LAKE TAHOE BASIN FRAMEWORK STUDY
WASTEWATER COLLECTION SYSTEM
OVERFLOW/RELEASE REDUCTION EVALUATION

LAKE TAHOE, CALIFORNIA AND NEVADA

FINAL

Prepared for:

Lake Tahoe Basin
Framework Implementation Study

Prepared by:

US Army Corps of Engineers
Sacramento District

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EXECUTIVE SUMMARY

Purpose

This report presents results of a risk evaluation of shorezone wastewater lines and of system exfiltration for the Lake Tahoe basin. The Tahoe Regional Planning Agency (TRPA), State and local agencies, the eight local sewer agencies and others are concerned with the potential impact that the wastewater facilities within the Lake Tahoe basin have on the nutrient load of Lake Tahoe. This report provides the results of the following evaluations:

- **Exfiltration**. A quantified assessment of the contribution of sewage exfiltration loading to the groundwater in the Lake Tahoe basin
- **Risk Assessment**. A qualitative assessment of risk from overflows/releases from shorezone wastewater collection systems
- **Recommended Priority Projects**. Preliminary future action plans for reducing risks of overflows/releases relative to the Environmental Improvement Program (EIP) and the EIP project #638

This report is part of a comprehensive effort to assess sources of nutrients and sediment to Lake Tahoe. Most management strategies and implementation actions have been and continue to be focused on controlling nutrient and sediment loading into Lake Tahoe.

This Overflow/Release Reduction Evaluation is a portion of the Lake Tahoe Framework Implementation Report that Congress directed the U.S. Army Corps of Engineers (Corps) to complete. The Framework Report will present alternatives for improvement of environmental quality at Lake Tahoe by enhanced implementation of projects. Basin Stakeholders identified the effort presented in this Overflow/Release Reduction Evaluation as a critical missing element to presenting any alternatives for improvement of environmental quality. A summary of recommendations from the Overflow/Release Reduction Evaluation will be included in the report to Congress. Results from the exfiltration portion of this Overflow/Release Reduction Evaluation will be incorporated into another separate portion of the Framework Report that includes an evaluation of impacts to basin groundwater.

Future activities should consider giving priority to those areas with the greatest contribution to the nutrient loading budget. The information presented in this report can assist agencies and policy makers in identifying a general course of action to proceed with the formulation and implementation of a basin wide approach to assess the relative risk and contribution from exfiltration and overflows and releases as compared to other sources of nutrient contribution in the Lake Tahoe basin.

Summary of Evaluation and Results

This study was based on information from existing reports, existing sewer system data, information and opinion provided by the personnel of the sewer districts, comparisons with national standards, and professional judgment. No new fieldwork was included in this scope due to budgetary constraints.

Exfiltration Estimate

This portion of the study provides a quantified estimate of exfiltration (leakage) from wastewater collection systems (sewers) in the sewer districts within the Lake Tahoe basin. Unlike the risk assessment of shorezone sewers, the exfiltration estimate considered the entire wastewater collection system within the basin. This estimate will be incorporated into the groundwater study that is being conducted by the Corps as part of the Lake Tahoe Basin Framework Report and to assist research into establishment of a Lake Tahoe Total Maximum Daily Load (TMDL).

Study methodology included:

- Estimating unit exfiltration rates (units of gallons per day per inch of diameter per mile of pipe)
- Estimating annual exfiltration quantities for each sewer district by extending the unit rates from the first step above to miles of pipe in each district
- Assessing the relative contribution of exfiltration to the nutrient loading of Lake Tahoe

At the onset of this study, it was hopeful that significant new scientific information would be available on exfiltration from studies elsewhere in the nation or world. It was found that the most comprehensive set of data on record was generated in Lake Tahoe in 1983. Due to the aforementioned budget constraint, new field-testing was not performed in this study. The existing data and assumptions were reviewed and best engineering judgment applied to draw the study conclusions. The most significant departure from the previous Lake Tahoe study in 1983 involved the application of judgmental correction factors that were used to convert the test data to estimated in situ values. Using all the correction factors estimated in 1983 resulted in an exfiltration estimate of 0.49 million gallons annually. The more conservative value this report recommended for use in further analysis corrects only for the difference in test vs. actual hydraulic head rather than all five correction factors expressed in the 1983 report. The correction factors not included in this reports estimate were discounted due to the uncertainty. There are no data by which to assess the accuracy of these correction factors. Using only the hydraulic head correction resulted in an exfiltration estimate of 15.4 million gallons annually.

If the total annual loading to Lake Tahoe from nitrogen and phosphorus is 922,000 lb/year and 101,000 lb/year, respectively (USDA, 2000), then an exfiltration estimate of 15.4 million gallons per year equals approximately 0.42% and 1.0% of the total annual nutrient budget for nitrogen and phosphorus respectively. This assessment includes leakage from pipe and does not include attenuation as exfiltration moves through the soil matrix that will be studied in the concurrent Corps groundwater study.

Exfiltration rates associated with damaged facilities can be substantial. However, they do not lend themselves to a systemic quantification. These conditions are generally found and corrected as part of the districts' current operations and maintenance programs. Conversations with Lahontan Regional Water Quality Control Board (Warden, Bruce. 2003 Lahontan) indicates that numerous complaints of leaking wastewater or septic conditions rarely have resulted in positive test results for leakage. While subjective, this lack of field substantiation of systemic leakage coupled with other findings in this assessment should be an important factor in determining future actions.

A significant testing program would be required to provide significantly better data regarding basin wide exfiltration conditions.

Assessment of Risk

This portion of the study provides a qualitative assessment of risk from overflows/releases from the wastewater collection system in the shorezone and sensitive stream environmental zones on the lake. This assessment is an integral step to providing recommendations regarding wastewater system replacement/retrofit as a part of alternatives for inclusion into the Corps Lake Tahoe Basin Framework Report.

Study methodology included:

- Establish assessment methodologies based on characteristics of identified critical sewer facilities within the study area.
- Categorize critical sewer facilities based on the potential magnitude of overflows/releases.
- Apply risk evaluation criteria to identify key conditions that pose potential problems and assign a level of risk relating to the likelihood of an overflow/release occurring.
- Prioritize potential problems based on the potential magnitude and likelihood of an overflow/release.

Critical sewer facilities of the wastewater collection systems are those whose failure would have significant impact on the water quality of Lake Tahoe. For purposes of this study, these facilities have been identified as gravity sewers and manholes, pump stations, and force mains.

The critical sewer facilities were categorized based upon the potential magnitude of the impacts to Lake Tahoe should an overflow/release occur. The categories are grouped by the number of equivalent dwellings (du) that the facility serves. The risk categories are designated A, B, and C, as described below in Table ES-1.

Table ES-1. Risk Categories Based on Potential Magnitude of Overflow/Release

Category	Description of Risk
A	Facility serving 80 or more equivalent dwellings (du) [(a)]
B	Facility serving 30 to 80 du
C	Facility serving less than 30 du

[(a)] An equivalent dwelling is any facility producing wastewater equivalent to a typical residence; i.e., approximately 200 gallons per day.

Qualitative risk levels were established as low, medium, and high and were defined in terms of the likelihood of overflows/releases occurring. A risk evaluation was conducted for key conditions that are symptomatic of failing critical sewer facilities, and, if present, serve as indicators of potential problems. The qualitative risk level was then assigned to each key location. This risk evaluation process is detailed in Section 5 of this report and briefly summarized in Table ES-2.

Table ES-2. Relative Risk of the Likelihood of Overflows/Releases Occurring

Risk Levels	Description of Risk
Low	Minimal overflow/release risk in near future, but potential for further deterioration of condition
Medium	Overflow/release unlikely in near future, deterioration of condition is likely
High	Overflow/release likely in the foreseeable future

Potential problems reflecting a combination of risk magnitude categories and risk levels as shown in Table ES-3. The priorities of the potential problems were divided into six priority levels, one being the highest priority. The priority levels indicate which potential problems should be corrected first to provide the greatest reduction in the risk. Only potential problems having a risk level of medium or high were studied further.

Table ES-3. Prioritization of Potential Problems

Risk Category	Risk Level	Priority Level
A	High	1
B	High	2
C	High	3
A	Medium	4
B	Medium	5
C	Medium	6

Risk reduction action plans and associated first costs were developed to address the identified problem conditions. Potential risk reduction measures were identified for each of the risk criteria/key conditions that were associated with medium to high risks. To standardize the approach, alternative reduction measures were identified which would be appropriate to address typical general problem conditions. For example, measures to replace a typical reach of pipe would include both trenchless and traditional trenching methods. Unit costs were also developed for the alternative measures for use in estimating the costs of the action plans.

The following steps were followed to develop risk reduction action plans for each district.

1. Identify alternative risk reduction measures that would be appropriate to address typical high risk problems
2. Assess the advantages and disadvantages of each risk reduction measures
3. Estimate unit costs for various risk reduction measures
4. Identify the measures associated with each high risk problem
5. Estimate the first cost associated with each potential action plan

Problems within each sewer districts were prioritized from level one to level six. Table ES-4 lists the total first cost of potential action plans for each sewer district. Chapters 7 through 14 give more in-depth descriptions of each of the Lake Tahoe sewer districts; including district top priorities shown project by project. Table ES-5 lists the total cost of the only the top 5 priorities of each district. If more than 5 level one priorities have been identified, all priority one levels are shown for the district.

Table ES-4. Total First Costs of Potential Action Plans

District	Total First Cost of Potential Action Plans
Incline Village General Improvement District	$6,276,200
Tahoe Douglas District	$5,141,000
Round Hill General Improvement District	$2,293,600
Douglas County Sewer Improvement District #1	$3,211,900
Kingsbury General Improvement District	$1,571,800
South Tahoe Public Utility District	$26,023,900
Tahoe City Public Utility District	$26,139,300
North Tahoe Public Utility District	$17,569,800
Total	**$88,227,500**

Table ES-5. Costs of Top 5 Priority Action Plans

District	First Cost
Incline Village General Improvement District	$406,300
Tahoe Douglas District	$1,272,000
Round Hill General Improvement District	$2,293,600
Douglas County Sewer Improvement District #1	$1,002,000
Kingsbury General Improvement District	$1,571,800
South Tahoe Public Utility District	$10,623,300
Tahoe City Public Utility District	$8,216,300
North Tahoe Public Utility District	$3,998,600
Total for all Sewer Districts for Top Priority Action Plans	**$29,384,000**

Summary Findings and Conclusions

The findings of this study are statements of fact or of the best available information at the time of the study. This study also provides conclusions that are the professional judgments of experts knowledgeable in sanitary sewer. The recommendations that have been listed in this study are industrial standards applied to Lake Tahoe and accepted by professionals in the sanitary sewer industry.

Summarized findings and conclusions include:

- It does not appear that exfiltration from the sewers in the Lake Tahoe basin is a major factor contributing to the nutrient loading of Lake Tahoe
- It was estimated that the nutrient loading from exfiltration escaping sewer conveyance systems was 3,850 pounds per year of nitrogen and 1,030 pounds per year of phosphorus. These loadings represent 0.42 percent, and 1.0 percent of the total loadings of nitrogen and phosphorus, respectively, to the Lake Tahoe basin from all sources. It is expected that actual loading that reaches Lake Tahoe will be less due to attenuation as exfiltration moves through the soil matrix.
- The exfiltration rates estimated in this study are based on limited available information and are intended to represent district wide averages over the long term and not of spills or releases due to short-term/dramatic events such as system failures. A substantial testing program would be required to provide significantly better data regarding basin wide exfiltration conditions.
- Overflows or releases in the Lake Tahoe basin have occurred in the past and will continue, however, the sewer districts, Lahontan, or TRPA have not reported catastrophic spills in many years. Performances of the sewer systems in all Lake Tahoe districts are comparable with or better than those districts located outside of the Lake Tahoe basin.
- Much of the sewer is relatively old, 30 to 40 years. Degradation due to age can lead to structural failure and increases in both exfiltration and infiltration. Proper management and operation and maintenance of the sewer facilities are critical to safeguard the investment of the sewer infrastructure.
- Interviews with the sewer districts show that less than 1 percent to 6 percent of the original sewer lines have been replaced since the early 1980's. Several districts maintain capital replacement funds in addition to using contingency sewer repair funds to address collection system rehabilitation and replacement requirements. Many districts indicated they do not have comprehensive capital replacement programs.

Summary Recommendations

The recommendations that have been listed in this study are industrial standards applied to Lake Tahoe and accepted by professionals in the sanitary sewer industry.

Summarized recommendations include:

A regional consensus on funding, environmental regulations, and standards for the design and construction should be reached by the Lake Tahoe sanitary sewer stakeholders. A basin wide approach to a comprehensive capital improvement program (CIP) should be considered for the replacement or rehabilitation of the sewer facilities located in the Lake Tahoe basin.

Lake Tahoe's natural mountain beauty has drawn and astounded people for many years. Lake Tahoe is one of the largest and deepest in the United States and is known for the crystal clarity of its water. Even though the conditions (overflow/releases and exfiltration) are better than nationwide averages, the Lake Tahoe basin should be held to standards that preserve this "national treasure".

A dynamic approach to the management, operation, maintenance, rehabilitation, and replacement of the sewer systems is recommended to maintain their performance and to reduce the risk of overflows/releases. The age of the sewer system is 30 to 40 years old with some sewer facilities over 50 years old. A 50 year service life expectancy is typical for most sewage lines thus the sewer districts in Lake Tahoe are nearing this threshold. Sewage lines have been known to last significantly longer than 50 years, but increased monitoring and inspection is required to verify the longevity. Sewer facilities located within the environmentally sensitive areas should be evaluated immediately and an action plan developed for these problems to ensure lake clarity for years to come.

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ABBREVIATIONS AND ACRONYMS

ACP	Asbestos Cement Pipe
ADWF	Average Dry Weather Flow
BMP	Best Management Practice
CALTRANS	California Department of Transportation
CCTV	Closed Circuit Television
CEQA	California Environmental Quality Act
CIP	Cast Iron Pipe
CIPP	Cured in Place Piping (lining)
Corps	U.S. Army Corps of Engineers
DCSID	Douglas County Sewer Improvement District
DIP	Ductile Iron Pipe
EA	Each
EIP	Environmental Improvement Plan
EIR/EIS	Environmental Impact Report/Statement
EPA	United States Environmental Protection Agency
FM	Force Main
FONSE	Finding of No Significant Effect
GPM	Gallons per Minute
GSP	Galvanized Steel Pipe
HP	Horsepower
IEC	Initial Environmental Checklist
IVGID	Incline Village General Improvement District
KGID	Kingsbury General Improvement District
KW	Kilowatt
LF	Linear Foot
LS	Lump Sum
MOU	Memorandum of Understanding
NA	Not Available/Not Applicable
NDEP	Nevada Division of Environmental Protection
NDF	Nevada Division of Forestry
NDOT	Nevada Department of Transportation
NDOW	Nevada Division of Wildlife
NEPA	National Environmental Policy Act
NTPUD	North Tahoe Public Utility District
O&M	Operation and Maintenance
PS	Pump Station
PVC	Polyvinyl Chloride
RHGID	Round Hill General Improvement District
SEZ	Stream Environment Zone
SS	Sanitary Sewer
STPUD	South Tahoe Public Utility District
TCPUD	Tahoe City Public Utility District
TDD	Tahoe-Douglas District
TRPA	Tahoe Regional Planning Agency
USDA	United States Department of Agriculture
USFS	United States Forest Service
VCP	Vitrified Clay Pipe

LAKE TAHOE BASIN FRAMEWORK STUDY
WASTEWATER COLLECTION SYSTEM OVERFLOW/RELEASE REDUCTION EVALUATION

LAKE TAHOE, CALIFORNIA AND NEVADA

1.0 INTRODUCTION

1.1 Purpose

The U.S. Army Corps of Engineers (Corps), Tahoe Regional Planning Agency (TRPA), the eight local sewer agencies, State and local agencies, and others are concerned with the potential impact that the wastewater facilities within the Lake Tahoe basin have on the nutrient load of Lake Tahoe. The primary purpose of this report is to provide these agencies with the results of the following evaluations:

1. An order of magnitude assessment of the contribution of sewage exfiltration loading to the groundwater in the Lake Tahoe basin
2. A qualitative assessment of risk from overflows/releases from the wastewater collection system
3. Preliminary future action plans for reducing risks of overflows/releases relative to the Environmental Improvement Program (EIP) and the EIP project #638

The information presented in this report can assist the agencies in identifying a general course of action to proceed with the formulation and implementation of a basin wide approach to assessing the relative contribution of exfiltration and reducing risks of overflows and releases to Lake Tahoe.

1.2 Scope

This study was based upon existing sewer system data and information. The scope of work includes the following tasks:

<u>Exfiltration</u>:

Total annual exfiltration rates from sewers were estimated for each sewer district. The estimates were based on information from existing reports and on information provided by the personnel of the sewer districts, comparisons with national standards, and professional judgment. No field-testing was conducted for this study. Primary work tasks included the following:

- Estimating unit exfiltration rates from facility types in the project area
- Estimating annual exfiltration quantities for each sewer district

- Assessing the relative contribution of exfiltration to the nutrient loading of Lake Tahoe

Risk Assessment:

The primary tasks performed for the risk assessment included the following:

1. Establishing planning objectives and constraints
2. Establishing guidelines for assessing risk
3. Identifying and prioritizing potential problems
4. Identifying and screening structural and nonstructural potential risk reduction measures
5. Identifying and prioritizing potential action plans to reduce risk

The assessment was limited to addressing the risk of SSOs (which includes exposed sanitary sewer lines) from wastewater collection systems located within or near the shorezone of Lake Tahoe and/or within environmentally sensitive areas as delineated by the Tahoe Regional Planning Agency. These limits are defined below.

For the purpose of this study, sanitary sewer overflows (SSOs) were defined as overflows or releases of wastewater that would reach Lake Tahoe. This does not include sewer backups into buildings that are caused by blockages within the building sewer lateral or other malfunctions of building laterals.

1.3 Background

The study area addressed in this report is the Lake Tahoe basin, which is located along the California-Nevada State line, east of Sacramento, California, and south of Reno, Nevada, as shown on Figure 1-1. The area includes portions of Alpine, El Dorado, and Placer Counties in California and portions of rural Carson City, and Douglas and Washoe Counties in Nevada.

The loss of about 1 foot per year of clarity in Lake Tahoe's waters during the past 30 years is well documented (Goldman, 1974; USFS, 2000; TRG, 2001). Increased nutrient and sediment loadings, due to development and other human activity, are stimulating algal growth and increasing the concentration of fine suspended particles in Lake Tahoe, resulting in the loss of clarity.

VICINITY AND DISTRICT LOCATION MAP

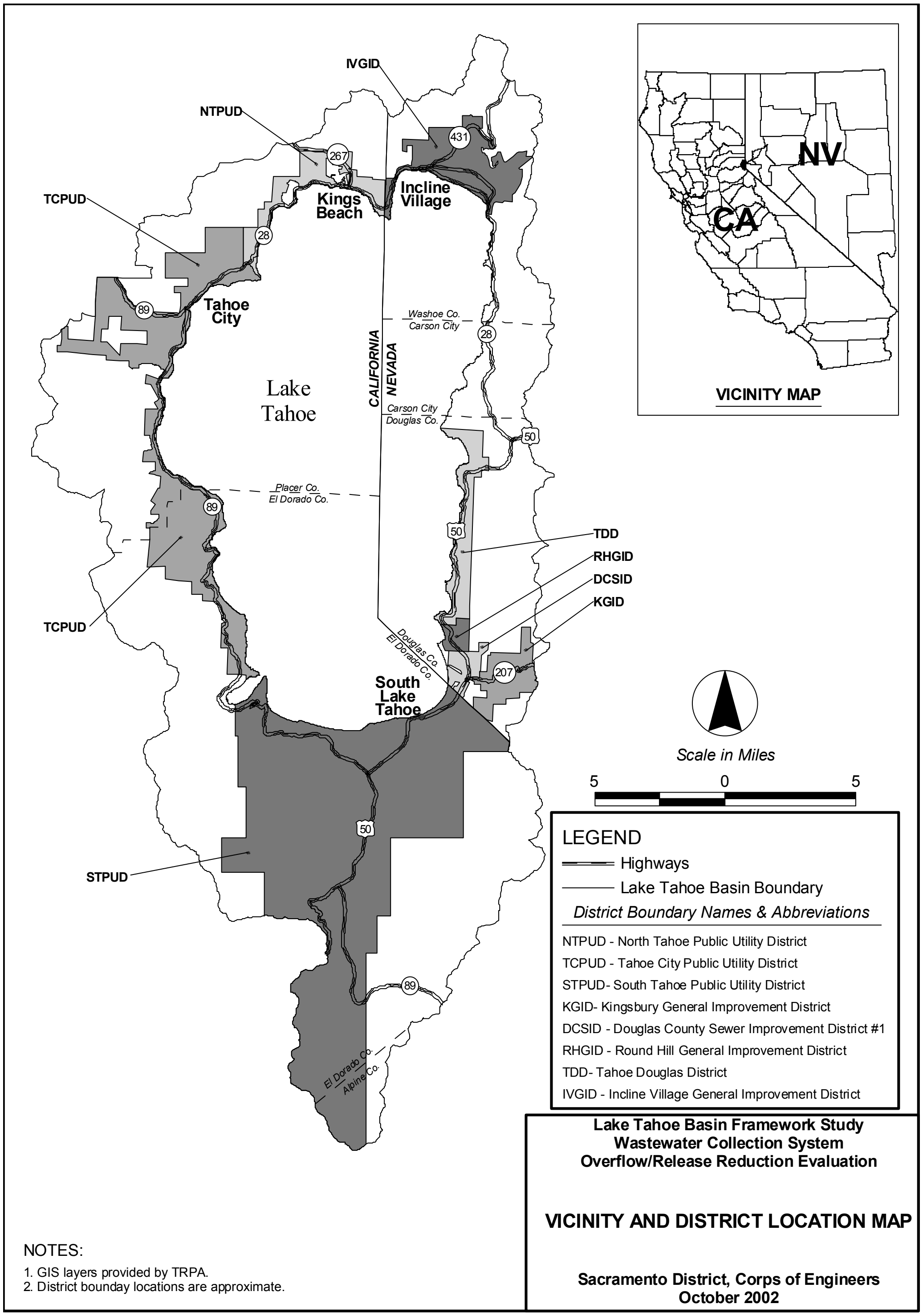


Figure 1-1

It may take up to 30 years to see changes in the clarity resulting from immediate reductions of nutrients going into Lake Tahoe. Some scientists have concluded that if the buildup of nutrients in the lake is not reversed within the next 10 years, the costs of solving the problem will be so great and the impacts so extreme that they will exceed the currently available capacity for resolution (USFS, 2000).

Most of the management strategies and implementation actions have been and continue to be focused on controlling nutrient and sediment inputs into the lake. Future activities should give priority to those areas with the greatest contribution to the nutrient loading budget.

The Lake Tahoe Watershed Assessment (USFS, 2000) presents a preliminary nutrient budget for Lake Tahoe developed by Reuter et al. (1998). The five major sources of nutrients identified in the budget and their estimated contributions are presented in Table 1-1.

Table 1-1. Lake Tahoe Estimated Annual Nutrient Budget (1)

Lake Tahoe Estimated Annual Nutrient Budget (Metric tons (MT) per year)			
Source of Inputs	Nitrogen (MT)	Phosphorus (MT)	
	Total	Total	Soluble
Atmospheric Deposition	233.9 (56%)	12.4 (27%)	5.6
Stream Loading	81.6 (20%)	13.3 (29%)	2.4
Direct Runoff	41.8 (10%)	15.5 (34%)	5.0
Ground Water	60 (14%)	4 (9%)	4
Shoreline Erosion	0.75 (<1%)	0.45 (1%)	No Data
Total	**418.1**	**45.7**	**17.0**

(1) These estimates are acknowledged to be initial estimates, and it is recognized that further study is needed to more accurately quantify pollutant contributions (USFS, 2000).

Although not specifically listed as a major source of nutrient loading in Table 1-1, wastewater deserves attention. It is known to have been a major contributor to the nutrient loading of the lake in the past. In fact, the cessation of sewage disposal in the basin was an early success in the effort to reduce loading to the lake.

Populated areas in the basin first used septic tanks and leach fields for disposal. These were replaced by wastewater lines (sewers) and secondary and tertiary waste treatment facilities.

Mandated by the Porter-Cologne Water Quality Control Act in California, and an Executive order by the Governor of Nevada, sewers were constructed to serve developed areas so that all wastewater could be treated and exported outside the Lake Tahoe basin. This program spanned over 10 years and was finished in the late 1970's. Currently, eight sewer districts operate within the Lake Tahoe basin (refer to Figure 1-1). These include:

- South Tahoe Public Utility District (STPUD)
- Tahoe City Public Utility District (TCPUD)
- North Tahoe Public Utility District (NTPUD)
- Incline Village General Improvement District (IVGID)

- Douglas County Sewer Improvement District No.1 (DCSID) and three satellite collection systems of DCSID:
  - Kingsbury General Improvement District (KGID)
  - Round Hill General Improvement District (RHGID)
  - Tahoe Douglas District (TDD)

The eight districts serve approximately 55,000 customers with approximately 900 miles of sewer lines within the basin. IVGID, STPUD, and DCSID operate wastewater collection, treatment facilities, and effluent export lines within the Lake Tahoe basin. NTPUD and TCPUD export raw sewage to the Tahoe-Truckee Sanitation Agency in Truckee, California, for treatment outside the basin.

Much of the sewer system is approaching 30 to 40 years old, and many existing sewers are located in the shorezone or stream environment zones. As such, exfiltration and/or sewage overflows and releases pose a threat of becoming a major source of nutrient loading to Lake Tahoe.

Regulatory support exists to minimize the potential threat posed by the sewer system serving the Lake Tahoe basin. TRPA ordinances require that Lake Tahoe's sewer agencies "shall have in place and vigorously implement plans for detecting and correcting sewage exfiltration problems in their collection and transport facilities" (TRPA Code of Ordinances, 1987). The Lahontan Basin Plan also addresses the need for The Lahontan Regional Board to "fully utilize its regulatory authority" to ensure the quality of Lake Tahoe's sewer systems. Additionally, the US Environmental Protection Agency (EPA) is developing new sanitary sewer overflow (SSO) regulations. These new regulations would require sewage collection utilities to develop capacity assurance, management, operations, and maintenance (CMOM) programs. Intended to reduce SSOs, CMOM programs include detailed system assessments and ongoing monitoring, reporting, mapping, record keeping, and other activities.

1.4 Study Area

The study area consists of the shorezone, stream environment zones, and wetland areas. These areas are shown in Chapters 7 through 14 for each sewer district.

TRPA defines the shorezone of Lake Tahoe as the area including the nearshore, foreshore, and the backshore. These definitions are listed below:

- Nearshore: the zone extending from the low water elevation of Lake Tahoe (6223.0 feet Lake Tahoe Datum) to a lake bottom elevation of 6193.0 feet Lake Tahoe Datum, but in any case, the nearshore is a minimum lateral distance of 350 feet measured from the shoreline. The shoreline is defined as the highest line normally covered by waters of a lake or body of water. For Lake Tahoe, the shoreline elevation is 6229.1 feet Lake Tahoe Datum.
- Foreshore: The area between the high-and low-water level, 6229.1 feet and 6223.0 feet, respectively.
- Backshore: The area between the high-water elevation and the area of wave runup plus 10 feet or the area of instability plus 10 feet if there is a bluff adjacent to the

high- water elevation. The area of instability is either (1) The distance from the high water line to the horizontal distance of 1.5 times the height of the bluff located adjacent to the shoreline (the height of the bluff is the difference between the high water elevation and the elevation of the top of the bluff) or (2) Defined in a report submitted by the applicant and prepared by a licensed geological, geotechnical, or soils engineer or an engineering geologist.
- Lakezone: the zone including that area of a lake located beyond the lakeward (in the direction of the lake) limits of the nearshore.

The environmentally sensitive areas include:

- Stream Environment Zone (SEZ): SEZs are biological communities that owe their characteristics to the presence of surface water or seasonal high ground water table. The SEZs were identified by TRPA by drawing the continuous boundary of the soil type, vegetation, flood plains, and minimum buffer strip on a base map containing information on the presence of water and areas of topographic depression. The boundary farthest from the stream was marked as the SEZ boundary.
- Wetlands: Low-lying areas where the water table stands near or above the land surface for a portion of the year. These areas are characterized by poor drainage, standing water, and hydrophytes and include but are not limited to those areas identified in the land capability classification system as Class 1B lands. Refer to TRPA's land capability map and Goals and Policies.

For the purposes of this study, the shorezone has been defined by using TRPA's Shorezone Tolerance District mapping. The shorezone, or more specifically, the backshore, has not been mapped by TRPA. The backshore is evaluated on a parcel-by-parcel basis, which must be submitted to TRPA by the parcel owner when new improvements are proposed. The backshore is then calculated based on the above description of the backshore. Discussions with TRPA have indicated that the Shorezone Tolerance District mapping extends onto shore to give an approximate location of the backshore. The Shorezone Tolerance Districts are broken into eight categories based on topography, soil capabilities and limitation, vegetation characteristics, and other factors. Refer to TRPA's Code of Ordinances, Chapter 53 – Shorezone Tolerance Districts and Development Standards. Typically, sewer facilities were evaluated from the shoreline to approximately 500 feet inland.

The study area within the SEZs was typically limited to creek crossings where the failure of a sewer facility could immediately impact the water quality of Lake Tahoe.

The wetlands areas are generally located on U.S. Forest Service lands. These areas are typically found within the SEZs.

1.5 Study Authority

The authority for this study is provided under the fiscal year 2002 Energy and Water Development Appropriations Bill (Public Law 107-66), passed by Congress in October 2001. A portion of the bill states the following:

That using $1,000,000 of the funds provided herein, the Secretary of the Army, acting through the Chief of Engineers, is directed to conduct a comprehensive watershed study at full Federal expense to provide a framework for implementing activities to improve environmental quality of the Lake Tahoe Basin and the Secretary shall submit a feasibility level report within 30 months of enactment of this Act.

The scope of work for the comprehensive watershed study was established cooperatively between the Corps and TRPA. Important insight was also obtained from the stakeholder outreach program. The stakeholders reflected a broad range of interests in the Lake Tahoe basin.

It was agreed that the work would be executed in FY02 using appropriated funds. Elements of work and the format of the report were discussed in a conference call between the Corps Sacramento District, Division Headquarters, and the South Pacific Division at the end of October. At this early stage of the project, it was speculated that the requested report would be at a feasibility level of detail, but could go directly to Congressional committees rather than follow the traditional Feasibility Report or Framework Report process. The uncertain nature of continuing study funding shaped some of this early decision-making.

Criteria for selecting the scopes of work for inclusion in the framework study included:

- Project subject matter that was basin-wide in scope (i.e. 'Comprehensive').
- Projects that were either direct improvements to 'environmental quality' or indirectly led to improvements of 'environmental quality' through the establishment of criteria for further projects.
- Projects that fit the overall Corps mission and our role as established in the original Federal Interagency Partnership/Presidential Forum documents.
- Projects that were "ripe" for execution.
- Projects that could result in a useful product to improve 'environmental quality' even if FY03 & FY04 funding did not materialize.
- Projects that are un-funded by other EIP and Federal Partnership sources.

1.6 Pertinent Documents

Several studies and reports have provided background information that is pertinent to the efforts of this study. These studies and reports are summarized below.

1.6.1 U.S. Army Corps of Engineers

"Expedited Reconnaissance Study, Tahoe Basin, California and Nevada," October 1996.

This study (1) inventoried the environmental, water quality, flooding, and other water resources and related problems and opportunities in the Tahoe Basin; (2) described the existing and expected future biological, physical, and socioeconomic conditions relative to the problems and opportunities; (3) identified likely measures to address the problems and opportunities; and (4) formulated strategies using existing Corps authorities that could be used to evaluate and implement potential projects. In this study, Lake Tahoe sewer agencies identified potential and existing sewer problems, which included age, releases, and exposed sewer lines. The study concluded by recommending under Section 219, Environmental Infrastructure, to be considered for the existing sewer problems in the region.

"Evaluation of Constraints Affecting Implementation of the Environmental Improvement Program," June 2001

This evaluation assessed the challenges affecting implementation of the EIP and efficiently completing an increased workload to protect the clarity of Lake Tahoe and achieve the environment thresholds. The strategies developed by the stakeholders were: to accomplish, maintain, or exceed multiple environmental goals; and develop an integrated, proactive approach to environmental management. Three alternatives were developed representing a range of strategies for achieving an efficient implementation of the EIP. Alternative 1 highlights procedural changes but does not affect the current leadership structure of the executive partnerships. Alternative 2 identifies the TRPA as the lead agency for implementing the EIP. This alternative would clearly leadership of the EIP. Alternative 3 would have all agencies adopt the EIP as the restoration strategy for the Basin and establish an interagency EIP implementation team.

1.6.2 Tahoe Regional Planning Agency

"Tahoe Regional Planning Compact" Public Law 96-551 – December 1980.

The Tahoe Regional Planning Compact is an act of the 96th Congress that created and authorized the Tahoe Regional Planning Agency (TRPA) in order to encourage the wise use and conservation of the waters of Lake Tahoe and of the resources of the area around the lake. Under the Compact, several plans and documents were created to help achieve the mission of the TRPA; they include, but are not limited to, environmental threshold carrying capacities, goals and policies, design review guidelines and best management practices (BMPs), regulatory codes, plan area statements, community plans, master plans, redevelopment plans, and other specific plans and programs.

"Environmental Improvement Program," January 1997 revised April 2001.

The TRPA has developed the Lake Tahoe Environmental Improvement Program (EIP) to meet or exceed thresholds that have been established within nine categories. These categories are air quality and transportation, water quality, soil conservation, vegetation, fisheries, wildlife, scenic, noise, and recreation. Water quality has received much attention. Sewer systems within the Lake Tahoe basin have been identified as a potential detriment to water quality. Sewer replacement or relocation has been identified as a project within the EIP. Project number 638 lists shorezone sewer line replacement/relocation as a $61 million cost.

The Environmental Improvement Program (EIP) is TRPA's capital improvement plan for the Lake Tahoe basin. Projects created through the EIP are intended to restore and maintain the environmental thresholds in the basin.

"Draft 1996 Evaluation Report—Environmental Threshold Carrying Capacities and the Regional Plan Package for the Lake Tahoe Region," December 1996.
This report presents the results of TRPA's second comprehensive evaluation of environmental threshold carrying capacities and the subsequent Regional Plan package. It provides information and recommendations to assist the TRPA Governing Board in making necessary adjustments to the environmental threshold carrying capacities and the Regional Plan package, in compliance with the provisions of the Tahoe Regional Planning Compact.

"Regional Plan for the Lake Tahoe Basin – Annual Water Quality Report."
The Annual Water Quality Report presents results from water quality monitoring activities in the Lake Tahoe basin conducted for the seven water quality indicators identified by the water quality threshold category of the EIP.

"Water Quality Management Plan ("208 Plan") for the Lake Tahoe Region, Volume 1, Water Quality Management Plan" November 1998.
This water quality management plan was formulated to comply with section 208 of the Federal Clean Water Act (33 USC 466 et seq.) and the Code of Federal Regulations (40 CFR Part 130 and Part 35); thus, it is called the 208 plan. The 208 plan was first adopted by TRPA in 1981 and is the guiding document for TRPA's regional plan and environmental improvement program for elements that are related to water quality. The plan addresses water quality problems in the Lake Tahoe basin through controls on land use, erosion, runoff, disturbance to stream environment zones, forest practices, fertilizer use, wastewater, atmospheric deposition of nutrients, spills, vessel wastes, dredging, and projects in the shorezone. The control programs are a combination of regulatory, voluntary, and capital improvement programs and planning processes. Regulations that are directly related to sewers are the prohibition of the discharge of wastewaters to Lake Tahoe, its tributaries, and the groundwaters of the Tahoe region. It also requires all agencies that collect or transport sewage to have plans for detecting and correcting exfiltration problems. TRPA may amend the plan to reflect the changes to the regional plan made by TRPA in 1986 and 1987.

"2001 Environmental Thresholds Evaluation," December 2001.
Beginning in 1991 and every 5 years thereafter, TRPA conducts a comprehensive evaluation to determine if each of the nine environmental threshold carrying capacities ("thresholds") is being achieved and/or maintained; provides specific recommendations to address problem areas; and directs general planning efforts for the next 5 year period. In terms of the water quality thresholds, most of the indicators were not in attainment. For example, the winter-time average Secchi depth (lake clarity loss) is moving away from attainment, although this rate of decline has slowed since 1988. At the same time, the phytoplankton primary productivity continues to increase away from attainment, although there is slight leveling trend in the last few years.

"Goals and Policies," adopted September 1986.
Goals and Policies of the Regional Plan for the Lake Tahoe Basin are divided into several elements: a Land Use Element, Transportation Element, Conservation Element, Recreation

Element, Public Services and Facilities Element, and Implementation Element. These elements illustrate the needs and goals of the region and provide statements of policy to steer decision-making as it affects the region's resources and remaining capacities. This document sets forth standards for water quality, air quality, soils, wildlife, fisheries, vegetation, scenic quality, and recreation. Goals identified in the document depict the desired ends or values to be achieved and the policies that establish the strategies necessary to achieve the goals.

"Code of Ordinances," January 2001.

The Code of Ordinances establishes the minimum standards for planning, land use, site development, growth management, subdivisions, shorezone provisions, grading and construction, resource management, water quality, and air quality and creates rules of procedure that are applicable throughout the Tahoe Region. Any political subdivision or public agency may adopt and enforce an equal or higher requirement to the same subject or regulation in its territory. All projects and activities within the basin are required to comply with the provisions set forth in the Code Ordinances, which represent the coordination of a series of documents relating to land use regulation and environmental protection in the Tahoe Region, including the Tahoe Regional Planning Compact, the environmental threshold carrying capacities, the Goals and Policies Plan, the Plan Area Statements and Maps, and other TRPA plans and programs.

1.6.3 U.S. Department of Agriculture

"Lake Tahoe Watershed Assessment," May 2000.

This study is a comprehensive review and compilation of scientific research, particularly that research conducted in the last 20 years, on the Lake Tahoe basin for use by resource managers in the basin. Information is presented on the environmental history; the atmosphere and air quality; aquatic resources; water quality and limnology, biological integrity; and social, economic, and institutional conditions in the basin. Research needs in these areas are also assessed. The status of research, monitoring, and modeling activities in the basin is described, and an adaptive management approach is proposed for the basin.

1.6.4 South Tahoe Public Utility District

"Tahoe Basin Sewer System Exfiltration/Overflow Study, California Portion, Phase II Report," June 1983.

This study was done to determine if exfiltration and overflow exist in the sewer system on the California side of the Tahoe basin. Of the total 635 miles of sewer line in the three public utilities districts on the California side, 9 miles were field tested for exfiltration. Reaches were selected for testing based on risk categories of pipe age, pipe material, normal flow in the system, average pipeline slope in the subarea, surrounding groundwater levels, and other pertinent characteristics. Overflow was analyzed based on historical records kept by the districts. Unit rates of exfiltration were estimated for several categories, and a total exfiltration/overflow load was estimated for nitrogen and phosphorus. The potential load to Lake Tahoe was estimated to be less than one-hundredth of 1 percent of the total load from other sources. Annual overflows appeared to be declining, which was attributed to the implementation of improved maintenance and infiltration and inflow reduction programs.

In this study, the potential loading to Lake Tahoe from exfiltrating sewers was estimated to be 90 pounds per year of total nitrogen and 25 pounds per year of total phosphorous.

2.0 NEED FOR AND OBJECTIVES OF ACTION

This chapter presents a description of the pertinent problems and opportunities in the study area and the planning objectives and constraints. Problems and opportunities presented in this study are related to the Federal objective and the specific planning objectives. Planning objectives are statements that describe the desired results of the planning process by solving the problems and taking advantage of the opportunities identified. Constraints are restrictions that limit the planning process. This information provides a basis for assessing exfiltration and for identifying a preliminary action plan to reduce risks of overflows or releases.

2.1 National Objectives

The national or Federal objective of water and related land resources planning is to contribute to national economic development consistent with the Nation's environment, pursuant to national environmental statutes, applicable Executive orders, and other Federal planning requirements.

Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to the NED are the direct net benefits that accrue in the planning area and the rest of the Nation.

The Corps has added a second national objective for Ecosystem Restoration in response to legislation and administration policy. This objective is to contribute to the Nation's ecosystems through restoration with contributions measured by changes in the amounts and values of habitat.

2.2 No Action Plan

Under the no action plan, the Federal Government would take no additional special action toward implementing an action plan for reducing risks of overflows or releases to Lake Tahoe. The eight districts would continue to operate and maintain the wastewater collection system to comply with existing local, State, and Federal regulatory requirements. Differences would continue to exist between the operation and maintenance practices of the districts. Some districts have in place rehabilitation or replacement programs aimed at correcting deficient sewer facilities before a failure occurs. Other districts monitor and repair or replace sewer facilities, as needed. As the sewer facilities within the basin get older, disciplined monitoring, rehabilitation, and replacement efforts will be necessary to maintain the integrity of the system and to prevent overflows and releases to Lake Tahoe.

The conditions of the sewer systems in Lake Tahoe are currently acceptable, but if the no action plan was the chosen plan, the likelihood of overflows/releases will increase. Sewer districts will be required to maintain the systems at an acceptable level at any cost without the assistance of the Federal Government. Increase overflows/releases could affect economics of Lake Tahoe along with water quality and the scenic beauty of the federally designated treasure.

2.3 Problems and Opportunities

Input regarding problems and opportunities was received through coordination with the eight sewer districts in the Lake Tahoe basin, Lahontan Regional Water Quality Control Board, TRPA, and other agencies.

The primary problems and opportunities are based on the No-Action conditions that are described in Section 2.2 and are as follows:

- Most of the sewer lines, pump stations, and force mains are 30 to 40 years old. At this age, the risk of failure and the need for maintenance/rehabilitation/replacement generally increases. Structural failures due age, minimal coverage, and exposed lines have also been identified as potential problems.
- Many sewer facilities are located within the shorezone and SEZs/wetland areas. Due to the proximity to the lake, these facilities are at particularly high risk. A spill or release in one of these environmentally sensitive areas typically leads directly to Lake Tahoe, introducing additional nitrogen and phosphorous in addition to health concerns.
- Access to many facilities is inadequate due to encroachments into the easements, physical constraints associated with location, or regulatory constraints due to being located in environmentally sensitive areas. This greatly limits critical operation and maintenance activities.
- Provisions do not exist to allow inspection of force mains. This limits maintenance activities necessary to safeguard these facilities.

2.4 Planning Objectives

The eight sewer districts, TRPA, Lahontan, and the Corps have, based on professional judgment and input received from concerned public agencies, identified the following to be the main objectives for assessing overflows or releases and exfiltration and for formulating a preliminary risk reduction plan:

- To formulate a preliminary risk reduction plan to prevent overflows or releases from the wastewater collection system that reach Lake Tahoe. Overflows or releases caused by severe natural conditions such as earthquakes have not been considered in this study.
- To assess the relative magnitude of exfiltration that may add to the nutrient loading of Lake Tahoe.

2.5 Planning Constraints

The preliminary risk reduction plan will be formulated to conform to Congressional direction and current applicable laws, regulations, and policies. Constraints to the plan formulation and evaluation process have been identified as follows:

- Employ cost effective measures to reduce risks of wastewater collection system overflows or releases.
- Develop a tentative plan that reduces, to the extent practical, adverse impacts on the Lake Tahoe basin socioeconomic and environmental resources.
- Develop a tentative plan in accordance with the Federal objective of water and related land resource planning, including features that contribute to national economic development and are consistent with environmental statutes, Executive orders, and other Federal planning requirements for protecting the Nation's environment.

3.0 SETTING

3.1 Environmental Setting

3.1.1 Topography

The Lake Tahoe basin is a bowl-shaped watershed located between two mountain ranges, the Sierra Nevada on the west and the Carson Range on the east. The surrounding peaks range in elevation from about 8,000 to 10,881 feet (Freel Peak) above mean sea level. The elevation of the lake surface varies between 6,223 and 6,229 feet and the bottom of the lake is about 4,580 feet. The 191 square mile lake collects water from 63 local watersheds in the basin. The Truckee River at Tahoe City is the only outlet from Lake Tahoe.

3.1.2 Geology and Soils

The Lake Tahoe basin is a result of regional faulting followed by uplift and downdrop to form a relatively flat valley enclosed by steeply sloping mountains. Lake Tahoe was formed over time, collecting runoff from the surrounding watershed, which has relatively small land area compared to the receiving waters of the lake.

Granitic rock with several different rock overlays underlies the Lake Tahoe basin. Volcanic Rock dominates the upper geologic layers in the north part of the basin. Near Incline Village in the Northeast, the upper geologic layers are dominated by large alluvial fans produced by creeks draining to Crystal Bay. The Carson Range and the Sierra Nevada to the east, west and south are largely granitic rock with sporadic metamorphic rock. The Sierra Nevada range was significantly modified by glaciation, leaving glacial moraines and glacial outwash deposits in the southern portion of the Basin. The Carson Range was unaffected by glacial activity.

Soils in the Lake Tahoe region are variable and exhibit a range of characteristics as a result of the five basic soil formation processes: parent material, climate, biosphere, relief, and time. Parent material in the area consists of granitic, metamorphic or volcanic rock, glacial outwashes, and mixed alluvium providing the soil’s basic chemical and mineralogical composition.

The Soil Conservation Service has mapped to soil associations within the Lake Tahoe basin. Refer to Table 3-1 for a description and location of soils.

Table 3-1. Lake Tahoe Basin Soil Associations

Soil Association	Description	Locations
Nearly level to gently sloping soils along streams, on fans, and in meadows		
Loamy alluvial land-Elmira, wet variant-Celio association	Nearly level to gently sloping, somewhat poorly drained to poorly drained gravelly loamy coarse sands and loamy coarse sands to silt loams	Shoreline
Nearly level to steep soils on moraines, glacial outwash terraces, and fans		
Elmira-Gefo Association	Nearly level to moderately steep, somewhat excessively drained gravelly loamy coarse sands	Shoreline
Inville-Jabu Association	Nearly level to moderately steep, well drained and moderately well drained coarse sandy loams that are deep to very deep over a pan.	Shoreline
Meeks-Tallac Association	Nearly level to steep, moderately well drained to somewhat excessively drained gravelly to extremely stony loamy coarse sands that are deep to very deep over pan.	Shoreline
Cagwin-Toem Association	Gently rolling to very steep, somewhat excessively drained and excessively drained loamy coarse sands and gravelly coarse sands that are shallow to deep over granitic rock.	Shoreline
Tahoma-Jorge Association	Gently sloping to steep, well drained gravelly to very stony sandy loams that are deep to very deep over latite ad andesite conglomerate.	Shoreline
Umpa-Fugawee Association	Gently sloping to steep, well-drained very stony sandy loams that are moderately deep over andesite and andesitic conglomerate.	Shoreline
Waca-Meiss Assocation	Strongly sloping to steep, well-drained and excessively drained cobbly coarse sandy loams and cobbly loams that are moderately deep to shallow over andesite or andesitic tuff.	
Shakespeare-Rock Land Association	Strongly sloping to steep, moderately well drained gravelly loams or stony loams that are deep to very deep over metamorphic rock, and undulating to very steep land that is 50 to 90 percent rock outcrop.	
Rock Land-Stony Colluvial Land Association	Gently sloping to very steep land that is 50 to 90 percent rock outcrop, cobblestones, stones, and boulders	Shoreline

A recent study by the Desert Research Institute (Lake Tahoe Water Quality and Shore Erosion Study, 2002 by Kenneth D. Adams) compared over 60 years of aerial photographs to analyze changes in the Lake Tahoe shoreline and to estimate the pattern of erosion. The study concluded that 190,000 square meters of shorezone land was lost to erosion and 51,000 square meters of new beach area was created. According to the study, 429,000 metric tons of sediment eroded from the shorezone into Lake Tahoe. This erosion could potentially expose existing sanitary sewer lines, or create difficulties for the installation of new sewer facilities.

3.1.3 Land Use and Recreation

The TRPA Regional Plan land uses in the Lake Tahoe basin include: (1) residential; (2) tourist accommodation; (3) commercial; (4) public service; (5) recreation; and (6) resource management (TRPA, Code of Ordinances, 2001). “Sixty-eight percent of the land in the Tahoe Basin is publicly owned and used for recreation and open space” (City of South Lake Tahoe, 1992). Refer to Table 3-2 for the land ownerships in the Lake Tahoe basin.

Table 3-2. Land Ownership in the Lake Tahoe Basin

Ownership	Acreage
Total Land Area	201,898
Private Land Area	65,607
Public Land Area	**136,291**
Federal	
National Forest	126,645
Bureau of Reclamation	64
Total Federal	**126,709**
State	
California	3,535
Nevada	6,047
Total State	**9,582**

Table provided by the City of South Lake Tahoe, 1992

3.1.4 Groundwater

Groundwater in the Lake Tahoe Basin is known to contribute nutrients to the lake (USDA 2000). The U.S. Army Corps of Engineers is conducting the Lake Tahoe Basin Framework Groundwater Study. The goal of the study is to estimate nutrient loading of phosphorus and nitrogen to the lake via ground water. It will also identify known and potential nutrient sources, and recommend potential nutrient reduction alternatives.

