

Census figures and projections for the Towns of Geneva and Linn are shown in Table 5 below. As can be seen, the Town of Geneva has been growing at a slower rate than the Town of Linn (4.2 percent for Geneva versus 6.3 percent for Linn) for the period 1980 to 2000. However, Wisconsin Department of Administration (DOA) population estimates place the growth of Geneva for the period 2000 to 2025 at almost 81 percent, an annual increase of 2.4 percent. Contrasted with this figure is the relatively slow growth of neighboring Linn at a rate of 6 percent (0.24 percent annually) for the same projected time frame.

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**TABLE 5**

**Census Population Estimates**

| Population | 1980 Census | 1990 Census | 2000 Census | 2025 Projection |
|---|---|---|---|---|
| Geneva | 3,933 | 3,472 | 4,099 | 7,423 |
| Linn | 2,064 | 2,062 | 2,194 | 2,331 |

Source: WI DOA

According to the DOA, the disparity in growth rates between the towns is because projections out to 2025 are based upon the historical growth rates from 1990 to 2000. Census records indicate a precipitous drop in population for Geneva between 1980 and 1990 while the population for Linn stayed relatively flat for the same time frame. The Geneva population rebounded well above 1980 levels in 2000. Since the DOA estimates trend only the 1990 to 2000 time frame, their eventual 2025 projections indicate a much faster growth rate for Geneva than for Linn. In any case, the Town of Linn Comprehensive Plan envisions little, if any, population growth. Rather it is envisioned that smaller residences will be purchased and small lots merged for the construction of larger units.

One should keep in mind the census is conducted in April, therefore, these figures do not account for seasonal residents, only full-time residents. Therefore, the actual population creating a load for a sanitary system would be much higher.

Applying the DOA annual population projection rate of 2.04 percent per year for Geneva and 0.24 percent for Linn yields the population projections (seasonal and permanent) for the facility planning area as shown in Table 6.

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**TABLE 6**

**Facility Planning Area Population Projections**

| | 2000 Population | Annual Increase | 2027 Population Estimate |
|---|---|---|---|
| Geneva Portion | 1,873 | 2.04% | 3,557 |
| Linn Portion | 882 | 0.24% | 942 |
| Total | 2,755 | 1.77% | 4,499 |

### 3.4 Per Capita Wastewater Flows

Section NR 110.09 of the Wisconsin Administrative Code requires that current and future wastewater flows be calculated by multiplying a gallon per capita per day (gpcd) allowance by the estimated total of the existing and future resident populations to be served. This allowance includes estimates for commercial and institutional sources as well as residential sources.

The Wisconsin Administrative Code specifies the use of a per capita wastewater generation rate of 100 gpcd. The code further specifies peaking factors of 2.5 for interceptors and main (trunk) sewers and 4.0 for submain and branch sewers.

## 3.5 On-Site Disposal System Regulations (Comm 83)

Several alternative types of on-site wastewater treatment systems have recently been approved by the state as part of a revision to the Wisconsin Administrative Code Department of Commerce Chapter 83. Some of the alternative systems that are available (with certain restrictions) are aerobic pretreatment units, sand filters, drip-line effluent dispersal, disinfection units, and sand, gravel, peat and plastic filter media as described below.

- Aerobic pretreatment units, by their definition, pre-treat effluent from a septic tank before the wastewater is discharged to a soil absorption system. These units are typically employed on site for each individual user.

- Disinfection units employ chlorination, ozone disinfection or ultraviolet light disinfection to treat effluent from septic systems.

- Sand filters remove contaminants in wastewater and can include single pass or recirculating filters.

- Drip-line dispersal units slowly meter the discharge of wastewater into the soil. Potential drawbacks can be encountered due to power required and regular maintenance of this somewhat complicated system.

- Sand, gravel, peat and plastic filter media augments or replaces the filter bed of a conventional in ground septic system by increasing the contact surfaces for the wastewater and, thereby, decreasing the surface area required for the filter bed.

The technologies listed above hold great promise for areas where traditional treatment technologies are not suitable. However, even with the most effective treatment, there still needs to be a way to dispose of the treated effluent either to a receiving stream, percolated through the subsurface or used to irrigate the landscape. Comm 83 allows for larger flow rates per square foot of application area *if* the treated effluent can meet a 30/30 treatment standard (30 mg/L $BOD_5$, 30 mg/L TSS). While there may be properties which would benefit from replacing their traditional septic systems with one of the aforementioned technologies, it is doubtful that a single fix exists which will be able to alleviate all the issues of unsuitable soil types, steep slopes and high groundwater conditions in the facility planning area.

# 4. EVALUATION OF ALTERNATIVES

## 4.1 Introduction

One of the primary purposes of a facilities planning report is to conduct a cost-effective analysis of appropriate alternatives. This section summarizes the evaluation of alternatives for wastewater treatment and disposal within the facility planning area.

For consistency with the terminology used in the Linn Sanitary Facilities Planning Report, the alternatives presented herein are generally classified into two distinct categories:

***Type I Improvements***

Improvement programs which address wastewater treatment and disposal needs on an individual house-by-house basis. The responsible agency (municipalities or sanitary districts) would adopt and enforce an inspection and maintenance program. Owners of dwelling units that are determined to have failing and/or unacceptable systems would be required to install the necessary improvements at their own expense.

***Type II Improvements***

Improvement programs which address wastewater treatment and disposal needs on a global or neighborhood-by-neighborhood basis. These programs would involve the elimination of the existing on-site systems, and construction of collection and pumping systems to convey wastewater to remote site(s) for treatment and disposal.

## 4.2 Type I Improvements

The implementation of a plan based on addressing wastewater treatment and disposal on a unit basis will require selection of a management model to be used by the responsible governing authority. In any case, the enforcement of ordinances through inspections is required. These issues are discussed below, including a cost comparison of the alternative Type I improvements.

***4.2.1 Management Model Changes*** - Management of onsite systems on a global perspective can take many forms depending upon the involvement of the responsible government entity. The USEPA outlines five different models for onsite wastewater management in their "Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems". These models operate on a continuum of authority by the regulatory agency from a strictly advisory role to complete ownership of the systems.

***The "Homeowner Awareness" Management Model*** - "Homeowner Awareness" specifies appropriate program elements and activities where treatment systems are owned and operated by individual property owners in areas of low environmental sensitivity. This model is adequate where treatment technologies are limited to conventional systems that require little owner attention. To help ensure that timely maintenance is performed, the regulatory authority mails maintenance reminders to owners at appropriate intervals.

***The "Maintenance Contracts" Management Model*** - "Maintenance Contracts" specifies program elements and activities where more complex designs are employed to enhance the capacity of conventional systems to accept and treat wastewater. Because of treatment complexity, contracts with qualified technicians are needed to ensure proper and timely maintenance.

***The "Operating Permits" Management Model*** - "Operating Permits" specifies program elements and activities where sustained performance of treatment systems is critical to protect public health and water quality. Limited-term operating permits are issued to the owner and are renewable for another term if the owner demonstrates that the system is in compliance with the terms and conditions of the permit. Performance-based designs may be incorporated into programs with management controls at this level.

***The "Responsible Management Entity Operations and Maintenance" Management Model*** - "Responsible Management Entity (RME) Operation and Maintenance" specifies program elements and activities where frequent and highly reliable operation and maintenance of decentralized systems is required to ensure water resource protection in sensitive environments. Under this model, the operating permit is issued to an RME instead of the property owner to provide the needed assurance that the appropriate maintenance is performed.

***The "Responsible Management Entity Ownership" Management Model*** - "RME Ownership" specifies that program elements and activities for treatment systems are owned, operated and maintained by the RME, which removes the property owner from responsibility for the system. This program is analogous to central sewerage and provides the greatest assurance of system performance in the most sensitive of environments.

Walworth County Municipal Code, Section 70, requires permits for onsite wastewater systems prior to construction or if changes are made to an existing system. One qualifying condition for onsite permits is a maintenance and management plan must be provided along with a contingency plan outlining available treatment options in the event the system fails and cannot be repaired. Inspection and maintenance intervals are also set by the code. Homeowners are sent reminder notices and are required to submit signed documentation by licensed individuals that all requirements per the appropriate code have been met. Given these regulatory requirements, Walworth County currently fits most closely into the "Maintenance Contracts" management model.

Responsible entities having authority over the facility planning area may wish to adopt an increased level of management responsibility in addition to requiring owners of failing systems to make capital changes to their onsite treatment systems. A higher level management model naturally requires an increased funding level, which in turn means higher fees and taxes for residents. Ideally, these costs would not be a significant plus-up for residents, but rather a shift of operations and maintenance costs from their household budgets to their taxes.

***4.2.2 Inspection and Enforcement*** - Regardless of the management model chosen, Type I improvements begin with a rigorous inspection program. Such programs as that recently conducted by the Linn Sanitary District, as outlined in Section 2, subsection 2.3, are a good starting point, however, to be effective they require enforcement for those systems deemed to be "failing". Wisconsin Statute 145.245(4) defines a failing private sewage system by one of three failure modes. These three types of failures are characterized by either contamination of surface or groundwater, the discharge of sewage to the surface of the ground, or a failure which causes the system to back-up into the structure.

Using a higher management model could put the burden on the homeowner to not just demonstrate "non-failure" but also compliance with treatment standards. Homeowners would have the option of fixing failing or noncompliant systems through repairs, construction of a new conventional system or construction of a new alternative system as previously outlined in Section 3, subsection 3.5. Final authority for approving the corrective action would lie with the responsible regulatory authority. If the corrective action proposed does not meet the technical or regulatory requirements for the location in question (for soil types, slopes, groundwater elevation, etc), a method of last resort for the homeowner would be to propose installation of a holding tank.

***4.2.3 Holding Tanks*** - Holding tanks are watertight containers designed for the collection and holding of sewage. The tanks are constructed of concrete, steel or glass-fiber reinforced polyester. Wastewater from each building is conveyed through a pipeline by gravity to the holding tank, which is typically located on private property. The wastewater is stored in the holding tank until a septic service truck pumps it out. The tank is equipped with a warning device that activates an audible and/or visible alarm when the level in the tank is almost full. Actuation of the alarm indicates to the owner that the tank needs to be pumped. The removed septage is transported to a remote wastewater plant for treatment.

Per Comm 83, holding tanks for residential homes are to be designed in accordance with the "Holding Tank Component Manual for Private Onsite Wastewater Systems (June 11, 1999)". This manual specifies the minimum allowable capacity to be 2,000 gallons or five times the estimated average daily flow, whichever is greater. Estimated daily flow for a private onsite system is calculated using the provisions of Comm 83 which uses 100 gallons per bedroom per day. For a typical three-bedroom house, this calculation yields only 1,500 gallons (3 bedrooms x 100 gallons/bedroom x 5 = 1,500 gallons), which results in using the 2,000-gallon minimum.

The deciding factor in most typical residential cases then becomes one of pumping frequency. The Wisconsin Administrative Code (NR110.13) prescribes a wastewater flow rate of 100 gpcd for sewage collection systems. Based on 2.4 people per house and 100 gallons of wastewater per person per day, an average household would produce approximately 240 gallons of wastewater per day per house. With a typical 3,000-gallon holding tank, pumping would be required every 12½ days for homes in use full-time.

The advantages of installing a holding tank include relatively low initial cost and less involvement in day-to-day operations for the municipality. Holding tank operations could be contracted out similar to garbage collection. A disadvantage of installing holding tanks is a dramatic increase in the truck traffic within residential neighborhoods associated with hauling septage from the holding tanks. Further, if sewer service is eventually installed, those homeowners who had installed holding tanks for failing septic systems would have paid twice for improving their sewerage service – once for a holding tank and again for connecting to the sewer system.

It is worthy to note that per Walworth County Code, installation of a holding tank is prohibited if any other type of private sewage system as allowed by Comm 83.61 may be utilized. This includes mound systems and recirculating sand filters. The County Code further prohibits holding tanks as primary systems on any newly created lots of parcels platted after August 13, 1974. Section 70-41 also requires the owner of each holding tank to enter into a maintenance agreement with the municipality guaranteeing that the local governmental unit which signed the agreement will service the holding tank, if the owner fails to have the tank properly serviced in response to orders issued by the County.

***4.2.4 Costs*** - The costs associated with making Type I improvements will vary considerably among individual properties. It will depend upon the condition of the existing treatment system, the lot characteristics (soils, slopes, depth to groundwater, etc) and the flows and loads from the residences. Costs are also dependent upon what changes (if any) the municipality wishes to make in their current system of inspection and enforcement. For comparison purposes, included in Appendix D is a cost analysis that assumes a worse-case scenario that all residences need their septic tanks replaced with individual holding tanks. Seasonal residences were calculated based on ½ time usage.