3.1.5 Surface Water

Lake Tahoe is considered to be ultra-oligotrophic. It has very low concentrations of nutrients, high oxygen content, and extremely clear waters. The clarity is largely due to low algal productivity as a condition of low nutrient concentration. A trend of increasing algal productivity and the resulting increase in algal biomass is contributing to the decline of lake clarity. The littoral or near-shore zone area around the perimeter of the lake that is less than 100 feet deep constitutes 20% of the lakes surface area. There is evidence that algal production in the littoral zone is related to nutrient inputs and land development (TRPA 1998). Data collected in 1980 and 1981 shows that periphyton (attached algae) biomass production in the littoral zone is greatest off developed areas.

3.1.6 Transportation

Highways 50, 89, and 28 combine to form a continuous loop around the lake. Sewer lines underlie portions of all these highways. Traffic in the basin is highest during the summer. During these peak months traffic volumes range from 105,000 vehicles/day on Highway 50 near the State Line in South Lake Tahoe to 9,500 vehicles/day on Highway 89 near D.L. Bliss State Park on the west shore.

Construction work between the end of May and the first weekend in September is limited. Road delays are limited during this timeframe and roadways may not be closed. This allows traffic and tourism during peak season to be interrupted for only brief periods of time.

3.1.7 Population

The development and urbanization of the Lake Tahoe area is generally recognized as occurred during and following the 1960 Winter Olympics held in Squaw Valley (TRPA 1998). Early population estimates for the Lake Tahoe Basin were as high as 418,000 by 1980. The actual total population of the Basin in 1998 was estimated to be 55,000 (USDA 2000). Population growth is now projected at less than one percent per year.

The major urban areas include Incline Village and Stateline, on the Nevada side; and the city of South Lake Tahoe, Tahoe City, and Kings Beach in California.

The Lake Tahoe basin also experiences high seasonal, overnight and day recreational use. Estimates of the number of recreational visitors to the Basin range from 2.6 million to 23 million annual visitor days depending on the calculation method used to estimate the actual number *(USDA 2000).*

3.2 Permitting Requirements & Regulatory Framework

Districts conducting repair, rehabilitation, and replacement work within the basin must comply with Federal laws, California and Nevada State laws, and regional and local regulations. This section presents the key regulatory issues identified and a brief summary of the primary regulations as they relate to this study.

3.2.1 Regulatory Setting

Discussions with district personnel were held to identify the permitting process. The primary processes included the time and effort for completing the permitting process, the need to permit every project, and the security and permitting fees. These issues are summarized below.

The construction season in Lake Tahoe is from May to October. Timely issuances of permits are critical. The minimum review period for a project is 120 days. This requires projects to be designed and submitted for approval by early February. Projects would need to be submitted no later than December to allow for the bidding process to occur if the districts want to start construction in May.

The districts do the same type of repair, rehabilitation, and replacement work repeatedly. The current process requires permitting at each environmentally sensitive site. Some districts believe that a set of mitigation procedures could be followed to allow for typical rehabilitation and replacement work without going the full permitting process for each considered site.

3.2.2 Federal

3.2.2.1 United States Environmental Protection Agency

The United States Environmental Protection Agency (EPA) oversees National Environmental Policy Act (NEPA) compliance, and implementation of and compliance with provisions of the Clean Water and Clean Air Acts, as well as many other regulations. Most of these regulations are managed by the EPA and enforced by State agencies. The EPA then oversees compliance by each state.

NEPA regulations often pertain to operational activities. For the NEPA environmental review process, all NEPA documents are submitted to the EPA who then reviews the document for completeness and publishes notices in the Federal Register. However, the Code of Federal Regulations does provide a number of exclusions that may eliminate the need for a project to submit to the environmental review process.

Capacity, Management, Operation, and Maintenance (CMOM), a new EPA regulation is scheduled for release in late 2002, will be enforced by state agencies. In general, this regulation pertains to the control of sewage spills from sewer collection facilities and prohibits bypasses or releases (spills) from sewage collection systems. The CMOM regulation places an obligation on collection facilities to maintain or retrofit their collection systems to eliminate spills and to notify parties who may be exposed to spills.

The regulations clearly focus on five major points that directly affect a sewer district. Under the CMOM regulation the sewer district must:

- Properly manage, operate and maintain, at all times all parts of the collection system.
- Provide adequate capacity to convey base flows and peak flows.
- Take all feasible steps to stop and mitigate the impacts of sanitary sewer overflows.
- Provide notification to parties with a reasonable potential of exposure to the pollutants associated with the overflow event.
- Develop a written summary of the permittee's CMOM program and audit and make this available to any member of the public upon request.

Currently, none of the sewer districts in the Lake Tahoe basin are required to have a NPDES permit. The districts discharge effluent to treatment facilities, which are then discharged to reservoirs that are not waters of the United States, and are outside of the Lake Tahoe basin.

Also pertaining to both construction and operations for the Lake Tahoe basin is the Outstanding National Resource Water (ONRW) Anti-degradation Policy. Because the EPA has designated Lake Tahoe as an ONRW, the EPA prohibits, through this policy, new or increased discharges that lower long-term water quality.

3.2.2.2 United States Forest Service

The U.S. Forest Service (USFS), Lake Tahoe Basin Management Unit (LTBMU), controls over 70 percent of the land in the Lake Tahoe Basin (Lahontan Regional Water Quality Control Board, 1994). The LTBMU implements its Land and Resources Management Plan (1988) and the statewide USFS 208 Plan (1979). As a part of its management strategy, the LTBMU has chosen to focus on water quality protection rather than resource extraction.

The USFS has permitting and enforcement authority on National Forest lands. Sewer lines located on National Forest lands were granted rights-of-way via special use permits, which allow access to maintain these lines. Special use permits issued by the Forest Service are generally issued for a period of 20 years but can be issued for a maximum of 40 years. Sewer lines on National Forest land should be accessed via the permitted rights-of-way. If access is encumbered along the rights-of-way, the Forest Service should be contacted to coordinate an alternate means of access. The Forest Service may limit sewer line access when the ground is saturated or at times if the rights-of-way passes through known sensitive habitat. Other provisions set forth in the special use permits may also limit access.

3.2.2.3 United States Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Acts (ESA) through formal consultation. This enables the USFWS to review project proposals for possible impacts to threatened and endangered species. In order to comply with the ESA, Federal agencies are required to initiate Section 7 consultation by submitting a biological assessment on actions that may adversely affect a listed species. Through this consultation process, the USFWS will issue a Biological Opinion, which includes reasonable and prudent measures for avoiding a "taking" of listed species and compensatory mitigation. This Biological Opinion will serve as the incidental take permit for the project. Once consultation has been initiated the USFWS has 135 days to issue a Biological Opinion. If special-status species habitats are affected then the USFWS will require compensatory mitigation.

3.2.2.4 United States Army Corps of Engineers

The Corps constructs and operates a variety of recreational facilities and makes navigational safety findings on proposed projects. The Corps administers Sections 9 and 10 of the River and Harbor Act, Section 404 of the Clean Water Act, Section 103 of the Marine Protection, Research and Sanctuaries Act, and reviews projects under Section 402 of the Federal Water Pollution Control Act (TRPA, 1999).

Section 404 of the Clean Water Act provides enforcement authority against activities that discharge fill material and/or require excavation in waters of the United States, including wetlands. Waters of the U.S. are defined as "navigable waters, tributaries to navigable waters, interstate waters, the oceans out to 200 miles, and intrastate waters which are used by interstate travelers for recreation or other purposes; as a source of fish or shellfish sold in interstate commerce; or for industrial purposes by industries engaged in interstate commerce" (USEPA, 2002). Actions typically subject to Section 404 requirements are those that would take place in wetlands or stream channels that convey natural runoff, including intermittent streams, even if they have been realigned. Permits pursuant to Section 404(b) require an evaluation of the project demonstrating that it is the least environmentally damaging practicable alternative. Any activity that discharges into "waters of the U.S." requires a Section 404 permit. The permit requires mitigation of unavoidable impacts on wetlands.

The U.S. Army Corps of Engineers, under the Rivers and Harbors Act, requires permits for activities involving the obstruction of navigable waters of the United States. Navigable waters are "those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce" (33 CFR Part 329). Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States without a permit from Corps. Section 10 requirements apply to any person or entity proposing to work in, over, or under navigable waters of the United States. If Section 404 of the Clean Water Act (Section 404) jurisdiction encompasses areas regulated by Section 10, Corps typically combines the permit requirements of Section 10 and Section 404 into one permitting process.

The following types of activities involving navigable waters of the United States typically require permits from Corps under either Section 404 or Section 10, or both:

(1) Construction or modification of levees, dams, and dikes;

(2) Other structures or work, including excavation, dredging, and/or disposal activities within, under, or over the navigable waters;
(3) Activities that alter or modify the course, condition, location, or physical capacity of these waters; and
(4) Discharges of dredged or fill material. (CALFED, 2001)

Coverage conditions and compliance measures for individual 404 permits are developed on a project-by-project basis. The coverage conditions are developed from the project description. Compliance measures are based on an established set of previously utilized measures and project specific construction activity impacts. Typical compliance measures include:

(1) Double-trenching through wetlands in order to preserve and replace the seed bank when construction is complete. Double-trenching is a method where the top 6-12 inches of soil are removed and stockpiled, then replaced as soon as the trench is backfilled; thereby, preserving the wetland vegetation seed bank.
(2) Constructing only when wetlands are dry or the use of mats under construction equipment to avoid substantial impacts to moist wetlands.
(3) Setbacks or exclusion zones to avoid impacts to especially sensitive wetlands.
(4) Site restoration to pre-project or better conditions.
(5) Mitigation for impacts to wetlands beginning at a 1.5:1 ratio.

<u>3.2.2.4.1 General Permit No. 16 – Minimal Impact Activities, The Lake Tahoe Basin</u>. This General Permit authorizes minimal impact activities in the Lake Tahoe Region. Typical project work which could be authorized by GP16 includes the repair, modification, or replacement of existing piers, construction of new piers, placement of buoys and buoy fields, construction of shoreline revetment, maintenance dredging, construction or maintenance of culvert and drainage facilities, and restoration of stream channels and wetlands.

The applicant must submit to the Corps their Tahoe Regional Planning Agency (TRPA) and all other required state and local authorizations prior to initiation of any work. If the Corps does not provide written objections to the application or provide project specific conditions within thirty (30) days from the date the complete application was received, the work as proposed is authorized under this permit.

The General permit does not authorize the placement of dredged or fill material which impact one-third (1/3) or more acres of waters of the United States, including wetlands, unless the project impacts are associated with wetland or stream habitat restoration. Wetlands restoration work impacting greater than 3 acres requires notification to the appropriate U.S. Fish and Wildlife office concurrent with notification to the Corps. Projects, which cannot meet the requirements of the General Permit, will require processing under individual permit procedures.

Work in California may require authorization/approval from the California State Lands Commissions, the California Department of Fish and Game, the Lahontan Regional Water Quality Control Board, and local governments. Work in Nevada may require authorization/approval from the Nevada Division of State Lands, Nevada Division of Environmental Protection, and other state and local jurisdictions.

3.2.3 State of California Requirements

3.2.3.1 California Office of Planning and Research and California Resources Agency

Two State agencies, the Governor's Office of Planning and Research (OPR) and the Resources Agency, are responsible for the administration of the California Environmental Quality Act (CEQA).

The California Code of Regulations provides for several exemptions from CEQA. Sewer districts that propose projects that are exempt from CEQA under this definition can file a Notice of Exemption (NOE) with the county clerk of the county in which the project will be located. A NOE is not required, but if a NOE is filed, a shorter statute of limitations of 35 days (rather than the normal 180 day statute of limitations) commences for public comment. The NOE must include a brief project description, a finding that the project is exempt from CEQA that includes a citation of the relevant statute or guidelines section, and a brief statement of reasons to support the findings. Section 3.3 lists the potential applicable exemptions for sewer repair/replacement activities.

3.2.3.2 California Environmental Protection Agency

The California Environmental Protection Agency defers permitting and regulatory responsibilities pertaining to ground and surface water quality to the State Water Resource Control Board and its regional boards. The Lahontan Regional Water Quality Control Board is responsible for the Lake Tahoe basin.

3.2.3.3 Lahontan Regional Water Quality Control Board

The Lahontan Regional Water Quality Control Board (California RWQCB, Lahontan Region, 1994) is responsible for enforcing both Federal and State regulations set forth under the Clean Water Act, California Code of Regulations, the Porter-Cologne Water Quality Control Act, and several other laws intended to control solid, toxic, and hazardous wastes. These acts and laws grant Lahontan authority to set and revise water quality standards and discharge prohibitions, implement the Water Quality Control Plan for the Lahontan Region, and issue permits including Federal NPDES permits, Section 401 Water Quality Certifications, and State waste discharge requirements or waivers of waste discharge requirements. Planning and permitting actions taken by Lahontan are required to comply with CEQA.

Lahontan issues individual Board orders to sewer districts to cover Waste Discharge Requirements (WDR) on small maintenance projects. Activities that are covered by the individual Board orders are exempt from review and subject to the terms of the sewer district's individual Board order.

If a project is beyond the scope of what is allowed in the individual Board orders and will disturb less than one acre of land (less than five acres until 2003), the project is subject to Board Order 6-91-31. This order identifies general waste discharge requirements for small construction activities. The sewer district must submit a Report of Waste Discharge to Lahontan, including a construction schedule, the volume and characterization of potential discharge, a description of best management practices (BMPs) to treat storm water runoff, and revegetation/soil stabilization plans. The Report of Waste Discharge must be submitted to Lahontan at least 60 days prior to construction.

Larger projects that disturb more than one acre of land (more than five acres until 2003) are subject the Non-Point Discharge Elimination System (NPDES) General Permit, Board Order 6-00-03. Application for coverage under the NPDES General Permit includes submission of a Report of Waste Discharge, a Notice of Intent to comply with the NPDES General Permit, a Storm Water Pollution Prevention Plan (SWPPP), and a detailed monitoring plan. Again the Report of Waste Discharge includes a construction schedule, the volume and characterization of potential discharge, a description of best management practices (BMPs) to treat storm water runoff, and revegetation/soil stabilization plans. A SWPPP addresses erosion and sediment control and lists BMP's that will be used to prevent soil erosion and subsequent sediment loading of area waters. A SWPPP also usually includes a Hazardous Substance Control and Emergency Response Plan and a monitoring plan to ensure BMP's are effective. This application material must be submitted to Lahontan at least 60 days prior to construction.

Discharges to surface water from dewatering activities must be covered under a separate General NPDES Permit number 6-98-36 which applies to limited threat discharges to surface water.

Work that could potentially result in discharges to waters of the state will also require a 401 Water Quality Certification from Lahontan. Waters of the state include lakes, streams, wetlands and riparian zones. A 401 Water Quality Certification is a statement from the State Water Resource Control Board, on recommendation from the Regional Water Quality Control Board, that the proposed project will not violate water quality standards and will protect the water for beneficial uses. Section 401 of the Clean Water Act requires state certification or waiver of certification before the Corps can issue a Section 404 permit. Application for a 401 Water Quality Certification should include a detailed project description, including a construction schedule, location maps, estimates of the volume of dredge or fill material, and the size of the area to be disturbed. Copies of submitted applications for other permits and any other environmental documents should also be included.

Lahontan has prohibitions against discharges or threatened discharge attributable to human activity to the surface waters of the Lake Tahoe Basin (See Table 3-3), within the 100-year floodplain of any tributary to Lake Tahoe or within a SEZ. "The prohibitions do not directly prohibit the construction of new subdivisions, development of environmentally sensitive lands, or development which is not offset by remedial erosion control measures. The discharge of sediment and nutrients, which results from such development, is prohibited. If a person proposing a project can prove that it will cause no greater discharge than would result from development which is outside the areas addressed by the prohibitions and that it complies with other applicable control measures, the prohibitions do not apply" (California RWQCB, Lahontan Region, 1994). Lahontan can also grant a prohibition exemption before activity in these areas commences. "The prohibitions related to new development do not apply to repair or replacement of an existing structure. In addition, these prohibitions shall not apply to any new development holding a valid sewer permit issued before the October, 1980 date of approval of the Lake Tahoe Basin Water Quality Plan so long as all necessary approvals are obtained. BMPs will be required in these cases" (California RWQCB, Lahontan Region, 1994).

Table 3-3. Summary of Discharge Prohibitions in the Lake Tahoe Hydrologic Unit (California RWQCB, Lahontan Region, 1994)

General Prohibitions
Discharges that violate water quality objectives or impair beneficial uses.
Discharges that cause further degradation of waters where objectives are already being violated.
Discharges to surface waters of the Lake Tahoe HU.
Prohibitions Related to Sewage and Solid Wastes
Discharges to cesspools, septic tanks or other means of waste disposal in the Lake Tahoe watershed after January 1, 1972 (with limited exceptions).
Discharges from boats, marinas, or other shoreline appurtenances (also applies to fuel spills, etc.).
Discharges of treated or untreated domestic sewage, industrial wastes, garbage or other solid wastes to surface waters.
Discharges of garbage or solid waste to lands.
Prohibitions Related to Development
Discharges or threatened discharges below the highwater rim of Lake Tahoe or within the 100-year floodplains of tributaries.
Discharges or threatened discharges attributable to new pier construction in significant spawning habitats or offshore of important stream inlets in Lake Tahoe.
Discharges or threatened discharge attributable to the development of new subdivisions.
Discharges or threatened discharges attributable to new development which is not in accordance with land capability.
Discharges attributable to new development in Stream Environment Z ones.
Discharges attributable to new development not in accordance with offset requirements.

If an exemption is granted, then restoration requirements are necessary and may be accomplished onsite or offsite. “These restoration requirements shall be in lieu of any land coverage transfer requirement or TRPA water quality mitigation fee (TRPA Code of Ordinances Section 20.4.C).” Restoration of SEZ lands will require a 1.5: 1 mitigation ratio.

Sewer districts in California have additional individual board orders issued by the Lahontan. These MOUs and board orders allow the sewer districts to maintain their facilities without having to go through an extensive permitting process for routine maintenance. When work that is not covered by the MOUs or board orders is required, the districts must go through the full permitting process.

3.2.3.4 California Department of Fish and Game

The California Department of Fish and Game (DFG) Lake or Streambed Alteration Program requires that prior to any activity that alters the bed, bank or channel of any stream, lake or wetland, DFG must be notified. After notification is given the DFG issues a Streambed Alteration Agreement, which outlines the conditions in which activities can take place, and measures to avoid or minimize impacts. Typical mitigation measures include a 100-foot setback from streams, lakes, or wetlands where possible, and erosion control measures as outlined for water quality and NPDES permits.

In areas of the Lake Tahoe Basin where Threatened and Endangered Species exist, a 2081 incidental take permit is required to mitigate for the loss of any endangered species in the area. The primary species of concern is the State-listed endangered Tahoe yellow cress (*Rorippa subumellata*), which is found along the shoreline of the lake. If it is determined through consultation with DFG that the yellow cress may be adversely affected, then DFG is responsible for developing project alternatives that will continue to conserve the species. Conservation measures may include:

(1) The development of exclusion zones delineated by fencing.
(2) Salvaging and transplanting affected plants prior to construction.
(3) The control of invasive plant species by requiring all construction equipment prior to entering Tahoe yellow cress habitat to be cleaned using pressurized air.
(4) The development of compensatory mitigation using a ratio ranging from 1.5:1 to 3:1.

3.2.3.5 California Department of Transportation

Projects that include work to be done within the California Department of Transportation (Caltrans) rights-of-way require approval by the permit engineer for District 3. Some minimum design standards include a minimum of 36" of cover and alignment of the facility as close to the edge of right of way as possible. This enables Caltrans to maintain or expand the roadway with out impacting the sewer line.

3.2.3.6 California State Lands Commission

The California State Lands Commission (CSLC) administers state public trust lands, and maintains public easements along the shores of Lake Tahoe. Through review of discretionary projects, the CSLC is involved with the protection of California's rare, threatened, and endangered wildlife species and other environmental resources. During project review, the State Lands Commission is required to consult with the CDFG on potential impacts to special-status species. The CSLC will require mitigation for all projects under their jurisdiction, such as for impacts to the Tahoe yellow cress.

3.2.4 State of Nevada Requirements

3.2.4.1 Nevada Division of Environmental Protection

The Nevada Division of Environmental Protection (NDEP) requires a Temporary Working in Waterways Permit for work proposed within any type of water body e.g. lake, stream or wetland.

The NDEP has been authorized to implement Nevada's NPDES. As with California, a storm water permit is required if the project disturbs more than one acre (more than five acres until 2003). The storm water permit gives authorization to conduct the project under the general NPDES storm water permit. A temporary discharge permit may be required if any excavations need to be dewatered during construction.

Nevada Regulatory Statute 445A.170 requires the written permission of the state Department of Conservation and Natural Resources prior to "Construction or alteration of the Lake Tahoe shoreline below the high water elevation (6,229.1 feet)".

The Nevada Division of Environmental Protection is also the state agency authorized to issue 401 Water Quality Certifications in the state of Nevada.

3.2.4.2 Nevada Division of State Lands

The Nevada Division of State Lands requires an encroachment permit where installation, relocation, maintenance, or repair work on lines below the normal high water line of the lake is anticipated.

3.2.4.3 Nevada Division of Wildlife

The Nevada Division of Wildlife reviews and comments on all proposed projects submitted to State or Federal agencies. Their authority is exercised over State or Federal lands; they have no authority over private land. The "NDOW does not issue permits, but supplies Nevada Division of State Lands with comments recommending approval or denial of shorezone projects within their jurisdiction" (TRPA, 1999).

3.2.4.4 Nevada Department of Transportation

Projects that include work to be done within Nevada Department of Transportation (NDOT) rights-of-way require approval by NDOT. The approval process involves review and completion of the permit application package and submittal of four signed and stamped copies of the project plans. NDOT prefers that projects that require work within roadways do so by boring under the roadways. Projects that must excavate through the roadbed must be repaired by matching the existing depth of dense grade roadbed material with placement of open grade on top and repair all lane striping.

3.2.4.5 Nevada Division of Forestry

The Nevada Division of Forestry (NDF) is charged with maintaining a list of critically endangered plant species for Nevada. In order to obtain a permit for any activity or development proposal that could impact a listed plant species, both public and private landowners must consult with NDF. Currently the only species of concern on this list Tahoe yellow cress.

3.2.5 Tahoe Regional Planning Agency

In order to better conserve Tahoe's natural resources, California and Nevada approved a bi-state compact, and in 1969 the United States Congress ratified the agreement creating the Tahoe Regional Planning Agency (TRPA). The compact was revised in 1980 (P.L. 96-551) to give the TRPA authority to adopt environmental quality standards and to enforce ordinances designed to achieve these standards. TRPA authority also stems from "the water quality planning functions delegated by California, Nevada, and the EPA under Section 208 of the Clean Water Act. TRPA has a bistate Governing Body with appointed members, an Advisory Planning Commission which includes the Executive Officer of the Lahontan Regional Board and a technical staff under an Executive Director. TRPA is directed to ensure attainment of the most stringent state or federal standards for a variety of environmental parameters in addition to water quality; for example, it is a designated air quality and transportation planning agency in California (California RWQCB, Lahontan Region, 1994)." Aside from outlining TRPA's authority, P.L. 96-551 establishes an environmental review process for TRPA, which is legally separate from CEQA and NEPA. This process is described in more detail in Section 3.3.

The TRPA manages new development through its regional land use plan (TRPA 1987) and its 208 Plan. Rules are set to ensure attainment of a variety of TRPA environmental threshold carrying capacity standards (thresholds). These thresholds include standards for soils, air quality, vegetation, fisheries, wildlife, recreation, noise, and scenic resources as well as for water quality. The 208 Plan conveys TRPA's reliance on Lahontan's authority to accomplish its water quality-related goals in California. These two agencies entered into a Memorandum of Understanding (MOU) in 1994 in order to increase their level of coordination, avoid the duplication of effort, and implement their water quality plans in an equivalent manner.

As with the Lahontan Basin Plan, the 208 Plan and other TRPA documents outline activities that are prohibited in SEZ's, 100-year floodplains, and the Lake Tahoe shorezone. Although not strictly prohibited the 208 Plan recommends that sewer lines be relocated out of SEZs where feasible, making the in situ replacement of existing lines potentially difficult.

The sewer districts within the Lake Tahoe basin have each entered into a memorandum of understanding (MOU) with TRPA, increasing the scope of exempt activities. For example, the MOU between the North Tahoe Public Utility District (NTPUD) and TRPA considers activities to be exempt when excavation or backfilling work does not exceed 10 cubic yards, occurs during the grading season (May 1 through October 15) in land capability districts 4 through 7 and/or within an existing paved area or compacted road shoulder, and when the site is stabilized and/or revegetated within 72 hours to prevent erosion (NTPUD 1991). In general, the MOUs allow the districts to:

- Repair and replace wastewater collection system related equipment provided there is no increase in capacity and replacement facilities are similar in type and function;
- Install new service connections for TRPA-approved projects;
- Prune vegetation around existing sewer facilities and within easement areas involving no removal of vegetation;
- Locate underground lines and manholes;
- Grouting, sealing and pressure testing of sewer lines, service laterals, and appurtenances.

During an emergency, the districts can contact TRPA for an immediate emergency authorization. Larger projects that do not fall under these MOUs are subject to the entire permitting process. As a part of its permitting process, TRPA has a system of mitigation fees, offset requirements, and other provisions applicable to new development, or expansion/remodeling of existing development. This system mitigates the impacts of the new project and provides for offset of the impacts of earlier development in the Lake Tahoe basin. Examples of potential mitigation include:

(1) The establishment of a mitigation fee for work conducted in an SEZ.
(2) The establishment of a mitigation fee for impacts to the Tahoe yellow cress or its habitat.
(3) Mitigation for construction within environmentally sensitive areas is assessed at 1.5 to 1.
(4) The implementation of a construction season (Oct. 1 to May 1) for activities occurring in spawning gravels.
(5) No disturbance and all construction sites winterized after October 15.

3.3 Environmental Review Process

Overarching all of the compliance regulations enforced by the various agencies is the environmental review process established by NEPA, CEQA, and the TRPA. NEPA, CEQA, and TRPA provide exclusions/exemptions to the environmental review process. These exclusions/exemptions can be either statutory or categorical.

Under NEPA, if the project can be statutorily excluded, then the Project Agency does not have to provide NEPA documentation but must still comply with all other environmental laws and Executive orders. If the proposed action can be categorically excluded, a determination on Extraordinary Circumstances must be made by the Project Agency. If no Extraordinary Circumstances exist, the Project Agency develops an Administrative Record and the project can proceed. If Extraordinary Circumstances do exist, then an Environmental Assessment (EA) or Environmental Impact Statement (EIS) must be completed for the project.

For CEQA, statutory exemptions can be complete exemptions from CEQA, apply to only part of the requirements of CEQA, or apply only to the timing of CEQA compliance. Categorical exemptions apply to classes of projects for which the Secretary for Resources has made a finding that the class of projects will not have a significant effect on the environment and are declared to be categorically exempt from the requirement for the preparation of environmental documents.

CEQA statutory (15282) and categorical exemptions (15301-15303), according to Title 14 of the California Code of Regulations (CCR), that may be applicable to sewer projects include (the following exemptions are quoted, where possible, directly from the CCR):

(1) *14 CCR 15282. Other Statutory Exemptions*
  (a) The installation of new pipeline or maintenance, repair, restoration, removal, or demolition of an existing pipeline as set forth in Section 21080.21 of the Public Resources Code, as long as the project does not exceed one mile in length.

(2) *14 CCR 15301. Existing Facilities:* Class 1 consists of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination.

(3) *14 CCR 15302. Replacement or Reconstruction:* Class 2 consists of replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced.

(5) *14 CCR 15303. New Construction or Conversion of Small Structures:* Class 3 consists of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure.

Agencies that have projects that are exempt from CEQA can file a Notice of Exemption (NOE) with the county clerk of the county in which the project will be located; however, a NOE is not required.

If the proposed project is not excluded/exempt then the Lead Agency must submit to the environmental review process. The environmental review process for NEPA and CEQA provides numerous options for environmental review. One option is an Environmental Assessment/Initial Study (EA/IS): An EA/IS (an EA is a NEPA document and the IS the equivalent CEQA document) is developed for the project to determine if there are going to be significant impacts or controversy involved in the proposed project. If no significant impacts or controversy exist then the EA/IS is written with a Finding of No Significant Impact (FONSI)/Negative Declaration (again a FONSI is NEPA and a Negative Declaration is CEQA) and the project proceeds.

Another option is an Environmental Impact Report (EIR) and Environmental Impact Statement (EIS): For NEPA, the Project Agency must develop an EIS if there are significant effects or controversy regardless of the significance level after mitigation. For CEQA an EIR must be prepared for a project where there are significant effects that cannot be mitigated to a less-than-significant level. The EIS/EIR describes and analyzes the significant environmental effects of a project and discusses ways to mitigate or avoid the effects. There are several types of EIS/EIR's. A project EIS/EIR examines the environmental impacts of a specific project. A program EIS/EIR is prepared on a series of actions that can be characterized as one large project. This type of EIS/EIR allows the Lead Agency to complete a broad environmental review on a series of actions (the overall program) that will not be designed until sometime later, may be completed in phases, or may require different sources of funding and therefore may be completed at different times. There are other types of EIS/EIR's that are variations of these two types.

The TRPA permitting and environmental review process begins with the preparation of a permitting package including a project application and a completed Initial Environmental Checklist (IEC) for submission to TRPA. The IEC and associated documents provide information necessary to determine if the project can be approved with a Finding of No Significant Effect (FONSE) or if additional environmental review is required prior to project approval.

Again, whether a project is submitted for the entire environmental review process in whatever form is necessary, or whether it is excluded/exempted from this process the project must still comply with all other applicable regulations and permitting requirements. In order to shorten this permitting process, MOU's can be developed between the Permitting and the Project Agencies that outline general conditions under which the Project Agencies may proceed with various actions. Several MOU's have already been developed to exempt certain types of wastewater projects within the Lake Tahoe basin from State and regional permitting.

3.4 Conclusions

Wastewater projects within the Lake Tahoe Basin would require permits from various Federal, State, and Regional agencies. The prominent permitting agencies for these types of projects are the Lahontan RWQCB, TRPA, and NDEP. The NDEP, Lahontan RWQCB and TRPA have developed various plans, Codes of Ordinance, and thresholds that govern both construction and operational activities. Although many of these documents have indicated a preference or policy strategy for avoiding development (construction) within the shorezone (primarily lakeward of the high water mark) of Lake Tahoe and basin SEZ's (including the 100-year floodplain), it has been determined that no plan, ordinance, threshold, or policy strictly prohibits construction in these areas. However, obtaining permits for constructing within these areas may require considerable negotiation with the permitting agencies and mitigation for impacts, which may alter or preclude planned actions.

Another consideration is the development of the overall sewer repair and replacement program. The design of this program (phased, individual actions, long vs. short construction segments, etc.) will determine the number and types of permits necessary and the best type of document to develop for completing the environmental review process. Judicious forethought will be required to develop the best overall program design and substantial planning will be necessary to complete the permitting and environmental review process within an adequate timeframe.

Although constructing and operating wastewater facilities within the Lake Tahoe basin requires extensive permitting and environmental review, existing regulations provide a variety of options, which make conducting a sewer pipeline repair/replacement project feasible, if potentially difficult.

4.0 EXFILTRATION ESTIMATE

4.1 Purpose

The purpose of this report is to present an estimate of exfiltration (leakage) from wastewater collection systems (sewers) in sewer districts within the Lake Tahoe basin. This estimate is to be used in the groundwater study that is being conducted by the U.S. Army Corps of Engineers (Corps) as part of the Lake Tahoe Basin Framework Study. It also provides a basis to assess the relative magnitude of the contributions of exfiltration to the water quality problems of Lake Tahoe.

4.2 Background

Early actions to protect Lake Tahoe's water quality included the construction of wastewater collection systems (sewers) in all developed areas in the Lake Tahoe basin so that all wastewater could be exported and treated outside the basin. Mandated by the Porter-Cologne Water Quality Control Act in California and by an Executive order by the Governor of Nevada, this substantial program spanned over 10 years and was finished in the late 1970s. Currently, eight sewer districts operate the sewer systems within the Lake Tahoe basin, including three in California and five in Nevada, as follows:

California Districts

- South Tahoe Public Utility District (STPUD)
- Tahoe City Public Utility District (TCPUD)
- North Tahoe Public Utility District (NTPUD)

Nevada Districts

- Incline Village General Improvement District (IVGID)
- Douglas County Sewer Improvement District No.1 (DCSID) and three satellite collection systems of DCSID:
  - Kingsbury General Improvement District (KGID)
  - Tahoe-Douglas District (TDD)
  - Round Hill General Improvement District (RHGID)

See Figure 4-1 for the general locations of the sewer districts. IVGID, STPUD, and DCSID operate wastewater collection, treatment facilities, and effluent export sewers within the basin, while NTPUD and TCPUD operate collection systems and export raw wastewater for treatment to the Tahoe-Truckee Sanitary Agency in Truckee, California.

Sewer pipelines, even when newly constructed, typically leak to a certain extent. Thus, exfiltration from the sewers in the basin is potentially a significant source of nutrient loading to Lake Tahoe and the groundwater that drains into it.

Two recent findings have led some parties to believe that exfiltration from the sewers may be significant. These findings were made in a turbidity study of Lake Tahoe and a court case against a Lake Tahoe sewer district, described below.

The Lahontan Regional Water Quality Control Board completed a study (Taylor, 2002) in March 2002 in which turbidity and chlorophyll were investigated in the near shorezone of Lake Tahoe. Turbidity, an indication of water clarity, is a measure of how much light is scattered by the particles in a water sample. Sources of turbidity of water include suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms. There are many factors that contribute to turbidity, including boat traffic, wind, groundwater inflow of nutrients, urban runoff, atmospheric deposition, stream inflow, and algal growth. Chlorophyll can be considered an indicator of algal concentrations.

In the 2002 study, the spatial distribution of turbidity was mapped using an instrumented boat. Areas with occasional high turbidity occurred off South Lake Tahoe and Tahoe City. Areas with occasional high turbidity occurred off Incline Village and Kings Beach. Undeveloped areas such as Rubicon (on the west shore) and Deadman Point (on the east shore) consistently had low turbidity. The author found a strong correlation between elevated turbidity near the shore and development on the shore. However, it is not possible to confirm the source of the increased turbidity with the methods used in this study. The study cited water samples taken by other researchers and noted that one sample detected elevated fecal coliform, an indicator of the presence of warm-blooded animal feces, in Hatchery Creek at Star Harbor in Tahoe City. This high fecal coliform sample was taken near several sewer pump stations in an area where high turbidity and chlorophyll concentrations were also observed. The author suggested that sewer exfiltration was one possible cause, among many others. Additional testing with different methods from those used in the study would be required to confirm the source of the contamination.

In a civil lawsuit, a Lake Tahoe sewer district was sued for damages to a water supply well on the private property. The plaintiff alleged that the water supply well was contaminated by wastewater from a nearby manhole.

The engineer for the plaintiff estimated the leakage from the manhole when full and with its exit holes blocked to be about 9 gallons/minute. The engineer also stated that sewage could leak from the manhole without overflowing its top due to the seal in the manhole being removed. While it was the engineer's professional opinion that the likely source of contamination was from the soil around the site of the spill, the court did not determine if the determine if the contamination to the drinking well was caused by the spill, manhole exfiltration, or other outside influences. Therefore, this estimate of 9 gallons/minute was not included in this current study.

DISTRICT LOCATION MAP

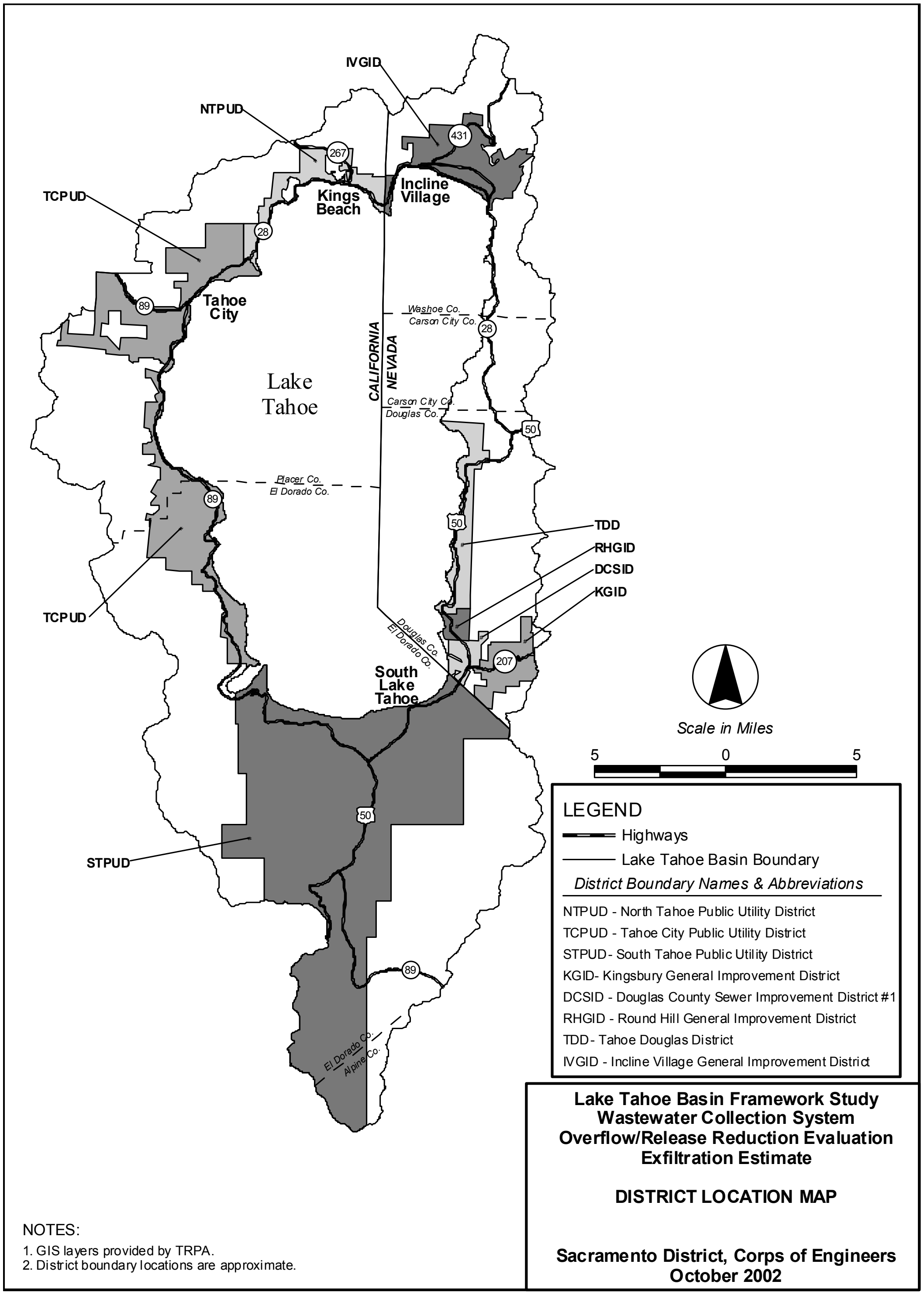


Figure 4-1

4.3 Scope

In this study, total annual exfiltration rates from sewers for each sewer district are estimated. The estimates are based on information from existing reports and on information provided by the personnel of the sewer districts. No field testing was conducted for this study. Primary work tasks included the following:

- Estimating unit exfiltration rates from facility types in the project area
- Estimating annual exfiltration quantities for each sewer district
- Assessing the relative contribution of exfiltration to the nutrient loading of Lake Tahoe

4.4 Data and Literature Search

A literature search and interviews were conducted to obtain information for use in estimating unit exfiltration rates from the sewers in the Lake Tahoe basin. The focus of the search included the following: existing computer models that could be used to predict exfiltration based on sewer parameters, published information about typical values of measured exfiltration in sewer districts nationwide, published information about measured exfiltration specific to the Lake Tahoe basin, and allowable leakage/exfiltration standards for new sewer construction.

In searching the literature, no widely accepted models were identified which could be used to predict exfiltration based on sewer parameters. This finding was verified by interviewing experienced wastewater engineers, as well as technical representatives of the Office of Waste Management of the U.S. Environmental Protection Agency. Representatives from both the regional and national EPA offices concurred that no exfiltration models exist for estimating sewer exfiltration (Wheeler, Greenberg, 2002).

Known exfiltration rates for *in situ* (actual operating) conditions from other sewer systems would give a basis of comparison and would help establish the reasonableness of exfiltration rates estimated for the sewer districts in the basin. An extensive literature search and interviews were conducted to identify known exfiltration rates. In searching the literature, the only published exfiltration rates for *in situ* conditions that could be found were presented in a 1983 study which was completed by STPUD, with TCPUD and NTPUD, to evaluate exfiltration and overflows from the sewer systems located on the California side of the Lake Tahoe basin. The findings of this study are presented in a report entitled *Tahoe Basin Sewer System Exfiltration/Overflow Study,* Kennedy/Jenks Engineers, 1983.

Also, interviews were conducted with personnel of districts outside the basin and the eight sewer districts in the basin. Personnel of the sewer districts in the basin indicated that no exfiltration studies have been conducted recently in the basin.

Conversely, infiltration data are relatively plentiful because reducing the amount of infiltration has been a primary focus of most districts. Unfortunately, a relationship between exfiltration and infiltration has not been established because each occurs under different hydraulic conditions.

4.5 Estimated Unit Exfiltration Rates

Due to the lack of data and information regarding *in situ* exfiltration rates, the unit exfiltration rates for this study were primarily based on the results of the 1983 exfiltration study. This information was the best available information.

The 1983 results are still useful in that general conditions in the sewer districts have not changed substantially. That is, the population base has not changed significantly because development has been limited; and effects of age on the system, with respect to exfiltration, have likely been offset by improved sewer system maintenance and management. The 1983 study and the use of its results for this study to estimate unit exfiltration rates are presented in this section.

4.5.1 Field Test Results

For the 1983 exfiltration study, 9 miles of the total 635 miles of the three public utilities districts on the California side were field pressure tested for exfiltration. Field testing of gravity sewers and force mains was accomplished using hydrostatic pressure methods. The tests of the gravity sewers were conducted by filling the test section of pipe with water to 1 foot above the crown of the pipe as measured in the manhole. The test sections of the gravity sewers were from manhole to manhole. One manhole was evaluated in each test section. Force mains were also tested hydrostatically at or near system operating pressures.

Each sewer system was divided into small, relatively uniform or homogeneous subareas. Each subarea was evaluated in terms of its risk for exfiltration based on pipe ages, pipe materials, normal flows in the system, surrounding groundwater levels, and other pertinent characteristics. Based on an analysis of these data, each subarea was classified as having a low, medium, or high risk of exfiltration. Test sections in the high and medium categories were selected to give a good representation of different areas within each district (not just for the worst subarea of sewers). Unit rates of exfiltration were estimated for those high-, medium-, and low-risk categories. The results of the field testing for exfiltration from gravity sewers ranged from 100 to 1,400 gallons/day/inch-diameter/mile and are shown in Table 4-1.

The unit exfiltration rate of 1,400 gallons/day/inch-diameter/mile for high risk areas of NTPUD is an average value that includes a few very high test results, which were due to noticeable breakages or piping discontinuities. These problems have since been repaired. Thus, this unit exfiltration rate may be overstated for current conditions.

Table 4-1. Summary of Sewer Exfiltration Field Test Results from the 1983 Exfiltration Study [(a)]

District	STPUD		TCPUD		NTPUD	
Sewer Exfiltration Area (Risk Category)	High	Medium	High	Medium	High	Medium
Number of Field Tests	16	15	47	14	37	21
Total Length of Sewer Tested: Feet	5,800	5,700	14,100	3,800	11,700	6,500
Miles	1.1	1.1	2.7	0.7	2.2	1.2
In.-Dia.-Mile	6.54	6.23	20.72	4.96	12.55	7.59
Average Field Test Unit Leakage Rate, GPD/Inch-Dia.-Mile [(b)]	300	100	150	100	1,400	150

NOTES:
(a) Table is adapted from the *Tahoe Basin Sewer System Exfiltration/Overflow Study* (Kennedy/Jenks Engineers, 1983).
(b) Geometric mean of all values with "zero" leakage set to 60 GPD/inch-dia.-mile.

To provide a basis by which to assess the reasonableness of the field testing results, the literature was searched for data about allowable exfiltration for new construction leak tests, which are done under conditions similar to the test conditions used in the 1983 exfiltration study. These allowable exfiltration rates for new construction were compared to the field test data to assess the reasonableness of the results. Allowable construction exfiltration rates for national and regional references were obtained, as well as one from TCPUD. This information is shown in Table 4-2. The EPA states that 200 gallons/day/inch-diameter/mile can normally be achieved with minimum to no effect on construction costs (US Environmental Protection Agency, 1977). The American Society for Testing and Materials (ASTM) allows for exfiltration rates ranging from 100 to 200 gallons/day/inch-diameter/mile for different pipe materials. TCPUD's Technical Specification for Sewer System Construction limits exfiltration to 10 gallons/day/inch-diameter/mile.

Table 4-2. Examples of Acceptance Exfiltration for New Gravity Sewer Construction from Various Sources [(a)]

Data Source	Acceptance Exfiltration for New Construction (Gallons/Day/Inch-Diameter/Mile of Pipe)
EPA Sewer Manual [(b)]	200
American Society of Civil Engineers Sewer Design Manual [(c)]	250-500
Engineering Contractors' Association Greenbook [(d)]	300
American Society for Testing and Materials (ASTM) Standard for Asbestos Cement Pipe [(e)]	100
ASTM Standard for Vitrified Clay Pipe [(f)]	200
Tahoe City Public Utility District Technical Specification for Sewer System Construction [(g)]	10

NOTES:
(a) Acceptance exfiltration tests from various sources are conducted under various conditions, typically, under 4 feet of hydrostatic pressure.
(b) U.S. Environmental Protection Agency, 1977.
(c) American Society of Civil Engineers, 1970.
(d) Engineering Contractors' Association, 2000.
(e) American Society for Testing and Materials, 1998.
(f) American Society for Testing and Materials, 1988.
(g) Tahoe City Public Utility District, 1989.

Excerpts from several agencies listed above regarding the test methods for acceptable exfiltration for new construction are listed below:

- Engineering Contractors' Association Greenbook (2000). 306-1.4.2 Water Exfiltration Test. Each section of sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers. The pipe and manhole shall be filled with water to a point 4 feet above the invert of the sewer at the center point of the upper manhole; or if groundwater present, 4 feet above the average adjacent groundwater level.
- ASTM Standard for Vitrified Clay Pipe-C1091 (1988). The hydrostatic exfiltration testing method includes a minimum 2 feet of head over the pipe barrel at the upper end of the test section. The maximum head at any location in the test section shall not exceed 10 feet. Allow a minimum 4 hours for water absorption in the pipe or release of trapped air, or both. Perform the test by maintaining the head in the standpipe by the addition of water and recording the volume of water and the time elapsed.
- EPA Handbook: Sewer System Infrastructure Analysis and Rehabilitation (1991). The test head should be 2 feet above the pipe crown at the highest point or 2 feet above the ground water. Water should be allowed to stand in test section for as much as 6 hours for absorption in the pipe. Concrete pipe may take longer, whereas vitrified clay and plastic pipe can be tested immediately.
- Tahoe City Public Utility District. Technical Specifications for Sewer System Construction (1989). Each section of sewer shall be tested by inserting stoppers in the lower end of the sewer, the inlet sewer of the upper manhole, and any side sewers at intervening manholes and filling the pipe and manholes to a point 4 feet below the

ground surface of the pipe, or prevailing ground water elevation, whichever is higher. However, the maximum allowable head of water above any portion of sewer being tested is 15 feet. The line shall be filled with water for at least one hour to allow for absorption in the pipe. The loss in water may be determined by measuring additions of water required to maintain the specified head or by measuring the rate of fall of water level, but the level shall not be allowed to fall less than one foot below the specified head.

The unit exfiltration rates derived from the hydrostatic pressure testing from the 1983 exfiltration study compare relatively well to allowable unit exfiltration rates for new construction. The district wide average unit exfiltration rates from the hydrostatic pressure tests generally ranged from 100 to 300, excluding the 1,400 gallons/day/inch-diameter/mile, and the allowable unit exfiltration rates for new construction acceptance testing generally ranged from 100 to 500 gallons/day/inch-diameter/mile. These values are in the same range. As such, the results of the 1983 field tests appear reasonable.

4.5.2 *In Situ* Unit Exfiltration Rates

In the 1983 exfiltration study, correction factors were applied to field-test data to estimate exfiltration rates for *in situ* (actual operating) flow conditions. Factors accounted for non-full pipe flow conditions as well as differences in hydraulic head, clogging of joints with soil, high groundwater, sewers with steep slopes, and areas with less than 100 percent build out. Typical values and descriptions of the factors are shown in Table 4-3.

Table 4-3. Typical Values of Correction Factors to Account for Field Test Conditions and Approximate *In Situ* Flowing Conditions From the 1983 Exfiltration Study

Correction Factor	Typical Values	Description
Hydraulic Head, Wetted Perimeter, Flow Depth	0.002-0.11	The average field test leakage rate is reduced in proportion to the decrease in wetted perimeter and the square root of the change in hydraulic head.
Clogging	0.08	Over the long term, the infiltrative capacity of the soil matrix surrounding the sewer defect will be reduced by clogging. Moreover, clogging of the sewer defect will also occur. Clogging is generally caused by a combination of physical, chemical, and biological factors.
Groundwater Conditions	0.75	Applied to reflect periods when the sewer is submerged by high groundwater, approximately 3 months in spring.
Sewer Slope (non-risk areas)	0.7	Applied to account for a decrease in flow depth due to significantly higher flow velocities.
Buildout	0.5-1	Applied to areas where sewer flow is substantially less than 100 percent of design capacity.