## 4.3 Type II Improvements

***4.3.1 Introduction*** - The nature of the varying lot sizes within the facility planning area poses a challenge for decision makers. Typically, adequate space can be found on lot sizes greater than one-acre for a functioning onsite treatment system with adequate room for a reserve area. The current Walworth County Code reflects this condition by requiring lots of 40,000 square feet (0.92 acres) for unsewered single family residences (zoned R-1). Lot sizes between 10,000 square feet and 40,000 square feet and zoned R-1 (unsewered) are classified as "substandard", however, are considered "buildable".

When planning Type II improvements, it is reasonable to reduce the number of sewer connections to only those homes which would benefit the most from these improvements rather than extending sanitary sewer service to every household in the facility planning area. Figure 5 outlines the areas which would most benefit from an extension of sewer service due to their smaller lot sizes, aging septic systems and proximity to Geneva Lake and Lake Como. There are approximately 760 units within these areas. For ease of accounting, the facility planning area has been divided into four subareas (see Figure 6 and Table 7).

- ***Subarea I*** consists of the Linn portion of the facility planning area and is dominated by small lots in the Knollwood Estates and southern portion of Sunset Hills subdivisions. This subarea also includes a 10 unit allowance for the Chef's Corner Bistro restaurant.

- ***Subarea II*** consists of the homes immediately adjacent to Lake Como's south shore. This subarea includes 96 homes plus a 44 unit allowance for the Wateredge Bed & Breakfast, the French Country Inn and the Mars Restaurant.

- ***Subarea III*** consists of the western half of the Geneva portion of the facility planning area to include the northern portion of the Sunset Hills subdivision.

- ***Subarea IV*** consists of the eastern half of the Geneva portion of the facility planning area to include the Wildwood Estates subdivision.

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**TABLE 7**

**Facility Planning Area Subareas**

| Subarea | Acres | Units |
|---|---|---|
| I | 540 | 340 X |
| II | 123 | 140 |
| III | 667 | 155 |
| IV | 1,395 | 124 |
| Total | 2,725 | 759 |

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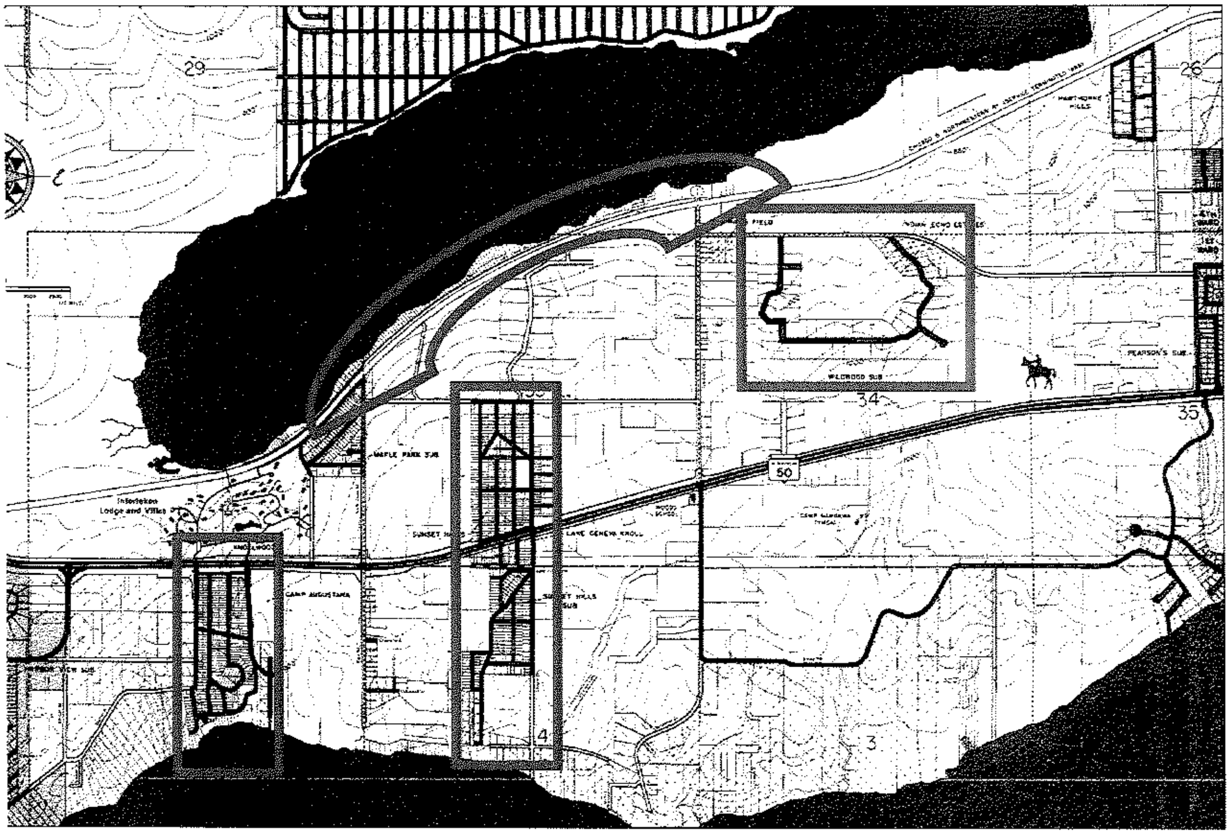
**FIGURE 5**

**Subdivision Concentrations**




***4.3.2 Wastewater Flows*** - There are three scenarios worthy of consideration in anticipating future wastewater loads requiring centralized collection and treatment. These scenarios include servicing only existing developments, servicing the entire future population and servicing as if all of the facility planning area will be built-out.

***Service existing developments*** - As previously mentioned, there are approximately 760 units which could immediately benefit from centralized collection and treatment. Applying the historical residencies of 2.43 persons per residence for Geneva and 2.24 persons