In the 1983 study, the unit exfiltration rates from the field tests were multiplied by the correction factors determined to be applicable to each test section. The resulting *in situ* unit exfiltration rates are shown in Table 4-4. The *in situ* unit exfiltration rates range from 0.08 to 2.5 gallons/day/inch-diameter/mile.

Table 4-4. *In Situ* Unit Exfiltration Rates from the 1983 Exfiltration Study [(a)]

District	STPUD			TCPUD			NTPUD		
Sewer Exfiltration Area	H	M	L	H	M	L	H	M	L
Sewer Length									
Inch-Dia.-Miles	310	190	1000	579	139	386	170	210	100
Miles	44	31	150	8	14	35	30	33	17
Effective Sewer Exfiltration Length, Inch-Dia.-Miles [(b)]	310	190	575	579	139	236	170	210	50
In situ Sewer Unit Exfiltration Rate, GPD/Inch-Dia.-Mile	0.54	0.19	0.08	0.26	0.19	0.09	2.5	0.27	0.19

NOTES:
(a) Table is adapted from the Tahoe Basin Sewer System Exfiltration/Overflow Study (Kennedy/Jenks Engineers, 1983).
(b) Effective sewer exfiltration length accounts for areas where the sewer is always submerged by high groundwater conditions.

As can be seen in Table 4-3, by multiplying by the correction factors, the resulting estimated *in situ* exfiltration rates are much lower than the field test exfiltration rates. One would anticipate the hydraulic head correction factor to significantly reduce the field values. However, appropriateness of the assumptions made to estimate the other correction factors is less quantifiable. There are no data by which to assess the accuracy of the correction factors.

A district wide weighted average *in situ* unit exfiltration rate was calculated for each of the California sewer districts based on information shown in Table 4-4. The estimated average *in situ* unit exfiltration rates are shown in Table 4-5 and range from 0.19 to 0.36 gallons/day/inch-diameter/mile. The following equation was used to calculate the *in situ* unit exfiltration rates for the California districts:

***In Situ* Unit Exfiltration Rate for each California District = Σ [(*In Situ* Unit Exfiltration Rate of each California District Risk Category) x (Length of Pipe for each Risk Category)/(Total Length of Pipe in each District)]**

I*n situ* unit exfiltration rates from the California sewer districts shown in Table 4-5 were used to calculate unit exfiltration rates for gravity sewers for the sewer districts in Nevada. These unit exfiltration rates from the California sewer districts were used to calculate one weighted average unit exfiltration rate for all the Nevada sewer districts. Using this average is reasonable considering the sewer systems in the Lake Tahoe basin were constructed during the same time, using predominantly the same material and installation methods. The result is shown in Table 4-5 and was from 0.36 gallons/day/inch-diameter/miles for the districts in Nevada. The following equation was used to calculate the *in situ* unit exfiltration rate for the Nevada sewer districts:

Nevada *In Situ* Unit Exfiltration Rate = Σ [(*In Situ* Unit Exfiltration Rate of each California District) x (Length of Pipe for each Risk Category)/(Total Length of Pipe in all California Districts)]

Table 4-5. Estimated *In Situ* Unit Exfiltration Rates for Gravity Sewers for Sewer Districts in the Lake Tahoe Basin, Reflecting Application of All Correction Factors

District	Approximate Length of Gravity Sewer Lines (Mi)	Estimated Average *In Situ* Unit Exfiltration Rate (Gallons/Day/Inch-Diameter/ Mile of Pipe)
California		
South Tahoe Public Utility District	225	0.19
Tahoe City Public Utility District	127	0.21
North Tahoe Public Utility District	80	1.1
Nevada		
Incline Village General Improvement District	75	0.36
Tahoe Douglas District	24	0.36
Round Hill General Improvement District	4	0.36
Douglas County Sewer Improvement District Number 1	9	0.36
Kingsbury General Improvement District	33	0.36

Due to the uncertainty about the accuracy of the correction factors, *in situ* exfiltration rates were also estimated by reflecting only the adjustment for reduced hydraulic head. This adjustment was made by multiplying the values in Table 4-5 by the inverse of the other adjustment factors. The results are presented in Table 4-6 and range from 6.0 to 34.9 gallons/day/inch-diameter/mile.

Table 4-6. Estimated *In Situ* Unit Exfiltration Rates for Gravity Sewers for Sewer Districts in the Lake Tahoe Basin, Reflecting Only the Correction Factor for Reduced Hydraulic Head

District	Estimated Average *In Situ* Unit Exfiltration Rate (Gallons/Day/Inch-Diameter/Mile of Pipe)	Estimated Average *In Situ* Unit Exfiltration Rate Reflecting Only the Correction Factor for Reduced Hydraulic Head (Gallons/Day/Inch-Diameter/Mile of Pipe) [(a)]
California		
South Tahoe Public Utility District	0.19	6.0
Tahoe City Public Utility District	0.21	6.7
North Tahoe Public Utility District	1.1	34.9
Nevada		
Incline Village General Improvement District	0.36	11.4
Tahoe Douglas District	0.36	11.4
Round Hill General Improvement District	0.36	11.4
Douglas County Sewer Improvement District Number 1	0.36	11.4
Kingsbury General Improvement District	0.36	11.4

(a) The unit exfiltration rates were adjusted by multiplying them by the inverse of the removed correction factors, 1/0.08 x 1/0.75 x 1/0.70 x 1/0.75 = 31.7.

Exfiltration rates for sewer force mains were estimated in the 1983 exfiltration study to be virtually zero for long-term leakage.

Exfiltration rates for pump stations were not evaluated in the 1983 study. Based on interviews with agency personnel, pump stations are inspected, cleaned, and repaired regularly. It is unlikely that exfiltration from pump stations is significant. As such, exfiltration rates for pump stations were estimated to be virtually zero for long-term leakage. Most pump stations are equipped with alarms to notify the sewer districts in the event of a problem. A discussion regarding each district's response times are noted in Sections 7 through 14.

4.6 Estimated Total Exfiltration

4.6.1 Estimated Annual Exfiltration

Estimated annual total exfiltration amounts for gravity sewers in the sewer districts were based on the *in situ* unit exfiltration rates shown in Tables 4-5 and 4-6. In general, the total exfiltration in each district was estimated by multiplying the district wide average *in situ* unit exfiltration rates (gallons/day/inch-diameter/mile) by the lengths of each diameter of pipe in each sewer district. The total exfiltration for all pipe sizes in each sewer district was summed to calculate a total annual exfiltration rate for each sewer district. Total annual exfiltration from each district is shown in Table 4-7, ranging from 0.01 to 2.4 million gallons. The estimated total annual exfiltration for the entire Lake Tahoe basin reflecting all correction factors is 0.49 million gallons. Reflecting only the adjustment for the reduced hydraulic head correction factor, the estimated total annual exfiltration rate is 15.4 million gallons. The following general equation was used to calculate total annual exfiltration:

Total Exfiltration Rate = Σ (*In Situ* Unit Exfiltration Rate) x (Diameter of each Pipe) x (Length of each Size of Pipe)

Table 4-7. Estimated Range of Total Annual Exfiltration for Gravity Sewers from Sewer Districts in the Lake Tahoe Basin

District	Estimated Annual Exfiltration, Reflecting All Correction Factors (Millions of Gallons)	Estimated Annual Exfiltration, Reflecting Only the Adjustment for Reduced Hydraulic Head Correction Factor (Millions of Gallons)
California		
South Tahoe Public Utility District	0.10	3.2
Tahoe City Public Utility District	0.08	2.5
North Tahoe Public Utility District	0.19	6.0
Nevada		
Incline Village General Improvement District	0.06	1.9
Tahoe Douglas District	0.02	0.6
Round Hill General Improvement District	0.01	0.3
Douglas County Sewer Improvement District Number 1	0.01	0.3
Kingsbury General Improvement District	0.02	0.6
Total	0.49	15.4

4.6.2 Relative Magnitude of Nutrient Loading to Lake Tahoe

For perspective, the potential loading of nitrogen and phosphorus from exfiltration was estimated and compared to the total loading of these nutrients from other major sources. In a recent study (USDA, 2000), it has been estimated that the nitrogen and phosphorus loadings from atmospheric deposition, stream loading, direct runoff, groundwater, and shoreline erosion to Lake Tahoe are 922,000 lb/year and 101,000 lb/year, respectively. Nitrogen and phosphorus concentrations in the sewage for the three sewer districts in California typically average 30 mg/l and 8 mg/l, respectively (Kennedy/Jenks Engineers, 1983). These values appear reasonable when compared to typical concentrations for medium strength domestic wastewater for nitrogen and phosphorus of 40 mg/l and 8 mg/l, respectively (Metcalf & Eddy, Inc., 1979). Because the Nevada side of the lake has similar demographics to the California side, it was assumed that the California concentrations also represent concentrations of sewage on the Nevada side. Based on those concentrations and on the range of *in situ* exfiltration rates presented in Table 4-1, the estimated nitrogen loading from sewers in the Lake Tahoe basin would range from about 123 to 3,850 lb/year. Similarly, the estimated phosphorus loading would range from 33 to 1,030 lb/year. These loadings range from 0.01 percent to 0.42 percent, and from 0.03 percent to 1.0 percent of the total loadings of total nitrogen and total phosphorus, respectively, to Lake Tahoe from all sources. Accordingly, exfiltration does not appear to be a major source of the loading of nitrogen and phosphorus in the Lake Tahoe basin.

4.6.3 Reasonableness of Evaluation and Sensitivity Analysis

There is no verified information about *in situ* exfiltration rates for sewers that provide a basis for comparing the *in situ* exfiltration rates in the 1983 exfiltration study. Therefore, it is difficult to assess the reasonableness of the *in situ* exfiltration rates from the 1983 exfiltration study, which were estimated from hydrostatic pressure tests. The estimated *in situ* unit exfiltration rates are substantially lower than the field hydrostatic pressure test exfiltration rates. This large difference between the field-test data and the *in situ* data has not been verified, but it is expected. Primarily, the difference is explained by the fact that the field testing was conducted under the conditions of 1 foot of head above a full pipe; sewers normally do not run full and often have very little flow, such as at night. Also considering other differing conditions between the hydrostatic pressure test and the *in situ* unit exfiltration rates, the unit exfiltration rates for *in situ* conditions from the 1983 exfiltration study seem reasonable.

However, even if the total estimated exfiltration rate in the current study is estimated by using the exfiltration rate that reflects only the adjustment for reduced hydraulic head, the loading of nitrogen and phosphorus would only be 0.42 and 1.0 percent, respectively, of the total loading to Lake Tahoe. The loading would still be relatively small.

Table 4-3 identified the correction factors for the hydraulic head varied from 0.002 to 0.11. Table 4-8 lists these factors in addition to a conservative value and shows the nutrient loading and percentages compared to other nutrient contributors.

Table 4-8. Hydraulic Head Correction Factors and Nutrient Loading

Hydraulic Head Correction Factors	Nitrogen (lbs/yr)	% of Nitrogen Contribution	Phosphorus (lbs/yr)	% of Phosphorus Contribution
0.002	123	0.01	33	0.03
0.06	3,850	0.42	1,030	1.02
0.11	6,417	0.70	1,717	1.70
0.5	64,167	3.48	8,583	8.5

The hydraulic head correction factor of 0.06 was used in this estimate based on the 1983 exfiltration study. This correction factor was the computed average from the 1983 study. With the limited growth in Lake Tahoe and the improvement in operation and maintenance, this was a reasonable factor.

4.7 Findings, Limitations, and Recommendations

Based on the findings of this study, it does not appear that exfiltration from the sewers in the Lake Tahoe basin is a major factor contributing to the nutrient loading of Lake Tahoe. The exfiltration rates estimated in this study are based on limited available information. They are intended to represent district wide averages over the long term and not of spills or releases due to short-term/dramatic events such as system failures.

Exfiltration rates associated with damaged facilities can be substantial. However, these conditions are generally found and corrected as part of the districts' current operations and maintenance programs.

Many districts have chemicals available to treat root intrusion into the sewer line. Roots typically intrude pipes at the joints. The roots typically enter the line through the top or side of the pipe (joint) where exfiltration is not a problem but infiltration is the issue. Exfiltration could be an issue if the roots intrude from the bottom of the pipe (joint) or the root intrusion (root ball) gets large enough to separate a pipe at the joint. Inspection and monitoring can identify these problems.

For planning purposes, the recommended exfiltration estimate to be used in the groundwater study that is being conducted by the U.S. Army Corps of Engineers is 15.4 million gallons per year. Based on this estimate, the total nitrogen and phosphorus would be 3,850 pounds per year and 1,030 pounds per year, respectively. This estimate included all sewer districts in the Lake Tahoe basin. This is a conservative estimate applying only the adjustment for reduced hydraulic head. The exfiltration estimate is based on California data only; there is no information on the Nevada districts. It is assumed that the exfiltration rates in Nevada would be similar to those in California, based on the same pipeline materials being used and same construction timeframe. This estimate does not take into account the soil matrix and any absorption and uptake by the soils.

A substantial testing program would be required to provide significantly better data regarding basin wide exfiltration conditions. It appears that such an effort may take a lower priority relative to other activities addressing major sources of nutrient loading to Lake Tahoe.

5.0 BASIS FOR EVALUATION OF RISK

The study area encompasses those sewer facilities that are considered potentially high risk due to their close proximity to Lake Tahoe, as described in Chapter 1. Guidelines and an evaluation process were established for further assessing the relative level of risk associated with the facilities. The guidelines provide a standardized approach for identifying and prioritizing potential problems and are presented in this chapter.

5.1 Risk Evaluation Process

In conducting the risk evaluation, the following step-by-step process was followed:

1. Interview district and agency personnel and obtain information regarding the sewer systems.
2. Identify critical sewer facilities within the study area.
3. Categorize critical sewer facilities relative to the potential magnitude of overflows/releases.
4. Apply risk evaluation criteria to identify key conditions that pose potential problems and assign a level of risk relating to the likelihood of an overflow/release occurring.
5. Prioritize potential problems based on the potential magnitude and likelihood of an overflow/release.

5.2 Critical Sewer Facilities

Critical sewer facilities of the wastewater collection systems are those whose failure would have significant impact on the water quality of Lake Tahoe. For purposes of this study, these facilities have been identified as gravity sewers and manholes, pump stations, and force mains.

5.3 Risk Relative to Magnitude and Likelihood of Occurring

The critical sewer facilities were categorized based upon the potential magnitude of the impacts to Lake Tahoe should an overflow/release occur. The categories are grouped by the number of equivalent dwellings (du) that the facility serves. The categories are designated A, B, and C, as described below in Table 5-1.

Table 5-1. Categories of Risk Relative to Potential Magnitude of Overflow/Release

Category	Description of Risk
A	Facility serving 80 or more equivalent dwellings (du) [a]
B	Facility serving 30 to 80 du
C	Facility serving less than 30 du

[a] An equivalent dwelling is any facility producing wastewater equivalent to a typical residence; i.e., approximately 200 gallons per day.

Qualitative risk levels were established as low, medium, and high and were defined in terms of the likelihood of overflows/releases occurring, as described in Table 5-2. A qualitative risk level was then assigned to each of the key conditions considered in the risk evaluation criteria.

Table 5-2. Risk Levels Relative to the Likelihood of Overflows/Releases Occurring

Risk Levels	Description of Risk
Low	Minimal risk in near future, but potential for further deterioration of condition
Medium	Unlikely in near future, deterioration of condition is likely
High	Likely in the foreseeable future

5.4 Risk Evaluation Criteria

Risk evaluation was established for key conditions that may exist at the critical sewer facilities, and, if present, serve as indicators of potential problems. As described above, corresponding qualitative risk levels of low, medium, or high were assigned to each key condition. The risk criteria/key condition and the corresponding risk levels are presented in Tables 5-3, 5-4, and 5-5 for gravity sewers and manholes, pump stations, and force mains, respectively.

From review of Tables 5-3, 5-4, and 5-5, it can be seen that for gravity sewers and manholes, the key conditions and risk criteria categories are the number of reported overflows/releases within the last 10 years; age; access; capacity; structural conditions; conditions of siphons; and conditions of operation and maintenance, such as bypasses, cleaning, and televising. The risk criteria/key conditions for pump stations are similar to those conditions for gravity sewers, except for the additional risk criteria categories of wet-well capacity and redundancy. The key conditions for force mains are similar to those of gravity sewers.

Table 5-3. Sanitary Gravity Sewers and Manholes Criteria for Assessing Risk of Overflows/Releases

Risk Criteria/Key Condition	Risk Level		
	Low	**Medium**	**High**
Reported Overflows/Releases within the Last 10 Years			
1. None reported	x		
2. One in last 10 years		x	
3. Greater than one in last 10 years			x
Age			
1. Is less than 10 years old	x		
2. Is between 11 and 50 years old		x	
3. Is greater than 50 years old			x
Access			
1. Adequate easements are maintained	x		
2. Easements inadequate (size or encroached upon)		x	
3. Located within environmentally sensitive areas		x	
4. Easements do not exist			x
Capacity			
1. Adequate capacity	x		
2. Surcharged lines		x	
3. Inadequate capacity during peak periods			x
Structural			
1. Adequate conditions	x		
2. Inadequate cover-subject to damage			x
3. Deterioration that can be repaired		x	
4. Deterioration that requires replacement			x
Siphons			
1. One redundant barrel	x		
2. No redundant barrel			x
Operation and Maintenance			
Bypass			
1. Line can be readily bypassed	x		
2. Line can be bypassed with some effort		x	
3. Line cannot be bypassed			x
Cleaning			
1. Cleaned every 1 to 3 years	x		
2. Cleaned every 3 to 5 years		x	
3. Cleaned only when problem occurs			x
4. Line requires frequent cleaning			x
Televising			
1. Televised every 1 to 3 years	x		
2. Televised every 3 to 5 years		x	
3. Televised every 5+ years or not televised			x

Table 5-4. Sanitary Sewer Pump Stations Criteria for Assessing Risk of Overflows/Releases

Risk Criteria/Key Condition	Risk Level		
	Low	Medium	High
Reported Overflows/Releases within the Last 10 Years			
1. None reported	x		
2. One in last 10 years		x	
3. Greater than one in last 10 years			x
Age			
1. Is less than 10 years old	x		
2. Is between 10 and 30 years old		x	
3. Is greater than 30 years old			x
Access			
1. Adequate easements are maintained	x		
2. Easements inadequate (size or encroached upon)		x	
3. Located within nearshore, foreshore, or environmentally sensitive areas		x	
4. Easements do not exist			x
Pumping Capacity			
1. Adequate capacity	x		
2. Inadequate capacity during peak flow			x
Wet-Well Capacity			
1. Has a volume that provides a maximum of five pump starts an hour during ADWF		x	
Structural			
1. Facility in adequate condition	x		
2. Deterioration that can be repaired		x	
3. Deterioration that requires replacement			x
Redundancy			
1. Has built-in generator as backup power	x		
2. Has a portable generator as backup power		x	
3. Does not have backup power or emergency sewage storage			x
4. Does not have at least one redundant pump			x
5. Does not have motor sensor, alarm, and telemetry			x
Operation and Maintenance			
Bypass			
1. Pump station can be readily bypassed	x		
2. Pump station can be bypassed with some effort		x	
3. Pump station cannot be bypassed			x

Table 5-5. Sanitary Sewer Force Mains Criteria for Assessing Risk of Overflows/Releases

Risk Criteria/Key Condition	Risk Level		
	Low	**Medium**	**High**
Reported Overflows/Releases within the Last 10 Years			
1. None reported	x		
2. One in last 10 years		x	
3. Greater than one in last 10 years			x
Age			
1. Is less than 10 years old	x		
2. Is between 10 and 50 years old		x	
3. Is greater than 50 years old			x
Access			
1. Adequate easements are maintained	x		
2. Easements inadequate (size or encroached upon)		x	
3. Located within environmentally sensitive areas		x	
4. Easements do not exist			x
Capacity			
1. Adequate capacity	x		
2. Inadequate capacity during peak periods		x	
Structural			
1. Lines are in adequate condition	x		
2. Inadequate cover – subject to damage			x
3. Deterioration that can be repaired		x	
4. Deterioration that requires replacement			x
Siphons			
1. One redundant barrel	x		
2. No redundant barrel			x
Operation and Maintenance			
Bypass			
1. Line can be readily bypassed	x		
2. Line can be bypassed with some effort		x	
3. Line cannot be bypassed			x
Cleaning			
1. Cleaned every 1 to 3 years	x		
2. Cleaned every 3 years to 5 years		x	
3. Cleaned only when problem occurs			x
4. Line requires frequent cleaning		x	
5. Pig launching facility not provided		x	
Televising			
1. Televised every 1 to 3 years	x		
2. Televised every 3 to 5 years		x	
3. Televised every 5+ years or not televised			x

5.4.1 Reported Overflows/Releases within the Last 10 Years

Sanitary sewer overflows (SSO's), or overflows, are common problems that are currently being addressed by the U.S. Environmental Protection Agency (EPA). The EPA is currently proposing an SSO rule that would prohibit any discharge from wastewater collection systems (sewers) upstream from a wastewater treatment plant that is operated under a National Pollutant Discharge Elimination System (NPDES) permit. Sewer districts in the Lake Tahoe basin are not regulated by NPDES permits because they do not discharge effluent into waters of the United States. However, TRPA regulations do prohibit discharge of raw and untreated sewage and treated sewage effluent into the waters of Lake Tahoe, its tributaries, or the groundwater of the Lake Tahoe basin.

Several major studies and national surveys have been conducted to assess the existing conditions of sanitary sewer systems and the extent and nature of SSO problems. Although system performance varies significantly from system to system, some representative information has been presented. The State of Oklahoma developed a statewide estimate of 79 SSO's/year/1,000 miles of sewer. Results from four case studies of four large municipalities across the nation ranged from 51 to 147 SSO's/year/1,000 miles of sewer (EPA, 2001). Table 5-6 lists the SSO's of the four municipalities. The Lake Tahoe basin was added for comparison.

Conditions in the Lake Tahoe basin seem to be better than they are nationwide. Based on information from the Lahontan Regional Water Quality Control Board, average reported overflows on the California side of the basin were approximately 16 overflows/year/1,000 miles. Based on interviews with the districts in Nevada, overflows were approximately 12 overflows/year/1,000 miles. If all districts in the Lake Tahoe basins are combined, the approximate SSO is 15 overflows/year/1,000 miles. Most of the overflows were caused by blockages; some were caused by pump station failures. Most of the overflows were outside the shorezone and stream environment zones, and most overflows did not occur in the same place more than once. All of these facts indicate that the overflows were arbitrary and that these overflows may or may not be fixed by routine maintenance. Based on limited data from the sewer districts on the Nevada side, conditions appear to be similar.

Information about overflows was obtained from interviews with the personnel of the sewer districts. This information was verified for sewer districts in California by reviewing overflow records kept by the Lahontan Regional Water Quality Control Board.

Table 5-6. SSOs (excluding basement backups) from Four Large Municipalities

Parameter	City/Region						
	Louisville	**Oakland**	**Charlotte**	**MD Suburbs/ Washington D.C.**	**Lake Tahoe Basin(1)**	**Reno(2)**	**Placerville(3)**
Miles of sewers maintained	1,534	1,500	2,445	4,600	900	600 ±	49 ±
Reporting period	1993-94	1993-94	1983-93	1990-94	1987-2001	2001-2002	2002
Type of failure							
Blockages caused by oil and grease, roots, or solids	7	300	—	—	—	—	—
Hydraulic capacity exceeded	0	0	180	—	—	—	—
Pump station failures	25	0	4	—	—	—	—
Sewer breaks	12	600	—	—	—	—	—
Rainfall induced I/I	115	08	—	—	—	—	—
Total SSOs/year (excluding basement backups)	165	—	359	234*	13	58	11
Total SSOs/yr/1,000 miles (excluding basement backups)	110	—	147	51	15	97(4)	225

*NOTE: Data do not include basement backups. MD Suburbs/Washington, DC reported an average of 592 basement backups per year, either caused by a problem outside the property line or high flows or surcharging in a sewer main.
(1)SSO information is from the Lahontan Regional Water Quality Control Board for the California districts and from interviews with the Nevada districts. These numbers are approximate. All sewer districts were combined for an overall SSO total.
(2)SSO information collected from the City of Reno.
(3)SSO information collected from the City of Placerville.
(4)Approximately 25% to 40% of reported SSO's are located on private property.

5.4.2 Age

The age of a sewer pipe is often an indication of its condition. The service life of sanitary sewer pipe of various materials is generally accepted as 50 years. The service life of sanitary sewer pump station components is generally accepted as 30 years. Once the sewer systems reach is age, the need for major rehabilitation or replacement can be expected. Sewer pipe may last longer than 50 years, but increased monitoring and inspection should take place to ensure these lines are functional. The sewer systems in the Lake Tahoe basin, most of which were constructed in the early 1960's to the early 1970's, are approaching 30 to 40 years in age. Some of the earliest sewer facilities were constructed in the 1940's and 1950's.

Information about the age of sewer facilities was obtained from interviews with the sewer districts and review of plan and as-built drawings and sewer system master plans. Approximate ages were assumed for sewer facilities when specific information was not available. District input and the ages of the sewer facilities were used to estimate their conditions unless more specific information was available.

5.4.3 Access

Adequate access and proper easements to sewer facilities are required for normal operations, maintenance, and emergency activities. Adequate access is also needed for construction equipment when repair or replacement of a sewer facility is necessary.

Easements should be monitored for encroachment by development. The easements should be maintained and freely accessible.

Because easement restrictions have not been enforced, some of the gravity sewers and force mains around the Lake Tahoe basin are inaccessible. Easements to the shorezone have been encroached by development and landscaping, fences, and other small structures. Easements in the shorezone have been encroached by structures such as piers. Although these structures can be removed during construction or emergency response and replaced afterwards, access is effectively blocked for routine maintenance and inspection. Sewer locations in streets are generally preferred to improve sewer operation and maintenance. Pump station locations near streets are also preferred.

Some gravity sewers in the Lake Tahoe basin are located in environmentally sensitive areas such as on U.S. Forest Service land. Sewer districts with gravity sewers on Forest Service land were granted rights-of-way via special-use permits issued by the Forest Service that allow access to maintain sewer lines. Sewers on Forest Service land must be accessed via the rights-of-way. If access is encumbered along the rights-of-way, the Forest Service must be contacted for guidance about alternate means of access. The Forest Service may limit access to sewers when the ground is saturated or at times if the rights-of-way pass through known habitat of endangered species. Other provisions set forth in the special-use permits may also limit access. Again, sewer locations in streets are greatly preferred.

In the Lake Tahoe basin, a common problem with force mains is gaining access inside the pipe to clean and inspect them. Because force mains are pressure pipes, they are generally not provided with accesses (i.e., manholes) into the pipe. Also, many of the force mains were designed without provisions for cleaning, such as pigging facilities, so that cleaning is not readily possible. Most long reaches of force mains cannot be inspected because the television equipment cannot extend beyond the length between manholes into the pipe. Some force mains have never been cleaned or inspected.

Information about accessibility and easements was obtained from interviews with the sewer districts and the Forest Service. In addition to pipelines, the districts identified pump stations with limited access.

5.4.4 Capacity/Pumping Capacity/Wet Well Capacity

To meet the objective of eliminating overflows, the sewer facilities should be able to convey at least the maximum peak hourly flow without overflowing and spilling. Many sanitary sewer systems across the United States have overflows due to a lack of flow capacity during wet weather. This problem is often caused by infiltration/inflow problems that exceed the flows allowed for in design of the system.

The pump stations should be able to pump at least the maximum wet weather flow without causing the upstream sewers to overflow. Inadequate pumping capacity is often caused by quantities of infiltration and inflow problems that exceed the amount allowed for during the design of the system.

The flow rate in a force main is limited by the pressure rating of the pipe and the pump. For this reason the pump and the force main are normally designed as a unit. The main problem is where the flow rate draining into the pump station is underestimated and the pump and force main are undersized. The system could possibly be retrofitted with a higher capacity pump as long as the increased velocities and pressures in the force main do not exceed ratings.

Pump station wet wells store sewage before pumping, provide submergence over the pump suction, and provide a smooth transition of flow from the sewer into the pump. In terms of pump station reliability, the main concern is matching the pump to the size of the wet well. Insufficient storage volume in the wet well can result in the pump motors overloading. Pump motors should not operate for short periods that require frequent stop and starts. Although each pump is designed differently, for the purposes of this study, it was assumed that a pump that had more than five starts per hour during average dry weather flow (ADWF) had a problem.

In general, the sewer facilities in the Lake Tahoe basin do not have problems with capacity. First, the design dry-weather peak flow has not been realized because development has been severely limited and full buildout has not occurred and will not occur in the near future. This can potentially cause problems with scouring velocity and the buildup of debris in low spots in force mains and siphons. Pump stations and force mains were over designed based on potential growth that has been limited. Second, infiltration/inflow has not been a major problem because many of the sewer districts have implemented infiltration/inflow reduction programs.

Information about sewer facility capacities was obtained from interviews with personnel of the sewer districts. The districts identified potential problems with capacities of sewer facilities.

5.4.5 Structural

Nationwide, severe or catastrophic sewer collapses are rare, though they are becoming more frequent as the Nation's infrastructure ages.

Besides earth and traffic loadings, there are several factors involved in the structural failure of sewer pipes. Major factors include corrosive soils or groundwater, inadequate bedding and backfill, root intrusion into a leaking pipe, and corrosive sewage gas releases. The extent of external and internal corrosiveness is largely dependent on the material of the pipe. Much of the pipe material that was used to construct gravity sewers in the Lake Tahoe basin was asbestos cement pipe (ACP). Over time, it has been found that ACP does not resist corrosion well. It tends to soften when exposed to sewer gases for long periods. Furthermore, the soils in the Lake Tahoe basin are known to be, in general, corrosive. For this reason, many gravity sewers in the Lake Tahoe basin are potentially in poor structural condition due to corrosion. Voiding of soil around the gravity sewers could also be a problem in the Lake Tahoe basin because sewer construction techniques in the 1960's and 1970's are considered by some to be marginal in some areas. Inappropriate backfill materials may have been used, and compaction was not sufficient. Resulting sags in the pipeline alignment have been observed by the sewer districts.

Force mains in the Lake Tahoe basin were constructed of various materials, including ACP, reinforced concrete, ductile iron, vitrified clay, and cement mortar lined and coated steel. ACP, reinforced concrete, and ductile iron pipes do not resist corrosion well. Furthermore, the soils in the Lake Tahoe basin are known to be, in general, corrosive. Therefore, many force mains in the Lake Tahoe basin are potentially in poor structural condition due to corrosion.

Sewers are prone to damage when they do not have adequate soil cover. Minimum cover of earth fill over the gravity sewers and force mains should be 5 feet. Many areas in the shorezone have eroded so that cover is only a couple of feet, and, in some cases, sewers are exposed.

At stream crossings, gravity sewers and force mains should be designed with enough soil cover to resist streambed lowering by scour. In addition, sewer pipelines must be able to withstand flotation (hydrostatic uplift) and freezing. A minimum cover of 5 feet for stabilized channels and 7 feet for shifting channels was assumed to be needed.

In the United States, structural problems with pump stations are rare. However, maintenance of the pump station structure is critical in protecting the pump station equipment. For example, the foundation of a pump can become deteriorated enough to allow the pump to excessively vibrate and eventually fail. Maintenance of the structural components of pump stations should not be neglected.

Information about the structural condition of sewer facilities was obtained from interviews with personnel of the sewer districts. Sewer district personnel identified gravity sewers that were in poor condition. All other gravity sewers were assumed to be in good condition.

Pump stations are inspected frequently. The sewer districts did not identify any pump stations that had structural problems.

The sewer districts identified force mains that were in poor condition. These identified force mains were assumed to have structural problems. All other force mains were assumed to be in good condition.

5.4.6 Siphons

To cross under waterways and other deep features, inverted siphons (siphons) are frequently used to meet cover requirements. Because siphons are prone to clog, their use should be avoided where possible.

The main problem with siphons in the Lake Tahoe basin is when they are used to cross a stream. Reliability in this situation is critical because any release would be in or near a stream, which could drain directly into to Lake Tahoe. Also, stream crossings are often in remote locations, and problems cannot be responded to quickly.

Information about existing siphons was obtained from interviews with the sewer districts. The districts identified siphons with problems.

5.4.7 Redundancy

Reliability of sewer pump stations is critical to protect the environment from overflows. Designing redundant components into the pump stations can greatly reduce the chances of pump station failure and is commonly practiced. Pump station components should have redundancy in the following equipment:

1. Power supply or emergency storage
2. Pumps and motors
3. Instrumentation and control equipment

Most of the sewer districts have improved the reliability of their pump stations by adding the components listed above. However, the pump stations in the Lake Tahoe basin are older and were not built with all the components now found in modern stations. Also, a few of the smaller pump stations do not have at least one redundant pump. Reliability of power source is a major problem in the Lake Tahoe basin because of the severe winter weather. Power outages often occur several times each year. Recently, simultaneous electrical and natural gas outages occurred in the same area. For this reason, some sewer districts put major pump stations on propane back up power. Although many of the pump stations in the basin share portable generators, some of the smaller pump stations do not have any back up power.

Information about redundancy and reliability was obtained from interviews with the sewer districts and sewer master plans. The districts identified pump stations that have problems with reliability.

5.4.8 Operation and Maintenance: Bypass

Bypassing gravity sewers is generally not a problem because of the abundance of manholes. The same generally is true for gravity sewers in the Lake Tahoe basin. Therefore, cleaning was not used as risk criteria for gravity sewers and manholes.

Bypassing a pump station is sometimes necessary to make repairs and to avoid overflows. The ideal system configuration is to have a permanent bypass pipe to a nearby pump station or gravity sewer that could handle the bypassed flow. The use of this configuration is rare because of the conditions necessary for it to work. Temporary bypass equipment is normally used for pump stations.

Conditions are similar in the Lake Tahoe basin. Most of the sewer districts bypass their pump stations by using vacuum and tanker trucks. One of the districts does have a permanent bypass facility to a nearby sewer district. Some of the districts have problems with bypassing their pump stations because of lack of access to the pump stations.

Bypassing a reach of a force main is sometimes necessary to make repairs and to avoid overflows. Current good design practice is to provide an isolation valve every 800 to 1,000 feet so that a bypass can be made around a reach of force main with temporary piping or a hose. The use of this configuration is rare because of the cost of isolation valves and the high maintenance required. Normal practice is to repair a failed force main with temporary equipment such as a service clamp, which does not require the damaged reach to be shut off of while it is being repaired.

Similar conditions exist in the Lake Tahoe basin. Most of the sewer districts do not have isolation valves on their force mains. One of the districts does have isolation valves on its major sewers. Some of the districts have problems with bypassing their force mains because of lack of access to the force mains.

Information about pump station and force main bypasses was obtained from interviews with the sewer districts. The districts identified pump stations and force mains with bypassing problems.

5.4.9 Operation and Maintenance: Cleaning

Preventive maintenance can reduce operation costs during both the short and the long term because it is far less expensive to maintain system appurtenances than to repair or replace them. Additionally, with increased attention to the system, the incidence of backups and overflows can be reduced. For example, frequent maintenance has been shown to reduce stoppages in gravity sewers. Systems with cleaning schedules every 1 to 2 years have been shown to have far fewer blockages than those cleaned every 3 to 6 years (EPA, 2001).

In the mid-1980's, most of the sewer districts in the Lake Tahoe basin increased the cleaning schedules of their gravity sewers to once every two to eight years. Some districts, however, have problem areas that are cleaned more frequently. These areas may include; inadequate sewer slopes, high sediment deposition, illegal discharges, and grease build up from restaurants.

Because it is usually more difficult to clean a force main, force mains often go uncleaned. Gaining access to clean and inspect them is difficult because force mains are closed pipes from the pump station to the next pump station or gravity sewer. Also, the scouring velocity is usually maintained in the force main so that the force main stays relatively clean compared to gravity sewers. However, over time, the pipe may develop rust and scale on the interior surfaces that collect organic and solid materials, eventually causing the potential for stoppages or pipe failure from corrosion.

The preferred way to clean a force main is with a special tool called a pig. To do so, the pig and a special access structure called a launch need to be installed. Many force mains across the country were constructed with no pig launching facilities. A much less expensive method of cleaning a force main is hydroflushing. However, for this method, the pipe needs to be drained and taken out of service for a long period. Due to the limitations of the length of the hydroflushing equipment, intermediate access points are necessary. These access points, called manholes, are different from manholes for gravity sewers. They are nozzles on top of the pipe and can be unbolted during shutdown. This design feature was not common in the past, but is currently recommended to be installed every 1,000 feet on a force main.

In the mid 1980's, some sewer districts in the Lake Tahoe basin increased their cleaning schedules of their force mains. However, some of the force mains were designed with no pig launching facilities or access points so that cleaning is not possible. These force mains have not been cleaned or inspected since construction.

Sewer pump stations are generally cleaned relatively frequently. The same generality is true for pump stations in the Lake Tahoe basin. Therefore, cleaning was not used as risk criteria for pump stations.

Information about cleaning schedules of the gravity sewers and manholes and force mains was obtained from interviews with the personnel of the sewer districts. The districts identified gravity sewers that require frequent cleaning and force mains that have problems with cleaning.

5.4.10 Operation and Maintenance: Televising

Again, preventive maintenance can reduce operation costs during both the short and the long term because it is far less expensive to maintain system appurtenances than to repair or replace them. Additionally, with increased attention to the system, the incidence of backups and overflows can be reduced. For example, as described above, frequent maintenance has been shown to reduce stoppages in gravity sewers, with cleaning schedules of every 1 to 2 years being the most effective.

In general, lack of inspection of gravity sewers and manholes is not a major problem with most of the sewer districts in the Lake Tahoe basin because the districts have implemented infiltration/inflow reduction programs since the mid-1980's. Most sewer districts in the Lake Tahoe basin inspect their gravity sewers every 3 to 5 years. However, some of the districts only inspect their gravity sewers when a problem occurs.

Because they are usually more difficult to clean, force mains often go uninspected. Gaining access to clean and inspect them is difficult because force mains are closed pipes from the pump station to the next pump station or gravity sewer. Also, the scouring velocity is usually maintained in the force main so that the force main stays relatively trouble-free compared to gravity sewers. However, over time, the pipe may develop rust (in iron pipes) and scale on the interior surfaces that collect organic and solid materials, eventually causing the potential for stoppages or pipe failure from corrosion. These events are typically very rare.

The normal way to inspect a force main is with televising equipment. For this method, the pump normally needs to be shut off and the force main depressurized. Due to the limitations of the length of the televising equipment, intermediate access points are necessary.

Information about the inspection schedules of the gravity sewers and force mains was obtained from interviews with the personnel of the sewer districts. The sewer districts identified gravity sewers and force mains that have problems with inspection.

5.5 <u>Potential Problem Identification and Prioritization Process</u>

As shown in Table 5-7, potential problems were prioritized reflecting the risk categories in Table 5-1 and the criteria and risk levels listed in Tables 5-3, 5-4, and 5-5. The priorities of the potential problems were divided into six priority levels, one being the highest priority. The priority levels indicate which potential problems should be corrected first to provide the greatest reduction in the risk. Only potential problems having a risk level of medium or high were studied further.

Table 5-7. Prioritization of Potential Problems

Priority Level	Risk Category	Risk Level
1	*A*	High
2	*B*	High
3	*C*	High
4	*A*	Medium
5	*B*	Medium
6	*C*	Medium

Risk levels rated as low were not included in this study. Low risk level items may include rehabilitated sewers and upgraded pump stations located in the study area.

6.0 BASIS FOR DEVELOPING RISK REDUCTION ACTION PLANS

Potential risk reduction action plans were developed to address the identified problem conditions and the associated first costs were estimated for each plan. To standardize the approach, alternative reduction measures were identified which would be appropriate to address the general problem conditions. Unit costs were also developed for the alternative measures for use in estimating the costs of the action plans. This material is presented in this chapter.

6.1 Approach to Developing Potential Risk Reduction Action Plans

The following steps were followed to develop risk reduction action plans for each district.

1. Identify alternative risk reduction measures that would be appropriate to address the identified high risk problems
2. Assess the advantages and disadvantages of potential risk reduction measures
3. Estimate unit costs for various risk reduction measures
4. Identify the reduction measures associated with a potential action plan for each high risk problem
5. Estimate the first cost associated with each potential action plan

6.2 Alternative Risk Reduction Measures

Potential risk reduction measures were identified for each of the risk criteria/key conditions presented in Chapter 5 that were associated with medium to high risks. The advantages and disadvantages of each measure were also evaluated. The reduction measures are presented by risk criteria/key condition in Tables 6-1, 6-3, and 6-5 for gravity sewers and manholes, pump stations, and force mains, respectively. The advantages and disadvantages of each measure are listed in Tables 6-2, 6-4, and 6-6. A general description of the key measures is provided below.

6.2.1 Maintenance

Maintenance of a sewer system is necessary to maintain capacity and to prevent possible blockages and pump station backups. Maintenance includes televising and cleaning of the sewers. Televising can locate possible joint defects, root intrusion, pipe sags, and cracks along the sewer. Cleaning such as hydrojetting can remove grease and other blockages within the sewer. A scheduled televising and cleaning program is typically established to maintain the system. A more frequent program can be implemented for problematic areas such as, flat lines and lines that serve restaurants.

Pump stations require inspection typically for water tightness, pump and control testing, and inspection and cleaning of the wet well.

6.2.2 Easements

Easements must be maintained to allow access to the sewers for purposes of maintenance, rehabilitation, replacement, and emergency repairs.

Easements for the sewer system are necessary to allow access for purposes of inspection, rehabilitation, replacement, and maintenance. Moreover, the width of the easement should be wide enough to allow for excavation of gravity sewers and force mains when replacement or rehabilitation is necessary. Easements in private property need to be confirmed. Access agreements with other public agencies (e.g., U.S. Forest Service) need to be developed and maintained to provide for routine and emergency maintenance activities.

Easements need to be monitored for encroachment by development and enforced to maintain accessibility.

Whenever feasible, the sewer system should not be constructed in the shorezone, stream environment zones, or any other environmentally sensitive areas. Locating the sewer system in streets or other public properties should be utilized where possible.

Table 6-1. Sanitary Sewer Gravity Lines and Manholes Potential Risk Reduction Measures

Risk/Condition	Measures
Reported Spills/Releases within the Last 10 Years	
1. Less than one	Maintenance - implement cleaning and inspection program to reduce spills/releases
2. Greater than one	Maintenance - implement cleaning and inspection program to reduce spills/releases
Age	
1. Is between 11 and 50 years old	Maintenance - monitor through regular cleaning and inspection, trenchless or conventional replacement or rehabilitation when necessary
2. Is greater than 50 years old	Maintenance - monitor through regular cleaning and inspection, trenchless or conventional replacement or rehabilitation when necessary
Access	
1. Easements Conditions are being violated	Confirm and enforce easement conditions
2. Easements required	Obtain easement and maintain its integrity, or relocate facilities
Capacity	
1. Inadequate capacity during peak periods	Increase capacity, reduce I/I if appropriate
2. Surcharged lines	Increase capacity, reduce I/I if appropriate
Structural	
1. Inadequate cover subject to damage	Conventional deeper replacement, relocate and/or convert to low-pressure pumping system (grinder pumps)
2. Deterioration that can be repaired	Rehabilitate
3. Deterioration that requires replacement	Trenchless or conventional replacement
Inverted Siphons	
1. No redundant barrel	Add redundant barrel and appurtenant facilities
Operation and Maintenance	
Cleaning	
1. Cleaned every 3 years to 5 years	Establish and implement regular cleaning and inspection program (once every 1 to 3 years)
2. Cleaned only when problem occurs	Establish and implement regular cleaning and inspection program (once every 1 to 3 years)
3. Line requires frequent cleaning	Identify condition requiring frequent cleaning and establish corrective plan
Televising	
1. Televised every 3 to 5 years	Establish and implement regular inspection program (every 1 to 3 years)
2. Televised every 5+ years or not televised	Establish and implement regular inspection program (every 1 to 3 years)

Table 6-2. Comparison of Risk Reduction Measures for Gravity Sewer Lines and Manholes

Measures	Advantages	Disadvantages
Maintenance ■ Cleaning ■ Inspection ■ Root Removal ■ Internal Grouting	• Reduces risk of spills/releases into sensitive areas • Low grouting costs	• Additional O&M costs • Grouting may add on 10 to 15 years of service life
Confirm and Enforce Easements **Obtain Easements**	• Access to facilities at all times	• Public concerns • Costs
Relocate Facility	• Access to facilities at all times • Provide opportunity to relocate out of sensitive area	• Costs • Implementation restrictions due to local regulatory requirements
Conventional Replacement ■ Open Cut – traditional design, open excavation	• Eliminates current problems along line • Can remove facility from environmentally sensitive areas	• • Expensive if deep cut • Disruptive to public
■ Tunneling	• Eliminates current problems along line • Reduces disruptions	• More expensive than open cut • Expensive ancillary works
Trenchless Replacement ■ Pipe Bursting - the existing pipeline is fragmented and forced into the surrounding soil by pulling a bursting head through the line.	• Can replace a variety of materials • Not dependent on structural condition of existing pipe	• Possible damage to nearby services • Suitable for brittle pipes • New line follows grade of existing line • Asbestos cement pipe may be considered a waste site if left in place
■ Microtunneling - is generally defined as remotely controlled pipejacking (personnel-entry is not required). Microtunneling is an extremely accurate, laser-guided method for installing pipelines in varied soil conditions from flowing soft ground to hard rock. Slurry pressure balanced microtunneling systems enable installations below the water table or in very wet soil without the need for dewatering.	• Works with most soils • Works through high groundwater • Can work around existing utilities	• Service connections can be problematic • New alignment required • Costs

Table 6-2. Comparison of Risk Reduction Measures for Gravity Sewer Lines and Manholes, (continued)

Measures	Advantages	Disadvantages
Low-Pressure Pumping System ■ Grinder Pumps – a tank collects all solid materials and effluent from the dwelling. The solids are ground to a small size suitable for pumping as a slurry with the effluent water. The grinder pump generates sufficient pressure to pump this slurry from the dwelling to the receiving line.	• Replaces line in environmentally sensitive areas • Dwellings can be lower than frontage street sewer • Small lines	• Requires re-plumbing at each dwelling • May require homeowner to maintain pumping equipment • Spill prevention/detection may be difficult due to the number of facilities • Additional electrical costs
Rehabilitation • **Sliplining** ■ Continuous Pipe ■ Short Pipe	• Quick installation • Large radius bends can be accommodated	• Grouting may be required • Circular cross section only • Loss of cross sectional area • Requires joints
• **Lining** ■ Cured in Place Pipe (CIPP) ■ Fold and Formed Lining ■ Inversion Lining	• Quick installation • No excavation required • Capacity of existing pipe maximized	• Bypass necessary during installation • High costs for small projects
Manholes ■ Cured in Place Relining ■ Grouting ■ Sealing ■ Coating ■ Replace defective cover ■ Replacement	• Renews structural integrity • Reduces inflow/infiltration • Can improve structural condition • Prevents inflow • New manhole	• Reduces diameter of manhole • Possible toxic fumes • Cannot rehabilitate severely deteriorated manholes • Cost • Excavation required

Table 6-3. Sanitary Sewer Pump Station, Potential Risk Reduction Measures

Risk/Condition	Measures
Reported Spills/Releases within the Last 10 Years	
1. Less than one	Maintenance - implement cleaning and inspection program to reduce spills/releases
2. Greater than one	Maintenance - implement cleaning and inspection program to reduce spills/releases
Age	
1. Is between 11 and 50 years old	Maintenance - monitor through regular cleaning and inspection
2. Is greater than 50 years old	Maintenance - monitor through regular cleaning and inspection, trenchless or conventional replacement
Access	
1. Easements conditions are being violated	Confirm and enforce easement conditions
2. Located within nearshore, foreshore or environmentally sensitive areas	Confirm and enforce easement conditions, or relocate facilities or convert to low-pressure pumping system (grinder pumps)
3. Easements required	Obtain easement and maintain its integrity, or relocate facilities
Pumping Capacity	
1. Inadequate capacity during peak flow	Increase capacity, reduce I/I if appropriate
Wet-Well Capacity	
1. Has a volume that requires more than 5 pump starts per hour during average dry weather flow (ADWF)	Increase capacity of wet-well, or relocate facilities if wet-well size cannot be increased at present location
Structural	
1. Deterioration that can be repaired	Repair deteriorated components
2. Deterioration that requires replacement	Replace pump station or convert to low-pressure pumping system (grinder pumps)
Redundancy	
1. Does not have motor sensor, alarm, and telemetry	Make provisions for motor sensor, alarm, and telemetry
2. Does not have at least one redundant pump	Make provisions for one redundant pump
3. Does not have back-up power or emergency sewage storage	Make provisions for on-site back-up power, change operating levels to allow emergency storage
4. Does not have portable generator as back-up power	Make provisions for on-site back-up power
Operation and Maintenance	
Bypass	
1. Pump station can be bypassed with some effort	Establish a bypass plan
2. Pump stations cannot be bypassed	Establish provisions to bypass

Table 6-4. Comparison of Risk Reduction Measures for Pump Stations

Measures	Advantages	Disadvantages
• **Maintenance** • Cleaning • Inspection • Root Removal • Internal Grouting	• Reduces risk of spills/releases into sensitive areas • Protective of structures (including wet wells) from root damage	• Additional O&M costs
• **Confirm and Enforce Easements** • **Obtain Easements**	• Access to facility at all times	• Public concerns • Cost
• **Relocate Facility**	• Allows access to facilities at all times • Provide opportunity to relocate out of sensitive area	• Cost • Disruptions to public • Implementability limitations due to planning regulations • Environmental impacts may exceed benefits
• **Pump and Motor Unit Replacement**	• Meets peak flow capacity	• Pump station may not support larger pump • Cost
• **Pump and Motor Addition**	• Meets peak flow capacity • Provides redundancy in system	• Pump station may not support additional pumps
• **Wet Well Enlargement**	• Provides optimal start/stop cycle of pumps	• Construction may not be possible at existing site
• **Independent Electrical Source Installation**	• Provides constant power to pump station	• Cost
• **Motor Sensor, Alarm, and Telemetry**	• Provides immediate failure notification	• Cost
• **Permanent Engine Generator**	• Provides permanent backup power	• Additional O&M costs
• **Portable Engine Generator**	• Provides backup power	• Generator must be transported to site during a power outage • Generator may be in other use and not available for pump stations service
• **Extra Fitting on Force Main to Allow Portable Pump to Bypass Station**	• Allows pump station to be shut down for inspection and cleaning	• Cost

Table 6-5. Sanitary Sewer Force Main, Potential Risk Reduction Measures

Risk/Condition	Measures
Reported Spills/Releases within the last 10 years	
1. Less than one	Maintenance – implement cleaning and inspection program to reduce spills/releases
2. Greater than one	Maintenance – implement cleaning and inspection program to reduce spills/releases
Age	
1. Is between 11 and 50 years old	Maintenance - monitor through regular cleaning and inspection
2. Is greater than 50 years old	Maintenance - monitor through regular cleaning and inspection, trenchless or conventional replacement
Access	
1. Easements inadequate (size or encroached upon)	Reestablish easement and maintain its integrity
2. Located within environmentally sensitive areas	Reestablish easement and maintain its integrity, or relocate facilities
3. Easements do not exist	Obtain easement and maintain its integrity, or relocate facilities
Capacity	
1. Inadequate capacity during peak periods	Increase capacity, reduce I/I if appropriate
Structural	
1. Inadequate cover subject to damage	Protect in-place, conventional replacement, relocate, and/or convert to low-pressure pumping system (grinder pumps)
2. Deterioration that can be repaired	Rehabilitation
3. Deterioration that requires replacement	Trenchless or conventional replacement
Inverted Siphons	
1. No redundant barrel	Add second barrel and appurtenant facilities
Operation and Maintenance	
Bypass	
1. Line can be bypassed with some effort	Establish a bypass plan
2. Line cannot be bypassed	Establish provisions to bypass
Cleaning	
1. Cleaned every 3 years to 5 years	Establish and implement regular cleaning and inspection program (once every 3 years)
2. Cleaned only when problem occurs	Establish and implement regular cleaning and inspection program (once every 3 years)
3. Line requires frequent cleaning	Identify condition requiring frequent cleaning and establish corrective plan
4. Pig launching facility not provided	Add pig launching facilities
Televising	
3. Televised every 3 to 5 years	Establish and implement regular inspection program (once every 1 to 3 years)
4. Televised every 5+ years or not televised	Establish and implement regular inspection program (once every 1 to 3 years)

Table 6-6. Comparison of Risk Reduction Measures for Force Mains

Measures	Advantages	Disadvantages
• **Maintenance** ■ Cleaning ■ Inspection ■ Root Removal ■ Internal Grouting	• Reduces risk of spills/releases into sensitive areas	• Additional O&M costs
• **Confirm and Enforce Easements** • **Obtain Easements**	• Provides access to facilities at all times	• Public concerns • Cost • Willingness of property owners
• **Relocate Facility**	• Access to facilities at all times • Provide opportunity to relocate out of sensitive area	• Cost • Disruption to public
• **Conventional Replacement** ■ Open Cut – traditional design, open excavation ■ Tunneling	• Eliminates current problems along line • Can remove facility from environmentally sensitive areas	• Expensive if deep cut • Disruptive to public
• **Trenchless Replacement** ■ Pipe Bursting - the existing pipeline is fragmented and forced into the surrounding soil by pulling a bursting head through the line. ■ Microtunneling - is generally defined as remotely controlled pipejacking (personnel-entry is not required). Microtunneling is an extremely accurate, laser-guided method for installing pipelines in varied soil conditions from flowing soft ground to hard rock. Slurry pressure balanced microtunneling systems enable installations below the water table or in very wet soil without the need for dewatering. ■ Directional Drilling – technique involves drilling a small diameter hole followed by back-reaming of the final pipe	• Eliminates current problems along line • Reduces disruptions • Can replace a variety of materials • Not dependent on condition of existing pipe • Slurry can be water • Can tunnel through cobbles • High groundwater heads • Quick installation • Can be used under water	• More expensive than open cut • Expensive ancillary works • Possible damage to nearby services • Suitable for brittle pipes • Cost • Service disruption • Difficult to use in sandy/granular materials
• **Rehabilitation and Maintenance** ■ Inspection/cleaning access ports ■ Parallel piping ■ Turnouts for bypassing with portable pumps and piping ■ Redundant barrel and appurtenant structures for siphons	• Addresses need for redundancy • Allows for inspection and cleaning	• Costs for installation of additional features to facilitate inspection, cleaning, and provide facility redundancy • Working within stream environment zones

6.2.3 Capacity

Most gravity sewers are designed to flow ½ to ¾ full during peak capacity. Surcharged sewers could potentially cause backups into basements and cause a spill through manholes. Pump stations and force mains should be able to handle the peak hourly flow.