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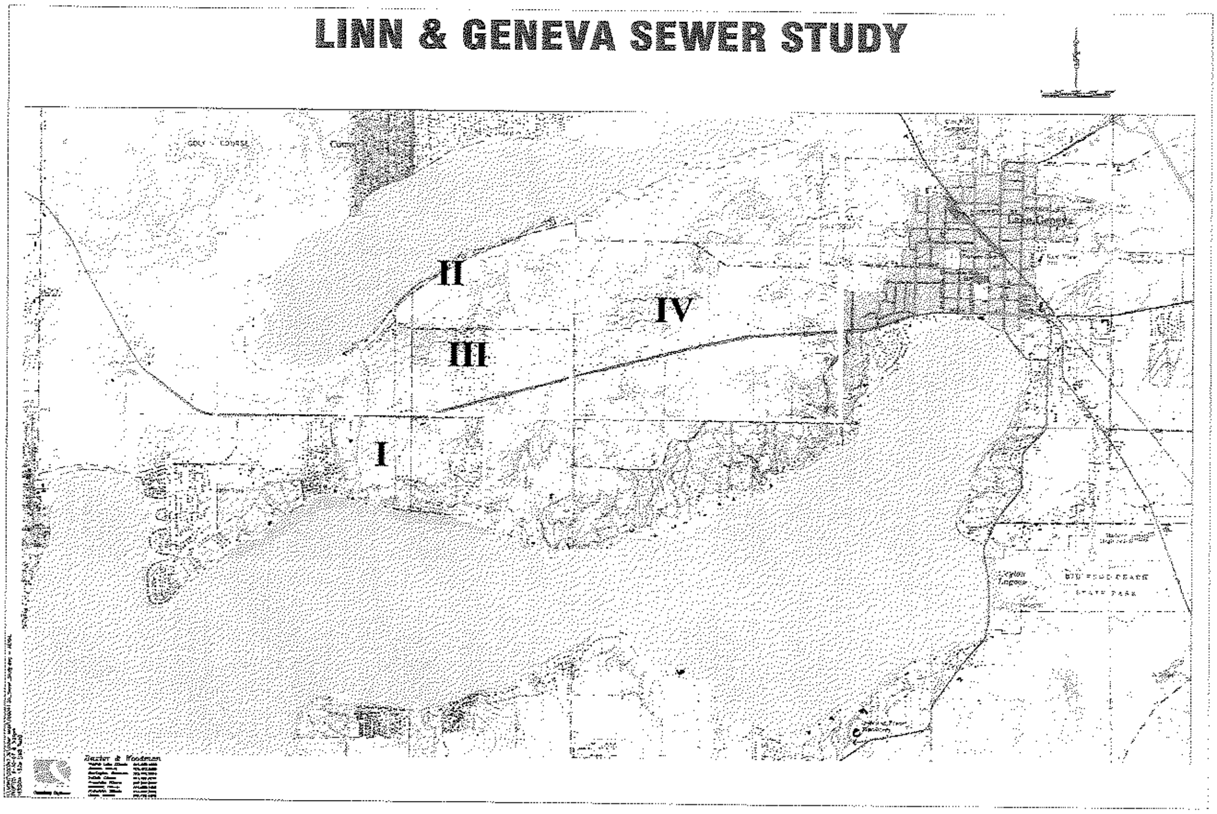
**FIGURE 6**

**Numbered Subareas**




per residence for Linn yields a potential population on these lots of 1,777 population equivalents (PE). Flows are calculated based upon 100 gpcd and a peaking factor of four. Table 8 highlights projected flows by subarea.

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**TABLE 8**

**Wastewater Flows – Existing Developments**

| Subarea | Population Equivalent | Average Flow (gpd) | Peak Flow (gpd) |
|---|---|---|---|
| I | 760 | 76,000 | 304,000 |
| II | 340 | 34,000 | 136,000 |
| III | 376 | 37,600 | 150,400 |
| IV | 301 | 30,100 | 120,400 |
| Total | 1,777 | 177,700 | 710,800 |

***Service the entire future population*** - As mentioned in Section 3, the anticipated future population (year 2027) for the facility planning area is approximately 4,500 people (based upon DOA trends). Using 100 gpcd and a peaking factor of four yields an average wastewater flow of 450,000 gallons per day and a peak flow of 1,800,000 gallons per day. Table 9 breaks these flows down by subarea.

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**TABLE 9**

**Wastewater Flows - Future Population**

| Subarea | Population Equivalent | Average Flow (gpd) | Peak Flow (gpd) |
|---|---|---|---|
| I | 942 | 94,200 | 376,800 |
| II | 534 | 53,400 | 213,600 |
| III | 1,245 | 124,500 | 498,000 |
| IV | 1,779 | 177,900 | 711,600 |
| Total | 4,500 | 450,000 | 1,800,000 |

***Plan service as if all of facility planning area will be built-out*** - The facility planning area consists of 2,725 acres. Utilizing the 2020 Walworth County Land Use Plan as a template, each subarea can be further divided into their intended uses (see Table 10) and the resultant wastewater flows computed.

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**TABLE 10**

**Wastewater Flows – Future Build-Out**

| Subarea | Urban | | Ag | | Env | | Total | | Average Flow (gpd) | Peak Flow (gpd) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Acres | PE | Acres | PE | Acres | PE | Acres | PE | | |
| I | 376 | 1,684 | 4 | 2 | 160 | 18 | 540 | 1,704 | 170,419 | 681,677 |
| II | 93 | 452 | 16 | 8 | 14 | 2 | 123 | 461 | 46,146 | 184,583 |
| III | 261 | 1,268 | 245 | 119 | 161 | 20 | 667 | 1,407 | 140,709 | 562,837 |
| IV | 475 | 2,309 | 299 | 145 | 621 | 75 | 1,395 | 2,529 | 252,927 | 1,011,706 |
| Total | 1,205 | 5,713 | 564 | 274 | 956 | 115 | 2,725 | 6,102 | 610,201 | 2,440,802 |

"Urban" areas include Urban Service Areas and Other Urban Areas. "Ag" includes Primary Agricultural Lands, Lands in A-3 Beyond PSA and Other Urban Lands and Other Agricultural Lands. "Env" areas include Primary Environmental Corridors, Secondary Environmental Corridors and Isolated Natural Resource areas. The Land Use Plan allows development within Environmental Corridors and Isolated Natural Resource Areas at a density of one residence per every five acres, however, discourages such development in favor of maintaining these areas in a natural state. For the purpose of this report, it is assumed that urban areas could be developed at an average density two residences per acre and agricultural land at a density of one residence per every five acres.

***Flow Scenario Comparisons*** - Table 11 below is a comparison of the three wastewater flow scenarios.

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**TABLE 11**

**Wastewater Flow Summary**

| | Population Served | Average Flow* (MGD) | Peak Flow** (MGD) |
|---|---|---|---|
| Existing Developments | 1,777 | 0.178 | 0.712 |
| Future Population | 4,500 | 0.450 | 1.800 |
| Future Build-Out | 6,102 | 0.610 | 2.441 |

* Production based upon 100 gpcd
** Assumes a peaking factor of 4

***4.3.3 Geneva National Sanitary District Capacity*** - The Linn Sanitary District met with representatives of the GNSD in late 1999 to discuss the possibility of discharging their wastewater to the GNSD's pumping station (LS1) tributary to the WalCoMet WWTP. This pumping station is located along Highway 50 approximately 1½ miles northwest of the District boundaries.