6.2.4 Pipe Replacement

Pipe replacement is often the most cost-effective measure of rehabilitation where using an alternative rehabilitation technique would require extensive point repairs. Pipe replacement is also utilized to increase pipe size when additional capacity is needed to prevent overflows and releases. Pipe replacement may be accomplished using standard open-cut methods or by using a trenchless technology such as pipe bursting, microtunneling, or boring and jacking.

6.2.4.1 Open-Cut Replacement

Open-cut replacement of a sewer uses the same standard techniques that are used to construct a new sewer. The replacement pipe may be installed in the same location as the existing pipe while utilizing by-pass pumping or an alternate alignment may be used. Open-cut methods have the advantage of being widely used and well understood by a large number of contractors. This acceptance generally results in a more reliable final product and greater bidding competition than may be found with other rehabilitation methods that often require specialty contractors. The major disadvantage to open-cut replacement is that it may disrupt traffic, restrict access to homes and businesses, and may not be practicable within the shorezone of Lake Tahoe where there are extensive construction constraints. Open-cut replacement may not be feasible along some portions of the sewer system due to numerous aboveground construction constraints along the route (i.e., homeowner piers and restaurant patios). Open cut methods can alos be used for installing parallel pipelines.

6.2.4.2 Pipe Bursting

Pipe bursting employs a pneumatic, hydraulic, or mechanical wedge that is expanded in the existing pipe, fracturing it, and pushing the pieces of the existing pipe into the surrounding soil. The new pipe is jacked into place directly behind the wedge. The new pipe is either high-density polyethylene (HDPE) with welded joints or short-jointed and thick-walled pipe with in-wall joints (joints with no bells). Installation of the new pipe is facilitated from an existing manhole access. With pipe bursting, the hydraulic wedge is guided by the existing pipe. Therefore, the new pipe will follow the grade of the existing pipe. Existing sewers that are free of sags or other hydraulic problems are most appropriate for this technique. Pipe of the same or slightly larger diameter than the existing pipe may be installed. Prior to pipe bursting, service laterals must be open-excavated and disconnected in order to avoid destroying them with the hydraulic wedge. Depending on the type of pipe bursting technology used, there is the potential to harm adjacent utilities. Therefore, care must be exercised in the selection of the type of equipment to be used where there are other utilities near the sewer.

6.2.4.3 Microtunneling and Boring and Jacking

Microtunneling and boring and jacking techniques usually incorporate a remote-controlled tunneling or boring machine with a cutting edge that creates a tunnel into which the new pipe is jacked. Because the tunneling or boring equipment is remote-controlled, the grade may be changed from that of the existing pipe. Any lateral connections must be made by open-cut excavation. Microtunneling and boring and jacking techniques are often used during installation of pipelines under roads or waterways and when aboveground construction constraints make an open-cut installation undesirable or impractical. Microtunneling is most often used for pipe replacement when the new pipe to be installed is significantly larger than the old pipe or the old pipe has collapsed or is on the verge of collapse. In either case, other forms of trenchless replacement such as pipe bursting would be impractical.

6.2.4.4 Horizontal Directional Drilling

A relatively new technique for replacing existing lines uses horizontal directional drilling (HDD) equipment. A pilot drill string is snaked through the existing line to the starting manhole or pit. A reaming tool is attached to the end of the drill string, followed by a swivel. The new pipe is attached behind the swivel. The entire string is then pulled back through the existing line. The reaming tool breaks out the old pipe and creates a hole for the new pipeline. This technique has been used with bentonite slurry to carry away debris and to lubricate the new pipe string as well as to ensure that any voids are filled. As with pipe bursting and microtunneling methods, any service laterals must be re-connected using open-cut pits. The use of large entry pits for the new pipe can be avoided by using key-holing methods whereby the pilot drilling operation begins outside the starting manhole and is directed along a pre-designed path into the starting manhole.

6.2.5 Lining

The broad definition of lining includes all rehabilitation techniques where a smaller diameter pipe is inserted, installed, or constructed inside of the existing sewer. A wide variety of techniques fall within this category and are generally distinguished by the type of liner used. The variations described below include slip lining, cured-in-place pipe, and fold-and-formed lining. These techniques offer the advantage of requiring little or no excavation for installation and are, therefore, most suitable for pipes where aboveground obstructions exist or where very deep excavation would be required to replace the pipe. Lining also allows minimal disruption to traffic where sewer lines are located within public roads. Minimal impacts to the shorezone would be expected using these techniques. Sewers must be cleaned and obstructions such as roots or protruding service connections must be removed prior to insertion of the liner. If all obstructions cannot be removed with conventional cleaning and cutting equipment, then excavation is necessary at those specific locations.

With all lining techniques, the connection of the liner pipe to the manhole is critical. The connection must be sealed with a flexible, watertight joint that allows expansion and contraction of the liner pipe without cracking or spalling. If the manhole connection is not properly made, migration of I/I from defects in the existing pipe to the manhole joint may result.

6.2.5.1 Slip Lining

Slip lining involves inserting a pipe of a slightly smaller diameter into the existing pipe, usually from an excavated insertion pit. The liner pipe must be flexible and is commonly made of HDPE, fiberglass, or polyvinyl chloride (PVC). Liner pipe joints are heat fused or gasketed, with heat-fused joints having the advantage of allowing the liner pipe to be closer in diameter to the existing pipe. The liner pipe is inserted by excavating an insertion pit at the center of the length of existing pipe. From this pit, the liner pipe may be inserted in both directions. The liner pipe is typically pulled through the sewer pipe with the assistance of a winch assembly that is installed in the next adjacent manhole. Because pulling the pipe often causes it to elongate, the pipe must be allowed to contract to its original length before service connections and seals to manholes are made. Alternatively, the liner can be installed by pushing the liner pipe into the old pipe using a sling or jacking assembly to avoid damage to the liner pipe.

The void left between the existing pipe and the new pipe may be filled with grout if desired. The decision on whether to grout the void depends on the structural integrity of the existing pipe and on the difference in size between the existing pipe and the liner. In general, grouting of the annular space is recommended in order to ensure the long-term strength of the newly lined pipe and to reduce potential I/I migration along the slip-lined pipe. An annular space could collapse in the future, thereby damaging the liner. The annular space should be at least 2 inches (50 mm) in order for grouting to be effective.

Once the slip lining is in place, service connections must be made to the liner pipe. This must be performed by excavating each service connection, breaking through the outside pipe, and making a connection to the slip liner pipe by use of sidewall heat fusion or a tapping saddle.

6.2.5.2 Cured-In-Place (Inversion) Piping

Cured-in-place (inversion) piping or lining consists of a felt or fabric sock that is impregnated with a resin that becomes rigid once it is thermally activated or cured. The impregnated liner is inserted into the existing pipe by attaching the liner inside out at one end of the pipe to be lined and then feeding the liner through the pipe by inverting it to its original shape. The liner is typically inverted into the existing pipe using water pressure. Once the liner is inserted, it is cured with the use of hot water or air causing the liner to become rigid. The resulting liner is seamless and jointless. Service connections are made by using a remote cutting device in conjunction with a television camera to remove the liner from the connection. If the existing service connection is defective, the connection must be excavated and properly repaired. Cured-in-place lining is a relatively quick method of rehabilitation and generally requires only 24 to 48 hours of bypass pumping of wastewater flows. Cured-in-place linings can be designed to handle structural loads, if necessary, where the existing pipe has structural defects or where additional loads are expected in the future.

6.2.5.3 Fold-and-Formed Lining

Fold-and-formed lining is similar to slip lining except that the liner pipe is deformed in some manner to aid insertion into the existing pipe. Depending on the specific manufacturer, the liner pipe may be made of PVC or HDPE. One method of deforming the liner is to fold it into a “U” shape before insertion into the existing pipe. The pipe is then returned to its original circular shape using heated air or water or by using a rounded shaping device or mandrel. Ideally, there will be no void between the existing pipe and the liner pipe after expansion of the liner pipe with the shaping device. For the U-shaped liner, the resulting pipe liner is seamless and jointless.

6.2.6 Grouting

Grouting involves injection of a chemical grout into the voids of a defective pipe joint to seal the joint and prevent inflow and infiltration (I/I) and exfiltration. For small-diameter pipes, the grout may be installed with a remote controlled device called a packer that operates in conjunction with a closed circuit television (CCTV). The packer is a cylindrical device with inflatable rubber sleeves on each end that will isolate the joint to be grouted from the remainder of the pipe. The joint is usually pressure tested prior to grouting and, if the air test fails, the joint is sealed. The grout usually consists of two components that are mixed within the packer at the point of application and may consist of a variety of gels depending on the manufacturer.

Grouting can repair circular cracks in pipe, but longitudinal cracks prevent the packer from sealing and cannot be repaired by this method. Pipe joints that are adjacent to service laterals cannot be grouted using standard techniques because the service lateral prevents sealing of the joint. However, innovative grouting techniques are available that seal and grout service laterals by using an arm that extends into the lateral and seals the lateral for grouting.

The long-term reliability of grouting is highly dependent on the condition of the existing pipe. The expected design life of a grouting project is on the order of 10 to 15 years as compared to 50 plus years for pipe replacement or lining. Unlike pipe bursting techniques that allow pipe capacity to be increased through installation of a new, larger diameter pipe, pipe rehabilitation through grouting techniques should only be used where the existing sewer is of sufficient capacity to meet projected sewage flow demands.

6.2.7 Inverted Siphons

Where inverted siphons exist, effective operation and maintenance (O&M) is vital to prevent spills and releases. O&M activities should include annual inspections and cleaning, if necessary. Where inverted siphons occur in the project study area, improvement measures include installation of additional barrels (minimum pipe size of 8 inches) with necessary appurtenances for flow control, convenient flushing, and maintenance. Control structures should be arranged so that normal flow can be diverted to one barrel, and so that either barrel may be removed from service for repair.

Unless system-specific requirement warrants it use, inverted siphons should be avoided, particularly in stream zones and other environmentally sensitive areas.

6.2.8 Manhole Rehabilitation Measures

The same approaches used in pipeline rehabilitation (replacement, grouting, and lining) are used to rehabilitate manholes. Access to manholes for repairs is much easier than sewer pipelines or service laterals, therefore a grouting program for manholes may be a more cost-effective method of eliminating I/I, repairing structural defects, and repairing maintenance problems in manholes than in pipelines. A manhole-grouting program is most effective when coupled with periodic checks to determine existing conditions.

Cementitious liners have been shown to be a cost-effective means of improving minor structural problems when sufficient liner thickness is applied. This is especially true in the upper reaches of the collection system where the sewage is still relatively fresh (i.e., not septic) and the sewer atmosphere is less corrosive. In downstream reaches where the sewage is more likely to be septic and oxygen levels in the sewer atmosphere have been depleted, other more corrosion-resistant techniques should be considered. Cured-in-place (CIP) manhole rehabilitation techniques can be used in these more corrosive environments and to correct major structural problems.

6.2.9 Pump Station Measures

Where access to the pump station is limited, or where the force main that discharges from the pump station is subject to high likelihood of damage from external forces, pump station relocation may be warranted. Usually, relocation would be more costly and more disruptive to the public than implementation of other alternatives such as easement confirmation. In certain situations, relocation of the pumping station would afford opportunity to move the facility out of an environmentally sensitive area. However, implementation of a facility relocation may be restricted by local regulatory agencies, adding to the ultimate cost and compromising cost-effectiveness of this alternative measure.

6.2.9.1 Pump and Motor Replacement

To meet capacity requirements, pump and motor replacement may be necessary. If piping, space, and electrical systems permit, pump and motor replacement is easily implementable.

Where pump station aging results in increasingly costly O&M and compromise of mechanical integrity, replacement of pumping equipment and controls will likely be required.

6.2.9.2 Wet Well Enlargement

Consistent with current capacity requirements, enlargement of wet well volume may be warranted where fixed speed pumping is utilized or it is desirable to provide emergency response time. However, high costs of structural modifications may render the alternative measure undesirable. In, general wet well sizes were not problematic for the sewer districts. Access to the wet wells was identified as a problem, due to the location near Lake Tahoe; some wet wells have access only from the water side.

6.2.9.3 Independent Electrical Source Installation

Electrical power outages are common throughout the Lake Tahoe region. Power reliability is crucial to assure pump station operational integrity and to prevent spills and overflows. For large systems and high capacity requirements, dual services can be considered to provide effective power redundancy. In the Lake Tahoe region, however, independent electrical sources are usually unavailable. Alternatively, standby generators are typically used for backup power services.

6.2.9.4 Motor Sensors and Alarms with Telemetry

The means to enable timely and effective response to impending operational problems or emergency conditions must be provided for all pump stations, regardless of size and location. Regional operating permits typically require such systems. Implementation of monitoring and alarms sensors and telemetry is cost-effective for short- and long-term operating conditions.

6.2.9.5 Permanent and Portable Engine Generators

Where feasible, permanent on-site backup power systems need to be provided at all pump stations. Alternatively, portable standby generator provisions can be implemented for pump stations that serve a small area and where safe access is assured, or for short-term operating conditions. Portable equipment should be dedicated to specific pump system backup so that its availability in time of need can be assured. For the purposes of this study, it was recommended that all pump stations have on site generators or dedicated portable generators.

6.2.9.6 Bypass Connection for Portable Pump

To facilitate timely inspection, troubleshooting, or unscheduled maintenance of the pump station, piping and valving provisions should be installed to permit connection and operation of portable pumping equipment or other operating plans in place.

6.2.10 Force Main Measures

Force main measures include provisions to facilitate inspection and cleaning include pigging systems, installation of inspection/cleaning access ports at appropriate intervals along the force main alignment, as well as redundant/supplemental pipelines. For large-diameter force mains, pigging facilities may be cost-effective. To improve access for inspection and cleaning, smaller-diameter force mains can be fitted with access ports at intervals appropriate for prevailing cleaning and TV inspection methods.

Although costly, redundant/parallel force main installations can be considered where force main integrity is suspect (due to age, for example) and where the pipeline is currently located in environmentally sensitive and access-restricted areas. Alternatively, turnouts for isolation and bypass (using auxiliary piping and pumping equipment) can be provided at less disruption and cost that will allow for repair and replacement of damaged or deteriorated pipeline by sections. As has been employed by NTPUD, bypass valve stations should be provided at 3,000-foot intervals for emergency repairs as well as for periodic inspection and repairs. These facilities have proved to be a cost-effective alternative to permanent parallel pipeline installations.

6.2.11 Alternative Measures

As an alternative to traditional gravity sewers, pump stations, and force mains, grinder pumps may be considered. This system is a low pressure system that would be installed at each dwelling. This system would consist of a holding tank that collects solids and effluent. The solids are ground to a small size and are pumped as a slurry to a receiving sewer typically located within a public right of way. Typically, the property owner usually maintains this system to the point of connection at the receiving sewer.

6.3 Cost Estimates

First costs were estimated for each of the potential action plans developed for each district. First costs reflect the cost of construction at year 2002 prices and do not include interest during construction. The first costs were based on estimated unit costs for the reduction measures as described in this section.

6.3.1 First Cost

The first costs for the wastewater collection system presented in this chapter are reconnaissance level estimates that have been prepared using unit costs developed for similar projects. Unit costs were established from construction costs prepared by Camp Dresser and McKee, California Department of Transportation (Caltrans), R.S. Means Company, Inc., and the U.S. Army Corps of Engineers.

Percentage-based cost factors that have been included in the First Costs are described below:

- The cost for utility relocations has been estimated to be 10 percent of construction costs.
- Mobilization and demobilization has been estimated to be 5 percent of the construction costs.
- Fish and wildlife mitigation and cultural resources have been estimated at 35 percent and 5 percent, respectively, of the estimated construction costs.
- Planning, engineering, and design costs have been estimated at 20 percent of the construction costs excluding real estate. Construction management has been calculated at 10 percent of the construction costs. These percentages are based upon costs experienced by the Sacramento District Corps of Engineers.
- A contingency of 35 percent has been applied to the first cost items under the following categories: new construction, including rehabilitation, pumping equipment replacements, back up power additions, etc.

6.3.2 Gravity Sewer and Manhole Unit Costs

The unit prices for gravity sewer and manhole structural measures, varying with pipe diameter, are presented in Table 6-7 and Table 6-8. The unit prices are an average of unit prices for different pipe materials. For the different methods of pipe replacement, open-cut replacement, pipe bursting, microtunneling and boring and jacking, and horizontal directional drilling, the unit prices range from $80 to $400 per linear foot for up to 36 inches in diameter. Sliplining ranges from $47 to $195 per linear foot for up to 36 inches in diameter. The unit prices for lining is an average of the common techniques of lining and range from $36 to $300 per linear foot for up to 36 inches in diameter. For manholes, a diameter of 5 feet and depth of 10 feet were assumed for manholes. Unit costs for manholes were $10,500 and $650 per manhole for replacement and grouting, respectively. The unit prices do not include costs for easements, rock excavation, dewatering, conflicts with existing facilities, and special foundations. The unit prices are from various sources, as described above, and were adjusted to the 2002 price level using Engineer New Record (ENR) price indexes.

Table 6-7. Costs for Gravity Sewers

Measure	Unit	Cost per Diameter (Inches)									
		6	8	10	12	15	18	21	24	30	36
Operations and Maintenance											
Hydro-flushing	LF	2.50	2.50	3.00	3.00	3.75	4.75	4.75	6.00	6.00	6.00
Root Cutting	LF	1.40	1.75	2.10	2.40	3.15	3.40	3.70	4.00	4.80	5.50
Televising	LF	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
Open-Cut Replacement											
Pipeline	LF	155	171	178	198	201	223	259	308	329	394
Pipe Bursting											
Pipeline	LF	80	95	110	130	150	175	220	250	280	300
Mobilization	LS	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Micro-tunneling and Boring and Jacking											
Pipeline	LF	265	268	271	272	280	295	320	350	380	400
Mobilization	LS	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Horizontal Directional Drilling											
Pipeline	LF	265	268	271	272	280	295	320	350	380	400
Mobilization	LS	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Grouting	LF	5	7	8.50	10.50	13	15.50	18	20.50	25.50	30.00
Slip Lining	LF	47	51	54	59	66	85	110	130	150	195
CIPP Lining	LF	36	48	66	84	114	138	162	180	228	300

Table 6-8. Manhole Rehabilitation Costs

Manholes	Cost ($)
Replacement – 5 ‘ Diameter	10,500
Seal rim	520
Raise/replace cover	900
Coating	1,200
Grouting	650
Liner Inserts	4,000
Cover Replacement	900
Abandonment	5,000
Lateral Reconnection	1,000

6.3.3 Pump Station Costs

The costs for pump station structural measures, varying with pump station design capacity, are presented in Table 6-9. Costs for generators are presented in Table 6-10. The costs for constructing a new pump station are based on information gathered by the EPA on recently constructed pump stations (EPA, 1999). The EPA estimates that the cost to refurbish a pump station with new mechanical, electrical, and control equipment is between 15 and 30 percent of the cost of constructing a new pump station of the same capacity. For the purposes of this study, the unit price to replace this pumping equipment was assumed to be 25 percent of the cost of a new pump station. The costs for a new pump station range from $40,000 to $420,000 for a range of design flow rates from 0 to 2,000 gallons per minute. The costs for pumping equipment replacement a pump station ranges from $10,000 to $105,000. The costs for generators or back up power ranges from $19,800 for 30 kilowatts to $102,000 for 500 kilowatts.

Table 6-9. Comparison of Risk Reduction Measures for Gravity Sewer Lines and Manholes

Design Capacity (Gallons per Minute)	Construct New Pump Station ($)	Pumping Equipment Replacement ($)
0-50	40,000	10,000
50-100	60,000	15,000
100-300	120,000	30,000
300-500	180,000	45,000
500-800	260,000	65,000
800-1200	320,000	80,000
1200-1600	380,000	95,000
1600-2000	420,000	105,000

Table 6-10. Cost for Generator Assemblies

Generator Assemblies (Diesel, Battery Charger, Auto Transfer Switch)	Cost ($)
30 KW	19,800
100 KW	35,300
200 KW	47,700
300 KW	59,500
500 KW	102,000

6.3.4 Force Main Unit Costs

The unit prices for force mains, varying with pipe diameter, are presented in Table 6-11 and Table 6-12. The unit prices are an average of unit prices for different pipe materials. Costs are similar to those for gravity sewers. For the different methods of pipe replacement, open-cut replacement, pipe bursting, microtunneling and boring and jacking, and horizontal directional drilling, the unit prices range from $105 to $310 per linear foot for up to 36 inches in diameter.

Sliplining ranges from $47 to $66 per linear foot for up to 36 inches in diameter. Table 6-12 lists costs for inspection and cleaning ports for a force main. Unit prices do not include costs for easements, rock excavation, dewatering, conflicts with existing facilities, and special foundations. The unit prices are from various sources, as described above, and were adjusted to the 2002 price level using Engineer New Record (ENR) price indexes.

Table 6-11. Costs for Force Main Structural Measures

Measure	Unit	Cost per Diameter (Inches)									
		6	8	10	12	15	18	21	24	30	36
Operations and Maintenance											
Pigging	LF	2.50	2.50	3.00	3.00	3.75	4.75	4.75	6.00	6.00	6.00
Root Cutting	LF	1.40	1.75	2.10	2.40	3.15	3.40	3.70	4.00	4.80	5.50
Televising	LF	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
Open-Cut Replacement											
Pipeline	LF	155	171	178	198	201	223	259	308	329	394
Pipe Bursting											
Pipeline	LF	80	95	110	130	150	175	220	250	280	300
Mobilization	LS	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Micro-tunneling and Boring and Jacking											
Pipeline	LF	265	268	271	272	280	295	320	350	380	400
Mobilization	LS	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Horizontal Directional Drilling											
Pipeline	LF	265	268	271	272	280	295	320	350	380	400
Mobilization	LS	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Slip Lining	LF	47	51	54	59	66	85	110	130	150	195

Table 6-12. Force Main Inspection/Cleaning Access Ports

Force Main Inspection/Cleaning Access Ports	Costs ($)
Vault on reinforced concrete slab	10,300
Pipe Wye	1,250
Drain Valve	500
Excavation, Backfill, Repaving	3,900
Total	**15,950**

6.3.5 Miscellaneous Unit Costs

An alternative to the conventional installation of gravity sewers and pump stations is the use of a low pressure head system such as a grinder pump system. With this system, a grinder pump is installed at each dwelling. Unit costs are provided in Table 6-13.

Table 6-13. Grinder Pump Costs

System	Unit	Cost ($)
Grinder Pump	Each	6,000
Discharge Force Main (1-1/2")	LF	8
Collector Force Main (4")	LF	25
Connection to Existing System	Each	2,500
Electrical Connection	Each	2,000
Parcel Restoration	Each	2,000

7.0 INCLINE VILLAGE GENERAL IMPROVEMENT DISTRICT

7.1 Organization

The Crystal Bay Development founded the Incline Village General Improvement District (IVGID) in 1962. A portion of Incline Village was built in the early 1960's requiring water and sewer service. Initially, all homes were on septic tanks. The sewer system south of State Route 28 (near the lake) was built in 1963. The system north of State Route 28 was built in 1972. Commercial businesses were placed on a sewer conveyance system, which lead to all homes being placed on this conveyance system. IVGID's current boundary is from Crystal Bay (Stateline) to just east of Incline Village. Refer to Figure 1-1 for the location of IVGID.

7.2 Master Plans and Other Pertinent Documentation

The current sewer master plan for the IVGID was written in 1969. IVGID also maintains a sewer ordinance.

7.3 Overview of Sewer System

IVGID conveys sewage from its district to a treatment facility located within the district. Several pump stations are located near the shores of Lake Tahoe to pump sewage to the treatment plant. Refer to Table 7-1 for the IVGID sewer system information.

Sewer System Information:

Table 7-1. IVGID Sewer System Information

Service Area	9 Square miles
1. Length of Gravity Mains	132 miles
Length of Force Mains	(Included above)
Size of mains	6 – 18 inches in diameter
Main Pump Facilities	18
Satellite Pump Facilities	NA
Manholes	NA
Sewer System Mapping	Yes – Hard copy, some digital
Service Connections	4,500 metered
Average Daily Flow	1.3-1.5 million gallons
Peak Daily Flow	2.23 million gallons
Design Daily Flow (Treatment Facility)	2.5 million gallons 0.5 million gallons (ponds)

7.4 Treatment Facilities

IVGID treats the sewage within the district and exports the effluent over Spooner Summit to the Wetlands Facility in the Carson Valley, Nevada where it is used for wildlife habitat and evapotranspiration or it is sold to farmers for irrigation.

7.5 Maintenance Program

IVGID schedules television inspection every 5 years for sewer line inspection. Sewer lines are flushed with a high-pressure wash and then televised. The grease and grit typically found within the lines have not been a major problem. IVGID typically replaces any sewer line that may be troublesome. Older clay and asbestos cement pipe (ACP) sewer lines are replaced with polyvinyl chloride (PVC) pipe. Two vactor trucks and calcium hypochlorite are maintained by IVGID for the possibility of sewage clean up. Manholes are monitored for cracks and roots. Chemicals are added for root control when required.

7.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration has been monitored and repaired over the past several years through IVGID's maintenance program. IVGID personnel have indicated that the typical inflow problems occur from either damaged or opened manhole covers.

7.5.2 Observed Overflow/Spills

There have been no reported overflows or spills within the district since 1986. It is estimated that an average of one spill per year will occur according to IVGID personnel.

7.5.3 Regulatory Enforcement Actions

Currently, there are no enforcement actions against IVGID.

7.5.4 Existing/Anticipated Capacity Limitations

The sewer collection systems within Incline Village are adequately sized. The treatment plant has experienced some capacity problems in the past. In 1986, flows reached 5 million gallons per day. In 1997, flows reached the capacity of the plant at 3 million gallons per day.

7.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. Figure 7-1 identifies the location of the facility. Table 7-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 7-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures and unit costs are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.

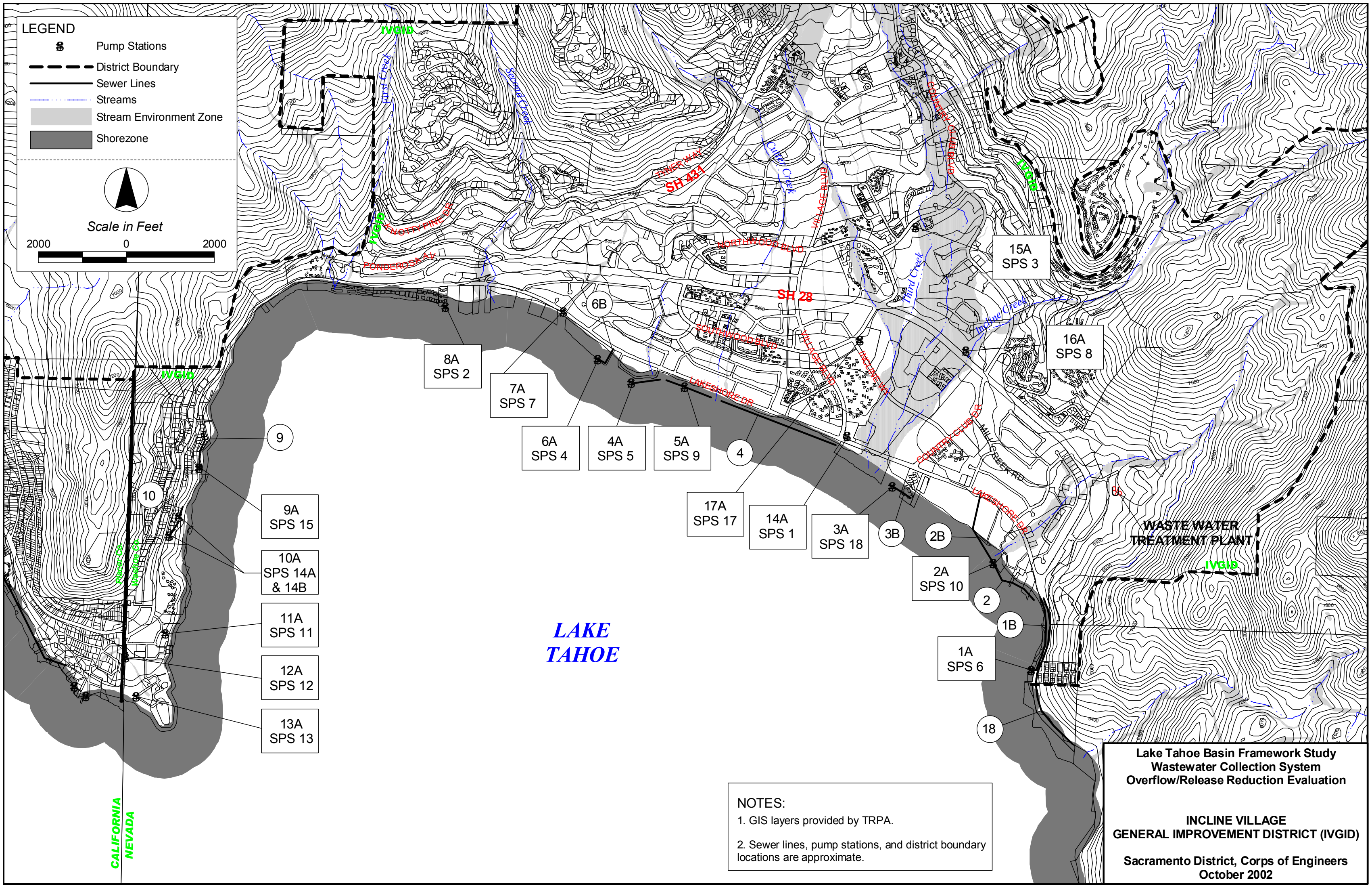

LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
IVGID
SH 431
SH 28
15A SPS 3
16A SPS 8
6B
8A SPS 2
7A SPS 7
6A SPS 4
4A SPS 5
5A SPS 9
4
9
10
9A SPS 15
10A SPS 14A & 14B
11A SPS 11
12A SPS 12
13A SPS 13
17A SPS 17
14A SPS 1
3A SPS 18
3B
2B
2A SPS 10
2
1B
1A SPS 6
18
WASTE WATER TREATMENT PLANT
LAKE TAHOE
CALIFORNIA
NEVADA
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
INCLINE VILLAGE
GENERAL IMPROVEMENT DISTRICT (IVGID)
Sacramento District, Corps of Engineers
October 2002

Figure 7-1

Table 7-2. Summary of Potential Problems for Critical Sewer Facilities for IVGID

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1A	SPS 6 Pump Station	2 Pumps– 80 GPM each Dry Pit Station	C	Age Redundancy	Medium Medium	Constructed in 1971 Portable generator for backup power	6
1B	Force Main	4” FM Class 150, 1,625 LF	C	Age Access	Medium Low	Constructed in 1971 In Highway 28	6
2	Gravity Lines	6” SS, 400 LF 6” SS, 1,000 LF 6” VCP, 670LF	C C C	Age Access Structural	Medium Medium High, Medium	Constructed in 1974 Located in Foreshore Replace 400’; Reline 1000’ SE of Pump Station	3
2A	SPS 10 Pump Station	2 – 460 GPM Pumps Dry Pit Station NG Generator	B	Age	Medium	Constructed in 1974	5
2B	Force Main	8” FM, 1,700 LF	B	Age	Medium		5
3A	SPS 18 Pump Station	2 Pumps – 25 GPM Submersible	C	Age Redundancy	Medium High	Age Unknown No backup generator either on-site or portable	3
3B	Force Main	No data	C	Age	Medium	Age unknown	6
4A	SPS 5 Pump Station	2 Pumps– 75 GPM Dry Pit Station	B	Age Redundancy	Low Medium	Constructed in 1999 Portable generator for standby power	5
4	Gravity Line	6” VCP, 1,600 LF	B	Age Access	Medium Medium	Constructed in 1968 Located in Foreshore, 20’ wide easement Approximately 20% of the Dwelling Units are pumped to SS in street.	5
5	Gravity Line	6” SS, 665 LF	C	Age Access	Medium Medium	Constructed in 1970 Located in Foreshore, 10’ wide easement	6
5A	SPS 9 Pump Station	2 Pumps- 50 GPM Total Dry Pit/Air Ejection	C	Age Redundancy	Medium High	Constructed in 1970 Portable generator	3
5B	Force Main	4” FM, 126 LF	C	Age Access	Medium Medium	Constructed in 1970 15’ wide easement	6
6A	SPS 4 Pump Station	2 Pumps, Capacity Unknown Dry Pit Station	C	Age	Medium	Constructed Prior to 1970	6
6B	Force Main	6” FM, 405 LF, 4” FM, 70 LF	C	Age	Medium	Constructed in 1970	6
8A	SPS 2 Pump Station	2 Pumps – 300 GPM each Dry Pit Station	A	Age	Medium	Constructed in 1962	4
9	Gravity sewer	6” - 200 LF	C	Age	Medium	Constructed in 1970s	6
9A	SPS 15 Pump Station	2 Pumps – 150 GPM Wet/Dry Pit Station	C	Age	Medium		6

Table 7-2. Summary of Potential Problems for Critical Sewer Facilities for IVGID, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
10	Gravity sewer	6" 400 LF	C	Age	Medium	Constructed in 1970s	6
10A	SPS 14A & 14B	2 pumps– 55 GPM each Submersible Grinder Uses generator at SPS 15 for backup power	C	Age	Medium		6
11A	SPS 11 Pump Station	2 pumps – 80 GPM Wet/Dry Pit Station	C	Age Redundancy	Medium High	No backup generator	3
12A	SPS 12 Pump Station	2 pumps – 900 GPM. Wet/Dry Pit Station	A	Age	Medium		4
13A	SPS 13 Pump Station	2 pumps – 200 GPM Wet/Dry Pit Station	A	Age	Medium		4
14A	SPS 1 Pump Station	3 pumps – 1100 GPM Wet/Dry Pit Station	A	Age	Medium		4
15A	SPS 3 Pump Station	2 pumps – 150 GPM, Wet/Dry Pit Station	B	Age Redundancy	Medium Medium	2 pumps at 85% capacity	4
16A	SPS 8 Pump Station	2 pumps – 1000 GPM, Wet/Dry Pit Station	A	Age	Medium	Constructed in 1970s	4
17A	SPS 17 Pump Station	2 pumps – 20 GPM, Submersible	C	Age Redundancy	Medium High	No backup power generator	3
18	Main Export Line from District to Spooner Summit	16" FM Cement-lined Asphalt Wrapped - Approx. 8 miles	A	Age	Medium	Constructed in 1970s	4

Table 7-3. Summary of Alternative Measures for IVGID

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
1A	Medium	SPS 6 pump station is 28 years	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	49,500	6
1B	Medium	Force Main - 4" FM Class 150, 1,625 LF Age	1. Monitor condition through regular cleaning and inspection 2. Procedures for bypassing force main 3. Replacement of force main 4. Provision of parallel line 5. Provision of force main inspection/cleaning access ports	• Perform maintenance and monitoring • Replace when necessary	752,800	6
2	High	35 yr old clay line in shore zone Lines need to be relined and/or replaced per District monitoring	1. Rehabilitation 2. Conventional or trenchless replacement	• Replace 660 LF; • Line 1,400 LF (e.g., CIPP)	467,800	5
2A	Medium	SPS 10 pump station is 28 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	148,600	3
2B	Medium	Force Main – 8" 1,700 LF	1. Monitor condition through regular cleaning and inspection 2. Procedures for bypassing force main 3. Replacement of force main 4. Provision of parallel line 5. Provision of force main inspection/cleaning access ports	• Perform maintenance and monitoring • Replace when necessary	806,700	6
3A	High	SPS 18 pump station Age Unknown No backup generator	1. On-site generator set 2. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 3. Replacement of equipment and related controls when necessary	• Install on-site generator • Perform regular O&M • Replace pumping equipment and controls when necessary	59,500	3

Table 7-3. Summary of Alternative Measures for IVGID, (continued)

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
3B	Medium	Force Main - No data	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace when necessary	151,900	6
4	Medium	Gravity Line, 6” VCP - 1,600 LF Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/CIPP 1,600 LF of gravity sewer when maintenance becomes excessive	382,600	5
4A	Medium	SPS 5 pump station Aging Portable generator	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	49,500	5
5	Medium	Gravity Line 6” - 665 LF Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/CIPP 650LF of gravity sewer when maintenance becomes excessive	195,900	6
5A	High	SPS 9 pump station is 32 years old Easement is only 10’ wide	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	49,500	3
5B	Medium	4” FM, 126 LF Line is middle age Easement is only 15’ wide	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace when necessary	120,600	6

Table 7-3. Summary of Alternative Measures for IVGID, (continued)

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
6A	Medium	SPS 4 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	6
6B	Medium	6” FM, 405 LF, 4” FM, 70 LF Age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace when necessary	271,900	6
7A	Medium	SPS 7 pump station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	214,800	4
8A	Medium	SPS 2 pump station Constructed in 1962; Dirt Road no vehicle access; Diesel Generator	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	6
9	Medium	6” gravity sewer 200 LF Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace when necessary	141,300	6
9A	Medium	SPS 15 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	6
10	Medium	6” gravity sewer 400 LF Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace when necessary	233,700	6

Table 7-3. Summary of Alternative Measures for IVGID, (continued)

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
10A	Medium	SPS 14A and 14B pump station s Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	6
11A	High	SPS 11 pump station Aging No back up generator	1. On-site generator set 2. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 3. Replacement of equipment and related controls when necessary	• Install on-site generator • Perform regular O&M • Replace pumping equipment and controls when necessary	89,200	3
12A	Medium	SPS 12 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	264,400	4
13A	Medium	SPS 13 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	4
14A	Medium	SPS 1 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	N/A	4
15A	Medium	SPS 3 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	99,100	4
16A	Medium	SPS 8 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	264,400	4

Table 7-3. Summary of Alternative Measures for IVGID, (continued)

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
17A	High	SPS 17 pump station Age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls when necessary	59,500	3
18	Medium	16" Export Force Main	1. Monitor condition through regular cleaning and inspection 2. Procedures for bypassing force main 3. Replacement of force main 4. Provision of parallel line 5. Provision of force main inspection/cleaning access ports	• Perform regular force main internal inspections • Install force main inspection access ports – 3,000' intervals	801,000	4

8.0 TAHOE DOUGLAS DISTRICT

8.1 Organization

The Tahoe Douglas District (TDD) was formed in 1969 to provide water and sanitary sewer for the community. In the early 1990's, the water system was given to Douglas County to maintain. The TDD boundary ranges from Glenbrook, Nevada, to Zephyr Cove, Nevada, where the Round Hill General Improvement District begins. Refer to Figure 1-1 for the location of TDD.

8.2 Master Plans and Other Pertinent Documentation

Currently, TDD does not have a sewer master plan but they do maintain materials and performance specification requirements for property owners.

8.3 Overview of Sewer System

TDD conveys sewage from its district to the Douglas County Sewer Improvement District treatment facility located south of TDD. Several pump stations are located near the shores of Lake Tahoe to pump sewage to the main gravity export line. Refer to Table 8-1 for TDD sewer system information.

Sewer System Information:

Table 8-1. TDD Sewer System Information

Service Area	5.6 Square miles
Length of Gravity Mains	24 miles
Length of Force Mains	7.4 miles
Size of mains	6 – 18 inches in diameter
Main Pump Facilities	19
Satellite Pump Facilities	NA
Manholes	463
Sewer System Mapping	Yes – Hard copy. Working on digital mapping.
Service Connections	1,500
Average Daily Flow	Not provided
Peak Daily Flow	Not provided
Design Daily Flow	Not provided

8.4 Treatment Facilities

TDD exports sewage to the treatment facility maintained and operated by the Douglas County Sewer Improvement District.

8.5 Maintenance Program

TDD contracts with a private company for the majority of its maintenance program. This company is available 24 hours a day and the usual response time is less than one-half hour. TDD relies on contractors for cleaning equipment.

Sections of gravity sewers are generally cleaned yearly. Hydroflushing is typically the cleaning method along with root removal. Manholes are also inspected during this cleaning process. Wet wells are pumped down and also hydroflushed.

Sewers are typically televised only when a problem has been identified.

8.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration has not been an issue according to the district. Peak flows tend to appear during the holiday periods (Christmas, July 4th) but do not appear during the wet seasons. The district informs homeowners when there is a suspected problem with the service lateral. Homeowners are responsible for maintaining the lateral.

8.5.2 Observed Overflow/Spills

Spill records were obtained from interviews with TDD. These spills have been reported to TRPA and Nevada Department of Environmental Protection (NDEP). Four reported spills have occurred within the last 10 years. The volumes of spills were approximately 50 gallons each. From the data received, no site spilled more than once.

8.5.3 Regulatory Enforcement Actions

No regulatory actions are currently in place for TDD.

8.5.4 Existing/Anticipated Capacity Limitations

Currently, the TDD has not identified capacity problems within the study area

8.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of the TDD is shown on Figure 8-1. Figure 8-2 and 8-3 identifies the location of the problem facility. Table 8-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 8-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.