LS1 was designed to accept wastewater from the Geneva National development as well as the Lake Como area. The Lake Como Sanitary District has since constructed a sanitary sewer system discharging directly to the WalCoMet WWTP, thereby bypassing LS1. Because of that, the existing lift station has excess capacity that could be used for other purposes, such as providing service to the facility planning area in question herein.

The GNSD sanitary sewer system was designed to handle an ultimate population of 6,800 PE. At 100 gpcd, this equates to 0.68 MGD average daily flow and 2.72 MGD peak daily flow. The force main from LS1 is 16 inches in diameter. At a maximum velocity of 8 feet per second (fps), the force main could handle 7.22 MGD, leaving 4.50 MGD available for other users. This excess capacity is strictly from a force main velocity perspective. A hydraulic analysis of the force main would be required to determine if the conditions are such that this much flow could be pumped without requiring additional lift via an intermediate pump station.

The excess pumping capacity at LS1 must also be considered. The current design capacity of LS1 is 2.88 MGD (2,000 gpm), which equates to a velocity of 3.2 fps in the force main. An estimate by WalCoMet placed the estimated year 2018 and 2028 PEs for GNSD at 3,953 and 5,450, respectively. Using 100 gpcd and a peaking factor of four yields flow rates for these two periods of 1.58 MGD and 2.18 MGD, respectively. These figures are summarized below in Table 12. Comparing Table 8 through Table 11 with Table 12, it is estimated that changes will be required to LS1 to accommodate the growth of Geneva National and flows from the facility planning area. LS1 is estimated to have a year 2028 excess capacity of 700,000 gallons per day (gpd). Peak flows for existing developments in the facility planning area are estimated to be 710,800 gpd. Given the amount of excess capacity provided by the existing 16-inch force main, the pumps in LS1 could be replaced with larger units capable of utilizing a greater percentage of the available pipe capacity.

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**TABLE 12**

**Geneva National SD Lift Station and Force Main Capacities**

| Flows (MGD) | 16" Force Main | | LS1 | |
|---|---|---|---|---|
| Capacity | 7.22 | | 2.88 | |
| GNSD 2028/Ultimate | 2.18 | 2.72 | 2.18 | 2.72 |
| Excess Available | 5.04 | 4.50 | 0.70 | 0.16 |

The WalCoMet WWTP requires areas desiring wastewater treatment be part of a sanitary district. A key decision required prior to any Type II improvements will be the nature of the sanitary district which will encompass the new service area. The sections of the facility planning area within the Town of Linn are already within the boundaries of the Linn Sanitary District; however, the portions within the Town of Geneva are not. Options include (but are not limited to) the facility planning area becoming a part of the GNSD, becoming a part of the Lake Como Sanitary District, becoming a part of the Linn Sanitary District or forming a new sanitary district.

***4.3.4 Alternatives Introduction*** - Three alternatives were evaluated for the Type II improvements. Each alternative includes the construction of a wastewater collection and conveyance system to transport flow to the WalCoMet WWTP for subsequent treatment and disposal. The collection systems consist of a network of gravity sewers, pumping stations and pressurized force mains. The layout of the wastewater collection facilities will vary somewhat for each of the alternative Type II improvement programs discussed in the following subsections of this report. The details specific to each alternative are illustrated and discussed. The three alternatives evaluated include:

> ***Alternative IIA - Treatment at the WalCoMet WWTP via the existing Interlaken Resort force main*** - Construction of the collection systems necessary to convey wastewater to the WalCoMet WWTP using the existing force main at the Interlaken Resort to the lift station located at the GNSD.
>
> ***Alternative IIB - Treatment at the WalCoMet WWTP via construction of a new force main in the Interlaken easement*** - Construction of the collection systems necessary to convey wastewater to the WalCoMet WWTP using a new pump station and force main in the same easement now used by the Interlaken Resort force main. Wastewater would be transported to the lift station located at the GNSD.

***Alternative IIC - Treatment at the WalCoMet WWTP via construction of new gravity/force main along Highway 50 -*** Construction of the collection systems necessary to convey wastewater to WalCoMet WWTP using a new pump station and force main along Highway 50. Wastewater would be transported to the lift station located at the GNSD.

***4.3.5 Alternative IIA - Treatment at the WalCoMet WWTP via the existing Interlaken Resort force main*** - In 1991, the Interlaken Resort abandoned their WWTP and constructed a lift station (LS13) and force main. Wastewater for the resort is now transported along an old railroad right-of-way through an 8-inch force main towards Highway 50. The force main enters a manhole located at the Geneva National Golf Club. From this manhole, wastewater flows by gravity through a 12-inch sewer to the GNSD LS1. LS1 pumps wastewater for the Geneva National Community and the Interlaken Resort to the WalCoMet treatment plant via a 16-inch force main.

As previously mentioned, a feasibility study was conducted by Baxter & Woodman, Inc. in 2004 to assess whether sufficient capacity existed at the existing Interlaken pump station and within the existing force main to service those homes along Lake Como's south shore. The report concluded that with upgrades to the pump station (new pumps and discharge piping), the existing 8-inch force main could accommodate approximately 420 homes. With the additional 420 homes, the 8-inch force main from LS13 to LS1 would be at its maximum capacity of 940 gpm. As previously reported in Section 2, the estimated number of existing homes in the facility planning area is 1,164 homes (770 in Geneva and 394 in Linn). The Interlaken force main would be able to take some of this load but would leave approximately two-thirds (1,164 – 420 = 744 homes) of the existing homes in the facility planning area without sewer service. However, as discussed previously, it is reasonable to consider sewer service only for those homes which could benefit the most, those being the approximately 760 units in the Sunset Hills, Knollwood Estates, Wildwood Estates and Lake Como South Shore areas. While it is true this subset of units is smaller than the total number of residences in the planning area, it is still greater than the available capacity of LS13 and the force main, leaving no available capacity for growth.

The connection of homes in the facility planning area to LS13 has some administrative and political challenges as well. The Interlaken Resort is a private corporation. Its force main is connected to a public sanitary district (GNSD). If homes from the Towns of Geneva and/or Linn connect to LS13, the situation would exist that a public collection system would be connected to a private entity for transport to another public entity. In anticipation of potential risks and liabilities in the previous Lake Como South Shore study, correspondence was initiated with the WDNR in February 2005. The DNR stated at that time that, while it was not their normal practice to allow a municipality to connect to systems owned by a private entity, the concept would be given consideration if (at a minimum) the following items were addressed:

- The municipality would need to demonstrate that they can maintain reasonable management controls.
- Connections must be viable and cost-effective; need to explore the uncertainties and risks compared to other alternatives.
- The municipality must address what sort of contractual arrangements with Interlaken would be established and how the municipalities' interests would be protected.
- The municipalities would have to obtain sufficient rights to LS13 and the force main if a Clean Water Fund loan is obtained to ensure the facilities are available and properly operated during the life of the loan.

- Agreements and/or contracts would have to be binding on any future owners of the Interlaken Resort.

In February 2007, a license agreement was signed between GNSD and the Interlaken Service Corporation (ISC) allowing for homes within the Town of Geneva to connect to the Interlaken force main subject to the terms of the license. Among these terms are:

- Payment of recapture costs of the Interlaken force main and/or LS1 to ISC by any new competing development or commercial enterprise tributary to LS13.

- Limited flow (in addition to Interlaken) to 150 gpm (0.216 mgd). Using a peak flow multiplier of 4 equates to an additional 225 homes which the license will allow to hook up to the system:

$$\frac{216{,}000 \text{ gpd}}{4} = 54{,}000 \text{ gpd average daily flow}$$

$$\frac{54{,}000 \text{ gpd}}{100 \text{ gal/person/day}} = 540 \text{ PE}$$

$$\frac{540 \text{ PE}}{2.4 \text{ people/residence}} = 225 \text{ units}$$

  The license also discusses a future development at the Interlaken Resort which will add 150 condominiums to the collection system. If these 150 units are subtracted from the 420 units calculated in the 2004 Baxter & Woodman study, a capacity balance of 270 units outside of the Interlaken Resort remain, slightly greater than the mandated number of units calculated above.

- The agreement assumes residences connected to LS1 via LS13 will become a part of GNSD. Assignment of the rights of the license may be assigned to another sanitary district only with the approval of ISC.

- Layouts provided as part of the agreement show the proposed force main from Lake Como's south shore tying directly into the Interlaken force main and not discharging into the wetwell of LS13. This arrangement would require pumps of sufficient capacity to pump against the pressure created by LS13

It is apparent exercising this option will only serve a portion of the homes within the facility planning area. If town authorities decided to use this option for a portion of the facility planning area (for example, Lake Como South Shore), they would be assuming all the risks and liabilities of the legal agreement with Interlaken and still need a separate plan for the remaining unserviced portion of the facility planning area.

***4.3.6 Alternative IIB - Treatment at the WalCoMet WWTP via construction of a new force main in the Interlaken easement*** - This alternative involves building a new lift station and force main within the Interlaken easement to LS1 at GNSD. The advantage of this option over Alternative IIA is the towns can service the homes within the facility planning area and maintain some sovereignty over their system. One obvious downside is that within the aforementioned license agreement between Interlaken and the GNSD is a clause which places terms on the use of the easement such as (but not limited to):

- Limiting the design capacity of the system.
- Exempting ISC from paying any of the costs involved with upgrading LS1 as a result of the new force main.
- Allows for recapture payments as previously outlined.

Limiting the design capacity of the lift station will clearly limit the service area the new force main will be able to support. As in Alternative IIA, town authorities may be required to build an additional lift station and force main elsewhere if Interlaken decides to limit the number of homes serviced to something less than the projected value.

***4.3.7 Alternative IIC - Treatment at the WalCoMet WWTP via construction of new gravity/force main along Highway 50*** - This alternative requires building a lift station and force main along Highway 50 and discharging to LS1 for transport to WalCoMet WWTP.

The advantage of this alternative is it allows a level of flexibility and control over the design of the collection system to insure it will be adequate for the entire facility planning area. It also will not be restricted by the caveats of the current licensing agreement between GNSD and Interlaken. One obvious disadvantage is in deciding how to connect to GNSD LS1. The 12-inch gravity sewer where the Interlaken force main connects into the GNSD system is also owned by ISC and subject to the same legal requirements of the license agreement. For this alternative to be free of these requirements means connecting directly to LS1 at a different location. Therefore, the feasibility of this option will be to some extent dependent upon being able to locate another outlet pipe into the LS1 wetwell and trenching into the Geneva National parking lot to make this connection.

### 4.4 Cost Comparison

The capital and annual operation and maintenance opinions of probable costs for the four alternatives are compared below. The comparisons were conducted assuming only those areas discussed above (Knollwood area, Sunset Hills area, Wildwood area and Lake Como South Shore) would be immediately impacted by the physical changes for the facility planning area. If the new/changed sanitary district decides to adopt more oversight over the onsite systems which are not in these areas, certainly there will be an added expense for these homeowners as well.

The detailed opinions of probable costs for each alternative are included in Appendix D. A summary of the present worth cost comparison is presented in Table 13.

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**TABLE 13**

**Cost Comparison**

| Wastewater Collection and Treatment Alternatives | Alternative I - Individual Holding Tanks | Alternative IIA - Use of LS13 | Alternative IIB - Use of Interlaken Easement | Alternative IIC - Use of Highway 50 |
|---|---|---|---|---|
| Construction Cost | $5,190,100 | $7,032,800 | $18,283,700 | $18,132,600 |
| Offsite Costs | $0 | $1,954,500 | $1,954,500 | $1,954,500 |
| Present Worth of Salvage Value | ($660,200) | ($866,000) | ($2,283,200) | ($2,258,000) |
| Present Worth of O&M | $16,770,400 | $18,906,700 | $5,568,900 | $5,542,200 |
| Total Present Worth Cost | $21,300,300 | $27,028,000 | $23,523,900 | $23,371,300 |
| Number of Homes | 660 | 716 | 759 | 759 |
| Present Worth Cost per Home | $32,300 | $37,800 | $31,000 | $30,800 |

The present worth cost consists of the capital cost plus the present worth value of the operation and maintenance costs less the present worth of the salvage value. The present worth cost evaluation is based on an interest rate of 5.125 percent and a 20-year planning period. The interest rate was established by WDNR for facilities planning reports.

# 5. SELECTED PLAN

## 5.1 Introduction

This section describes the proposed wastewater collection, treatment and disposal improvements within the facility planning area through the year 2027. This section also discusses the environmental impacts of the proposed improvements.

As discussed previously, municipalities should be free to include all homes in the facility planning area within any new or changed sanitary district, regardless of whether they were to receive sanitary service. On the contrary, from a water quality perspective, it is logical to sewer those communities which most need it (Type II improvements) and adopt a stricter onsite management scheme for those homes which have a greater likelihood of compliant systems (Type I improvements) within the same sanitary district. This combined approach of incorporating both Type I and Type II improvements makes sense from a cost and water quality standpoint, however, it does pose some challenges for decision makers.