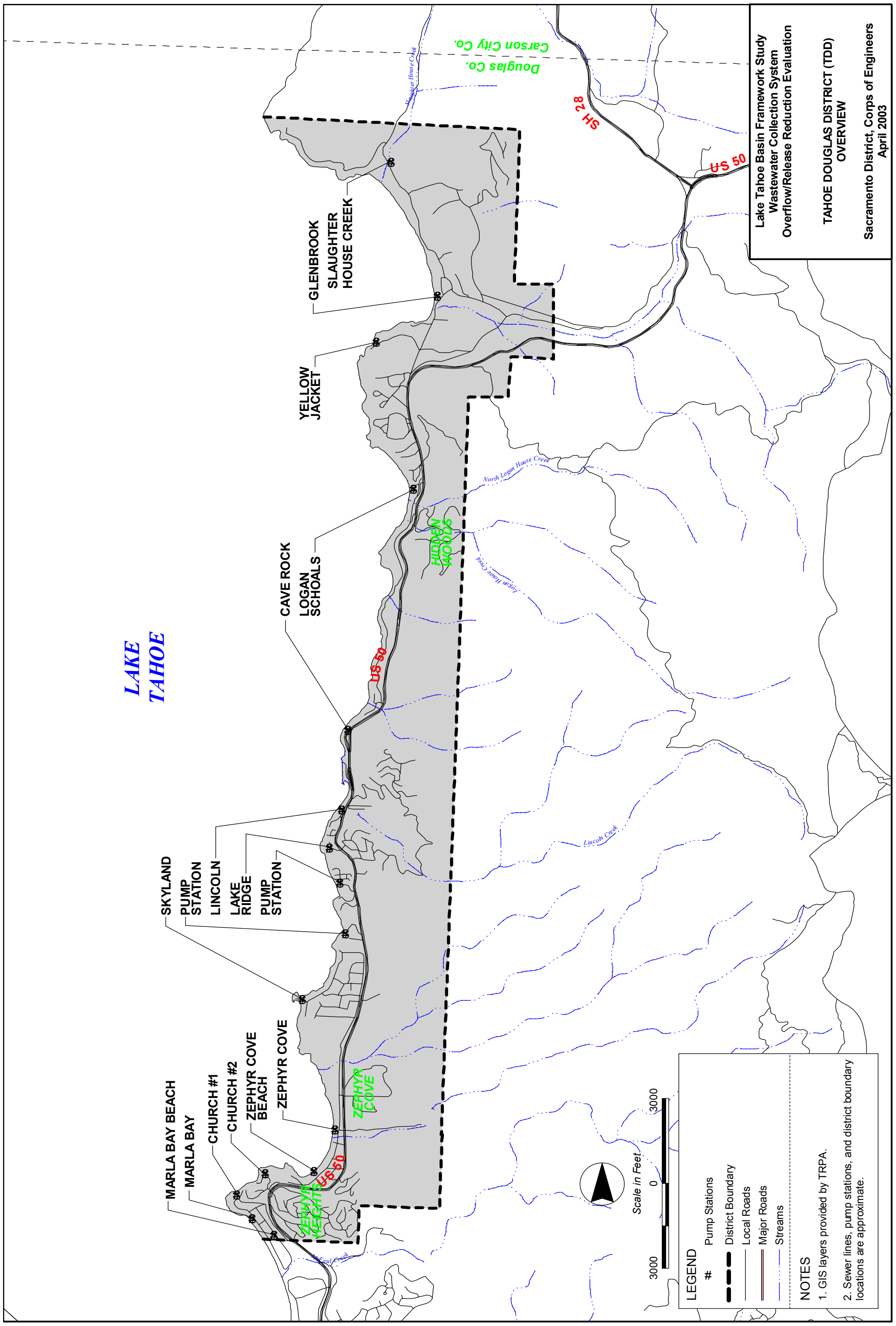

LAKE TAHOE
Carson City Co.
Douglas Co.
SH 28
US 50
GLENBROOK
SLAUGHTER HOUSE CREEK
YELLOW JACKET
CAVE ROCK
LOGAN SCHOALS
HIDDEN WOODS
SKYLAND
PUMP STATION
LINCOLN
LAKE RIDGE
PUMP STATION
MARLA BAY BEACH
MARLA BAY
CHURCH #1
CHURCH #2
ZEPHYR COVE BEACH
ZEPHYR COVE
ZEPHYR HEIGHTS
Scale in Feet
3000
0
3000
LEGEND
Pump Stations
District Boundary
Local Roads
Major Roads
Streams
NOTES
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE DOUGLAS DISTRICT (TDD)
OVERVIEW
Sacramento District, Corps of Engineers
April 2003

Figure 8-1

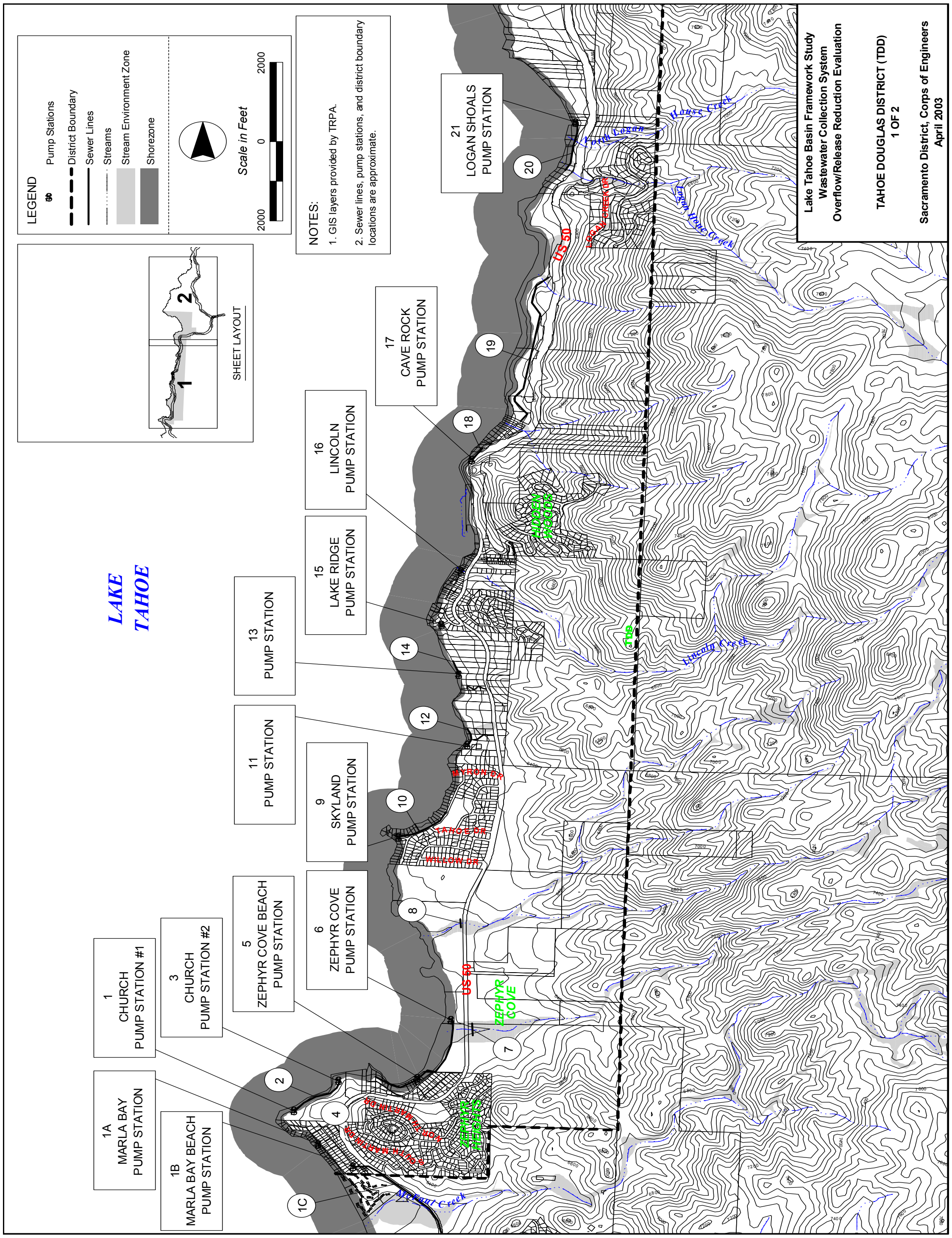

LAKE TAHOE
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000 0 2000
SHEET LAYOUT
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
1A MARLA BAY PUMP STATION
1B MARLA BAY BEACH PUMP STATION
1 CHURCH PUMP STATION #1
3 CHURCH PUMP STATION #2
5 ZEPHYR COVE BEACH PUMP STATION
6 ZEPHYR COVE PUMP STATION
9 SKYLAND PUMP STATION
11 PUMP STATION
13 PUMP STATION
15 LAKE RIDGE PUMP STATION
16 LINCOLN PUMP STATION
17 CAVE ROCK PUMP STATION
21 LOGAN SHOALS PUMP STATION
US 50
ZEPHYR COVE
Lincoln Creek
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE DOUGLAS DISTRICT (TDD)
1 OF 2
Sacramento District, Corps of Engineers
April 2003

Figure 8-2

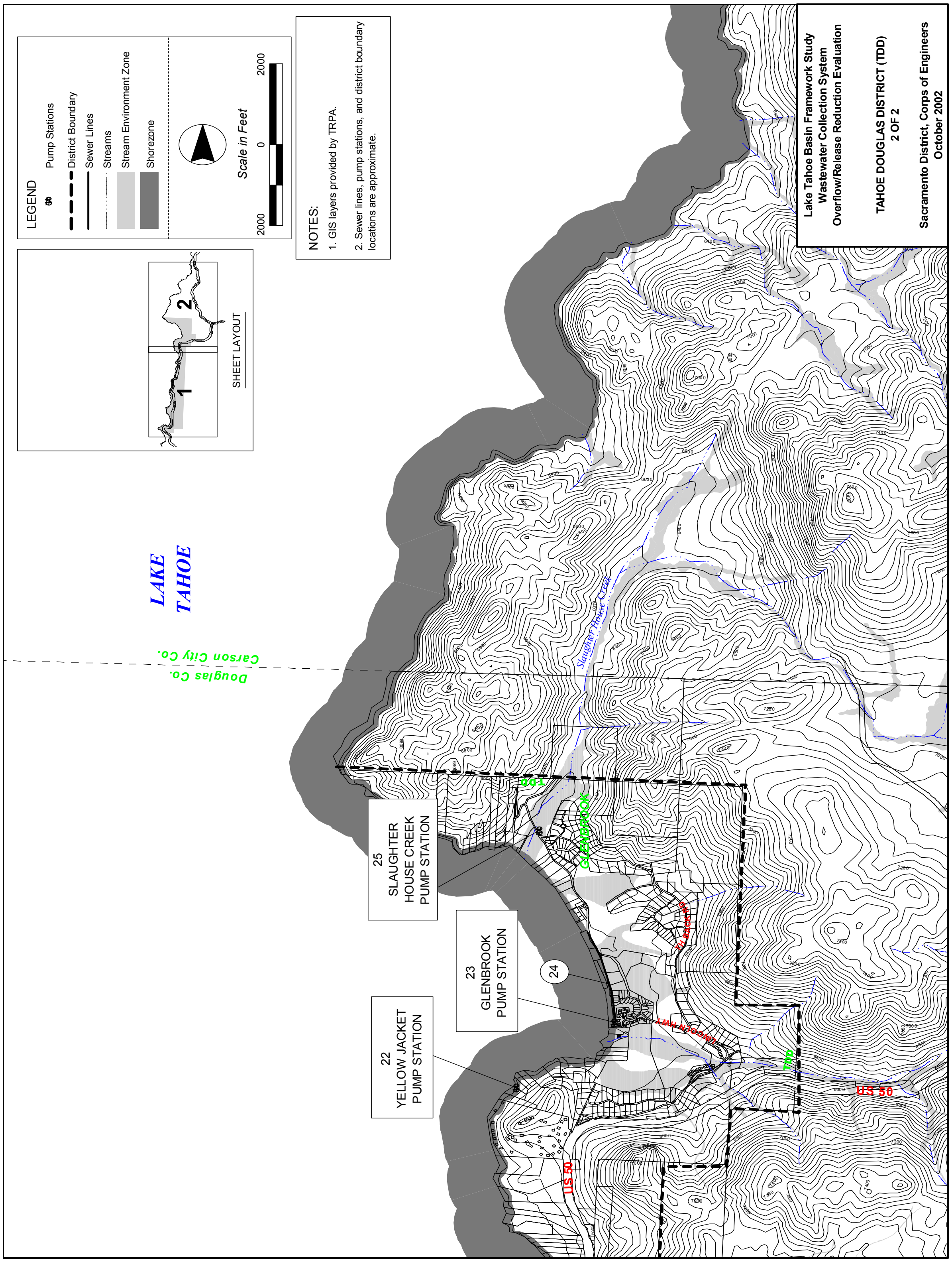

LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
SHEET LAYOUT
1
2
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE DOUGLAS DISTRICT (TDD)
2 OF 2
Sacramento District, Corps of Engineers
October 2002
LAKE TAHOE
Carson City Co.
Douglas Co.
Slaughter House Creek
25
SLAUGHTER HOUSE CREEK PUMP STATION
23
GLENBROOK PUMP STATION
24
22
YELLOW JACKET PUMP STATION
GLENBROOK
TDD
US 50

Figure 8-3

Table 8-2. Summary of Potential Problems for Critical Sewer Facilities in TDD

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1A	Marla Bay Pump Station	2 pumps – 1,730 GPM peak capacity	A	Age O&M	Medium Medium	1. Constructed early 1970s 2. Vactor trucks used for PS bypassing	4
1B	Marla Bay Beach Pump Station	2 pumps	C	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	6
1C	Marla Bay PS Force Main For conveyance of total wastewater from the District	15” ACP - 2600 LF	A	Age O&M	Medium High	1. Constructed in early 1970s 2. Line can not be bypassed; no provisions that facilitate inspection and cleaning	1
1	Church Pump Station #1	2 pumps	C	Age O&M	Medium Medium	3. Constructed in 1971 4. Vactor trucks used for PS bypassing	6
2	Gravity sewers to Church PS	X” - 1100 LF	C	Age	Medium	1. Constructed early 1970s	6
3	Church Pump Station #2	2 pumps	C	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	6
4	Gravity sewer	X” - 2700 LF	B	Age	Medium	1. Constructed early 1970s	5
5	Zephyr Cove Beach Pump Station	2 pumps	C	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	6
6	Zephyr Cove Pump Station	2 pumps – 1,700 GPM peak capacity	A	Age O&M	Medium Medium	1. Constructed in 1971 2. Has 500 gallon overflow tank; vactor trucks used for PS bypassing	4
7	Gravity sewer; Creek crossing	X” - 500 LF	C	Age	Medium	1. Constructed early 1970s	6
8	Gravity sewer; Creek crossing	X” - 400 LF	A	Age	Medium	1. Constructed in early 1970s	4
9	Skyland Pump Station	2 pumps – 1,750 GPM peak capacity	A	Age O&M	Medium Medium	1. Constructed in 1971 2. Has 2000 gallon overflow tank; vactor trucks used for PS bypassing	4
10	Gravity sewer	8" – 4,000 LF	A	Age	Medium	1. Constructed in early 1970s	4
11	Pump Station	2 pumps	C	Age	Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	4
12	Gravity sewer	X” - 500 LF	C	Age	Medium	1. Constructed in early 1970s	6
13	Pump Station	2 pumps	C	Age	Medium	1. Constructed in 1971	4

Table 8-2. Summary of Potential Problems for Critical Sewer Facilities in TDD (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
14	Gravity sewer	8" - 500 LF	A	Age O&M	Medium Medium	1. Constructed in early 1970s	6
15	Lake Ridge Pump Station	2 pumps	C	Age	Medium	1. Constructed in 1971	6
16	Lincoln Pump Station	2 pumps – 750 GPM peak capacity	A	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	4
17	Cave Rock Pump Station	2 pumps – 750 GPM peak capacity	A	Age	Medium	1. Constructed in 1971	4
18	Gravity sewer	8” – 500 LF	C	Age	Medium	1. Constructed in early 1970s	6
19	Force main	12" AC - 250 LF	A	Age	Medium	2. Constructed in early 1970s	4
20	Force main	12" AC – 1,400 LF	A	Age O&M	Medium High	1. Constructed in early 1970s 2. Line can not be bypassed	4
21	Logan Shoals Pump Station	2 pumps – 750 GPM peak capacity	A	Age	Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	6
22	Yellow Jacket Pump Station	2 pumps	C	Age O&M	Medium Medium	1. Constructed early 1970s 2. Vactor trucks used for PS bypassing	6
23	Glenbrook Pump Station	2 pumps – 750 GPM peak capacity	B	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	4
24	Gravity sewers	10" x – 2,200 LF	B	Age	Medium	1. Constructed early 1970s	4
25	Slaughter House Creek Pump Station	2 pumps	C	Age O&M	Medium Medium	1. Constructed in 1971 2. Vactor trucks used for PS bypassing	6

Table 8-3. Summary of Alternative Measures for TDD

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
1A	Medium	Marla Bay Pump Station Pump station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	291,400	4
1B	Medium	Marla Bay Beach Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
1C	High	Marla Bay PS 15" ACP Force Main Force main is about 30 years old	1. Monitoring condition through regular cleaning and inspections 2. Installation of inspection/cleaning ports 3. Conventional or trenchless replacement	• Performance of cleaning and inspection on annually • Install 15" inspection/cleaning ports every 400 feet	133,100	1
1	Medium	Church Pump Station #1 Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
2	Medium	Gravity sewers to Church PS Sewers are middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 1100 LF X" gravity sewers	155,700	6
3	Medium	Church Pump Station #2 Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
4	Medium	Gravity sewers Sewers are middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 2700 LF X" gravity sewers	382,100	5

Table 8-3. Summary of Alternative Measures for TDD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
5	Medium	Zephyr Cove Beach Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
6	Medium	Zephyr Cove Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	291,400	4
7	Medium	Gravity sewer; Creek crossing	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/slip line 500 LF X" sewer	259,000	6
8	Medium	Gravity sewer; Creek crossing	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/slip line 400 LF X" gravity sewer	220,600	4
9	Medium	Skyland Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	291,400	4
10	Medium	Gravity sewers	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 4000 LF X" gravity sewers	566,100	4
11	Medium	Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	4

Table 8-3. Summary of Alternative Measures for TDD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
12	Medium	Gravity sewer	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 700 LF X" sewers	99,100	6
13	Medium	Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
14	Medium	Gravity sewers	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 300 LF X" sewers	42,600	6
15	Medium	Lake Ridge Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
16	Medium	Lincoln Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	180,300	4
17	Medium	Cave Rock Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	180,300	4
18	Medium	Gravity sewer	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 500 LF X" sewer	70,600	4

Table 8-3. Summary of Alternative Measures for TDD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
19	Medium	Force main Creek crossing	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Replace 250 LF 12" AC force main	202,700	4
20	High	Force main, 1400 LF 12" AC	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Install inspection/cleaning ports at 400 foot intervals on 12" AC force main	335,600	1
21	Medium	Logan Shoals Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	180,300	4
22	Medium	Yellow Jacket Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related control	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6
23	Medium	Glenbrook Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	180,300	5
24	Medium	Gravity sewers	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform O&M– annual cleaning and TV inspection • Rehabilitate/CIPP 2200 LF X" sewers	329,600	5
25	Medium	Slaughter House Creek Pump Station Pump Station is 30 years old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	83,200	6

9.0 ROUND HILL GENERAL IMPROVEMENT DISTRICT

9.1 Organization

The Round Hill General Improvement District (RHGID) provides water and sanitary sewer for the community. The RHGID boundary ranges from just south of Zephyr Cove, Nevada, to approximately Elks Point, where the Douglas County Sewer Improvement District begins. Refer to Figure 1-1 for the location of RHGID.

9.2 Master Plans and Other Pertinent Documentation

Currently, RHGID does not have a sewer master plan but they do maintain a sewer ordinance.

9.3 Overview of Sewer System

RHGID conveys sewage from its district to the Douglas County Sewer Improvement District treatment facility. RHGID maintains 1 pump station in its district. Refer to Table 9-1 for the RHGID sewer system information.

Sewer System Information:

Table 9-1. RHGID Sewer System Information

Service Area	1.1 Square miles
Length of Gravity Mains	7 miles
Length of Force Mains	2 miles
1. Size of mains	6 – 18 inches in diameter
Main Pump Facilities	1
Satellite Pump Facilities	NA
Manholes	NA
Sewer System Mapping	Yes – Hard copy
Service Connections	1,300
Average Daily Flow	0.25 million gallons
Peak Daily Flow	0.54 million gallons
Design Daily Flow	? million gallons

9.4 Treatment Facilities

RHGID exports sewage to the treatment facility maintained and operated by the Douglas County Sewer Improvement District.

9.5 Maintenance Program

RHGID contracts with a private company for the majority of its maintenance program. This company is available 24 hours a day and the usual response time is less than one-half hour.

RHGID owns a vactor truck and keeps calcium hypochlorite on site for emergency sewage clean ups.

A maintenance schedule has been implemented by RHGID. Gravity sewers will generally be cleaned yearly. Hydroflushing is typically the cleaning method along with root removal. Manholes are also inspected during this cleaning process. The wet well on the pump station is pumped down and hydroflushed every couple of years.

Sewers are typically televised only when a problem has been identified.

9.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration has not been an issue according to the district. Peak flows tend to appear during the summer months. Groundwater has been noted as being high during the spring but has not been a significant issue.

9.5.2 Observed Overflow/Spills

Spill records were obtained from interviews with RHGID. These spills have been reported to TRPA and Nevada Department of Environmental Protection (NDEP). District personnel have reported zero spills over the last 3 years.

9.5.3 Regulatory Enforcement Actions

No regulatory actions are currently in place for RHGID.

9.5.4 Existing/Anticipated Capacity Limitations

Currently, the RHGID has not identified capacity problems within the study area.

9.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, a pump station, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of the RHGID is shown on Figure 9-1. Table 9-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 9-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.

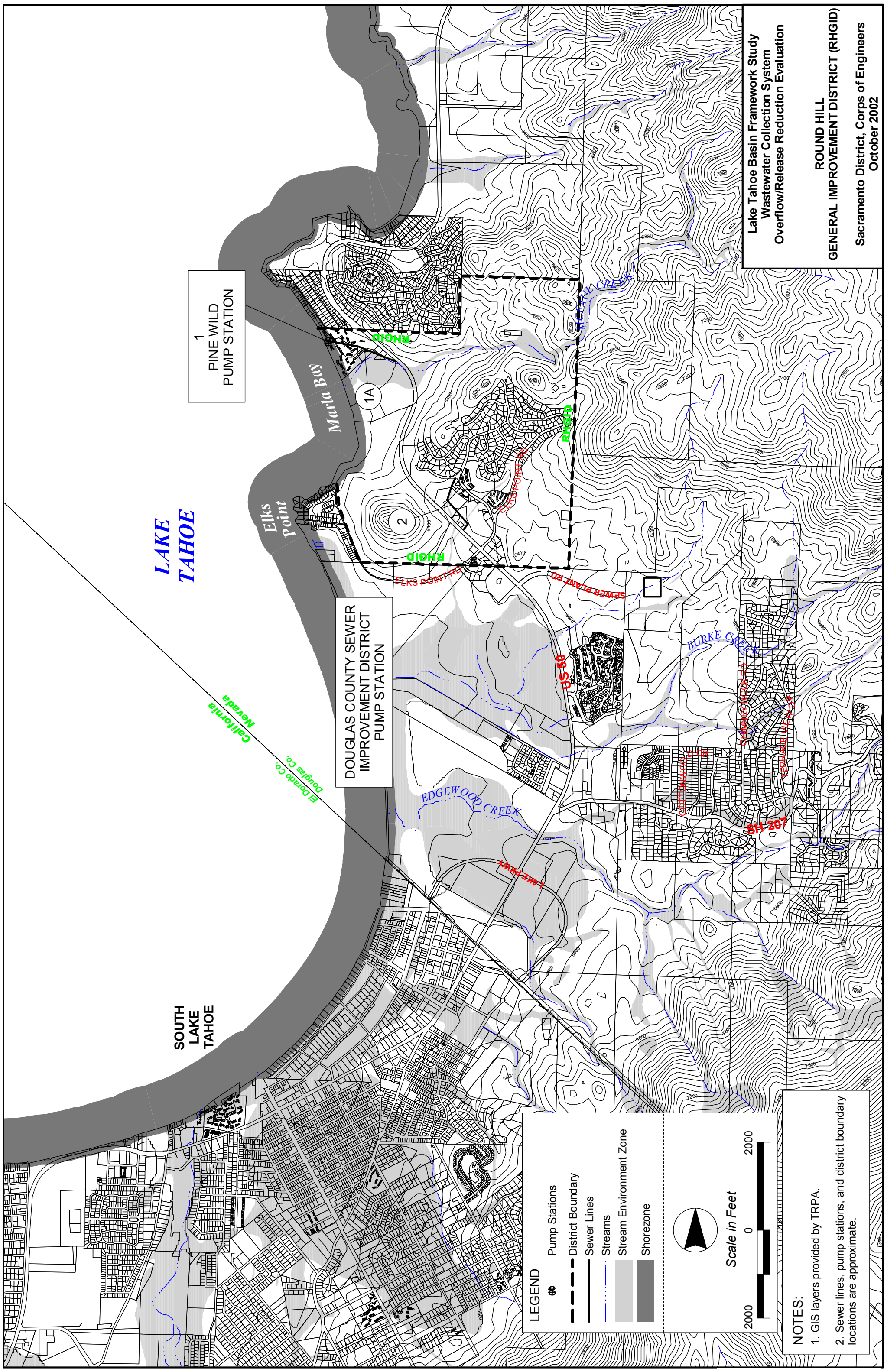

Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
ROUND HILL
GENERAL IMPROVEMENT DISTRICT (RHGID)
Sacramento District, Corps of Engineers
October 2002
1
PINE WILD
PUMP STATION
1A
2
DOUGLAS COUNTY SEWER
IMPROVEMENT DISTRICT
PUMP STATION
LAKE
TAHOE
SOUTH
LAKE
TAHOE
Marla Bay
Elks
Point
RHGID
California
Nevada
El Dorado Co.
Douglas Co.
EDGEWOOD CREEK
BURKE CREEK
US 50
SH 207
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 9-1

Table 9-2. Summary of Potential Problems for Critical Sewer Facilities in RHGID

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1	Pump Station	Pine Wild Pump Station 2 – 40 HP pumps PS is old and maintenance is excessive	A	Age	High	Facility is old and maintenance is excessive – pumping equipment and generator set may need replacement	1
1A	Force Main	6” Force Main, 2,000 LF	A	Age	Medium	Line is middle age and within stream zone	4
2	Gravity Line	18” Clay Line, 1,400 LF	A	Age Access	Medium High	Line may conflict with planned infiltration basin and monitoring wells; replacement is planned by the District in 2003+; Manholes covers are low lying and should be raised	1

Table 9-3. Summary of Alternative Measures for RHGID

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
1A	Medium	Force main – 6" 1,000 LF	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Perform line monitoring and maintenance • Provide access ports for inspection/cleaning (3)	995,100	4
1	High	Pump Station Facility requires excessive maintenance and needs to be replaced	1. O&M for regular inspection, equipment maintenance and equipment checks 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and generator set and controls in near future	132,200	1
2	High	18" Clay Line along infiltration basin, 1400 LF.	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement 3. Stabilization of creek bank	• Perform monitoring and maintenance – annual cleaning and TV inspection • Replace & relocate 1,400 LF along Elks Point Road – Scheduled for replacement in 2003+	1,166,300	1

10.0 DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1

10.1 Organization

The Douglas County Sewer Improvement District No. 1 (DCSID) was founded in the early 1950's. DCSID is located on the southeastern side of Lake Tahoe north of South Lake Tahoe. The service area for DCSID is approximately 1.7 square miles. DCSID provides sewer treatment for the following five districts: Tahoe-Douglas District, Round Hill General Improvement District, Elk Point Sanitation District, Kingsbury General Improvement District, and DCSID. Refer to Figure 1-1 for the location of DCSID.

10.2 Master Plans and Other Pertinent Documentation

DCSID has developed a District Development Plan for upgrading and improving its sewer facilities including the treatment plant. DCSID has also digitally mapped its sewer facilities. There is no sewer master plan for DCSID. DCSID follows Douglas County's Standard Specifications for construction activities.

10.3 Overview of Sewer System

DCSID maintains and operates approximately 36 miles of sewer lines and 5 pump stations. Table 10-1 lists the sewer system information.

Sewer System Information:

Table 10-1. DCSID Sewer System Information

Service Area	1.7 Square miles
Length of Gravity Mains	9.5 miles (20 additional miles of export line)
Length of Force Mains	6 miles (includes 5 miles of export main)
Size of Sewers	6 – 24 inches in diameter
Main Pump Facilities	5 (2 are owned by Elks Point Sanitation District - EPSD, but maintained by DCSID)
1. Satellite Pump Facilities	NA
Manholes	NA
Sewer System Mapping	Yes - Digital
Service Connections	4,730 (includes DCSID, EPSD, TDD, RHGID, and KGID)
Average Daily Flow	2.3 MGD
Peak Daily Flow	2.95 MGD
Design Daily Flow at Treatment Facility	3.75 MGD

10.4 Treatment Facilities

DCSID has provided sewage treatment since 1968 for the district and the four surrounding districts (TDD, RHGID, EPSD, and KGID). The export line takes the effluent over Kingsbury Grade (approximately 5 miles) where it is delivered through 20 miles of pipeline to land application sites or storage at the District’s Effluent Storage Facility in Carson Valley, Nevada.

10.5 Maintenance Program

DCSID contracts with a private company for the majority of its maintenance program. This company is available 24 hours a day and the usual response time is less than one-half hour. DCSID does own a vactor truck and keeps calcium hypochlorite available for sewage clean up.

Gravity sewers are generally cleaned yearly. Troublesome sewers are cleaned more often, generally every month. These sewers typically have grease and grit buildup from the surrounding businesses. Hydrojetting is typically the cleaning method along with root removal. Manholes are also inspected during this cleaning process.

Sewers are televised only when a problem has been identified.

Pump stations are usually cleaned three times a week. The wet-wells are pumped down and then flushed.

10.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration has not been an issue according to the district. Peak flows tend to appear during the holiday periods but do not appear during the wet seasons. The district inspects new house lateral connections and requires on the sale of a home, that the house lateral be inspected and corrected if problems exist.

10.5.2 Observed Overflow/Spills

Spill records were obtained from DCSID. These spills have been reported to TRPA and Nevada Department of Environmental Protection (NDEP). The spill records date back to 1987. Ten reported spills have occurred within the last 15 years. Of the ten spills, only one spill was described as possibly entering a creek. The volumes of spills varied from 50 gallons to approximately 4,000 gallons. From the data received, one site spilled twice. The entire sewer main was upsized and relocated to prevent additional spills. The force main on Sewer Plant Road leading into the treatment plant has had 4 leaks dating from June 1995 to February 1999. No reported leaks have occurred since May 1999.

10.5.3 Regulatory Enforcement Actions

No regulatory actions are currently in place for DCSID.

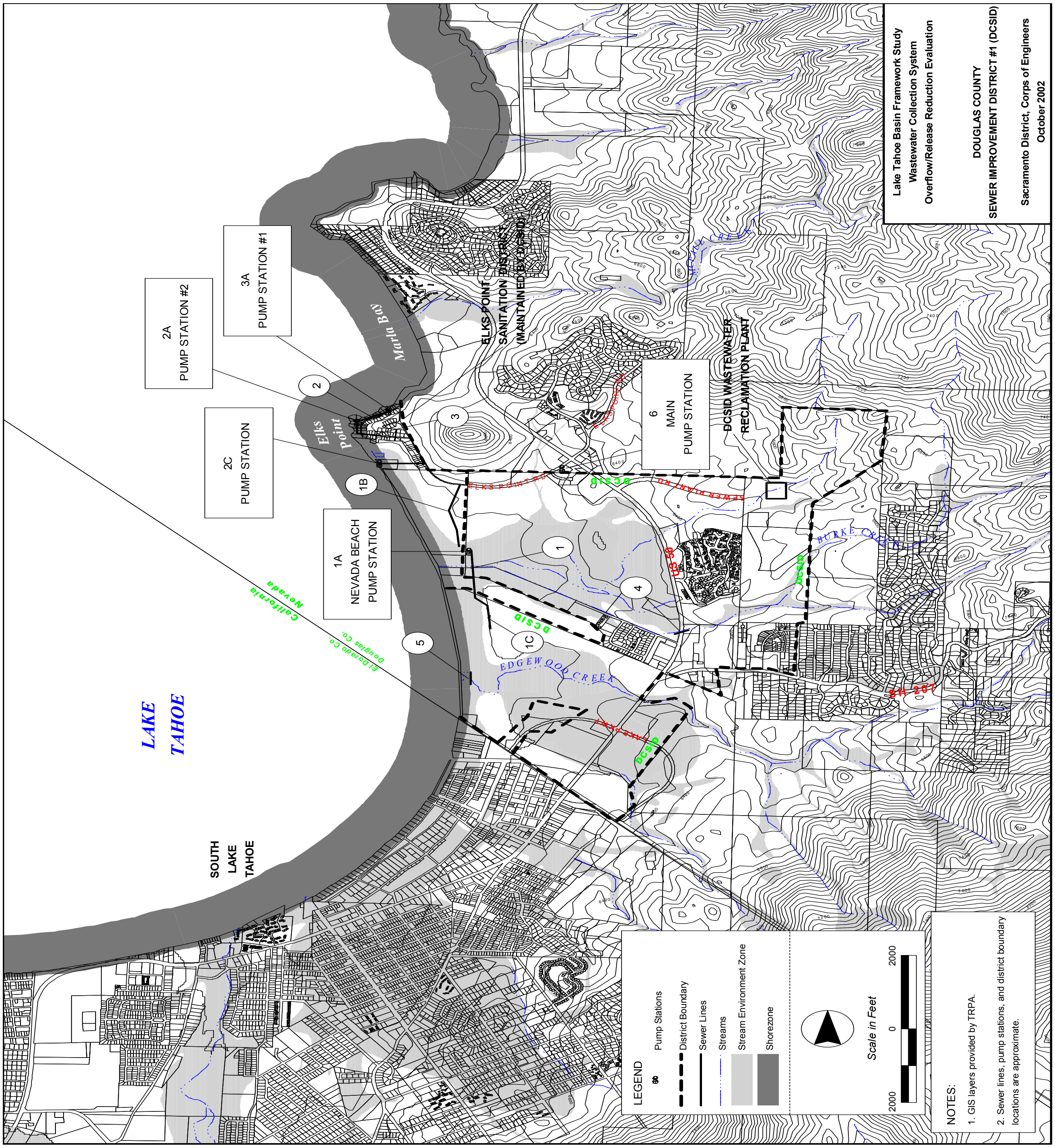
10.5.4 Existing/Anticipated Capacity Limitations

Currently, there are no capacity problems within the study area. Outside of the study area, DCSID is planning the replacement of a 12” gravity sewer to a 16” gravity sewer that services the casinos.

10.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. Figure 10-1 identifies the location of the facility. Table 10-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 10-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.


Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
DOUGLAS COUNTY
SEWER IMPROVEMENT DISTRICT #1 (DCSID)
Sacramento District, Corps of Engineers
October 2002
LAKE TAHOE
SOUTH LAKE TAHOE
1A NEVADA BEACH PUMP STATION
2A PUMP STATION #2
3A PUMP STATION #1
2C PUMP STATION
6 MAIN PUMP STATION
ELKS POINT SANITATION DISTRICT (MAINTAINED BY DCSID)
DCSID WASTEWATER RECLAMATION PLANT
Marla Bay
Elks Point
EDGEWOOD CREEK
BURKE CREEK
US 50
SH 207
DCSID
California
Nevada
Douglas Co.
El Dorado Co.
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
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Scale in Feet
2000 0 2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 10-1

Table 10-2. Summary of Potential Problems for Critical Sewer Facilities in DCSID

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1	Gravity Line	24" ACP, 364 LF at Burke Creek near NV Beach	A	Age Capacity	Medium High	Manholes subject to flooding	1
1A	NV Beach Pump Station 1 & 2	Pump station	A	Age	Medium	Redundant pump station constructed in 1998	4
1B	Force Main	16" Steel FM, 2,100 LF	A	Age	Medium	Constructed in 1960-1970s Without redundancy	4
1C	Gravity Lines	4,500 LF NV Beach Campgrounds	B	Age Access	Medium	Forest Service system drains to NV Pump Station	5
2	Force Main (Elk Point)	4" Steel FM, 900 LF	C	Age	Medium	Constructed in 1960-1970s	6
2A	Elk Pt. Pump Station No 2	Satellite PS	C	Age	Medium	Constructed in 1960-1970s	6
2C	Pump Station	Bitler's Cottages	C	Access	Medium	Private Station north of NV Beach, pumps into DCSID	6
3	Force Main (Elk Point)	4" Steel FM, 450 LF	C	Age	Medium	Constructed in 1960-1970s	6
3A	Elk Pt. Pump Station No 1	Satellite PS	C	Age	Medium	Constructed in 1960-1970s	6
4	Gravity Line	10" ACP, 305 LF at Burke Creek at Hwy 50	B	Age	Medium	Constructed in 1960-1970s	5
5	Gravity Line	24" ACP, 300 LF at Edgewood Creek	A	Age	Medium	Constructed in 1960-1970s	4
6	Main Pump Station	The main pump station for the District	A	Age	Medium	Constructed in 1960-1970s	4

Table 10-3. Summary of Alternative Measures for DCSID

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
1	High	24" ACP crossing of Burke Creek, 364 LF Manholes subject to flooding Sewer is middle age	1. Seal manhole rims 2. Monitoring condition through regular cleaning and inspections 3. Rehabilitation 4. Conventional or trenchless replacement	• Install manhole cover seals • Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 365 LF with slip lining	192,400	1
1A	Medium	NV Beach Pump Station 1 and 2	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Monitor and maintain • Replace pumping equipment and controls when necessary	291,400	4
1B	Medium	16" Steel force main, 2,100 LF Line is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Monitor and maintain • Provide access ports for inspection and cleaning (3)	133,100	4
1C	Medium	Gravity sewer 4,500 LF Sewers are middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 4500 LF – slip line	1,503,500	5
2	Medium	4" Steel force main from Elk Pt. PS #1, 450 LF Line is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Monitor and maintain • Conventional or trenchless replacement	447,100	6

Table 10-3. Summary of Alternative Measures for DCSID, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
2A	Medium	Elk Point Pump Station No 1 PS is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Monitor and maintain • Replace pumping equipment and controls when necessary	41,700	6
2C	Medium	Private pump station	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment when necessary	27,800	6
3	Medium	4" Steel force main from Elk Pt. PS #1, 900 LF Line is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Monitor and maintain • Conventional or trenchless replacement	257,400	6
3A	Medium	Elk Point Pump Station No 2 PS is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Monitor and maintain • Replace pumping equipment and controls when necessary	41,700	6
4	Medium	10" ACP crossing of Edgewood Creek, 300 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 300 LF with slip lining	112,600	5

Table 10-3. Summary of Alternative Measures for DCSID, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
5	Medium	Gravity sewer creek crossing – 24" ACP 300LF Edgewood Creek Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with slip lining	163,200	4
6	Medium	Main Pump Station Pump station is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment when necessary	221,900	4

11.0 KINGSBURY GENERAL IMPROVEMENT DISTRICT

11.1 Organization

The Kingsbury General Improvement District (KGID) was founded in 1964 to provide water and sanitary sewer for the community. KGID is located between South Tahoe Public Utility District and Douglas County Sewer Improvement District. The KGID boundary ranges from State Route 50 up Kingsbury Grade (State Highway 207) to Stateline. Refer to Figure 1-1 for the location of KGID.

11.2 Master Plans and Other Pertinent Documentation

Currently, KGID does not have a sewer master plan but they do maintain a sewer ordinance.

11.3 Overview of Sewer System

KGID conveys sewage from its district to the Douglas County Sewer Improvement District treatment facility. KGID maintains 4 pump stations in its district. Refer to Table 11-1 for the KGID sewer system information.

Sewer System Information:

Table 11-1. KGID Sewer System Information

Service Area	4.3 Square miles
Length of Gravity Mains	33 miles
Length of Force Mains	2 miles
Size of mains	6 – 18 inches in diameter
Main Pump Facilities	1
Satellite Pump Facilities	3
Manholes	NA
Sewer System Mapping	Yes – Hard copy
Service Connections	2,300
Average Daily Flow (2001)	477,000 gallons
Peak Daily Flow (2001)	756,000 gallons
Design Daily Flow	NA

11.4 Treatment Facilities

KGID exports sewage to the treatment facility maintained and operated by the Douglas County Sewer Improvement District.

11.5 Maintenance Program

KGID contracts with a private company for the majority of its maintenance program. This company is available 24 hours a day and the usual response time is less than one-half hour.

A maintenance schedule has been implemented by KGID. Gravity sewers are generally cleaned every 3 years. Hydroflushing is typically the cleaning method along with root removal. Manholes are also inspected during this cleaning process.

Sewers are typically televised only when a problem has been identified.

11.5.1 Inflow and Infiltration (I/I) Conditions

Flows increase during wet periods, especially in March. A television program is planned to check I/I.

11.5.2 Observed Overflow/Spills

Spill records were obtained from interviews with KGID. There has been one reported spill within the last 10 years.

11.5.3 Regulatory Enforcement Actions

No regulatory actions are currently in place for KGID.

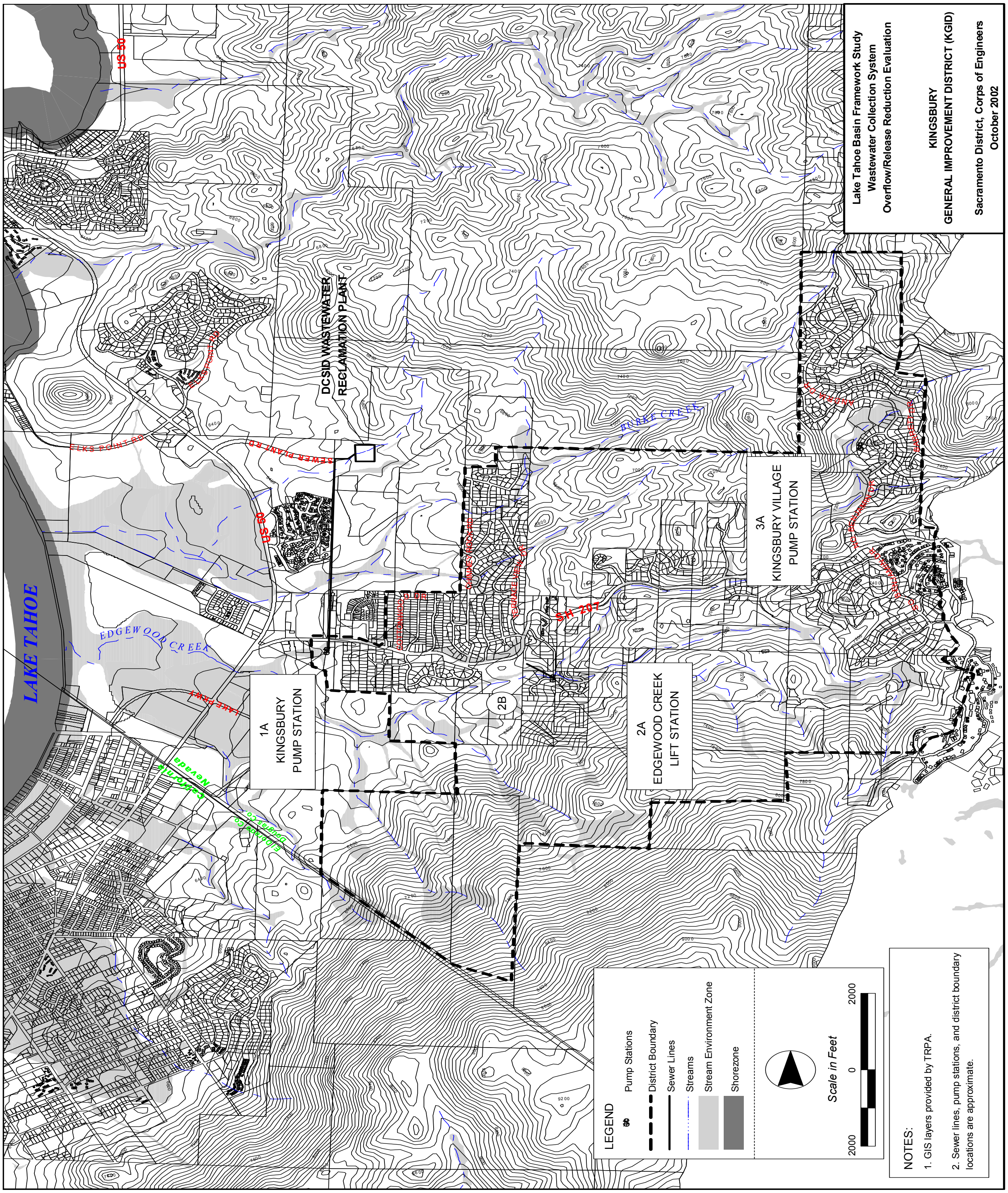
11.5.4 Existing/Anticipated Capacity Limitations

Currently, the KGID has not identified capacity problems within the study area.

11.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of the KGID is shown on Figure 11-1. Table 11-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 11-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.


Lake Tahoe Basin Framework Study
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2000
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2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 11-1

Table 11-2. Summary of Potential Problems for Critical Sewer Facilities in KGID

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1A	KGID Pump Station	No Data	A	Age	Low	Generator scheduled to be replaced in 2003 Controls and pumps replaced within last 10 years	5
1B	Force Main	14" FM, Class 150, 5,907 LF	A	Age Redundancy	Medium	Constructed in mid 1970s	4
1C	Force Main	400 LF - Burke Creek crossing	B	Age	Medium	Constructed in mid 1970s	5
2A	Pump Station, Kingsbury Palisades	No Data	B	Age Access Redundancy	Low	Pump and controls scheduled to be replaced in 2003 Constructed 1972-73 Located adjacent to Edgewood Creek	5
2B	Force Main	6" FM, Class 150, 900 LF	B	Age Access Redundancy	Medium	Constructed 1972-73	5
3A	Pump Station, Kingsbury Village	No Data	A	Age Access Redundancy	Low	Constructed 1972-73 Pumps and controls replaced in 2001 Located outside the Lake Tahoe basin	NA

Table 11-3. Summary of Alternative Measures for KGID

Location	Risk Level	Facility/Description of Problem	Alternative Measures	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
1A	Medium	KGID Pump Station Backup generator is old and ready for replacement Pump station is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary 3. Replace standby generator set - Note: generator is scheduled for replacement	• Install new backup generator (will be complete in 2003) • Perform regular O&M • Replace pumping equipment and controls	444,100	5
1B	Medium	14" FM, Class 150, 5,907 LF Force main is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Provide force main inspection/cleaning access ports at 1000' intervals	559,400	5
1C	Medium	Middle age force main – 400 LF crossing of Burke Creek	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Provide force main inspection/cleaning access ports (2)	219,500	5
2A	Medium	Kingsbury Palisades Pump Station Pump Station located adjacent to Edgewood Creek Pump station is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls (will be complete in 2003)	124,900	5

Table 11-3. Summary of Alternative Measures for KGID, (continued)

Location	Risk Level	Facility/Description of Problem	Alternative Measures	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
2B	Medium	6" FM, Class 150, 900 LF Force main is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main inspection/cleaning access ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Provide force main inspection/cleaning access ports (2)	223,900	5
3A	Medium	Kingsbury Village Pump Station Pump Station located adjacent to Edgewood Creek Pump station is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replace equipment and related controls when necessary	• Perform regular O&M • Replace pumping equipment and controls	83,200 (not included in overall costs)	NA (outside Lake Tahoe basin)

12.0 SOUTH TAHOE PUBLIC UTILITY DISTRICT

12.1 Organization

The South Tahoe Public Utility District (STPUD) was founded in 1950. STPUD is located on the southeastern side of Lake Tahoe. STPUD operates and maintains the water system, sewer system, a treatment plant, and an export system. The district service area encompasses 79 square miles. The service area contains portions of El Dorado County and extends north along State Route 89 to Cascade Lake, south along State Route 89 to Luther Pass, east on State Highway 50 to the Nevada state line, and west along State Highway 50 to Echo Lake.

12.2 Master Plans and Other Pertinent Documentation

The current sewer master plan for the STPUD was written in 1986. STPUD maintains a capital improvement program.

The Tahoe Basin Sewer Systems Exfiltration/Overflow Study was performed from 1982 through 1983.

No inflow/infiltration (I/I) study has been performed, but I/I has been carefully monitored through maintenance and rehabilitation projects.

12.3 Overview of Sewer System

STPUD conveys sewage from its district to a treatment facility within its district. Several pump stations are located near the shores of Lake Tahoe to pump sewage to the treatment plant. Refer to Table 12-1 for the STPUD sewer system information.

Sewer System Information:

Table 12-1. STPUD Sewer System Information

Service Area	79.3 Square miles
Length of Gravity Mains	420 miles
Length of Force Mains	40 miles
Size of mains	6 – 30 inches in diameter
Main Pump Facilities	39
Satellite Pump Facilities	NA
Manholes	6,500
Sewer System Mapping	Yes – Hard copy
Service Connections	16,800
Average Daily Flow	4.5 - 5.0 million gallons
Peak Daily Flow	8.1 million gallons
Design Daily Flow at Treatment Facility	7.7 million gallons

12.4 Treatment Facilities

STPUD treatment facility is located at the district headquarters in South Lake Tahoe, California. Treated effluent is exported 26 miles over Luther Pass to the district owned and operated Harvey Place Dam and Reservoir near Woodfords, California. Effluent is pumped approximately 15 miles through a force main from the treatment plant to the Luther Pass pump station. From the Luther Pass pump station; effluent travels by gravity through 11 miles of sewer to the reservoir.

12.5 Maintenance Program

STPUD schedules sewer cleaning yearly in accessible locations. Sewers are cleaned by hydrojetting and rodding for root removal. STPUD maintains 2 hydro trucks, 1 vactor/hydro combo truck, rodding equipment, and repair equipment for the sewer. Sewers are televised only when a problem has been identified. The district maintains a list for the troublesome sewers. These areas may be cleaned monthly to every 3 months.

12.5.1 Inflow and Infiltration (I/I) Conditions

Interviews with district personnel feel that I/I is under control. House laterals may be a large contributor to I/I according to the district.

12.5.2 Observed Overflow/Spills

Spill records were obtained from STPUD and Lahontan Regional Water Quality Control Board dating back to 1987. Over the last 15 years, there have been 101 reported spills.

12.5.3 Regulatory Enforcement Actions

Currently, there are no enforcement actions against STPUD.

12.5.4 Existing/Anticipated Capacity Limitations

The sewer collection systems in the Lake Tahoe basin were designed for a much greater population than the current population. The Tahoe Regional Planning Agency (TRPA) has limited the growth within the Lake Tahoe basin, such that capacity should not be an issue. There are a few gravity sewers that will surcharge. STPUD is currently evaluated a section of sewer that may need to be replaced in the Wildwood area.

12.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of STPUD is shown on Figure 12-1. Figures 12-2, 12-3, 12-4, 12-5, and 12-6 identify the location of potential problems with the sewer facility. Table 12-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 12-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures and unit costs are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.