The first of these challenges is with regards to zoning. Areas which are planned for Type II improvements are currently mostly zoned as R-1 (unsewered). Once these areas are planned for sanitary service, they could be carved out of their existing zoned area and rezoned as R-2, maintaining the R-1 designation for those areas with larger lot sizes (greater than 40,000 square feet). Note that rezoning some of these areas may require approval of an extraterritorial zoning committee (per the 2020 Walworth County Land Use Plan, the Village of Williams Bay has enacted extraterritorial zoning into and covering a large portion of the facility planning area [see Figure 7]).

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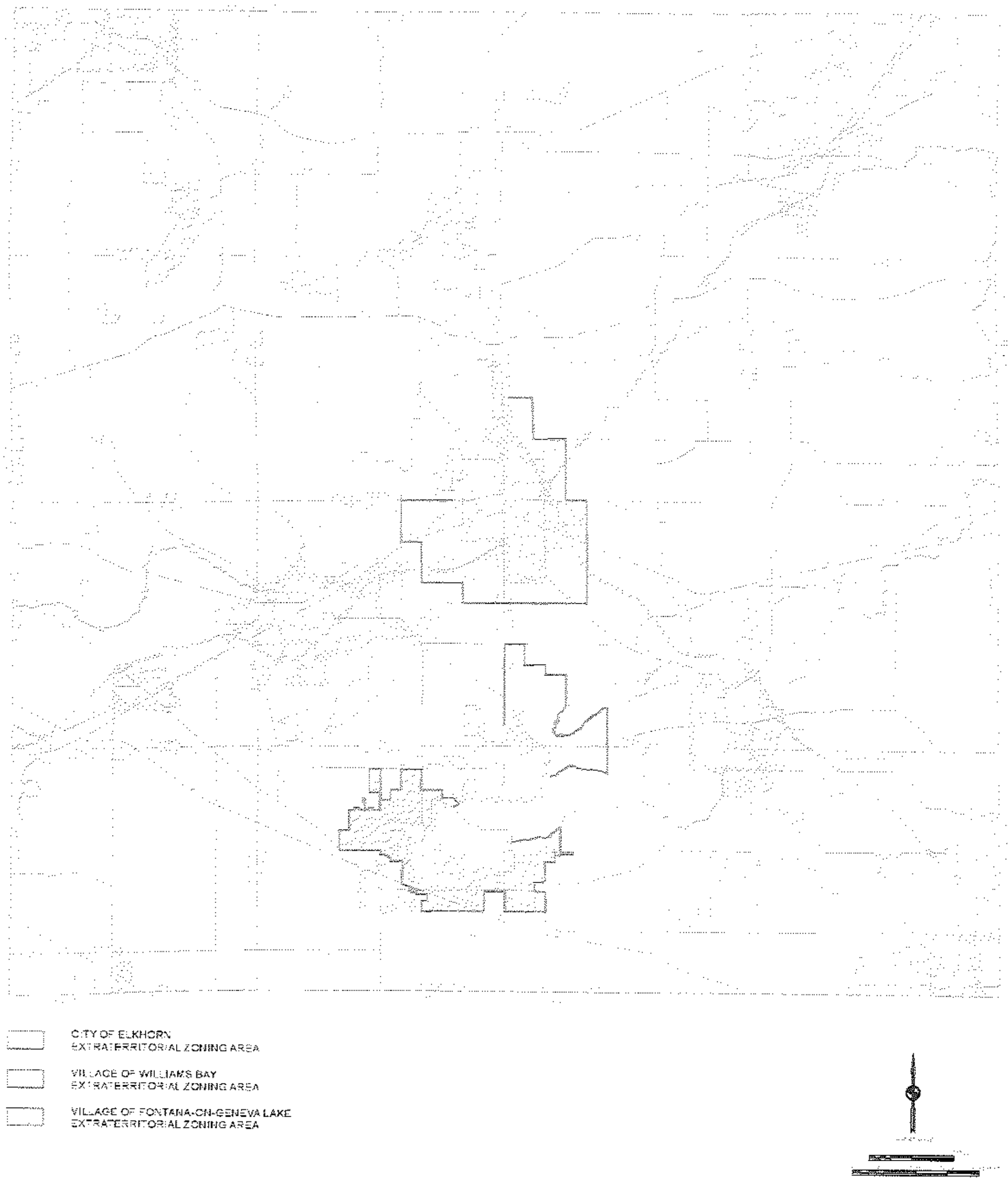
## FIGURE 7

## Williams Bay Extraterritorial Zoning Area

**EXTRATERRITORIAL ZONING IN WALWORTH COUNTY: 2000**




*Source: Walworth County and SEWRPC.*

The second obvious challenge is with regards to billing rates. Those homes connected to a sewer will naturally assume a charge from the sanitary district for this service. Likewise, those homes with onsite systems which will not be hooked up to the sanitary service but will have increased oversight by a sanitary district will also assume some type of charge for the district's services. How these charges are equitably arrived at will involve much communication between citizens groups, the Towns of Geneva and Linn, WalCoMet and the new/changed sanitary district.

Table 14 is a qualitative decision matrix outlining the relative merits of each option. Alternatives are rated against each other based upon a relative scale of one to four, with one indicating most favorable and four indicating least favorable. A discussion of each category follows.

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**TABLE 14**

**Alternative Relative Merits**

| | Holding Tanks | Interlaken Force Main | Interlaken Easement | Highway 50 |
|---|---|---|---|---|
| Costs | 3 | 4 | 2 | 1 |
| Feasibility | 1 | 4 | 3 | 2 |
| Outside Constraints | 1 | 4 | 3 | 2 |
| Construction Impacts | 1 | 2 | 3 | 4 |
| Neighborhood Aesthetics | 4 | 3 | 1 | 1 |
| Lake Water Quality | 2 | 2 | 1 | 1 |
| Home Value | 4 | 3 | 1 | 1 |

- Costs – Based upon opinion of probable present worth costs.

- Feasibility – Based upon technical challenges of each alternative. Holding tanks are technically benign, requiring no specialized engineering. The

Interlaken Force Main alternative will require a pumping station able to handle the variety of pressure conditions within the existing Interlaken Force Main. Both the Interlaken Easement and Highway 50 alternatives will require pump stations able to handle high heads.

- Outside Constraints – Based upon the number of outside agencies which may place limitations or caveats upon the proposed alternative.

- Construction Impacts – Based upon which alternative will have the greatest impact upon the community at-large during construction.

- Neighborhood Aesthetics – Based upon how each alternative will affect appearance of the planning area. The holding tank option scores lowest due to the increase of septic truck traffic. The Interlaken Force Main option similarly scores low because it only covers a portion of the planning area with the balance reverting to holding tanks.