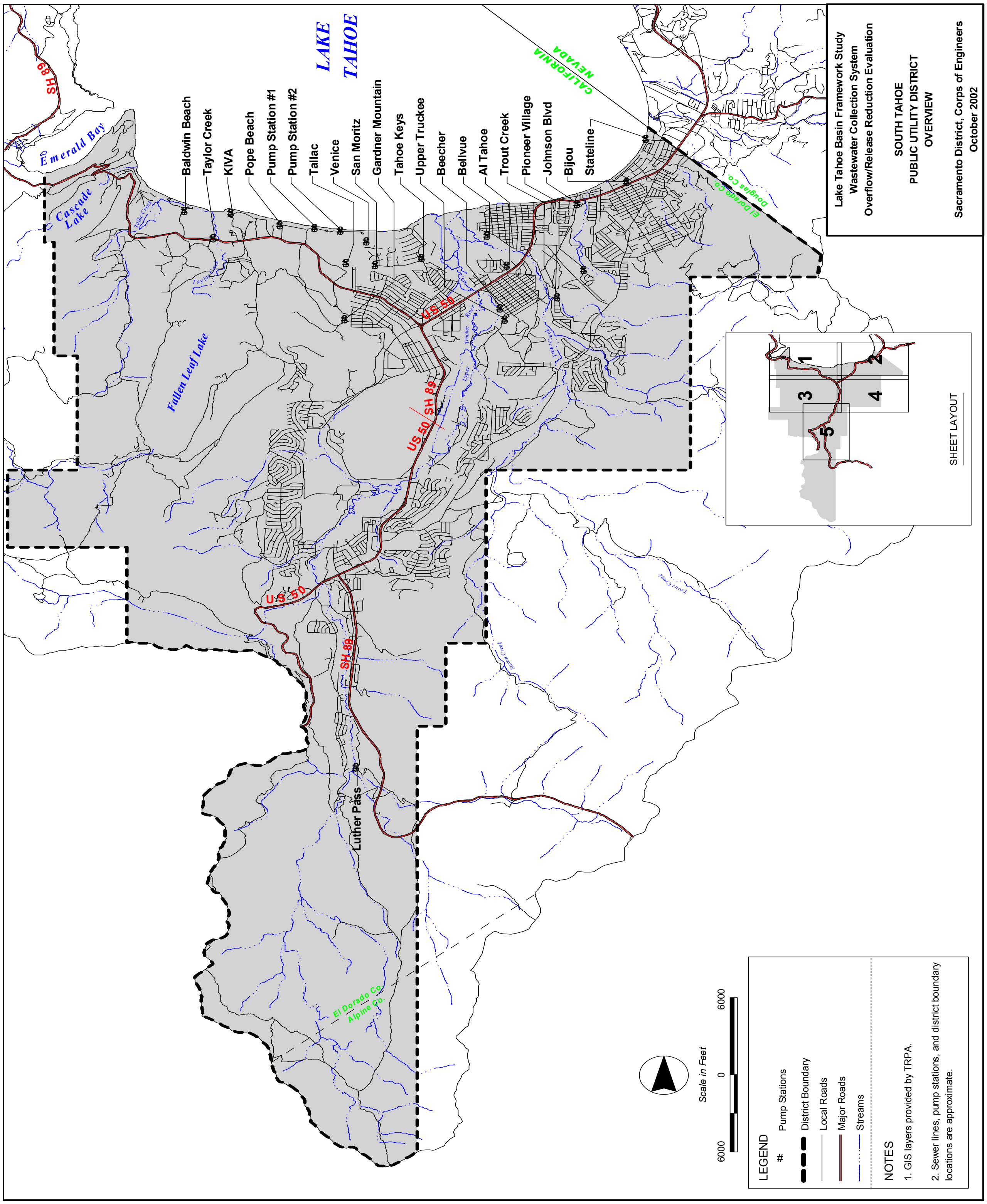
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
SOUTH TAHOE
PUBLIC UTILITY DISTRICT
OVERVIEW
Sacramento District, Corps of Engineers
October 2002
LAKE TAHOE
Emerald Bay
Cascade Lake
Fallen Leaf Lake
CALIFORNIA
NEVADA
El Dorado Co.
Douglas Co.
Alpine Co.
Baldwin Beach
Taylor Creek
KIVA
Pope Beach
Pump Station #1
Pump Station #2
Tallac
Venice
San Moritz
Gardner Mountain
Tahoe Keys
Upper Truckee
Beecher
Bellvue
Al Tahoe
Trout Creek
Pioneer Village
Johnson Blvd
Bijou
Stateline
Luther Pass
US 50
SH 89
SHEET LAYOUT
1
2
3
4
5
Scale in Feet
6000
0
6000
LEGEND
Pump Stations
District Boundary
Local Roads
Major Roads
Streams
NOTES
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 12-1

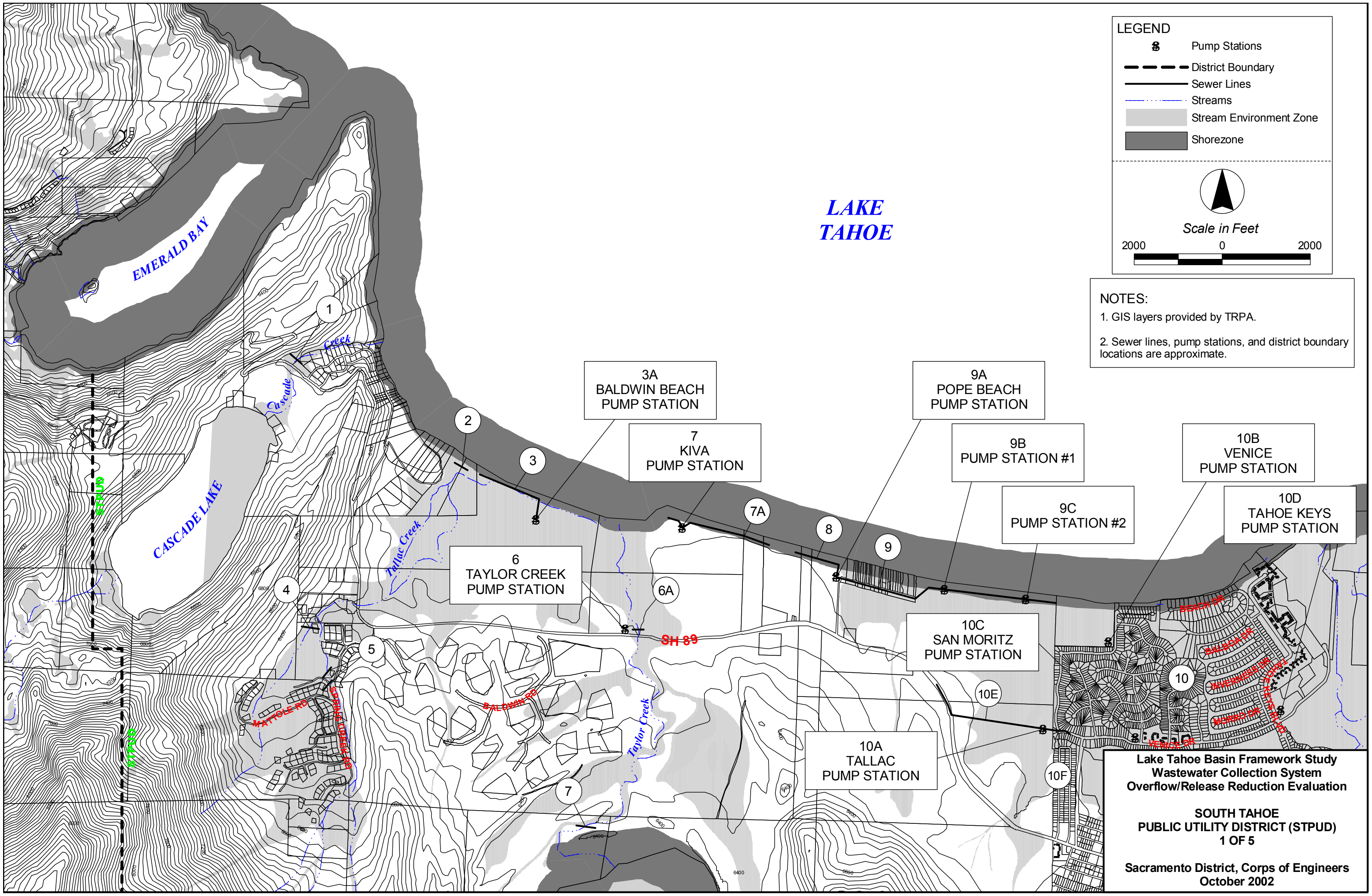
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000 0 2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
LAKE TAHOE
EMERALD BAY
CASCADE LAKE
Cascade Creek
Tallac Creek
Taylor Creek
SH 89
3A BALDWIN BEACH PUMP STATION
7 KIVA PUMP STATION
6 TAYLOR CREEK PUMP STATION
9A POPE BEACH PUMP STATION
9B PUMP STATION #1
9C PUMP STATION #2
10B VENICE PUMP STATION
10D TAHOE KEYS PUMP STATION
10C SAN MORITZ PUMP STATION
10A TALLAC PUMP STATION
1
2
3
4
5
6A
7
7A
8
9
10
10E
10F
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
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Figure 12-2

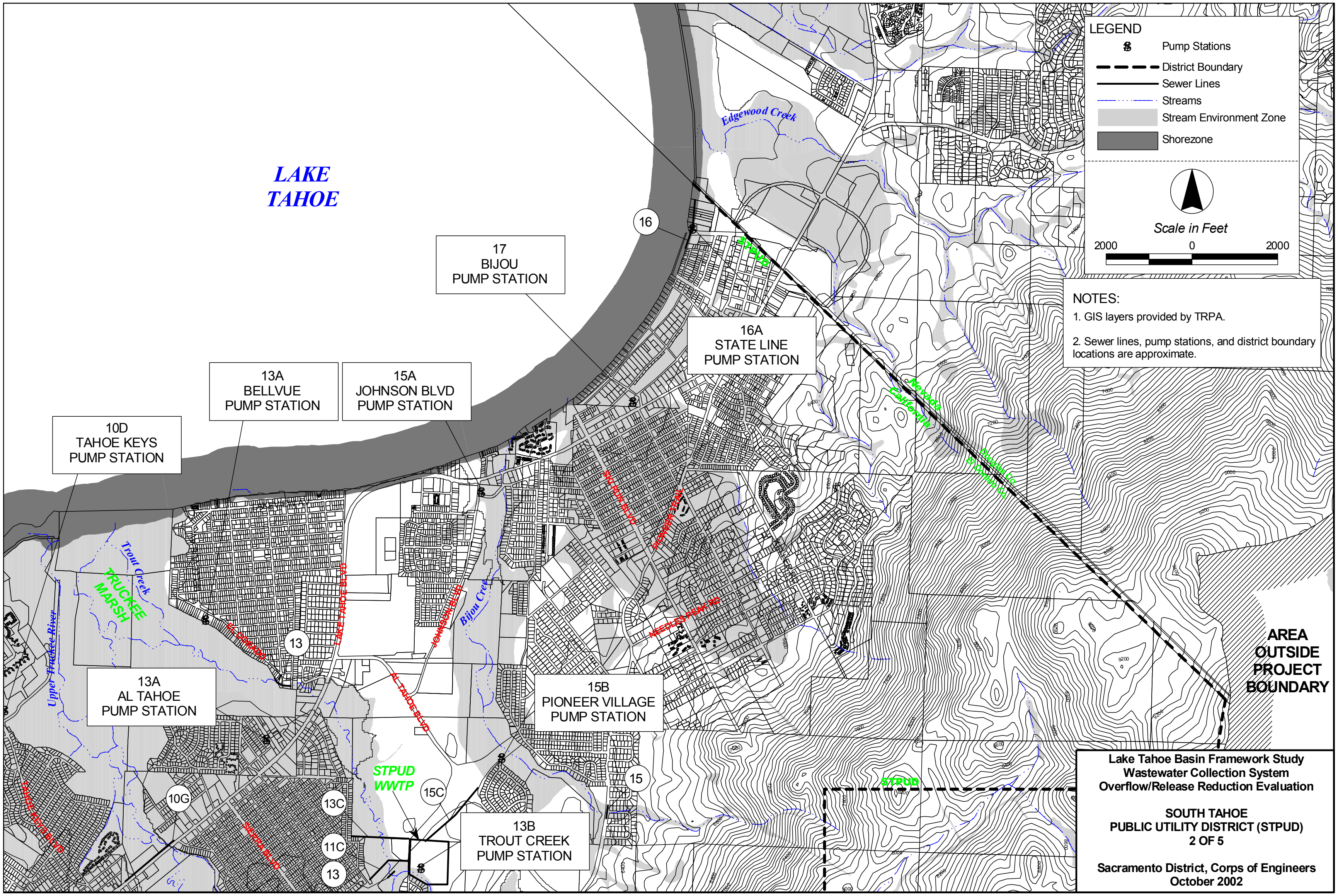
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000 0 2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
LAKE TAHOE
17 BIJOU PUMP STATION
16A STATE LINE PUMP STATION
13A BELLVUE PUMP STATION
15A JOHNSON BLVD PUMP STATION
10D TAHOE KEYS PUMP STATION
13A AL TAHOE PUMP STATION
15B PIONEER VILLAGE PUMP STATION
13B TROUT CREEK PUMP STATION
STPUD WWTP
16
13
15
15C
10G
13C
11C
Edgewood Creek
Trout Creek
Bijou Creek
Upper Truckee River
TRUCKEE MARSH
AL TAHOE BLVD
STPUD
AREA OUTSIDE PROJECT BOUNDARY
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
SOUTH TAHOE PUBLIC UTILITY DISTRICT (STPUD)
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Figure 12-3

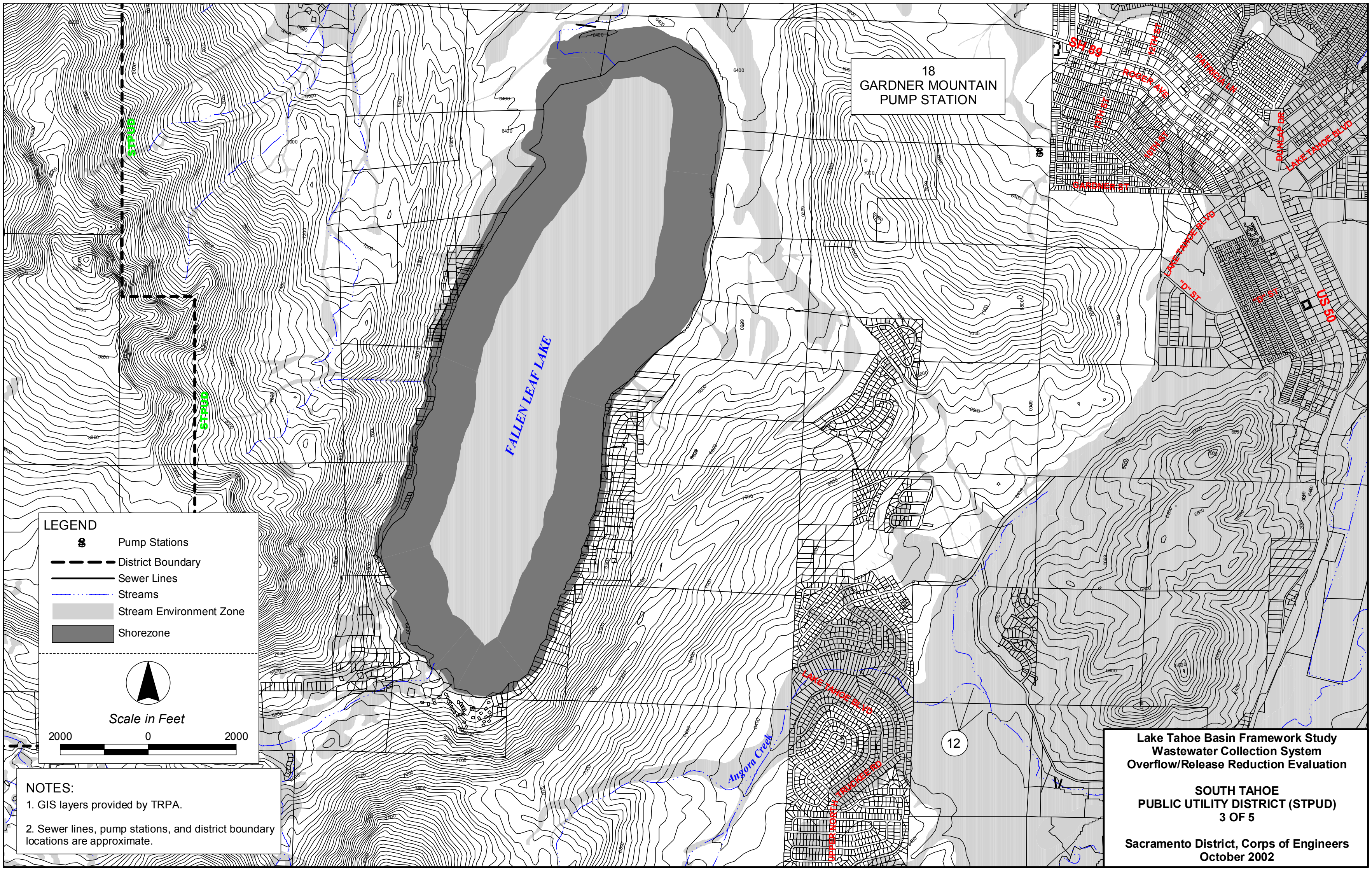
18
GARDNER MOUNTAIN
PUMP STATION
FALLEN LEAF LAKE
Angora Creek
US 50
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
12
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
SOUTH TAHOE
PUBLIC UTILITY DISTRICT (STPUD)
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Figure 12-4

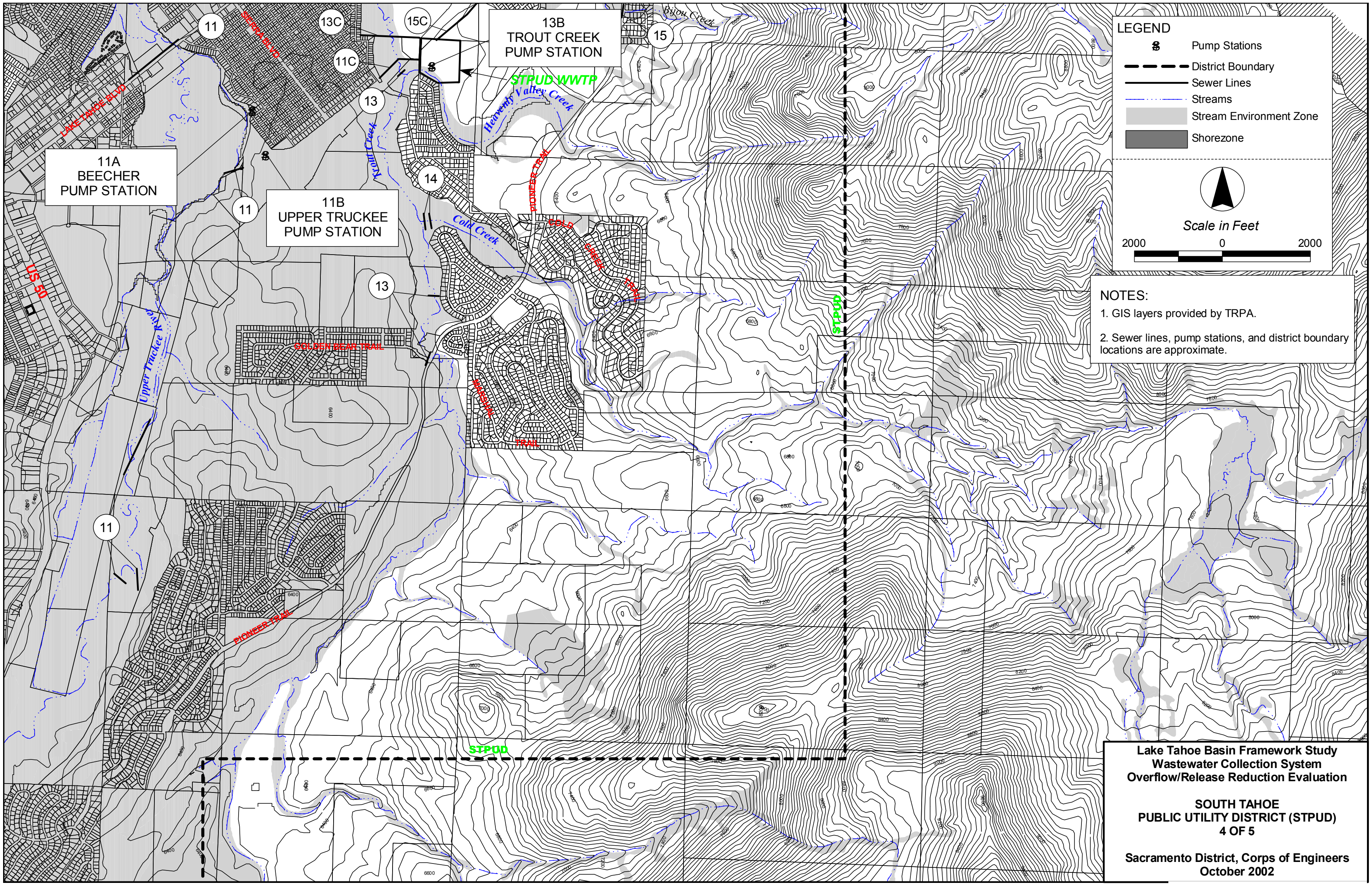
11
13C
15C
13B
TROUT CREEK
PUMP STATION
15
11C
STPUD WWTP
13
Heavenly Valley Creek
Trout Creek
Bijou Creek
LAKE TAHOE BLVD
11A
BEECHER
PUMP STATION
14
11
11B
UPPER TRUCKEE
PUMP STATION
Cold Creek
US 50
13
GOLDEN BEAR TRAIL
Upper Truckee River
STPUD
11
PIONEER TRAIL
STPUD
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
SOUTH TAHOE
PUBLIC UTILITY DISTRICT (STPUD)
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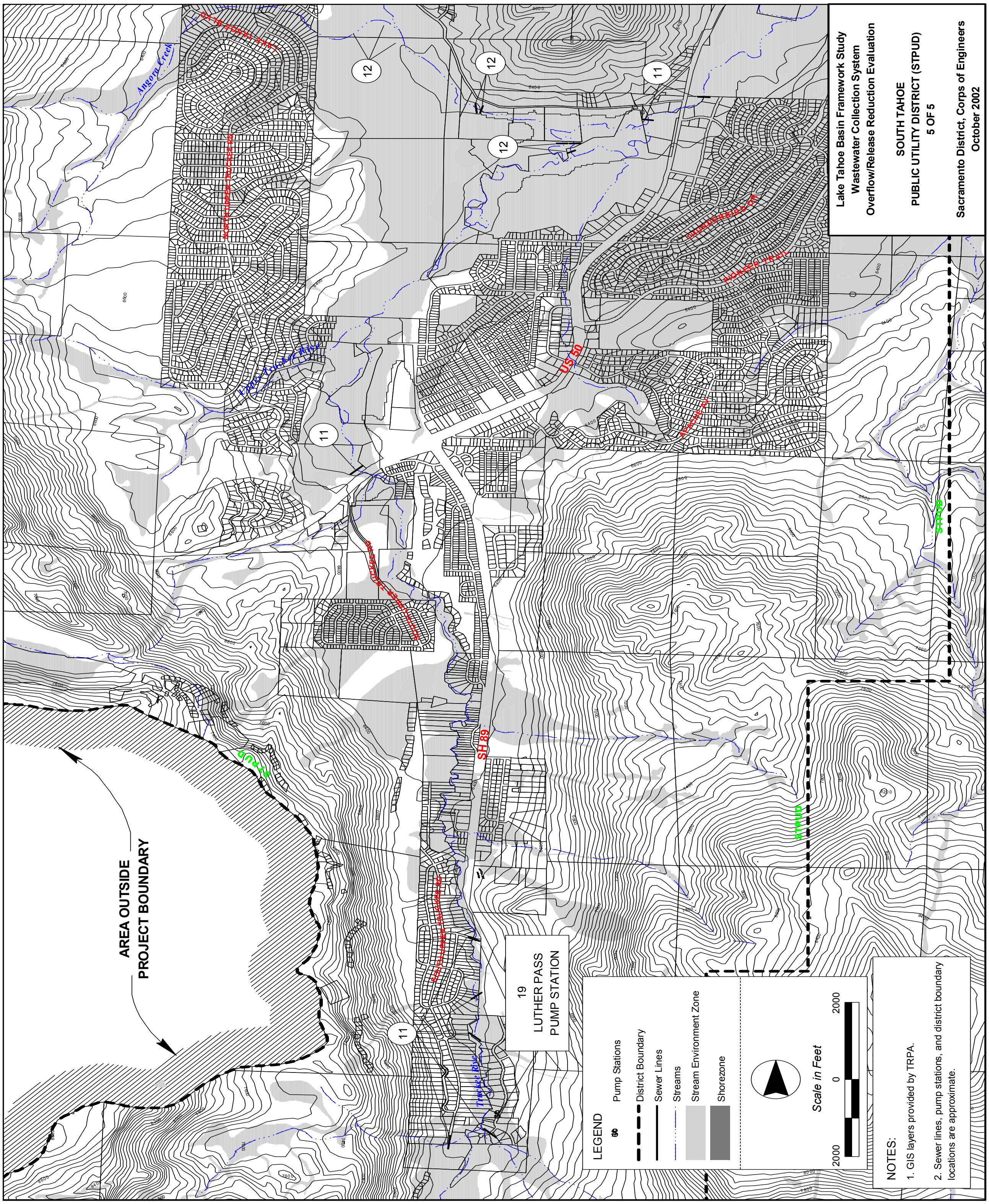
Figure 12-5


Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
SOUTH TAHOE
PUBLIC UTILITY DISTRICT (STPUD)
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Sacramento District, Corps of Engineers
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AREA OUTSIDE
PROJECT BOUNDARY
19
LUTHER PASS
PUMP STATION
US 50
SH 89
Angora Creek
STPUD
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 12-6

Table 12-2. Summary of Potential Problems for Critical Sewer Facilities in STPUD

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1	Cascade Creek Crossing	200 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
2	Tallac Creek Crossing	2 – 6” – 150 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
3	Baldwin Beach Gravity Sewers	2898 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
3A	Baldwin Beach Pump Station	2 – 400 GPM pumps	B	Age O&M	Medium High	Constructed during the late 1960s to mid 1970s No provisions for PS bypassing	2
4	Tallac Creek Crossing	136 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
5	Tallac Creek Crossing	150 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
6	Taylor Creek Pump Station	2 – 2100 GPM pumps	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
6A	Taylor Creek Pump Station Force Main	12” – 750 LF through Taylor creek area	A	Age Structural O&M	Medium Medium High	Constructed during the late 1960s to mid 1970s Force main is concrete encased and is partially exposed No provisions to facilitate line cleaning	1
7	Kiva Beach Gravity Sewers	1988 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
7A	Kiva Pump Station	2 – 210 GPM pumps	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
7B	Kiva Pump Station Force Main	6” FM	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
8	Camp Richardson Gravity Sewers	2100 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
9	Pope Beach Force Main	3540 LF – 4” FM	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
9A	Camp Richardson Pump Station	2 – 800 GPM pumps	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
9B	Pope Beach Pump Station #1	2 – 200 GPM ejectors	C	Age	Medium Medium	Constructed during the late 1960s to mid 1970s Has plug-in for portable generator	6

Table 12-2. Summary of Potential Problems for Critical Sewer Facilities in STPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
9C	Pump Station #2	2 – 200 GPM ejectors	C	Age Redundancy	Medium Medium	Constructed during the late 1960s to mid 1970s Has plug-in for portable generator	6
10	Tahoe Keys Gravity Sewers	30,000 LF	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
10A	Tallac Pump Station	2 – 2000 GPM pumps	A	Age O&M	Medium High	Constructed during the late 1960s to mid 1970s No provisions for PS bypassing	1
10F	Tallac PS Force Main	18" - 900 LF	A	Age Access O&M	Medium High	Constructed during the late 1960s to mid 1970s Access is restricted in marsh areas No provisions to facilitate line cleaning	1
10B	Venice Pump Station	2 – 100 GPM pumps	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
10C	San Moritz Pump Station	2 – 900 GPM pumps	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
10D	Tahoe Keys Pump Station	2 – 2500 GPM pumps	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
10E	Gravity Sewer to Tallac Pump Station	24" – 2235 LF 7 Manholes	A	Age Access	Medium High	Constructed during the late 1960s to mid 1970s Located in Truckee Marsh – access is prohibited	1
10G	Tahoe Keys PS Force Main	16" – 3000 LF through Trout Creek area	A	Age Access O&M	Medium Medium High	Constructed in late 1960s to mid 1970s In stream zone No provision to facilitate line cleaning	1
11A	Beecher Pump Station	2 – 30 GPM pumps	C	Age	Medium	Constructed during late 1960s to mid 1970s Has plug connection for portable generator	6
11	Upper Truckee River Crossings	6 gravity sewer crossings, 900 LF total; 5 – 24" force main crossings, 750 LF; 16" FM - 200 LF	A	Age Access	Medium High	Constructed during the late 1960's to mid 1970's Heavy equipment access prohibited by USFS during wet periods; additional access restrictions for export line would result if/when Upper Truckee River near the airport is rerouted by USFS; Additional pipeline crossings will also result with river rerouting	1
11	Upper Truckee River Crossings	6 gravity sewer crossings, 900 LF total; 5 – 24" force main crossings, 750 LF; 16" FM - 200 LF	A	Age Access	Medium High	Constructed during the late 1960's to mid 1970's Heavy equipment access prohibited by USFS during wet periods; additional access restrictions for export line would result if/when Upper Truckee River near the airport is rerouted by USFS; Additional pipeline crossings will also result with river rerouting	1

Table 12-2. Summary of Potential Problems for Critical Sewer Facilities in STPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
11B	Upper Truckee Pump Station	2 –2,800 GPM pumps	A	Age O&M	Medium Low	Constructed during the late 1960s to mid 1970s Provisions for PS bypassing	4
11C	Upper Truckee PS Force Main	18” – 1,750 LF through Trout Creek area	A	Age Access O&M	Medium Medium High	Constructed during the late 1960s to mid 1970s No force main redundancy No provisions to facilitate line cleaning	1
12	Angora Creek Crossings	6 – 150 LF crossings	A	Age Access	Medium High	Constructed during the late 1960s to mid 1970s Access prohibited by USFS	1
13	Trout Creek Crossings	1 – 24” FM, 150 LF 1 – 30” FM, 150 LF 2 – 200 LF Gravity sewers	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
13A	Al Tahoe Pump Station	2 – 3,000 GPM pumps 1 – Submersible pump 18” Force main	A	Age Capacity	Medium High	Constructed in 1958 One of most important pump stations in wastewater collection system; pumping redundancy may be insufficient	1
13B	Trout Creek Pump Station	2 – 1,800 GPM pumps 12 FM	A	Age O&M	Medium High	Constructed during the late 1960s to mid 1970s No provisions for PS bypassing; no force main redundancy	1
13C	Al Tahoe PS Force Main	18” – 2,000 LF through Trout Creek area	A	Age Access O&M	Medium Medium High	Constructed during the late 1950s In stream zone No provisions to facilitate line cleaning	1
14	Cord Creek/Lake Christopher Creek Crossings	4 - 15” Gravity sewer, 250 LF ea 1 – Gravity sewer, 250 LF	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
15	Bijou Creek Crossing	Gravity sewer	A	Age	Medium	Constructed during late 1960s to mid 1970s	4
15A	Johnson Boulevard Pump Station	2 – 1750 GPM pumps	A	Age	Medium	Constructed during the late 1960s to mid 1970s	4
15B	Pioneer Village Pump Station	2 – 325 GPM pumps 8” FM	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
15C	Pioneer Village PS Force Main	8” - 2000 LF	C	Access O&M	Medium High	In stream zone No provisions to facilitate line cleaning	3

Table 12-2. Summary of Potential Problems for Critical Sewer Facilities in STPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
16	State Line Gravity Lines	700 LF	C	Age	Medium	Constructed during the late 1960s to mid 1970s	6
16A	State Line Pump Station	2 – 150 GPM pumps	C	Age Redundancy	Medium High	Constructed during the late 1960s to mid 1970s No provisions for backup power	3
17	Bijou Pump Station	2 – 1600 GPM pumps Parallel discharge force mains	A	Age O&M	Medium Low	Constructed during the late 1960s to mid 1970s Provisions for pump station bypass	4
18	Gardner Mountain Pump Station	2 – 100 GPM pumps	C	Age Redundancy	Medium Medium	Constructed during the late 1960s to mid 1970s Has plug-in for portable generator	6
19	Luther Pass Export Pump Station	2 – 1000 HP pumps 2 – 750 HP pumps	A	Age Redundancy	Medium Medium	Constructed during the late 1960s to mid 1970s Existing transformer for power supply to pumping equipment is not readily available for replacement; pump motors need to be converted to 4160 volt power to be more compatible with available power from Sierra Pacific Power; Sierra Pacific is evaluating conditions	4

Table 12-3. Summary of Alternative Measures for STPUD

Location	Risk Level	Facility/Description of Condition	Potential Action Plan	Preferred Measures	First Costs, $ (excludes costs for O&M)	Priority Level
1	Medium	Cascade Creek Crossing - 200 LF: sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 200 LF of sewer	95,900	6
2	Medium	Tallac Creek Crossing, 2 – 6" – 150 LF: sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 2 sections of gravity sewer 150 LF each	177,600	6
3	Medium	Baldwin Beach Gravity Sewers – 2,900 LF: sewer is within shorezone; sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 2900 LF of gravity sewer	477,800	6
3A	High	Baldwin Beach Pump Station: facility has no provision for PS bypassing; facility is middle age	1. Establish a contingency backup plan 2. Provide connection points on force main for hook-up of portable pumping equipment 3. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 4. Replacement of pumping equipment and related controls 5. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	139,800	2
4	Medium	Tallac Creek Crossing - 136 LF: sewer is in stream zone; sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 136 LF of sewer	87,200	6

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
5	Medium	Tallac Creek Crossing – 150 LF: sewer is in stream zone; sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 150 LF of sewer	88,700	6
6	Medium	Taylor Creek Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	291,400	4
6A	Medium	Taylor Creek PS Force Main: line is middle age; force main is concrete encased and is partially exposed; no force main redundancy; no means for pipeline cleaning	1. Protect in place 2. Replace 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Protect existing 12" – 750 LF line in-situ, and • Install new 12" - 750 LF parallel force main for operating redundancy • Install 12" cleaning/inspection ports at 3000 foot intervals	553,100	1
7	Medium	Kiva Beach Gravity Sewers: sewers are middle age and in shorezone	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 2000 LF of sewer	337,100	6
7A	Medium	Kiva Beach Pump Station	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	6

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
7B	Medium	Kiva Beach Force Main: force main is middle age	1. Establish procedures to bypass 2. Replace 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Perform annual monitoring with inspection and cleaning • Establish procedures for bypassing	N/A	6
8	Medium	Camp Richardson Gravity Sewers: sewers are middle age and in shorezone	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 2,100 LF of gravity sewer	297,100	6
9	Medium	Pope Beach Pump Station #1	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	1,493,00	6
9A	Medium	Camp Richardson Pump Station	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	180,300	6
9B	Medium	Pope Beach Pump Station #1	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	27,800	6

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
9C	Medium	Pope Beach Pump Station #2	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	27,800	6
10	Medium	Tahoe Keys Gravity Sewers: sewers are middle age and within shorezone	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 30,000 LF of gravity sewers	4,495,300	4
10A	Medium	Tallac Pump Station: facility has no provision for bypassing and is middle age	1. Establish a contingency backup plan 2. Provide connection points on force main for hook-up of portable pumping equipment 3. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 4. Replacement of pumping equipment and related controls 5. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	312,300	1
10F	Medium	Tallac Pump Station Force Main: 900 LF – 18" line is middle age; access is restricted in marsh areas; no force main redundancy	1. Establish procedures to bypass 2. Replace 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Provide 900 LF of new 18" piping to parallel existing line • Provide 18" cleaning/inspection ports at 3000 foot intervals	757,500	1

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
10B	Medium	Venice Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	41,700	6
10C	Medium	San Moritz Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	221,900	4
10D	Medium	Tahoe Keys Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	291,400	4
10E	Medium	Gravity Sewer to Tallac Pump Station: 24" sewer is middle age; line is located in marsh area and access is limited	1. Developing and maintaining agreement (MOU) with USFS covering terms for sewer line inspection, repairs, and emergency replacement 2. Monitoring condition through regular cleaning and inspections 3. Rehabilitation 4. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 2250 LF – 24" of gravity sewer • Execute MOU for accessing sewer	1,191,200	1

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
10G	High	Tahoe Keys PS Force Main: 16" FM is middle age and is within stream zone; FM is without redundancy	1. Establish procedures to bypass 2. Provision of parallel line in the environmentally sensitive areas 3. Provision of cleaning/inspection ports	• Install 3000 LF of 16" line to parallel existing line • Install 16" cleaning/inspection ports at 3000 foot intervals	2,009,900	1
11	Medium	Upper Truckee River Creek Crossings	1. Developing and maintaining agreement (MOU) with USFS covering terms for sewer line inspection, repairs, and emergency replacement 2. Monitoring condition through regular cleaning and inspections 3. Rehabilitation 4. Conventional or trenchless replacement 5. Provision of cleaning/inspection ports for force mains	• Develop, execute and maintain MOU with USFS for maintenance and emergency repairs for all conditions including wet seasons • Establish procedures for air-lift of equipment and personnel to make repair • Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate: 6 sections of gravity sewer – 900 LF ; 5 sections of 24" FM; - 750 LF; 200 LF - 16" FM	1,696,000	1
11A	Medium	Beecher Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	41,700	6

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
11B	High	Upper Truckee Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	416,200	4
11C	High	Upper Truckee River PS Force Main: 18" FM is middle age and is within stream zone; FM is without redundancy	1. Establish procedures to bypass 2. Provide parallel line in the environmentally sensitive areas 3. Provision of cleaning/inspection ports	• Install 1750 LF of 18" line to parallel existing line • Provide18" cleaning/inspection ports at 3000 foot intervals	1,221,100	1
12	Medium	Angora Creek Crossings: sewers are middle age; access is limited by USFS	1. Developing and maintaining agreement (MOU) with USFS covering terms for sewer line inspection, repairs, and emergency replacement 2. Monitoring condition through regular cleaning and inspections 3. Rehabilitation 4. Conventional or trenchless replacement	• Develop, execute and maintain MOU with USFS for maintenance and emergency repairs for all conditions including wet seasons • Establish procedures for air-lift of equipment and personnel to make repair • Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 6 sections, 150 LF each	532,400	1

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
13	Medium	Trout Creek Crossings: sewers are middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate: 2 – 18" FM, 150 LF ea 1 – 24" FM, 150 LF 1 – 30" FM, 150 LF 2 – 200 LF Gravity sewers	461,600	4
13A	Medium	Al Tahoe Pump Station: is an extremely important pumping facility in the District; facility is old; pumping capacity redundancy may be insufficient	1. Provide additional installed standby pumps (submersibles to fit within existing facility) 2. Maintain extra pumping off-site and install when needed (current practice) 3. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 4. Replacement of pumping equipment and related controls 5. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment when maintenance becomes excessive	555,000	1
13C	Medium	Al Tahoe PS 18" Force Main: line is middle age and is within environmentally sensitive area; line is without redundancy	1. Establish procedures to bypass 2. Provision of parallel line in the environmentally sensitive areas 3. Provision of cleaning/inspection ports	• Install 2000 LF of 18" line to parallel existing line • Install cleaning/inspection ports at 3000 foot intervals	1,482,500	1

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
14	Medium	Cord Creek/Lake Christopher Creek Crossings: sewers are middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate: 4 - 15" gravity sewer, 250 LF ea, 1 – Gravity sewer, 250 LF	548,900	4
15	Medium	Bijou Creek Crossing: sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 250 LF of gravity sewer	102,800	4
15A	Medium	Johnson Boulevard Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	291,400	4
15B	Medium	Pioneer Village Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	124,900	6
15C	Medium	Pioneer Village PS Force Main: line is middle age; line crosses environmentally sensitive area; no provisions to facilitate cleaning; no force main redundancy	1. Establish procedures to bypass 2. Provision of parallel line in the environmentally sensitive areas 3. Provision of cleaning/inspection ports	• Install 2000" – 8" FM to parallel existing line across sensitive area to WWTP	1,016,600	3

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
16	Medium	State Line Gravity Sewers	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate 700 LF of sewer	99,100	6
16A	Medium	State Line Pump Station: facility is middle age; facility is without permanent backup power	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive 4. Provision for portable backup power 5. Installation of permanent backup power	• Perform regular O&M • Replace pumping equipment and controls when necessary	152,700	3
17	Medium	Bijou Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	263,700	4

Table 12-3. Summary of Alternative Measures for STPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternatives	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
18	Medium	Gardner Mountain Pump Station: facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of equipment and structure when wear is extensive and maintenance becomes excessive	• Perform regular O&M • Replace pumping equipment and controls when necessary	41,700	6
19	High	Luther Pass Export Pump Station: transformer for electrical primary power can not be readily replaced; Sierra Pacific power is planning to change service voltage to 4160 VAC	1. Purchase and store transformer – replace existing when necessary 2. Modify pumping equipment to accept new voltage	• Modify existing pump electrical equipment to be compatible with Sierra Pacific's proposed service modification	$150,000 (preliminary STPUD estimate, 2000) 416,200	4

13.0 TAHOE CITY PUBLIC UTILITY DISTRICT

13.1 Organization

The Tahoe City Public Utility District (TCPUD) was founded in 1938 to initially provide public water service to the community. Sanitary sewer services were added at a later date. The district boundary ranges from the Dollar Point area along the north shore of Lake Tahoe to D.L. Bliss State Park along the west shore, encompassing approximately 22 square miles. Refer to Figure 1-1 for the location of TCPUD. All wastewater from TCPUD is conveyed to a regional treatment facility in the Martis Valley (Truckee, CA).

13.2 Master Plans and Other Pertinent Documentation

The current Sewer Master Plan for the TCPUD was written in 1991. A draft Sewer Master Plan was issued in October 2001.

The Tahoe Basin Sewer Systems Exfiltration/Overflow Study was performed from 1982 through 1983.

No inflow/infiltration (I/I) study has been performed, but I/I has been carefully monitored through maintenance and rehabilitation projects.

TCPUD has technical specifications for sewer system construction. This manual is dated March 17, 1989.

13.3 Overview of Sewer System

TCPUD transports sewage from a number of communities along the north and west shores of Lake Tahoe. Refer to Table 13-1 for the TCPUD sewer system information.

Sewer System Information:

Table 13-1. TCPUD Sewer System Information

Service Area	22 Square miles
Length of Gravity Sewers	130 miles
Length of Force Mains	5 miles
Size of Sewers and Mains	6 – 36 inches in diameter
Pump Facilities	20
Manholes	NA
Sewer System Mapping	Yes – Hard copy
Service Connections	7,300
Average Daily Flow (1)	1.8 million gallons
Peak Daily Flow (2)	20 million gallons
Design Daily Flow (3)	7.8 million gallons

(1) Tahoe City Public Utility District Draft Sewer Master Plan, October 2001
(2) Storm event January 1 – 2, 1997
(3) Allocated maximum flows to the Tahoe Truckee Sanitary Sewer Agency

13.4 Treatment Facilities

The TCPUD exports its sewerage to the Tahoe Truckee Sanitary Sewer Agency (TTSA) in Truckee, California. Export lines from the north shore and the west shore intersect at the junction of State Route 89 and State Route 28 in Tahoe City. The export line heads out of the basin following State Route 89 to Truckee, California.

13.5 Maintenance Program

The TCPUD has a maintenance goal of hydro cleaning all accessible gravity lines yearly. Lines that are inaccessible by vactor trucks are typically flushed and inspected. These maintenance goals have been met the last three years. TCPUD has identified sewer lines that require more frequent cleaning and maintain these as necessary. The TCPUD has implemented television inspection every 5 years for sewer line inspection. Beginning in 2003, gravity sewer lines in the shorezone and stream areas will be televised every two years. Any cracks, minor joint displacement, leaking service connections, etc. are grouted and sealed. Spot repair is performed if structural defects or root intrusions are found.

TCPUD owns two vactor trucks to vacuum any spill and soil that has been contaminated. If a spill or soil cannot be vacuumed, cleaning with a 10% chlorination solution is used. This solution is used only if it does not impact any receiving waters. Response time to a reported spill is generally within an hour during off hours and more rapidly during work hours.

13.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration (I/I) had been problematic in past years. TCPUD has been monitoring I/I through television inspection and general maintenance of the sewer facilities. The district has noticed a decrease in flows over the last several years. Figure 13-1 compares the 16-year average flow vs. 2001 flow.

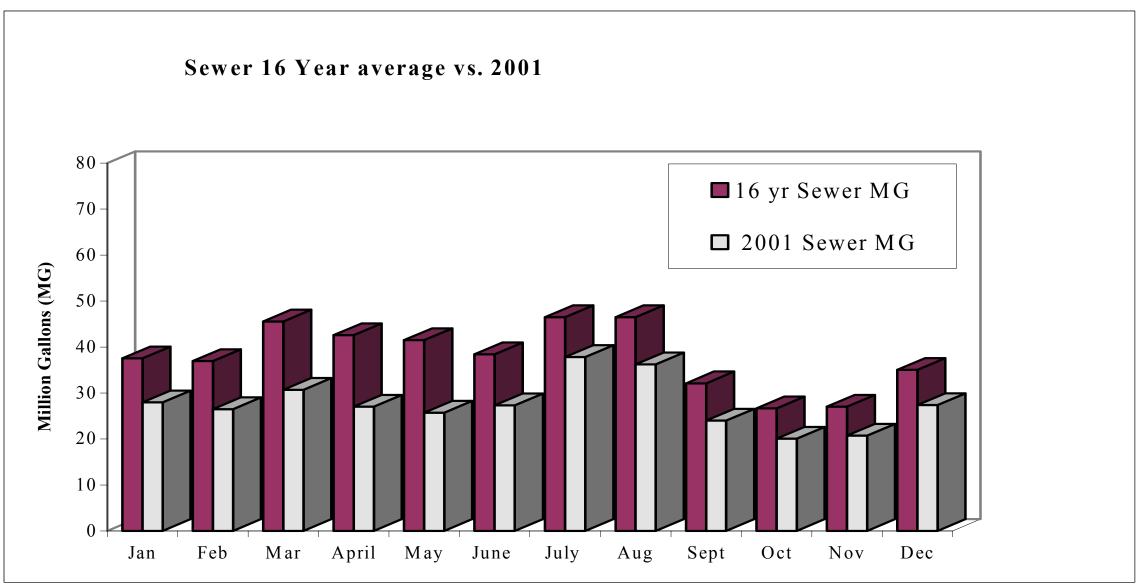


Table provided by Tahoe City Public Utility District

Figure 13-1 Flow Comparison

Figure 13-1 shows the decrease in flows for the year 2001 compared with the previous 16 years. Additional comparisons for the next several years should identify decreases in flow if the current maintenance program is continued.

13.5.2 Observed Overflow/Spills

Spill records were obtained from TCPUD and Lahontan Regional Water Quality Control Board dating back to 1987. Thirty reported spills have occurred within the last 15 years. Of the thirty spills, three where described as possibly entering Lake Tahoe. The volumes of spills reaching the lake were negligible to approximately 500 gallons. From the data received, no location has spilled more than once.

13.5.3 Regulatory Enforcement Actions

No regulatory actions are currently in place again TCPUD.

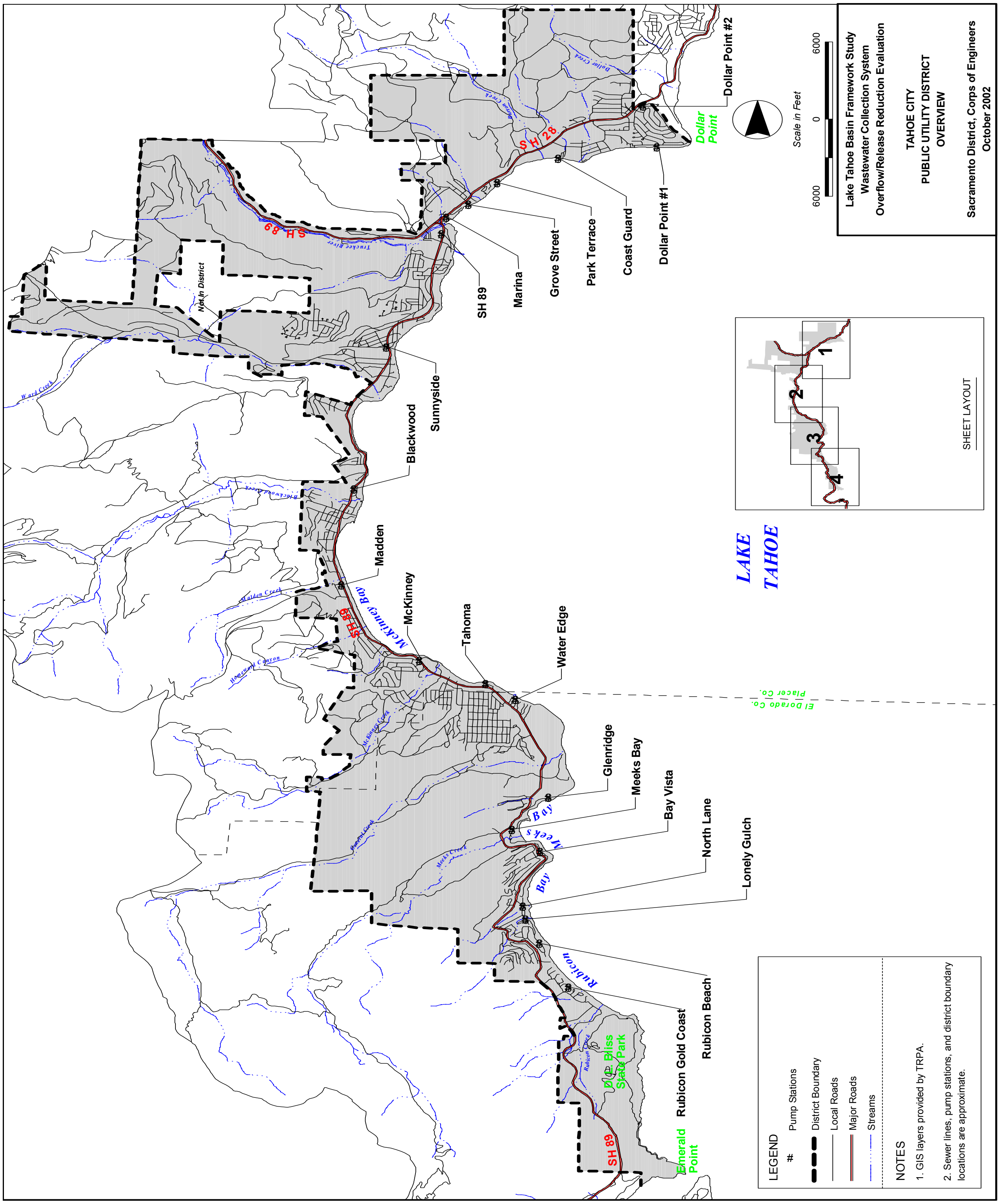
13.5.4 Existing/Anticipated Capacity Limitations

The sewer collection systems in the Lake Tahoe basin were designed for a much greater population than the current population. The Tahoe Regional Planning Agency (TRPA) has limited the growth within the Lake Tahoe basin, such that capacity should not be an issue. Currently, TCPUD serves approximately 7,300 customers. The predicted build out would increase the service to 7,605 customers.