- Lake Water Quality – Based upon potential for wastewater to impact the lake water quality. The alternatives with holding tanks scored lower because transition from septic system to holding tank normally occurs after septic system failure.

- Home Value – Based upon the affect each alternative potentially has upon home values.

For the four potentially sewered areas, we recommend Alternative IIC. Alternative IIA is not a good option because it is only able to serve those homes in Subarea 2. Alternative IIB is a better choice than IIA, but like Alternative IIA, it exposes the towns to the limitations imposed by the license. If these limitations could be deleted via eminent domain, Alternative IIB could become a competitive option. The remainder of this section discusses the proposed improvements that would be required should public acceptance of the abandonment of the existing on-site systems in favor of system-wide wastewater collection and treatment be received.

## 5.2 Wastewater Collection System

The wastewater collection and conveyance system for Alternative IIC includes twelve miles of gravity sewer, five wastewater pumping stations, four miles of force main, one hundred grinder pumps and three miles of low pressure sewer. The system has been sited to collect wastewater from the concentrated areas of onsite wastewater disposal systems. Preliminary layouts of the wastewater collection and conveyance systems are shown on Exhibits A through D.

The sanitary sewer system components should be sized based upon the year 2027 design population of the areas tributary to the wastewater collection system. The gravity collection system would consist of sewer mains, building services and pre-cast concrete manholes. Individual residences that cannot be served by gravity would be served by grinder pumps and low pressure sewers. A total of five sewage pump stations would be required to convey wastewater to the interceptor sewers. Small engine generators housed in weatherproof outdoor enclosures would be provided for each pumping station to provide continued operation during power failures.

Our opinion of probable capital costs for the wastewater collection and conveyance system is $18.1 million, including contingencies, engineering services, legal fees and land acquisition.

## 5.3 Environmental Considerations

***5.3.1 Wastewater Collection System*** - Construction of a sanitary sewer system will have a significant positive environmental impact due to improvements in groundwater and surface water quality resulting from abandonment of the existing onsite wastewater disposal systems. The only long term detrimental impact resulting from a wastewater collection system is the electrical power consumption of the wastewater pumping stations. Consideration of the primary environmental corridors should be taken into account with respect to the density of any future development within the facility planning area.

Some temporary adverse impacts resulting from the construction activities will occur. These include a modest increase in noise and air pollution. To minimize these effects, contractors will be required to limit the working hours and control the dust during construction activities.

Governmental agencies were contacted to obtain information regarding the environmental impacts resulting from the construction. Information from the WDNR Archaeologist indicates there are "numerous recorded archaeological sites and historic structures" within the facility planning area. He further recommends that a cultural resource management firm be consulted to better assess potential impacts to these sites and structures.

In a previous study done in the Town of Linn, the State Historical Society of Wisconsin believed that the project would not affect any structures that are listed in the State or National Registers, the Wisconsin Inventory of Historic Places or on a list of locally designated historic places. The Society also requested the project area be surveyed by a qualified archeologist after the sewer layout has been designed. The installation of wastewater collection facilities rarely have the potential to affect historical structures and archaeological sites due to their location within road rights-of-way, which have been previously disturbed.

The WDNR Bureau of Endangered Resources indicates that there are three species of rare fish and five species of rare plants within or close to the project area. Additionally, the WDNR reports that there are three high quality natural communities located within or near to the facility planning area. Due to the sensitive nature of this information, the specific locations of endangered species are exempt from public disclosure laws and are not included in this report. The WDNR recognizes the potential improvement in water quality due to improved wastewater collection and treatment, however, they request further coordination if planned construction projects will occur within one hundred feet of shoreline to insure proper erosion control measures are designed. The installation of wastewater collection facilities rarely has the potential to affect endangered resources as routes are normally along established roadways and rights-of-way.

The State Historical Society and Bureau of Endangered Resources will be contacted again after more definitive plans are available.

## 6. FINANCIAL CONSIDERATIONS

Alternative I addresses wastewater treatment and disposal needs on an individual house-by-house basis. Should this approach be adopted, the Towns should adopt and enforce a rigorous inspection and maintenance program. Dwelling units that are determined to have failing and/or non-compliant systems should be required to install the necessary improvements at the expense of the individual property owners. The total probable costs presented in Section 4 represent maximum costs, assuming that all of the existing on-site systems are replaced with holding tanks. Households having compliant systems would incur no additional cost.

Should a system-wide approach be implemented, the total cost for the improvements would be shared by all residents tributary to the system. The capital cost for a system-wide improvements program is expected to be financed through Clean Water Fund Loans from the WDNR.

We anticipate that the project will meet the requirements of the 2/3 rule, which affects the loan interest rate. A subsidized interest rate is available to municipalities in which at least two-thirds of the initial flow will be for wastewater originating from pre-October 18, 1972 residences. The credit for working septic systems would depend upon whether a new sanitary district would be formed or the facility planning area would be assimilated into an exiting sanitary district such as Geneva National Sanitary District, Lake Como Sanitary District or Linn Sanitary District.

Should the District apply for a Clean Water Fund Loan to cover the $18.1 million capital cost (less ineligible costs) for Alternative IIC at a rate of 3.15 percent, the total annual loan repayment costs over a 20-year period would be $1,236,000. This would be recovered through connection charges and the balance of the cost assessed to properties within the District.

The projected annual operating and maintenance (O&M) costs for Alternative IIC are $449,000. Currently, there are approximately 760 users in the facility planning area proposed for construction of a wastewater collection system. The annual average charge per user for the annual assessment and O&M would, therefore, be $2,190.

In addition to the charges by the District, each user would incur costs to abandon their onsite system and to construct a service line from the house to the District's system. These private property costs are estimated at approximately $1,800. The anticipated costs for a typical user under Alternative IIC are listed in Table 15. These costs are averages. Actual costs will vary depending upon the billing structure enacted by the sanitary district and whether a home is fitted with a gravity sewer or grinder pump.

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**TABLE 15**

**Anticipated User Costs**

| | |
|---|---|
| Private Property Costs | $1,800 |
| Connection Charge | $2,600 |
| Annual Assessment | $1,600 |
| Quarterly O & M Costs | $ 150 |

The up-front cost to the typical user would be approximately $4,400 with an annual cost of about $2,190 over the 20-year loan repayment period. Homeowners would have the option of paying the annual assessment as a lump sum in lieu of annual payments for approximately $23,900. A variety of methods could be employed by the sanitary district to recoup these costs including a front-foot assessment, a per unit charge, making it a part of the tax roll and/or having a fixed monthly cost.