13.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of TCPUD is shown on Figure 13-2. Figures 13-3, 13-4, 13-5, and 13-6 identify the location of a potential problem sewer facility. Table 13-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 13-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.



Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE CITY
PUBLIC UTILITY DISTRICT
OVERVIEW
Sacramento District, Corps of Engineers
October 2002
Scale in Feet
6000 0 6000
SHEET LAYOUT
1
2
3
4
LAKE TAHOE
Placer Co.
El Dorado Co.
Not in District
SH 28
SH 89
Dollar Point
Dollar Point #2
Dollar Point #1
Coast Guard
Park Terrace
Grove Street
Marina
SH 89
Sunnyside
Blackwood
Madden
McKinney
Tahoma
Water Edge
Glenridge
Meeks Bay
Bay Vista
North Lane
Lonely Gulch
Rubicon Beach
Rubicon Gold Coast
Emerald Point
D.L. Bliss State Park
McKinney Bay
Meeks Bay
Rubicon Bay
LEGEND
Pump Stations
District Boundary
Local Roads
Major Roads
Streams
NOTES
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 13-2

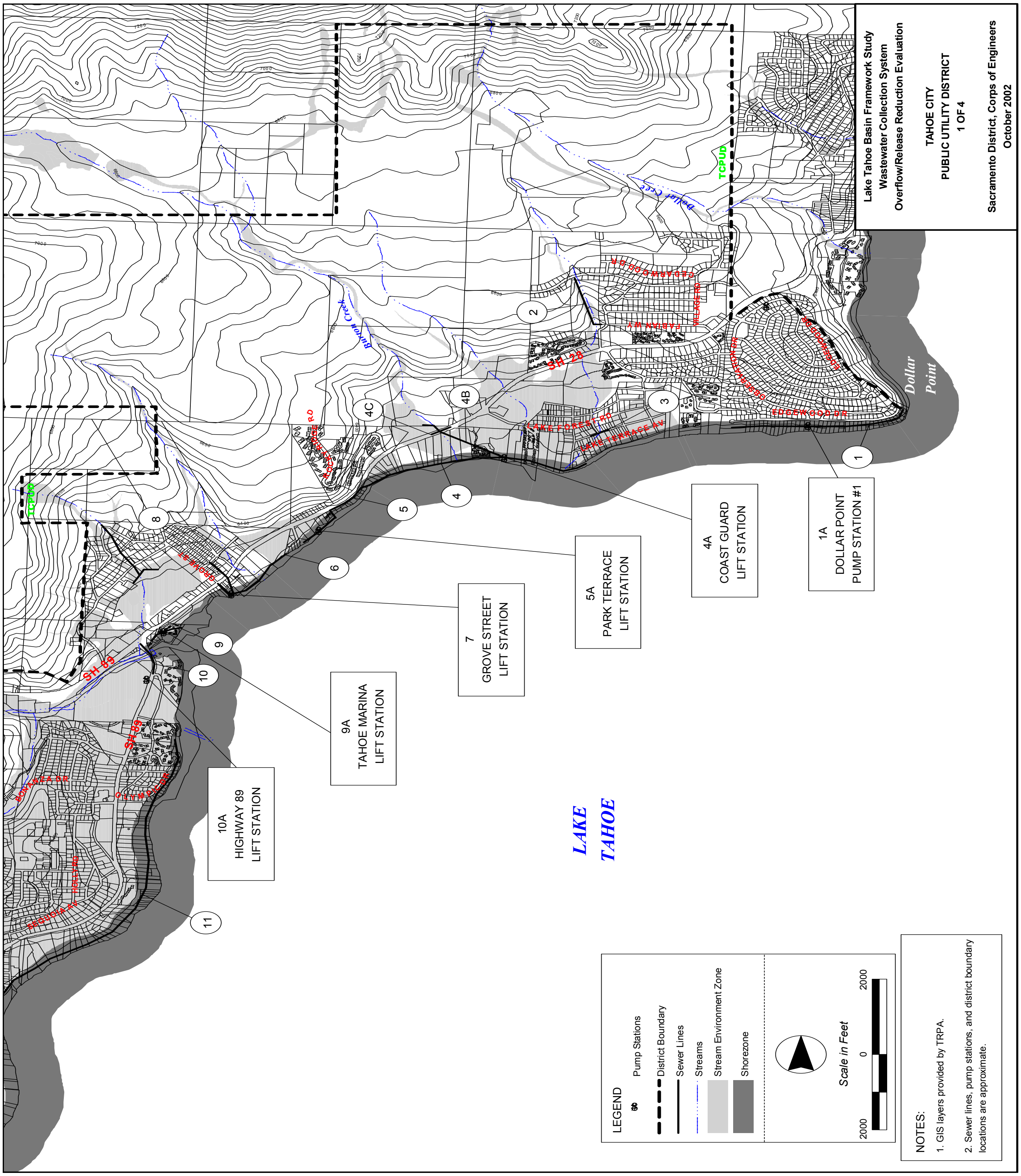

Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE CITY
PUBLIC UTILITY DISTRICT
1 OF 4
Sacramento District, Corps of Engineers
October 2002
1A
DOLLAR POINT
PUMP STATION #1
4A
COAST GUARD
LIFT STATION
5A
PARK TERRACE
LIFT STATION
7
GROVE STREET
LIFT STATION
9A
TAHOE MARINA
LIFT STATION
10A
HIGHWAY 89
LIFT STATION
LAKE
TAHOE
Dollar
Point
SH 28
SH 89
TCPUD
1
2
3
4
4B
4C
5
6
8
9
10
11
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 13-3

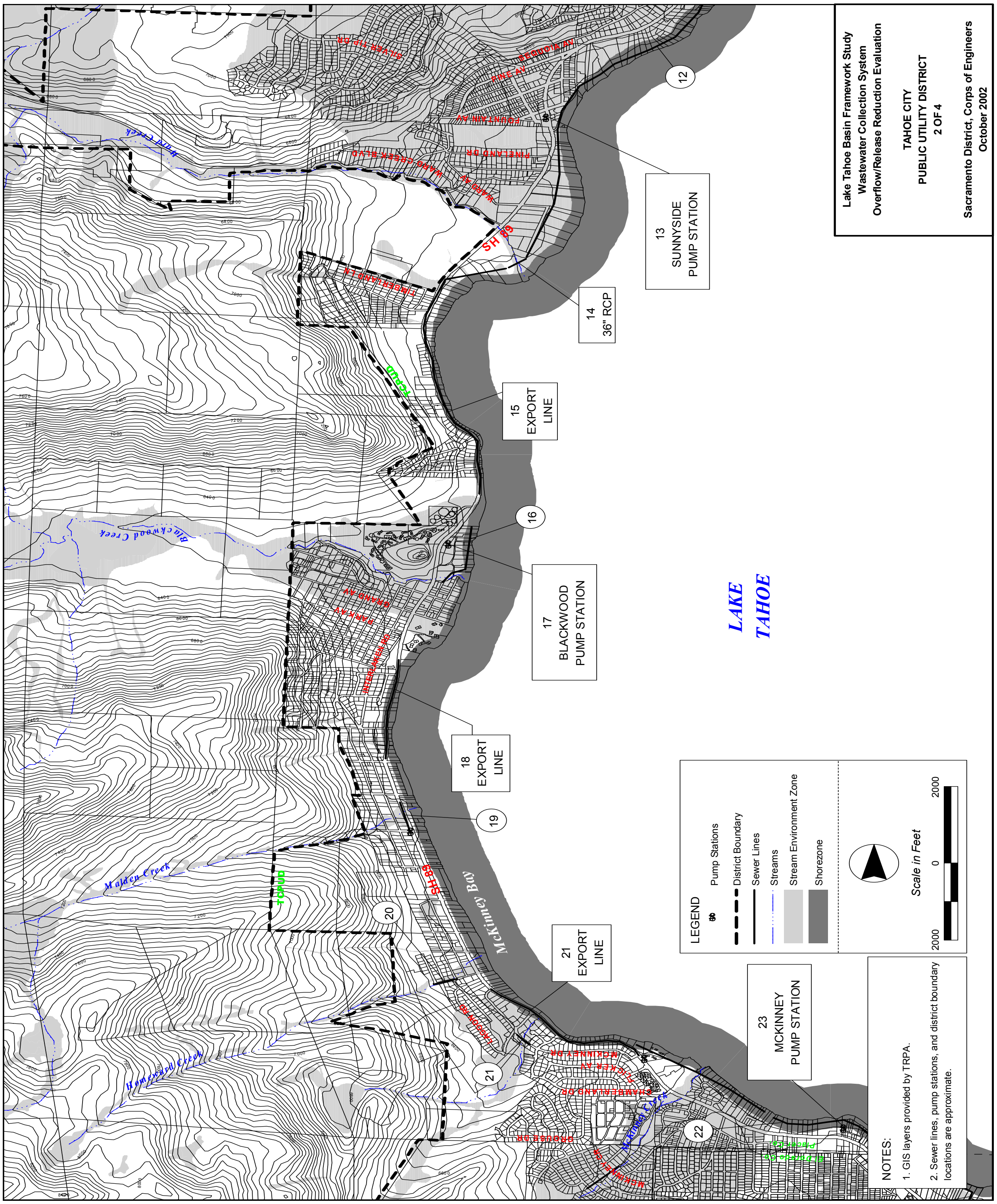
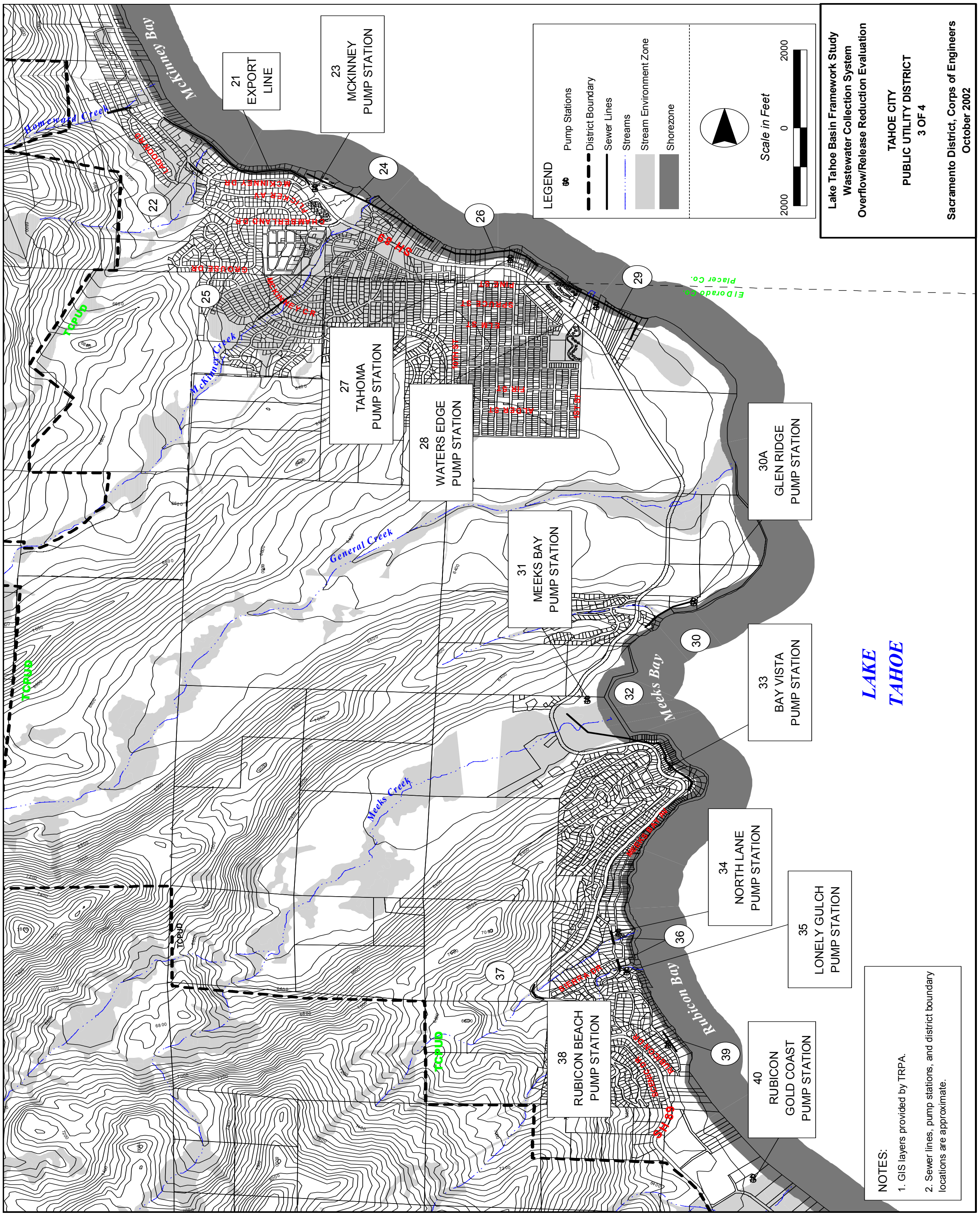

Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE CITY
PUBLIC UTILITY DISTRICT
2 OF 4
Sacramento District, Corps of Engineers
October 2002
12
13
SUNNYSIDE
PUMP STATION
14
36" RCP
15
EXPORT
LINE
16
17
BLACKWOOD
PUMP STATION
18
EXPORT
LINE
19
20
21
EXPORT
LINE
21
22
23
MCKINNEY
PUMP STATION
LAKE
TAHOE
Mckinney Bay
SH 89
Blackwood Creek
Madden Creek
Homewood Creek
Ward Creek
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 13-4


21
EXPORT
LINE
23
MCKINNEY
PUMP STATION
27
TAHOMA
PUMP STATION
28
WATERS EDGE
PUMP STATION
30A
GLEN RIDGE
PUMP STATION
31
MEEKS BAY
PUMP STATION
33
BAY VISTA
PUMP STATION
34
NORTH LANE
PUMP STATION
35
LONELY GULCH
PUMP STATION
38
RUBICON BEACH
PUMP STATION
40
RUBICON
GOLD COAST
PUMP STATION
22
24
25
26
29
30
32
36
37
39
McKinney Bay
Meeks Bay
Rubicon Bay
LAKE
TAHOE
Homewood Creek
McKinney Creek
General Creek
Meeks Creek
Placer Co.
El Dorado Co.
TCPUD
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
Lake Tahoe Basin Framework Study
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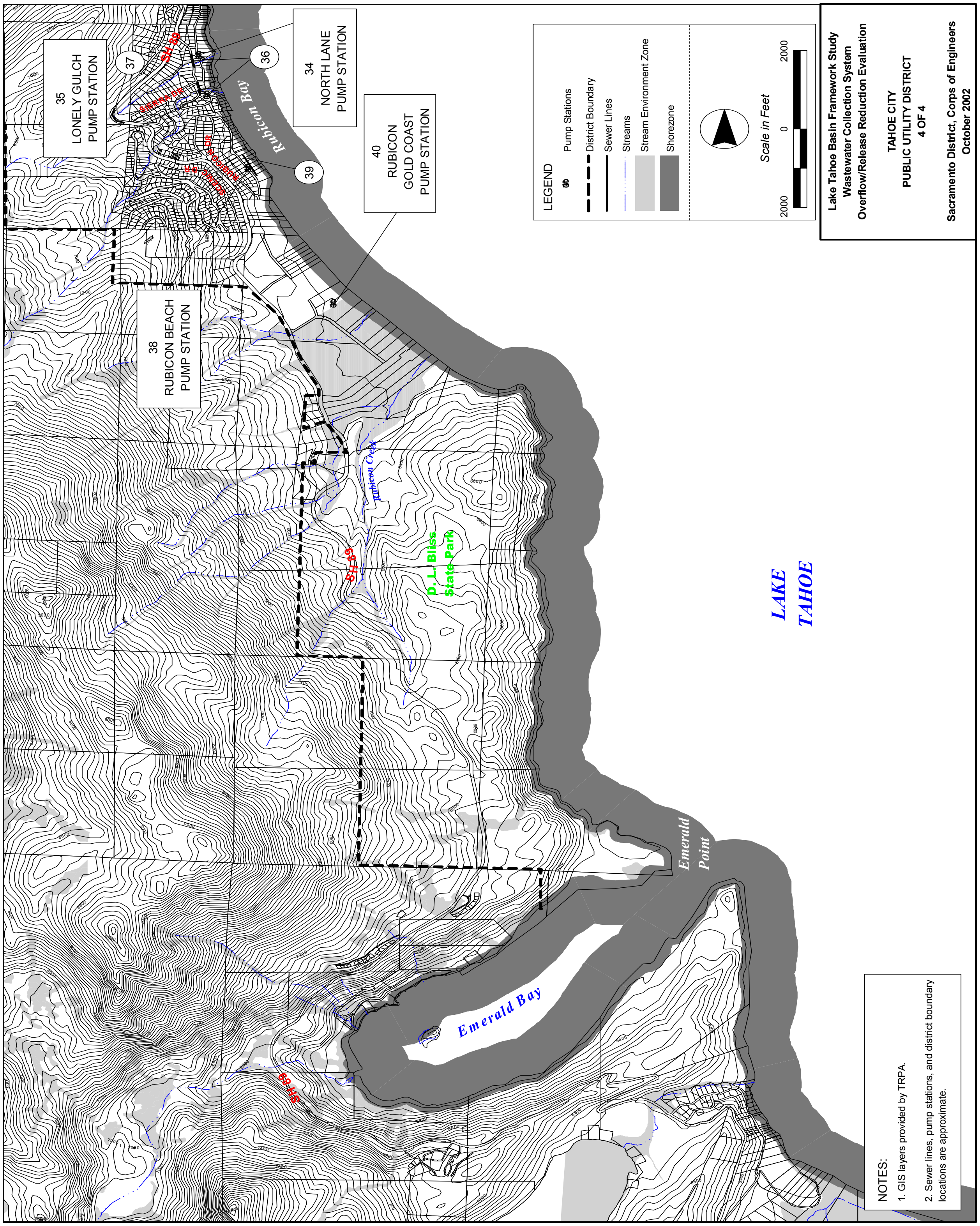
Overflow/Release Reduction Evaluation
TAHOE CITY
PUBLIC UTILITY DISTRICT
3 OF 4
Sacramento District, Corps of Engineers
October 2002
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 13-5


35
LONELY GULCH
PUMP STATION
34
NORTH LANE
PUMP STATION
40
RUBICON
GOLD COAST
PUMP STATION
38
RUBICON BEACH
PUMP STATION
37
36
39
Rubicon Bay
Rubicon Creek
SR 89
D. L. Bliss
State Park
LAKE
TAHOE
Emerald
Point
Emerald Bay
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000
0
2000
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
TAHOE CITY
PUBLIC UTILITY DISTRICT
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Sacramento District, Corps of Engineers
October 2002
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 13-6

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1	Lateral A - gravity line	8" ACP – Plastic Lined, Class 3300, 3,200 LF	B	Age Access Structural Structural Televising	Medium Medium High High Medium	1. Constructed in 1967 2. Located in foreshore 3. ACP liner pulling away 4. Portion of line exposed 5. Televised every 5 years	2
1A	Dollar Point Pump Station #1	2- 100 GPM pumps	B	Age Access Access Redundancy	High Medium Medium Medium	1. Constructed in 1967 2. Located in foreshore 3. Not accessible by vehicle by land 4. Has plug-in for portable power	2
1A	Dollar Point Force Main	4" CIP – 156 LF	B	Age Access	Medium Medium	1. Constructed in 1967 2. Not accessible by vehicle	5
2	Lateral "U" Gravity Line Parallels stream	6" – 1,600 LF	C	Age	Medium	1. Constructed in 1967	6
3	Sunrise Ave. Extension Gravity Line Creek crossing	6" – 260 LF	A	Age	Medium	1. Constructed in 1967	4
4	Laterals "H" and "V" – Gravity Line Creek crossing	1138 LF – 15" ACP – Plastic Lined; 3072 LF - 8" ACP – Plastic Lined	A	Age Access Structural	Medium Medium High	1. Constructed in 1967 2. Located in foreshore, line passes under several docks 3. Portion of line is located at toe of slope, manhole could be damaged by landslide	1
4A	Coast Guard Pump Station	2 – 700 GPM pumps	A	Age Structural	Medium Medium	1. Constructed in 1967 (pumping equipment and controls replaced in 1991) 2. Integrity of wet well interior is suspect	4
4B	Coast Guard Force Main	10" CIP and ACP – 2,700 LF	A	Age Access	Medium High	1. Constructed in 1967 2. Inspection difficult, no access points	1
4C	Siphon Creek crossing	18" – 760 LF	A	Age Redundancy	Medium Medium	1. Constructed in 1960's 2. No redundant barrel	4

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
5	"BB" and "CC" Gravity Line	6" – 1,500 LF	A	Age Access	Medium Medium	1. Constructed in 1958 2. Located in foreshore	4
5A	Park Terrace Pump Station	2 – 100 GPM pumps	A	Age Access Reported Releases	Low Medium Medium	1. Constructed in 1958 and re-constructed in 1989, new controls in 2002 2. Access via private driveway 3. Release reported in 1999 (telemetry failure)	4
5A	Park Terrace Force Main	4" ACP – 120 LF	A	Age	Medium	1. Constructed in 1989	4
6	Lake Terrace Gravity Line	6" – 1,980 LF	A	Age Capacity Cleaning	Medium Medium High	1. Constructed in 1956 2. High I/I upstream caused by faulty joints 3. Line requires frequent cleaning due to root intrusion	1
7	Grove Street Pump Station	2 – 275 GPM pumps Oldest pump station in the district	A	Reported Releases Age Access Structural Bypass	Medium High Medium High Medium	1. Release reported in 1995 2. Constructed in 1956 3. Located in foreshore 4. Excessive maintenance is required 5. Pump station can be bypassed with vacuum trucks	1
7A	Grove Street Force Main	4" ACP, PVC– 400 LF	A	Age Cleaning	Medium Medium	1. Constructed in 1956 2. Line requires frequent cleaning because of excessive grease build-up (serves many restaurants)	4
8	Main, "D", and "H" Gravity Lines Creek crossing	X" – 1,970 LF	A	Age Access	Medium Medium	1. Constructed in 1960's 2. Line runs parallel and crosses creek	4
9	Tahoe Marina Gravity Line	6" - 400 LF	C	Age Access	Medium Medium	1. Constructed in 1972 2. Located in foreshore	6
9A	Tahoe Marina Pump Station	2 – 100 GPM pumps	C	Age Access Redundancy Bypass	Medium Medium Medium Medium	1. Constructed in 1972 2. No wet well access with equipment unless driving on common area landscaping 3. No back-up generator, plug for portable 4. Pump station can be bypassed with vacuum trucks	6

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
9A	Tahoe Marina Pump Force Main	CIP – 400 LF	C	Age Televising Bypass	Medium High Medium	1. Constructed in 1972 (recent ultrasonic level control upgrade) 2. Portions of line do not have access points for televising 3. Can be bypassed using vacuum trucks at the pump station	3
10A	Highway 89 Pump Station	2 – 200 GPM pumps	A	Age Bypass	Medium Medium	1. Constructed in 1963 (pump equipment, controls, and standby generator replaced in 1991 and 1994) 2. Pump station can be bypassed with vacuum trucks 3. Integrity of wet well interior is suspect	4
10	Highway 89 Force Main	6" GSP - 400 LF	A	Age Structural Redundancy	Medium Medium Medium	1. Constructed in the 1960's 2. Attached to Fanny Bridge (Highway 89) 3. No redundant line	4
11	Lateral "A" and Tahoe Tavern Gravity Line	10" ACP – 2,900 LF	A	Age	Medium	1. Constructed in the 1960's	4
12	West Shore Export Line	36" – 1,500 LF	A	Age	Medium	1. Constructed in the 1960's	4
13	Sunnyside Pump Station	2 – 1200 GPM pumps 1 – 1000 GPM pump	A	Reported Releases Redundancy	High High	1. Two spills (Telemetry failure - 1986 and Flood related - 1997) 2. Generator capable of powering only 2 of the 3 pumps 3. Constructed in 1968 (Pumps and controls updated in 1991)	1
13A	Sunnyside Force Main	12" CIP – 2,500 LF 16" DIP – 2,500 LF	A	O&M	Medium	1. Provisions to facilitate inspection and cleaning of force main are limited (16" DIP installed in 1998)	4
14	West Shore Export Line	36" – 400 LF	A	Age	Medium	1. Constructed in the 1960's	4
15	West Shore Export Line	36" – 4,000 LF	A	Age	Medium	1. Constructed in the 1960's	4
16	Lateral "P" Gravity Line	6" – 1,200 LF	C	Age	Medium	1. Constructed in the 1960's	6
17	Blackwood Pump Station	3 – 1,750 GPM pumps	A	Redundancy Age	Medium	1. Constructed in 1969 (pumps and controls updated in 1991)	4
17	Blackwood Force Main	12" CIP – 90 LF 18" CIP – 90 LF	A	Age	Medium	1. Constructed in 1970s	4

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
18	West Shore Export Line	36" – 1,700 LF	A	Age	Medium	1. Constructed in the 1960's	4
19	West Shore Export Line (Madden Creek Crossing)	6" – 100 LF 12" – 100 LF (Force Main) 18" – 100 LF (Force Main)	A	Age	Medium	1. Constructed in the 1960's	4
20	Grand View Gravity Line Parallels stream	6" – 800 LF	B	Age	Medium	1. Constructed in the 1960's	5
21	West Shore Export Line	36" – 3,500 LF	A	Age	Medium	1. Constructed in the 1960's	4
22	Gravity Line Creek crossing	6" - 300 LF	C	Age	Medium	1. Constructed in the 1970s 2.	6
23	McKinney Pump Station	2 – 375 GPM pumps	A	Bypass Age Structural Access	Medium	1. Pump station can be bypassed with vacuum trucks 2. Constructed in 1969 (standby generator replaced in 1998, pumps and controls updated in 1991) 3. Can be subject to flooding from McKinney Creek 4. Presence of parked vehicles can impede emergency maintenance work	4
23	McKinney Force Main	6" PVC – 600 LF	A	Redundancy	High	1. No redundant line	1
24	Lateral "AAA" Gravity Line Parallels stream	6" x – 2,000 LF	B	Age	Medium	1. Constructed in 1970s	5
25	Lateral "LL" Gravity Line Parallels stream	6" - 1,000 LF	A	Age	Medium	1. Constructed in the 1960's	4
26	Lateral "AAA" Gravity Line	6" – 2,400 LF	C	Age	Medium	1. Constructed in 1970s	4

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
27	Tahoma Pump Station	2 – 150 GPM pumps	C	Bypass Age Access Structural	Medium	1. Pump station can be bypassed with vacuum trucks 2. Constructed in 1970 3. Access is difficult during deep snow conditions 4. Small trees growing adjacent to wet and dry wells that could cause structural damage	6
27	Tahoma Force Main	4” ACP (CL 150) – 310 LF	C	Redundancy	High	1. No redundant line	3
28	Waters Edge Pump Station	2 – 200 GPM pumps	B	Bypass	Medium	1. Pump station can be bypassed with vacuum trucks 2. Constructed in 1970 3. Wet well entrance frame can be subject to inflows	5
28	Waters Edge Force Main	6” ACP (CL 150) – 500 LF	B	Redundancy	High	1. No redundant line	2
29	Lateral “H” Gravity Line	6” – 1,700 LF	C	Age	Medium	1. Constructed in 1970s	6
30	Gravity Line	X” – 1,100 LF	C	Age	Medium	1. Constructed in 1970s	6
30A	Glenridge Pump Station	2 – 200 GPM pumps	B	Access Redundancy	Medium Medium	1. Steep and narrow roadway access, difficult during winter; difficult to deliver portable backup generator to the PS 2. No back-up generator, plug for portable 3. Constructed in 1973 4. Wet well entrance frame can be subject to inflows	5
30A	Glenridge Force Main	6” CIP – 1,330 LF	B	Redundancy	High	1. No redundant line	2
31	Meeks Bay Pump Station	2 – 400 GPM pumps	A	Age	Medium	1. Constructed in 1971 (pumps and controls updated in 1991) 2. Trees growing adjacent to wet well may cause damage from roots	4
31	Meeks Bay Force Main	12” CIP – 7,420 LF	A	Redundancy	High	1. No redundant line	1
32	Gravity Line	X” – 2,500 LF	B	Age	Medium	1. Constructed in 1970s	6
33	Bay Vista Pump Station	2 – 100 GPM pumps	***B***	Age Redundancy	Medium Medium	1. Constructed in the 1972 2. No on-site back-up generator - plug for portable	5

Table 13-2. Summary of Potential Problems for Critical Sewer Facilities in TCPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
34	North Lane Pump Station	2 – 250 GPM pumps	A	Age	Medium	1. Constructed in 1972	4
34	North Lane Force Main	6” CIP – 1,400 LF	A	Redundancy	High	1. No redundant line	1
35	Lonely Gulch Pump Station	2 – 100 GPM pumps	B	Age	Medium	1. Constructed in 1972 2. Wet well entrance frame can be subjected to inflows	5
36	Gravity sewer Creek crossing	X” – 200 LF	B	Age	Medium	1. Constructed in 1970s	4
37	Gravity sewer Creek crossing	X” – 200 LF	C	Age	Medium	1. Constructed in 1970s	6
38	Rubicon Beach Pump Station	2 – 100 GPM pumps	C	Age	Medium	1. Constructed in 1972	4
39	Gravity sewers	6” DI – 350 LF Lateral “E” in within shorezone	B	Age	Medium	1. Constructed in 1970s 2. Manhole tops are buried 3. Access for maintenance is difficult	5
40A	Gravity sewers	X” – 3100 LF	B	Age	Medium	1. Constructed 1970s	5
40	Rubicon Gold Coast Pump Station	2 sets of 2 in-series pumps, 700 GPM capacity	A	Age Structural	Medium High	1. Constructed in 1971 2. Parts Variable speed controls are difficult to obtain 3. Pumping equipment requires excessive maintenance (scheduled for replacement 2003) 4. Standby generator is difficult to repair and parts are difficult to obtain	1

Table 13-3. Summary of Alternative Measures for TCPUD

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
1	High	Lateral A - gravity line - 8" ACP – Plastic Lined, Class 3300, 3,200 LF Structural problems; line is middle age; access from lakeshore	1. Conventional or trenchless replacement 2. Elimination of line with conversion to low-pressure grinder pump system for 40 parcels	• Eliminate with conversion to grinder pump/small diameter force main installations for currently connected parcels	4,309,400	2
1A	High	Dollar Point Pump Station #1 - 2- 100 GPM pumps PS is middle age; not accessible with vehicles by land; plug for backup power generator only	1. Relocate PS 2. Re-establishment of easement for access 3. Replacement with conversion to grinder pump system – See above for Location 1	• Replace - See above for Location 1	N/A	2
1A	Medium	Dollar Point Force Main 4" CIP – 156 LF Line is middle age; not accessible by land with vehicle	1. Monitor through regular cleaning and inspection 2. Relocation of force main 3. Replacement with conversion to grinder pump system – See above for Location 1	• Replace – See above for Location 1	N/A	5
2	Medium	Lateral "U" Gravity Line 6" – 1,600 LF, Parallels stream Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement 4. Reinforcement of stream bank	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1600 LF of gravity sewers	276,200	6
3	Medium	Sunrise Ave. Extension Gravity Line 6" – 260 LF Creek crossing Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with slip lining 260 LF of gravity sewers	101,400	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
4	High	Laterals "H" and "V" – Gravity Lines, 8" - 3,072 LF and 15" – 1138 LF - ACP – Plastic Lined, (4,210 LF total) Creek crossing Lines are middle age Sewer is located in foreshore under several docks; Manhole could be damaged by landslide	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement 4. Replacement with relocation	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 4210 LF of gravity sewers	913,000	1
4A	High	Coast Guard Pump Station 2 – 700 GPM pumps PS is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary (replaced in 1991)	180,300	4
4B	High	Coast Guard Force Main 10" CIP and ACP – 2,700 LF Line middle age No pipeline access points for interior inspection	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 500–foot intervals • Perform monitoring and maintenance – annual cleaning and TV inspection	178,000	1
4C	Medium	Siphon 18" – 760 LF Creek crossing Line is middle age; No redundant barrel	1. Addition of second barrel and appurtenant facilities 2. Replacement of force main	• Install second barrel and appurtenant facilities	676,900	4
5	Medium	"BB" and "CC" Gravity Line 6" – 1,500 LF Sewer is old	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1500 LF of gravity sewers	465,600	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
5A	Medium	Park Terrace Pump Station - 2 – 100 GPM pumps PS is middle age; Access is limited to private driveway; No on-site backup generator, plug for portable generator only	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Provision of easement for accessing PS 4. Installation of on-site backup power	• Perform regular O&M • Replace pumping equipment and controls when necessary (new controls in 2002)	69,300	4
5A	Medium	Park Terrace Force Main 4" ACP – 120 LF Line is middle age	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports 5. Monitor through regular cleaning and inspection	• Monitor through regular cleaning and inspection • Replace 120 LF of force main	41,700	4
6	High	Lake Terrace Gravity Line 6" – 1,980 LF Cleaning requires high maintenance; line is old; high I/I due to root intrusion	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1,980 LF of gravity sewers	528,300	1
7	High	Grove Street Pump Station - 2 – 275 GPM pumps PS is old; excessive maintenance required; PS can be bypassed with vactor trucks	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement with relocation of pump station	• Construct new replacement pump station (reference is to current TCPUD planning)	1,539,900	1
7A	Medium	Grove Street Force Main 4" ACP, PVC– 400 LF Sewer is old; frequent cleaning due to grease buildup	1. Procedures for bypassing force main 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 200–foot intervals • Perform monitoring and maintenance – annual cleaning and TV inspection	88,900	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
8	Medium	Main, "D", and "H" Gravity Lines X" – 1,970 LF – parallels and crosses creek Line is old	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1970 LF of gravity sewers	391,700	4
9	Medium	Tahoe Marina Gravity Line 6" - 400 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 400 LF of gravity sewers	119,600	6
9A	Medium	Tahoe Marina Pump Station - 2 – 100 GPM pumps Plug for backup generator only; bypass PS with vac trucks; access limited for equipment - requires driving on landscaped area	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Re-establishment of access easement	• Perform regular O&M • Replace pumping equipment and controls when necessary (recent ultrasonic level control upgrade)	69,300	6
9A	High	Tahoe Marina Pump Force Main CIP – 400 LF Access points for inspection are limited; bypass line with vac trucks at PS	1. Provision of parallel line 2. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Install line-size inspection/cleaning ports at 200–foot intervals	41,700	3
10A	High	Highway 89 Pump Station - 2 – 200 GPM pumps PS is old; bypass with vactor trucks	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
10	Medium	Highway 89 Force Main 6" GSP - 400 LF No redundant line; line is old; structural dependence on bridge	1. Provision of parallel line 2. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 200–foot intervals • Perform monitoring and maintenance – annual cleaning and TV inspection	88,900	4
11	Medium	Lateral "A" and Tahoe Tavern Gravity Line 10" ACP – 2,900 LF Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 2900 LF of gravity sewers	434,600	4
12	Medium	West Shore Export Line 36" x – 1,500 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1500 LF of gravity sewers	1,383,800	4
13	High	Sunnyside Pump Station - 3 – 2400 GPM pumps 2 spills is 16 years; backup power limited to 2 of three pumps only	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Provision of supplemental on-site backup power for third pump	• Perform regular O&M • Replace pumping equipment and controls when necessary (updated in 1991) • Add generator for third pump to supplement existing backup power system	346,800	1

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
13A	Medium	Sunnyside Force Main 12" CIP – 2,500 LF; 16" DIP – 2,500 LF Lines are middle age; No provisions to facilitate inspection and cleaning of force mains	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Install line-size inspection/cleaning ports at 500–foot intervals (16" DIP installed in 1998)	444,000	4
14	Medium	West Shore Export Line 36" x – 400 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 400 LF of gravity sewers	332,900	4
15	Medium	West Shore Export Line 36" x – 4,000 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 4000 LF of gravity sewers	2,566,400	4
16	Medium	Lateral "P" Gravity Line 6" x – 1,200 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1200 LF of gravity sewers	291,500	6
17	Medium	Blackwood Pump Station - 3 – 1,750 GPM pumps Pump No. 3 is without controls	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary (updated in 1991)	27,800	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
17	Medium	Blackwood Force Main 12" CIP – 90 LF; 18" CIP – 90 LF Lines are middle age	1. Replacement of force main 2. Provision of parallel line 3. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Replace force mains	291,400	4
18	Medium	West Shore Export Line 36" x – 1,700 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 17010 LF of gravity sewers	1,550,000	4
19	Medium	West Shore Export Line (Madden Creek Crossing) 6" x – 100 LF; 12" x – 100 LF (Force Main); 18" x – 100 LF (Force Main) Lines are middle age	1. Replacement of force main 2. Provision of parallel line 3. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1000 LF of gravity sewers • Replace force mains	331,600	4
20	Medium	Grand View Gravity Line 6" x – 800 LF - Parallels stream Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement 4. Reinforcement of stream bank	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 800 LF of gravity sewers	171,900	5
22	Medium	Gravity Line 6" - 300 LF - Creek crossing Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 300 LF of gravity sewers	106,700	6

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
23	Medium	McKinney Pump Station - 2 – 750 GPM pumps Bypass PS with vactor trucks	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Prepare flood protection study • Install no-parking restraints • Replace pumping equipment and controls when necessary (pumps and controls updated in 1991, standby generator replaced in 1998)	83,200	4
23	High	McKinney Force Main 6" PVC – 600 LF Without redundant line	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Install line-size inspection/cleaning ports at 200–foot intervals	124,900	1
24	Medium	Lateral "AAA" Gravity Line 6" x – 2,000 LF - Parallels stream	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement 4. Reinforcement of stream bank	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 2000 LF of gravity sewers	328,200	5
25	Medium	Lateral "LL" Gravity Line 6" x - 1,000 LF - Parallels stream Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1000 LF of gravity sewers	197,900	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
26	Medium	Lateral "AAA" Gravity Line 6" – 2,400 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 2,400 LF of gravity sewers	380,600	4
27	Medium	Tahoma Pump Station - 2 – 300 GPM pumps Bypass PS with vac trucks Plug for backup generator only	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary • Install all-weather access path • Install bollard protection around electrical system pole • Install permanent backup generator	22,100	6
27	High	Tahoma Force Main 4" ACP (CL 150) – 310 LF Without redundant line	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 200–foot intervals • Perform monitoring and maintenance – annual cleaning and TV inspection	83,200	3
28	Medium	Waters Edge Pump Station - 2 – 400 GPM pumps Bypass PS with vactor trucks	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	5
28	High	Waters Edge Force Main 6" ACP (CL 150) – 500 LF Without redundant line	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 200-foot intervals	27,800	2

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
29	Medium	Lateral "H" Gravity Line 6" – 1,700 LF Line middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1,700 LF of gravity sewers	356,800	6
30	Medium	Gravity Line X" – 1,100 LF Line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 1,100 LF of gravity sewers	278,500	6
30A	Medium	Glenridge Pump Station - 2 – 400 GPM Plug for backup power generator only; access is steep and narrow	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Relocation of pump station	• Perform regular O&M • Provide on-site backup power • Raise wet well entrance frame to prevent inflow • Replace pumping equipment and controls when necessary	97,100	5
30A	High	Glenridge Force Main 6" CIP – 1,330 LF Without redundant line	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Install line-size inspection/cleaning ports at 500–foot intervals	83,200	2
31	Medium	Meeks Bay Pump Station - 2 – 400 GPM Pump station is aging	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary (updated in 1991)	124,900	4

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
31	High	Meeks Bay Force Main 12" CIP – 7,420 LF Without redundant line	1. Procedures to bypass 2. Replacement 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Perform monitoring and maintenance – annual cleaning and TV inspection • Install line-size inspection/cleaning ports at 500–foot intervals	83,200	1
32	Medium	Gravity Line X" – 2,500 LF	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 2,500 LF of gravity sewers	326,200	6
33	Medium	Bay Vista Pump Station - 2 – 100 GPM Plug for backup power only; PS is old	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary • Install permanent backup generator	111,000	5
34	High	North Lane Pump Station - 2 – 500 GPM	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	4
34	High	North Lane Force Main 6" CIP – 1,400 LF Without redundant line	1. Procedures to bypass 2. Replacement of force main 3. Provision of parallel line 4. Provision of force main cleaning/inspection ports	• Install line-size inspection/cleaning ports at 500–foot intervals • Perform monitoring and maintenance – annual cleaning and TV inspection	N/A	1

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
35	Medium	Lonely Gulch Pump Station - 2 pumps, 200 GPM	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Raise elevation of wet well frame to prevent inflow • Replace pumping equipment and controls when necessary	69,500	5
36	Medium	X" – 200 LF gravity sewer Creek crossing; line is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with slip lining 200 LF of gravity sewers	93,600	4
37	Medium	X" – 200 LF gravity sewer Creek crossing	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with slip lining 200 LF of gravity sewers	93,600	6
38	Medium	Rubicon Beach Pump Station – 2 pumps, 200 GPM Access is difficult	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Relocation of pump station	• Perform regular O&M • Replace pumping equipment and controls when necessary	41,700	4
39	Medium	Gravity sewers X" – 350 LF	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 350 LF of gravity sewers	45,700	5

Table 13-3. Summary of Alternative Measures for TCPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
40A	Medium	Gravity sewers X" – 3,100 LF	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate with CIPP 3,100 LF of gravity sewers	1,603,300	5
40	High	Rubicon Gold Coast Pump Station – 4 pumps, 1,400 GPM	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls 3. Replacement of on-site backup power systems	• Perform regular O&M • Replace backup power facilities • Replace pumping equipment and controls when necessary (scheduled for replacement, 2003)	222,000	1

14.0 NORTH TAHOE PUBLIC UTILITY DISTRICT

14.1 Organization

The North Tahoe Public Utility District (NTPUD) was founded in 1948 to collect, treat, and dispose of wastewater from Kings Beach, Brockway, Tahoe Vista and the surrounding areas, refer to Figure 1-1. By 1978, all wastewater from NTPUD was transported to a new regional treatment facility in the Martis Valley (Truckee, CA). Today the NTPUD operates the wastewater collection and transportation system. Along with the wastewater operations, NTPUD also operates a water treatment facility, the recreation programs, and the beaches and parks within its district boundaries.

14.2 Master Plans and Other Pertinent Documentation

The current Sewer Master Plan for the NTPUD was written in 1991. There are plans to update the Sewer Master Plan, but no date has been established. The Tahoe Basin Sewer Systems Exfiltration/Overflow Study was performed from 1982 through 1983. No other exfiltration study has been performed. No inflow/infiltration (I/I) study has been performed, but I/I has been carefully looked at through maintenance and rehabilitation projects.

14.3 Overview of Sewer System

NTPUD transports sewage from a number of communities along the north shore of Lake Tahoe. Because of the terrain, many pump stations are required to transport sewage to the treatment facility. Sewage generally flows toward the lake in gravity collection lines, where it is collected and pumped through one or more of the four main pump stations. A satellite pump station may be required in areas where the lowest point in the gravity system is too low to flow into a main station. Refer to Table 14-1 for the NTPUD sewer system information.

Sewer System Information:

Table 14-1. NTPUD Sewer System Information

Service Area	6.5 Square miles
1. Length of Mains	84 miles
Length of Force Mains	7 miles
Size of mains	6 – 36 inches in diameter
Pump Facilities	18
Manholes	NA
Sewer System Mapping	Yes – Digital
Service Connections*	5,046
Average Daily Flow	1.23 million gallons
Peak Daily Flow	3.8 million gallons
Design Daily Flow	11 million gallons

*Service Connection Data 1998

14.4 Treatment Facilities

The NTPUD exports its sewerage to the Tahoe Truckee Sanitary Sewer Agency (TTSA). The export lines starts at the Dollar Hill pump station and travels through the Tahoe City Public Utility District where it heads out of the basin following State Highway 89 to Truckee.

14.5 Maintenance Program

The NTPUD schedules television inspection every 3 to 5 years for sewer line inspection. Sewer lines are flushed with a high-pressure wash and then televised. Any cracks, minor joint displacement, leaking service connections, etc. are grouted and sealed.

The NTPUD also has “holiday lines”. These are lines that are either flat or have a higher potential of being plugged. These lines are typically flushed before large holidays. Most of these lines are near restaurants along Highway 28.

14.5.1 Inflow and Infiltration (I/I) Conditions

Inflow and infiltration has not been an issue according to the district. Wet weather tends to increase flow, but not significantly.

14.5.2 Observed Overflow/Spills

Recorded overflow and spills over the last several years have been reported at less than one per year. Spill records were obtained from the Lahontan Regional Water Quality Control Board and from interviews with NTPUD. Seven spills have been reported over the last 15 years. Only one location had reported 2 spills. The quantity of sewage spilled was reported from 50 gallons to 600 gallons.

14.5.3 Regulatory Enforcement Actions

Currently, there are no regulatory enforcement actions against NTPUD.

14.5.4 Existing/Anticipated Capacity Limitations

The sewer collection systems in the Lake Tahoe basin were designed for a much greater population than the current population. In general, capacity is not an issue for NTPUD.

14.6 Identification and Prioritization of Problems

Sewer facilities within the study area including gravity sewers, manholes, pump stations, and force mains were identified from district maps, interviews with district personnel, and field inspections. These facilities were mapped and the assessment of risk based on the discussion from Chapter 5 was applied to each of these sewer facilities. An overview of the NTPUD is shown on Figure 14-1. Figures 14-2 and 14-3 identify the location of the problem facilities. Table 14-2 identifies the type and description of the facility, the category, the criteria, the risk factor, and then briefly describes the problem. A priority level is then assigned to the identified problem. Table 14-3 identifies the problem, lists several alternative measures, and then describes a potential action plan. First costs are given for the selected measure and the priority level for each problem is listed. These measures are discussed in more detail in Chapter 6.

Operation and maintenance is generally the first potential action plan for most conditions. No costs were given for the continued operation and maintenance of the sewer system. It was assumed that the sewer districts know the operation and maintenance costs.

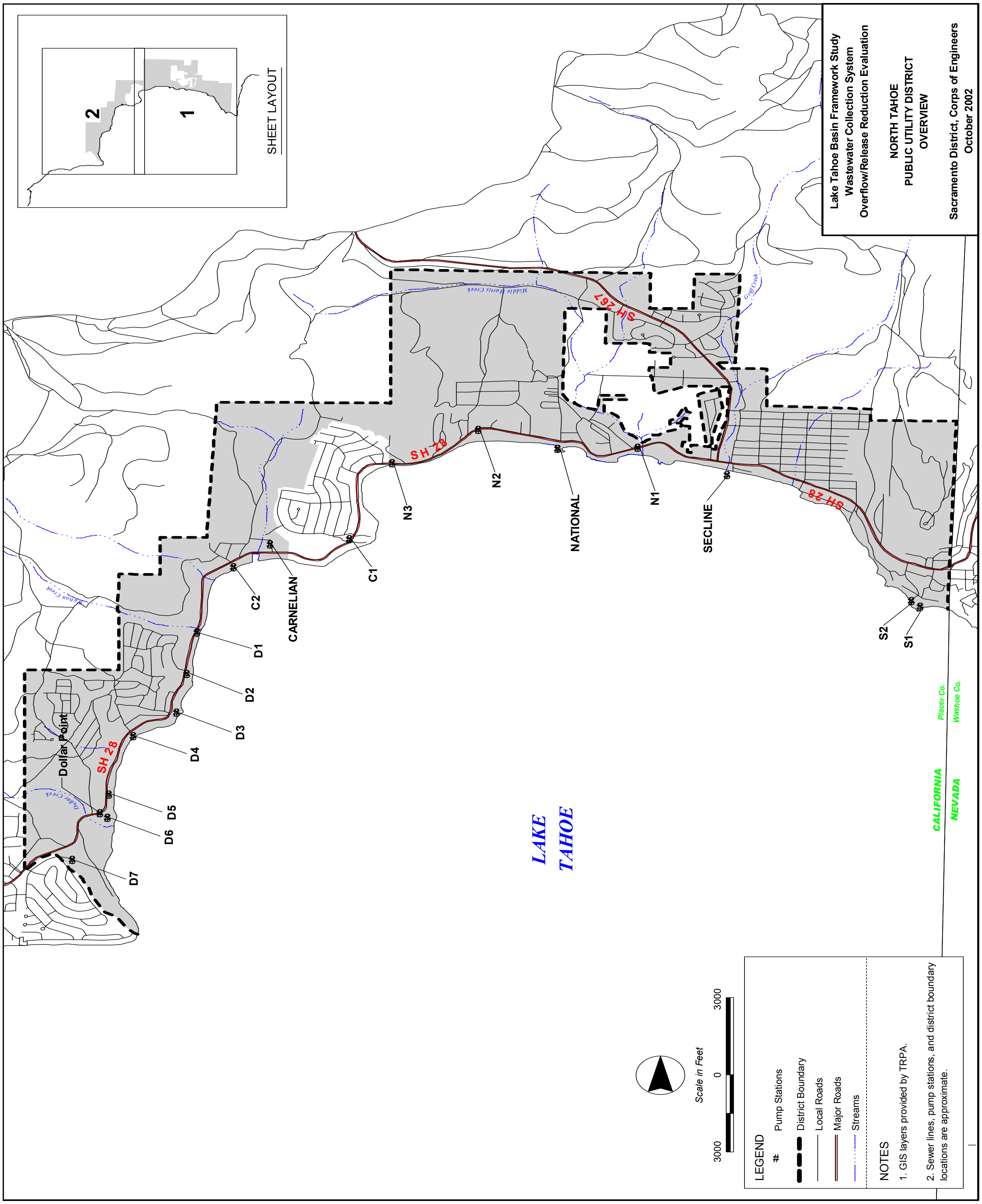
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
NORTH TAHOE
PUBLIC UTILITY DISTRICT
OVERVIEW
Sacramento District, Corps of Engineers
October 2002
SHEET LAYOUT
1
2
LAKE
TAHOE
SH 28
SH 267
Middle Martis Creek
Dollar Point
Dollar Creek
D1
D2
D3
D4
D5
D6
D7
C1
C2
CARNELIAN
N1
N2
N3
NATIONAL
SECLINE
S1
S2
CALIFORNIA
NEVADA
Placer Co.
Washoe Co.
Scale in Feet
3000
0
3000
LEGEND
Pump Stations
District Boundary
Local Roads
Major Roads
Streams
NOTES
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 14-1

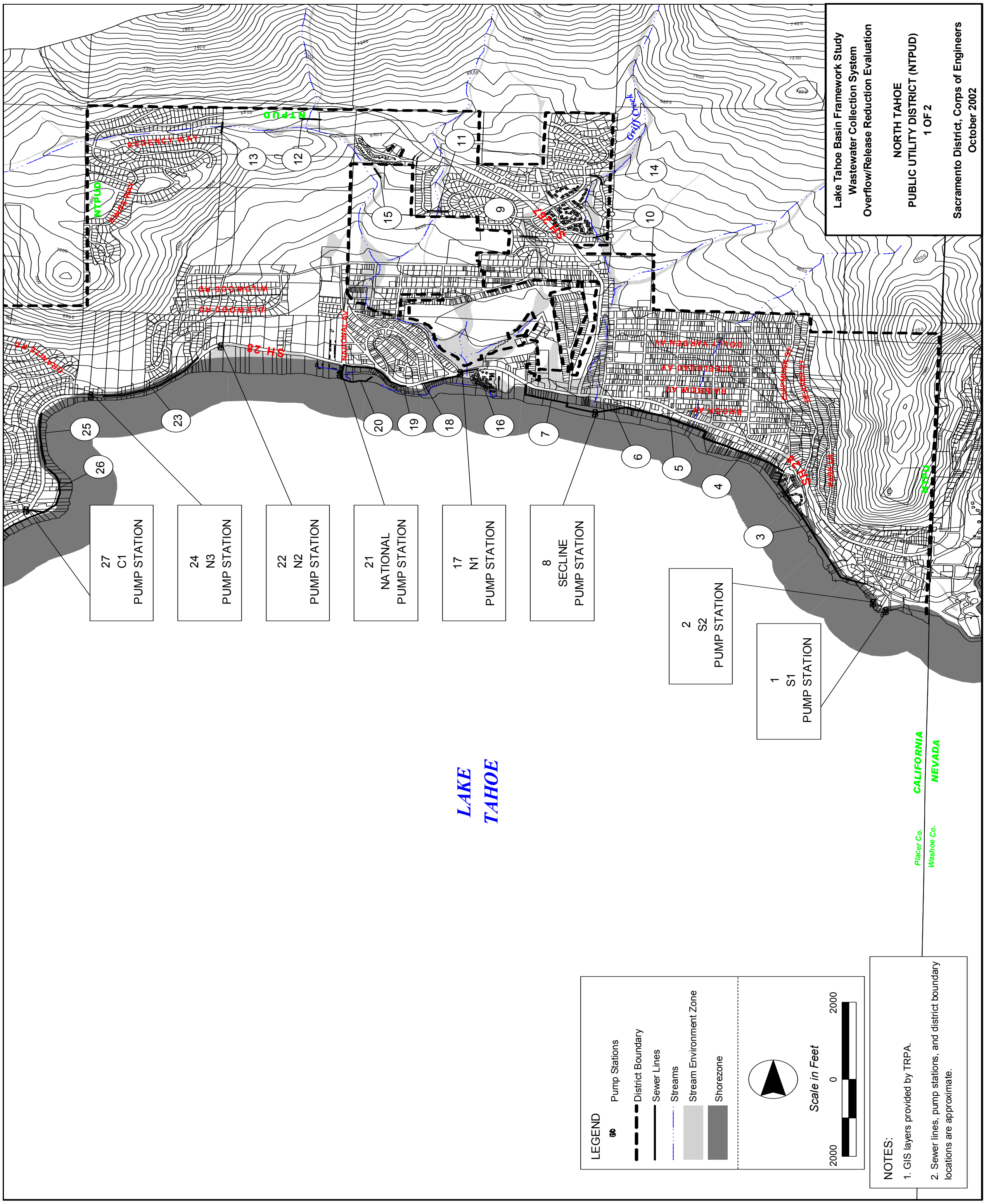
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
NORTH TAHOE
PUBLIC UTILITY DISTRICT (NTPUD)
1 OF 2
Sacramento District, Corps of Engineers
October 2002
27 C1 PUMP STATION
24 N3 PUMP STATION
22 N2 PUMP STATION
21 NATIONAL PUMP STATION
17 N1 PUMP STATION
8 SECLINE PUMP STATION
2 S2 PUMP STATION
1 S1 PUMP STATION
LAKE TAHOE
CALIFORNIA
NEVADA
Placer Co.
Washoe Co.
NTPUD
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000 0 2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.

Figure 14-2

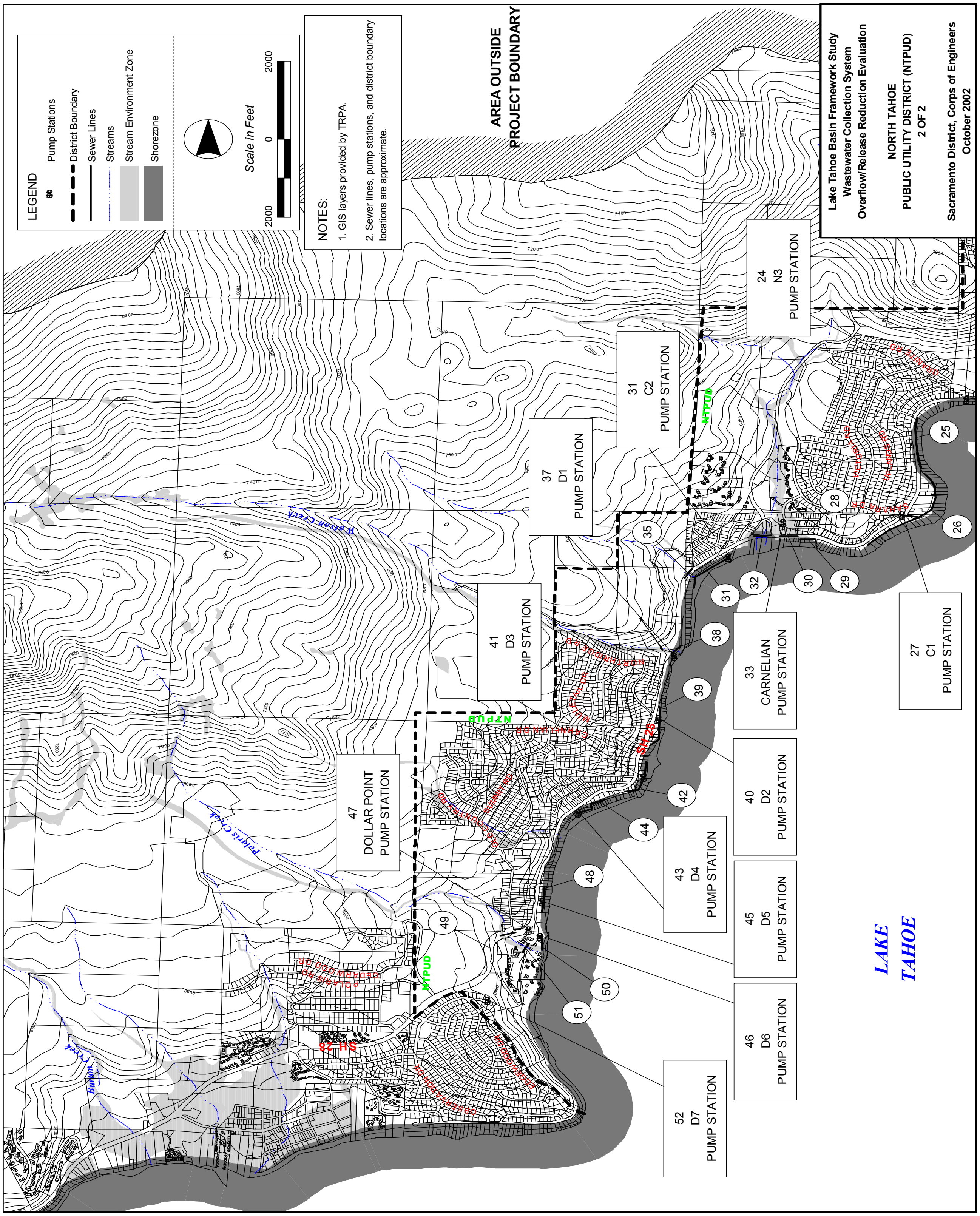
LEGEND
Pump Stations
District Boundary
Sewer Lines
Streams
Stream Environment Zone
Shorezone
Scale in Feet
2000 0 2000
NOTES:
1. GIS layers provided by TRPA.
2. Sewer lines, pump stations, and district boundary locations are approximate.
AREA OUTSIDE PROJECT BOUNDARY
Lake Tahoe Basin Framework Study
Wastewater Collection System
Overflow/Release Reduction Evaluation
NORTH TAHOE PUBLIC UTILITY DISTRICT (NTPUD)
2 OF 2
Sacramento District, Corps of Engineers
October 2002
24 N3 PUMP STATION
31 C2 PUMP STATION
37 D1 PUMP STATION
41 D3 PUMP STATION
47 DOLLAR POINT PUMP STATION
33 CARNELIAN PUMP STATION
27 C1 PUMP STATION
40 D2 PUMP STATION
43 D4 PUMP STATION
45 D5 PUMP STATION
46 D6 PUMP STATION
52 D7 PUMP STATION
NTPUD
SH 28
Watson Creek
Burton Creek
LAKE TAHOE

Figure 14-3

Table 14-2. Summary of Potential Problems for Critical Sewer Facilities in NTPUD

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
1	Pump Station S1	2-75 GPM pumps	C	Age Redundancy	Medium Medium	1. Constructed before 1977 2. Has plug for hookup of portable backup power generator	6
2	Pump Station S2	2-75 GPM pumps	C	Age Redundancy	Medium Medium	1. Constructed before 1977 2. Has plug for hookup of portable backup power generator	6
3	Gravity sewer	15" AC – 3915 LF	B	Age Capacity Access	Medium Low Medium	1. Constructed before 1977 2. Oversized 3. Access limited by lakefront homes	5
4	Gravity sewer	X" – 475 LF	C	Age	Medium	1. Constructed before 1977	6
5	Gravity sewer	X" – 8400 LF	C B A	Age	Medium Medium Medium	1. Constructed before 1977	4
6	Gravity sewer	16" DIP – 750 LF	A	Age Structural	Medium	1. Constructed before 1977 2. Sewer is wet – subject to lake wave action 3. Manholes are exposed to wave action but are protected by riprap	4
7	Force main (A main wastewater export component)	14" – 2100 LF	A	Age	Medium	1. Constructed before 1977 2. Force main is in shorezone	4
8	Secline Pump Station (A main wastewater export pump station)	1-2400GPM and 1-xxx GPM pumps	A	Age	Medium	1. Constructed before 1977 2. Has on-site generator facilities for backup power	4
9	Gravity sewer; Creek crossing	X" – 275 LF	A	Age	Medium	1. Constructed before 1977	5
10	Gravity sewer; Creek crossing	X" – 250 LF, 1 MH	A	Age	Medium	1. Constructed before 1977	4
11	Gravity sewer; Creek crossing	X" – 404 LF, 2 MHs	C	Age	Medium	1. Constructed before 1977	6

Table 14-2. Summary of Potential Problems for Critical Sewer Facilities in NTPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
12	Gravity sewer; Creek crossing	X" – 250 LF, 3 MHs	A	Age	Medium	1. Constructed before 1977	4
13	Gravity sewer; Creek crossing	X" – 275 LF, 2 MHs	B	Age	Medium	1. Constructed before 1977	5
14	Gravity sewer; Creek crossing	X" – 256 LF, 2 MHs	A	Age	Medium	1. Constructed before 1977	4
15	Gravity sewer; Creek crossing	X" – 250 LF, 2 MHs	A	Age	Medium	1. Constructed before 1977	4
16	Gravity sewer; Creek crossing	X" – 250 LF, 2 MHs In Hwy 28 near Pump Station N1	C	Age	Medium	1. Constructed before 1977	6
17A	Force main Creek crossing	14" – 250 LF in Hwy 28 near Pump Station N1	A	Age	Medium	1. Constructed before 1977	4
17	Pump Station N1	2-100 GPM pumps,	A	Age O&M Bypass	Medium Medium	1. Constructed before 1965 2. Can be bypassed with some effort	6
18	Gravity sewer	X" – 1,081 LF	A	Age	Medium	1. Constructed before 1965	6
19	Gravity sewer	X" – 1,563 LF	C	Age	Medium	1. Constructed before 1965 2. Located near/within shorezone	6
20	Force main	14" – 600 LF	A	Age	Medium	1. Constructed before 1977 2. Located in beach 3. Needs replacement 4. Located within shorezone	1

Table 14-2. Summary of Potential Problems for Critical Sewer Facilities in NTPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
21 National Pump Station	A main wastewater export facility for the District	2- 2,350 GPM pumps, 1-750 GPM pump	A	Age	Medium	1. Constructed before 1977 2. One spill observed at MH upstream of pump station 3. A recent spill occurred in 2002 due to operator error 4. Can bypass pump station with portable pump 5. Generator for backup power is on-site	4
22	Pump Station N2	2 – 25 GPM pumps	C	Age	Medium	1. Constructed before 1977 2. No on-site permanent backup power	6
23	Force main	20" – 2000 LF in Hwy 28 Granite to Estates Dr	A	Age	Medium	1. Constructed before 1977 2. Located within shorezone 3. Sections of the force main can be bypassed	4
24	Pump Station N3	2 – 100 GPM pumps	C	Age	Medium	1. Constructed before 1977	6
25	Force main	20" – 1,000 LF in Hwy 28 South of Agate Rd	A	Age	Medium	1. Constructed before 1977 2. Located within shorezone 3. Sections of the force main can be bypassed	4
26	Gravity sewer	X" – 1,440 LF, west and east to Pump Station C1	C	Age	Medium	1. Constructed before 1977	6
27	Pump Station C1	2 – 100 GPM pumps	C	Age	Medium	1. Constructed before 1977 2. No on-site backup power; plug for portable generator	6
28	Gravity sewer Creek crossing	X" – 250 LF	A	Age	Medium	1. Constructed before 1977 2. Located within stream zone	4
29	Gravity sewer	6" – 336 LF	C	Age	Medium	1. Constructed before 1977	6
30	Force main	20" FM to Carnelian PS in vicinity of Onyx St. and Hwy 28	A	Age O&M Bypass	Medium High	1. Force main can not be isolated (in 3000' section as for other export force main components in the District) with installation of temporary piping for inspection, maintenance, or repairs	1
31	Pump Station C2	2- 300 GPM pumps Located in Garwood's parking lot	A	Age	Medium	1. Constructed before 1977	4
32	Force main Creek crossing	24" - 250 LF	A	Age	Medium	1. Constructed before 1977 2. Located within stream zone	4

Table 14-2. Summary of Potential Problems for Critical Sewer Facilities in NTPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
33 Carnelian Pump Station	A main wastewater export facility for the District	2 – 2,870 GPM pumps, 1 – 850 GPM pump	A	Age	Medium	1. 1986 for upgrades	4
35	Gravity sewer Creek crossing	X" – 250 LF In Hwy 28	C	Age	Medium	1. Constructed before 1977 2. Located within stream zone	6
36	Force main Creek crossing	24" – 250 LF In Hwy 28	A	Age	`Medium	1. Constructed before 1977 2. Located within stream zone	4
37	Pump Station D1 (Watson Creek Lift Station)	2-100 GPM pumps	C	Age Redundancy	Medium Medium	1. Constructed before 1977 2. Has plug for portable backup power generator	6
38	Gravity sewer	6" AC – 1,819 LF; near Garwood's Restaurant, piping is to Pump Station C2	C	Age Access	Medium Medium	1. Constructed before 1975 2. Located within shorezone; subject to submergence 3. Access is blocked by restaurant; sewer can be TV'd	6
38	Gravity sewer Creek crossing	X" – 317 LF Near Pump Station D1	C	Age	Medium	1. Constructed before 1977 2. Located within stream zone	6
39	Gravity sewer	X" – 1,314 LF	C	Age	Medium	1. Constructed before 1977 2. Located near within shorezone	6
40	Pump Station D2	2 – 100 GPM pumps	C	Age	Medium	1. Constructed before 1977 2. No on-site backup power; plug for portable generator	6
41	Pump Station D3	2-150 GPM pumps	A	Age Redundancy	Medium Medium	1. Constructed before 1977 2. Located within shorezone 3. Has plug for backup power generator	4
42	Gravity sewer	X" – 1175 LF Ferguson Ave. to Pump Station D3	C	Age	Medium	1. Constructed before 1977 2. Located near within shorezone	6
43	Pump Station D4	2-250 GPM pumps	A	Age Redundancy	Medium Medium	1. Constructed before 1977 2. Located within shorezone 3. Has plug for backup power generator	4

Table 14-2. Summary of Potential Problems for Critical Sewer Facilities in NTPUD, (continued)

Location	Critical Sewer Facility		Risk Category	Risk Criteria	Risk Level	Potential Problem Description	Priority Level
	Type	Description					
44	Gravity sewer	X" – 1,600 LF Between Hwy 28 and Ferguson Ave – flow is to Pump Station D4	B	Age	Medium	1. Constructed before 1977 2. Located in shorezone	5
45	Pump Station D5 (Lake Forest Pump Station)	2-100 GPM pumps	C	Age	Medium	1. Constructed before 1977 2. Located within shorezone	6
46	Pump Station D2	2-200 GPM pumps	A	Age	Medium	1. Constructed before 1977 2. Located near within shorezone	4
47	Dollar Point Pump station The main wastewater export pump station for the District	2 – 3000 GPM pumps	A	Redundancy Age	High Medium	1. Constructed before 1977 2. No on-site backup power generator	1
48	Gravity sewer	6" – 1,141 LF, 5 MHs	A	Age	Medium	1. Constructed before 1977 2. Located near shorezone	4
49	Force main – Dollar Pt. Pump Station to TCPUD Creek crossing	22" – 250 LF	A	Age	Medium	1. Constructed before 1977 2. Located within stream zone 3. Parallel force main constructed in 1990s	4
50	Gravity sewer Creek crossing	6" – 225 LF	A	Age	Medium	1. Constructed before 1977 2. Located in shorezone	4
51	Gravity sewer; creek crossing	6" – 250 LF	C	Age	Medium	1. Constructed before 1977 2. Located in fore shore	6
52	Pump Station D2 (Ridgewood Lift Station)	2-100 GPM pumps	A	Age	Medium	1. Constructed before 1977 2. Located near within shorezone 3. Has plug for backup power portable generator	4

Table 14-3. Summary of Alternative Measures for NTPUD

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
1	Medium	Pump station S1 - satellite pump station Facility is middle age Redundancy - Facility is without permanent, on-site backup power generator	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment and related controls 3. Dedicated portable generator 4. On-site permanent backup power generator	• Perform O&M • Provide permanent on-site backup power generator	83,200	6
2	Medium	Pump station S2 - satellite pump station Facility is middle age Redundancy - Facility is without permanent, on-site backup power generator	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment and related controls 3. Dedicated portable generator 4. On-site permanent backup power generator	• Perform O&M • Provide permanent on-site backup power generator	83,200	6
3	Medium	Gravity sewer, 15" ACP – 3,925 LF, In Brockway area Capacity - Sewer is oversized for projected service requirements Access is limited due to lake front homes	1. Conventional or trenchless replacement 2. Confirm and enforce easements 3. Maintenance – monitor through regular cleaning and inspections	• Perform O&M– annual cleaning and TV inspection • Enforce easements • Rehabilitate 3,925 LF 15" AC with slip liner	853,700	5
4	Medium	X" – 457 LF Gravity sewer, Brockway area westerly toward Secline Pump Station Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 475 LF of gravity sewer when maintenance becomes excessive	200,200	6
5	Medium	1,850 LF X" Gravity sewer to Secline Pump Station Sewer is middle age	1. Monitoring condition through regular cleaning and inspections 2. Rehabilitation 3. Conventional or trenchless replacement	• Perform monitoring and maintenance – annual cleaning and TV inspection • Rehabilitate/slip line 1,850 LF of gravity sewer	977,800	4

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
6	Medium	500 LF - 16" DIP Gravity sewer to Secline Pump Station Sewer is middle age; sewer and MHs are subjected to lake wave action although MHs are protected by riprap	1. O&M for cleaning and inspections 2. Conventional or trenchless replacement 3. Relocation sewer line out of lake wave influence	• Perform monitoring and maintenance – annual cleaning and TV inspection • Relocate 16" gravity sewer and MHs to Brockway Vista	379,300	4
7	Medium	14" Force main from Secline Pump Station Force main is located in shorezone Force main is middle age	1. O&M for monitoring and maintaining 2. Conventional or trenchless replacement 3. Relocation	• Perform monitoring and maintenance • Relocate 2,100 LF – 14" to new alignment in/adjacent to Hwy 28	1,579,900	4
8	Medium	Secline pump station - main wastewater export pump station Pump station is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	291,400	4
9	Medium	Gravity sewer creek crossing, Lincoln Drive – 275 LF X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 275 LF gravity sewer when maintenance becomes excessive	102,800	5
10	Medium	Gravity sewer creek crossing, Cambridge Drive – 250 LF, X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/ slip line 250 LF of gravity sewer when maintenance becomes excessive	102,800	4
11	Medium	X" – 404 LF Gravity sewer creek crossing along Whitehall Ave Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 400 LF of gravity sewer when maintenance becomes excessive	124,100	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
12	Medium	Gravity sewer creek crossing, North of Regency Way – 250 LF, X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 250 LF of gravity sewer when maintenance becomes excessive	102,800	4
13	Medium	Gravity sewer creek crossing, East of Stratford Way – 250 LF X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 250 LF of gravity sewer when maintenance becomes excessive	102,800	5
14	Medium	Gravity sewer creek crossing, Canterbury Drive – 256 LF X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 256 LF of gravity sewer when maintenance becomes excessive	103,700	4
15	Medium	Gravity sewer creek crossing, South of Allenby Way – 250 LF Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 250 LF of gravity sewer when maintenance becomes excessive	102,800	4
16	Medium	Gravity sewer creek crossing, in Hwy 28 near Pump Station N1 – 250 LF X" Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 250 LF of gravity sewer when maintenance becomes excessive	123,700	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
17	Medium	Pump station N1 - satellite pump station Facility can be bypassed but with some effort Facility is middle age	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment only 3. Bypass valving on pump station discharge force main	• Perform regular O&M • Replace pumping equipment and controls • Install force main bypass valving	83,200	4
17A	Medium	250 LF X" force main sewer creek crossing in Hwy 28 near Pump Station N1 Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace 250 LF of force main when maintenance becomes excessive	227,900	4
18	Medium	1,081 LF – 6" Gravity sewer along Hwy 28 to Pump Station N1 Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 1100 LF of gravity sewer when maintenance becomes excessive	223,200	6
19	Medium	1,563 LF – 6" Gravity sewer along Hwy 28 to National Pump Station Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 1,575 LF of gravity sewer when maintenance becomes excessive	349,400	6
20	High	14" force main to National Pump Station – 600 LF Age; Structural problems – needs replacement; located in beach area	1. Conventional replacement 2. Force main replacement and relocation	• Replace and relocate 14" - 600 LF of force main to alignment in/along Hwy 28	485,500	1
21	Medium	National pump station - main wastewater export pump station Pump station is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	416,200	4

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
22	Medium	Pump station N2 - satellite pump station Facility is middle age Plug for portable backup power generator	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment only 3. Installation of on-site backup power generator	• Perform regular O&M • Replace pumping equipment and controls • Install on-site backup power generator	69,300	4
23	Medium	20" force main – 2,000 LF in Hwy 28 Granite to Estates Dr	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace 2,000 LF – 20" FM when maintenance becomes excessive	1,574,200	4
24	Medium	Pump station N3 - satellite pump station Facility is middle age	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment related controls only	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	6
25	Medium	1,000 LF – 20" x Force main sewer in Hwy 28 north of Pump Station C1 Force main is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace 1,000 LF – 20" FM when maintenance becomes excessive	869,500	4
26	Medium	3,330 LF – X" x Gravity sewer to Pump Station C1 Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 3,330 LF of gravity sewer when maintenance becomes excessive	555,400	6
27	Medium	Pump station C1 - satellite pump station Facility is middle age Plug for portable backup power generator	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment only 3. Installation of on-site backup power generator	• Perform regular O&M • Replace pumping equipment and controls • Install on-site backup power generator	83,200	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
29	Medium	336 LF – 6" Gravity sewer on Bay St. Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 350 LF of gravity sewer when maintenance becomes excessive	184,500	6
30	High	20" force main to Carnelian Pump Station O&M redundancy - FM bypass capability is limited	1. Parallel force main 2. Bypass isolation in-line valve assembly	• Install 20" valve with turnout appurtenances for temporary piping connections; locate at Onyx St and Hwy 28	400,400	1
31	Medium	Pump station C2 - satellite pump station Facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	124,900	4
32	Medium	250 LF x 24" force main creek crossing in Hwy 28 near Carnelian Pump Station Force main is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace 250 LF – 24" force main when maintenance becomes excessive	336,700	4
33	Medium	Carnelian pump station - main wastewater export pump station Pump station is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pump equipment and controls when necessary	416,200	4
35	Medium	X" Gravity sewer creek crossing in Hwy 28 north of Pump Station D2	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 250 LF of gravity sewer when maintenance becomes excessive	102,800	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
36	Medium	250 LF 24" force main creek crossing in Hwy 28 south of Pump Station C2 Force main is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace 250 LF – 24" force main when maintenance becomes excessive	350,600	4
38	Medium	1,819 LF - 6" ACP Gravity sewer to Pump Station C2 near Garwood's Sewer is middle age Sewer is subject lake submergence and access is blocked	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement 3. Confirm easement or relocate system	• Perform maintenance and monitoring– annual cleaning and TV inspection • Relocate system to accessible location; install grinder pump and small diameter discharge piping for each of 20 parcels	2,139,500	6
38	Medium	X" Gravity sewer creek crossing in Hwy 28 north of Pump Station D1	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 350 LF of gravity sewer when maintenance becomes excessive	311,000	6
39	Medium	1,314 LF – 6" Gravity sewer to Pump Station D2 Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 1,314 LF gravity sewer when maintenance becomes excessive	326,100	6
40	Medium	Pump Station D2 - satellite pump station Facility is middle age No on-site backup power	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment only 3. Installation of on-site backup power	• Perform regular O&M • Replace pumping equipment and controls • Install on-site backup power generator	83,200	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
41	Medium	Pump station D3 - satellite pump station Facility is without on-site backup power generator although plug is available for service by portable generator Facility is middle age	3. Dedicated portable generator 4. On-site backup power generator 5. O&M for regular inspections, equipment maintenance and equipment checks 6. Replacement of pumping equipment related controls only	• Provide on-site backup power generator • Replace pumping equipment and controls when necessary	83,200	4
42	Medium	6" Gravity sewer, 1,175 LF Ferguson Ave to Pump Station D3 Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 1,175 LF of gravity sewer when maintenance becomes excessive	372,500	6
43	Medium	Pump station D4 - satellite pump station Redundancy - Facility is without on-site backup power generator although plug is available for service by portable generator Facility is middle age	1. Dedicated portable generator 2. On-site backup power generator 3. O&M for regular inspections, equipment maintenance and equipment checks 4. Replacement of pumping equipment and related controls only	• Provide on-site backup power generator • Replace pumping equipment and controls when necessary	83,200	4
44	Medium	Gravity sewer – 1,600LF X" between Hwy 28 and Ferguson Ave; feeds Pump Station D4 Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 1,600 LF of gravity sewer when maintenance becomes excessive	361,600	5
45	Medium	Pump station D5 (Lake Forest) - satellite pump station Facility is middle age Redundancy - Facility is without permanent, on-site backup power generator	1. O&M for regular inspections, equipment maintenance and equipment checks 2. Replacement of pumping equipment and related controls 3. Dedicated portable generator 4. On-site permanent backup power generator	• Perform O&M • Provide permanent on-site backup power generator	83,200	6

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
46	Medium	Pump station D6 - satellite pump station Facility is middle age	1. O&M for regular inspections, equipment maintenance and efficiency checks, and cleaning 2. Replacement of pumping equipment and related controls	• Perform regular O&M • Replace pumping equipment and controls when necessary	83,200	4
47	High	Dollar Point pump station - main wastewater export pump station complex Redundancy – Facility is without permanent on-site backup power generator Pump station is middle age	1. On-site backup power generator 2. Connection for portable generator	• Install permanent on-site backup power generator	555,000	1
48	Medium	1,141 LF X" Gravity sewer to Pump Station D5 Sewer is in shorezone and is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 1,150 LF of gravity sewer when maintenance becomes excessive	239,800	4
49	Medium	250 LF - 22" force main creek crossing in Hwy 28 south of Dollar Pt Pump Station Force main is middle age but export system includes parallel force main	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring • Replace/slip line 250 LF – 22" force main when maintenance becomes excessive	302,500	4
50	Medium	Gravity sewer creek crossing in Hwy 28 south of Pump Station D6 – 250 LF X"	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate/slip line 250 LF of gravity sewer when maintenance becomes excessive	123,700	4

Table 14-3. Summary of Alternative Measures for NTPUD, (continued)

Location	Risk Level	Facility/Description of Condition	Alternative Measures	Potential Action Plan	First Costs, $ (excludes costs for O&M)	Priority Level
51	Medium	6" Gravity sewer creek crossing in Dollar Cove Sewer is middle age	1. Maintenance – monitor through regular cleaning and inspection 2. Conventional or trenchless replacement	• Perform maintenance and monitoring– annual cleaning and TV inspection • Rehabilitate 250 LF of gravity sewer when maintenance becomes excessive	170,300	6
52	Medium	Pump station D2 - satellite pump station Redundancy - Facility is without on-site backup power generator although plug is available for service by portable generator Facility is middle age	1. Dedicated portable generator 2. On-site backup power generator	• Provide on-site backup power generator	83,200	4

15.0 BENEFITS OF REDUCING RISK

Sanitary sewer systems represent a major investment are usually the largest infrastructure asset within a community. A general assessment of the potential benefits of implementing risk reduction actions was conducted as part of this evaluation. The assessment included review of TRPA's units of benefits, potential regulatory fines from California and Nevada, EPA's draft CMOM rule and cost-benefit analysis, and developing hypothetical examples relating nitrogen and phosphorus loadings associated with assumed release conditions, and a brief overview of potential impacts to drinking water intake lines from the overflow/release of raw sewage.

15.1 TRPA's Units of Benefits

The TRPA utilizes units of benefits as a quantifiable measure of project value in relation to particular environmental threshold indicators. Units of benefits are intended to evaluate how the EIP is performing in terms of contributions toward attaining or maintaining thresholds and applicable standards. In the EIP, the TRPA lists the units of benefits for the Shorezone Sewer Line Replacement/Relocation as acres improved (WQ2-E) and acres treated source control (WQ2-A). The improved and treated acreages are not quantified due to the difficulties in measuring the improvements to water quality by improving the sewer facilities. These units of benefits fall under the TRPA's Water Quality categories relating to sediment loading and turbidity. A possible unit of benefit could include the possible reduction a nutrient loading to Lake Tahoe. Section 15.4, Hypothetical Overflow/Release, indicates the potential release of nutrients to Lake Tahoe due to a failed pump station. TRPA is currently working on new units of benefits to better quantify water quality improvements for several of these thresholds.

15.2 Regulatory Fines

The Porter Cologne Act in California allows Lahontan to levy fines for the release of sewage. These fines can be $10,000 per day in which the violation occurs and up to $10 per gallon of sewage release over 1,000 gallons if the sewage is not cleaned up. For these fines to be applied, the sewer districts must show negligence. Lahontan typically works with the district to bring the district into compliance with its discharge requirements.

The Nevada Department of Environmental Protection (NDEP) can fine a sewer district not more that $25,000 for each day of the violation. This civil penalty is listed in the state of Nevada revised statutes NRS 445A:700. Typically, NDEP tries not to levy fines but works with the districts to bring them into compliance with the discharge requirements.

Under Article VI of the TRPA Compact, "any person who violates any provision of this compact or any ordinance or regulation of the agency or any condition of approval imposed by the agency is subject to a civil penalty not to exceed $5,000. Any such person is subject to an additional civil penalty not to exceed $5,000 per day, for each day on which such a violation persists."

15.3 EPA's CMOM and Cost-Benefit Analysis

Capacity, Management, Operation, and Maintenance (CMOM), a proposed EPA regulation, was scheduled for release in late 2002 but is now delayed, will be enforced by state agencies. In general, this regulation pertains to the control of sewage spills from sewer collection facilities and prohibits bypasses or releases (spills) from sewage collection systems. The CMOM regulation places an obligation on collection facilities to maintain or retrofit their collection systems to eliminate spills and to notify parties who may be exposed to spills.

For the development of the proposed CMOM regulations, the EPA estimated the incremental costs and benefits for municipal sanitary sewer collection system and the proposed SSO (CMOM) rule. The estimated costs in 1999 dollars range from $93.5 million to $126.5 million annually and $36 million to $97 million annually for benefits. These costs are based on improvement to the municipal systems. The benefits are based on improved water quality, prevention of illness, and improved operation and maintenance. The EPA based these amounts on the 19,000 municipal systems that will be potentially regulated under this new rule. Table 15-1 compares the benefits and costs for these municipal systems. The EPA has determined that the benefits of the proposed CMOM justify the costs, taking into account qualitative and quantitative benefits and costs.

Table 15-1. Comparison of Annualized Benefits to Costs for the Municipal Sanitary Sewer Collection System and SSO Proposed Rule

Monetized Benefits (1)	**Low ($ million)**	**High ($ million)**
Water Quality Benefits	$12	$73
Improved O&M/MOM Program	$24	$24
Estimated Benefits	**$36**	**$97**
Costs	**Low ($ million)**	**High ($ million)**
Municipalities	$93	$126
State/Federal Administration	$0.5	$0.5
Estimated Costs	**$93.5**	**$126.5**

Table from the EPA's Capacity, Management, Operation, and Maintenance (CMOM) Proposed Regulations January 4, 200l
(1) Additional benefits can be expected from the proposed regulation

The baseline the EPA used for estimating these costs and benefits associated in Table 15-1 is consistent with EPA's understanding of the existing NPDES regulations that prohibit discharges to waters of the U.S. from municipal collection systems.

The EPA has noted that these costs and benefits are not comparable because the marginal benefits have not been estimated with the associated increase in the stringent control objectives. Also, the EPA has not estimated the costs associated with eliminating all SSOs. The EPA only partially monetized the benefits of water quality and improved O&M.

15.4 Hypothetical Overflow/Release

Reducing the risk of overflows or releases would be beneficial from the standpoint that the associated nitrogen and phosphorus loadings to Lake Tahoe would be avoided. To illustrate, the loadings associated with two hypothetical releases are presented below.

Assuming a pump station with an average daily flow of 250 gpm and no backup power is located on the shorezone of Lake Tahoe. The power fails for a 4-hour period. After the wet well fills, sewage spills into the lake. Assuming the release averaged 250 gpm over the period, the release to the lake would be around 60,000 gallons of sewage. Assuming concentrations for nitrogen and phosphorus of 40 mg/l and 8 mg/l, respectively, the spill would deliver around 20 pounds of nitrogen and 4 pounds of phosphorus. If backup power had been in place at the time of the main power failure, this spill could have been avoided. Table 15-2 shows the results of a spill for times ranging from 1 to 24 hours. The gallons of sewage spilled ranges from 15,000 to 360,000 gallons, respectively. Also, nitrogen and phosphorus loading would be 5 pounds and one pound to 120 pounds and 24 pounds, respectively. Possible fines from TRPA and Lahontan are shown for these releases.

Table 15-2. Pump Station Spill Quantities

Hours of Spill	Amount of Release (Gallons)	Nitrogen (lbs)	Phosphorus (lbs)	Maximum Possible Fine (includes TRPA and Lahontan)
1	15,000	5	1	$155,000
2	30,000	10	2	$305,000
4	60,000	20	4	$605,000
8	120,000	40	8	$1,205,000
12	180,000	60	12	$1,805,000
16	240,000	80	16	$2,405,000
24*	360,000	120	24	$3,615,000

*For a 24 hour release, the percent nitrogen and phosphorus loading as compared to the total yearly loading to Lake Tahoe are 0.0013% and 0.0024%, respectively.

As previously discussed, the critical sewer facilities were categorized based upon the potential magnitude of the impacts to Lake Tahoe should an overflow/release occur. The categories were established based upon the number of equivalent dwellings (du) that the facility serves. The range in potential nitrogen and phosphorus loadings were computed for each category assuming a 24-hr failure, an average flow of 200 gallons per day per unit, and concentrations for nitrogen and phosphorus of 40 mg/l and 8 mg/l, respectively. Table 15.3 lists the gallons and the loading of nitrogen and phosphorus from a potential spill based on Categories A, B, and C. Under these assumptions, loadings of nitrogen and phosphorus would range from 5.3 to 120 pounds per day and 1.1 to 24 pounds per day for Category A facilities, from 2 to 5.3 pounds per day and 0.4 to 1.1 pounds per day for Category B facilities, and from 0.07 to 2 pounds per day and 0.01 to 0.4 pounds per day for Category C facilities.

Table 15-3. Relative Comparison of Nutrients between Categories

Category	Description	Gallons of Wastewater Per Day	Pounds Per Day of Nitrogen	Pounds Per Day of Phosphorus
A	80 to 1800 du	16,000 to 360,000	5.3 to 120	1.1 to 24
B	30 to 80 du	6,000 to 16,000	2 to 5.3	0.4 to 1.1
C	1 to 30 du	200 to 6,000	0.07 to 2	0.01 to 0.4

Major sewage spills could have an enormous affect on business, tourism, recreation, and other esthetic and financial burdens on the Lake Tahoe economy. An evaluation of the social/economical impacts was not included in this study due to limited available funds.

15.5 Drinking Water Intake Lines

Many of the Lake Tahoe sewer districts along with counties, private entities, and private homeowners operate drinking water systems. Water from Lake Tahoe is used by many of these entities for their drinking water supply. Concerns have been raised that if a sanitary sewer facility located in the shorezone were to fail, the possibility of polluting the water intake lines increases.

According to several sewer districts, water intake lines for larger water districts are a minimum 500 feet to 1,000 feet from the shoreline. If a release were to occur, there would be significant dilution of raw sewage and Lake Tahoe.

Under the Safe Drinking Water Act, the EPA requires pubic water districts serving at least 15 service connections or 20 or more people to monitor for coliform bacteria. According to the EPA, most districts analyze first for total coliform due to the fast results. If a sample is positive for total coliform, the same sample is then analyzed for either fecal coliform or Escherichia coli, E. coli. Both are indicators of human or animal waste.

Water can be treated using chlorine, ozone, or ultra violet light, all of which kill or inactivate E. coli. Water districts that use water from Lake Tahoe are required to disinfect to make certain that all bacterial contamination is inactivated. Districts using water from Lake Tahoe are required to take extra precaution against bacterial contamination due to surface water being more susceptible to contamination. Private homeowners or districts that serve less the 20 people should have their water supply tested periodically.

With the safety precautions required by law, drinking water from a water districts contaminated by a sewage spill should not pose a significant threat to human safety. Individual water systems on the other hand, could pose a health threat to private homeowners due to sewage contamination. Monitoring of individual surface water systems is essential to prevent illness.

16.0 FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The findings are statements of fact or of the best available information at the time of the study. This study also provides conclusions that are the professional judgments of experts knowledgeable in sanitary sewer. The recommendations that have been listed in this study are industrial standards applied to Lake Tahoe and accepted by professionals in the sanitary sewer industry.

16.1 Findings

The findings of this study are statements of fact or of the best available information at the time of the study. The major findings are:

- Much of the sewer is relatively old, 30 to 40 years. Some of the sewers are older than 50 years. The capacity of the sewer collection systems have not been identified as a problem because they were designed to serve a much larger population than currently exists or is planned.
- Key conditions/problems were found to exist within the sewer system of each district that pose a medium to high degree of risk that could potentially lead to an overflow/release to Lake Tahoe. The frequently occurring conditions included: age, access, and lack of redundancy or inspection ports.
- Overflows or releases in the Lake Tahoe basin have occurred in the past and will continue, however, the sewer districts, Lahontan, or TRPA have not reported catastrophic spills in many years.
- Overflows or releases must be responded to immediately to minimize environmental and health risks. Each district has established response times typically less than 30 minutes.
- The time and place of sewage overflows and releases due to blockages or failures are unpredictable.
- Interviews with the sewer districts show that less than 1 percent to 6 percent of the original sewer lines have been replaced since the early 1980's. Several districts maintain capital replacement funds in addition to using contingency sewer repair funds to address collection system rehabilitation and replacement requirements.
- The environmental permitting process associated with repair, rehabilitation, or replacement construction activities can be laborious, costly, and time consuming. These conditions can impact the ability to accomplish the work within the available construction period that extends from May to October.
- Availability of system information, planning, and operation and maintenance activities varies between districts.

16.2 Conclusions

This study provides conclusions that are the professional judgments of experts knowledgeable in sanitary sewer. These conclusions are:

- Performances of the sewer systems in all Lake Tahoe districts appear to be in better shape than those districts located outside of the Lake Tahoe basin.
- The sanitary sewer collection system without proper operation, maintenance, and replacements, will continue to degrade. This can lead to structural failure in both gravity sewers and force mains, failure of pump stations, increases in both exfiltration and inflow and infiltration, and the possible loss of capacity within the system.
- Proper management and operation and maintenance of the sewer facilities is critical to safeguard the investment of the sewer infrastructure. This also provides efficient operation and can extend the life expectancy of the facilities. All districts perform O&M in accordance with established procedures. Implementation of a well planned, systematic, and comprehensive inspection and maintenance programs are crucial due to the age of the collection system.
- It was estimated that the nutrient loading from exfiltration was 123 pounds per year to 3,850 pounds per year of nitrogen, and 33 pounds per year to 1,030 pounds per year of phosphorus. These loadings range from 0.01 percent to 0.42 percent, and from 0.03 percent to 1.0 percent of the total loadings of nitrogen and phosphorus, respectively, to Lake Tahoe from all sources.
- It does not appear that exfiltration from the sewers in the Lake Tahoe basin is a major factor contributing to the nutrient loading of Lake Tahoe. The exfiltration rates estimated in this study are based on limited available information. They are intended to represent district wide averages over the long term and not of spills or releases due to short-term/dramatic events such as system failures.
- A substantial testing program would be required to provide significantly better data regarding basin wide exfiltration conditions. It appears that such an effort may take a lower priority relative to other activities addressing major sources of nutrient loading to Lake Tahoe.
- Potential Action Plans have been developed for each district. Refinement and implementation of these plans could reduce the risk of overflows/releases in the study area.
- Digital mapping of the sewer system can serve as a useful tool for tracking overflows/releases, and operation and maintenance actions.

First costs were developed for all potential actions plans for the Lake Tahoe sewer districts. These costs could change after a thorough monitoring and inspection demonstrate either adequate or deteriorating conditions. Table 16-1 identifies total first cost of potential action plans for each district. Costs range from approximately $1.6 million for Kingsbury General Improvement District to $26 million for Tahoe City Public Utility District.

Table 16-1. Total First Costs of Potential Action Plans

District	Total First Cost of Potential Action Plans
• Incline Village General Improvement District	$6,276,200
• Tahoe Douglas District	$5,141,000
• Round Hill General Improvement District	$2,293,600
• Douglas County Sewer Improvement District #1	$3,211,900
• Kingsbury General Improvement District	$1,571,800
• South Tahoe Public Utility District	$26,023,900
• Tahoe City Public Utility District	$26,139,300
• North Tahoe Public Utility District	$17,569,800
Total	**$88,227,500**

Problems within each sewer districts were prioritized from level one to level six. Level one was considered to be top priority while level six is a much lower priority. Each district is listed below with its top priorities shown. These priorities could change if additional inspection and monitoring demonstrates that the sewer facility is in good condition and that conditions with other facilities have deteriorated. Chapters 7 through 14 give more in-depth descriptions of each of the Lake Tahoe sewer districts; refer to these chapters for the locations of the potential action plans. Table 16-2 lists the top 5 priorities of each district. If more than 5 level one priorities have been identified, all priority one levels are shown for the district. As shown in Table 16-2, priority levels vary between the districts. First costs range from $49,500 for the replacement of pumping equipment to $4.3 million for the conversion to a grinder pumping system.

Table 16-2. Costs of Top Priority Action Plans

District	Priority Level	Facility Description	Location	Potential Action Plan	First Cost
Incline Village	3	SPS 10 Pump Station	2A	Replace pumping equipment and controls when necessary	$148,600
	3	SPS 18 Pump Station	3A	Install on-site Generator	$59,500
	3	SPS 9 Pump Station	5A	Replace pumping equipment and controls when necessary	$49,500
	3	SPS 11 Pump Station	11A	Install on-site Generator	$89,200
	3	SPS 17 Pump Station	17A	Replace pumping equipment and controls when necessary	$59,500
Total					**$406,300**

Table 16-2. Costs of Top Priority Action Plans (continued)

District	Priority Level	Facility Description	Location	Potential Action Plan	First Cost
Tahoe Douglas	1	Marla Bay Force Main	1C	Install inspection/cleaning ports every 400 feet	$133,100
	1	Logan Shoals Force Main	20	Install inspection/cleaning ports every 400 feet	$335,600
	4	Marla Bay Pump Station	1A	Replace pumping equipment and controls when necessary	$291,400
	4	Zephyr Cove Pump Station	6	Replace pumping equipment and controls when necessary	$291,400
	4	Gravity Sewer, creek crossing near Hwy 50	8	Rehabilitate/Slip line 400 feet	$220,600
Total					**$1,272,100**
Round Hill	1	Gravity Sewer near proposed infiltration basin	2	Replace and relocate 1,400 feet of sewer line	$1,166,300
	1	Pine Wild Pump Station	1	Replace pumping equipment and controls when necessary	$132,200
	4	Pine Wild Force Main	1A	Install inspection/cleaning ports every 400 feet	$995,100
Total					**$2,293,600**
Douglas County	1	Gravity Sewer crossing Burke Creek	1	Seal manholes; Rehabilitate/Slip line 365 feet	$192,400
	4	Nevada Beach Pump Station	1A	Replace pumping equipment and controls when necessary	$291,400
	4	Nevada Beach Force Main	1B	Install inspection/cleaning ports every 400 feet	$133,100
	4	Gravity Sewer crossing Edgewood Creek	5	Rehabilitate/Slip line 300 feet	$163,200
	4	Main Pump Station	6	Replace pumping equipment and controls when necessary	$221,900
Total					**$1,002,000**

Table 16-2. Costs of Top Priority Action Plans (continued)

District	Priority Level	Facility Description	Location	Potential Action Plan	First Cost
Kingsbury	5	KGID Pump Station	1A	Replace pumping equipment and controls when necessary	$444,100
	5	KGID Force Main	1B	Install inspection/cleaning ports every 1,000 feet	$559,400
	5	KGID Force Main – Burke Creek crossing	1C	Install inspection/cleaning access ports	$219,500
	5	Kingsbury Palisades Pump Station	2A	Replace pumping equipment and controls (will be complete in 2003)	$124,900
	5	Kingsbury Palisades Force Main	2B	Install inspection/cleaning access ports	$223,900
Total					**$1,571,800**
South Tahoe	1	Taylor Creek Force Main	6A	Install parallel force main for redundancy	$553,100
	1	Tallac Pump Station	10A	Provide connection point to force main for the hook-up of portable pumping equipment	$312,300
	1	Tallac Force Main	10F	Install 900 feet of parallel force main for redundancy	$757,500
	1	Gravity Sewer to Tallac Pump Station	10E	Rehabilitate/Slip line 2,250 feet	$1,191,200
	1	Tahoe Keys Force Main	10G	Install parallel force main for redundancy	$2,009,900
	1	Gravity Sewers – Upper Truckee Creek crossings	11	Rehabilitate/Slip line gravity sewers	$1,696,000
	1	Upper Truckee Force Main	11B	Install parallel force main for redundancy	$1,221,100
	1	Gravity Sewers – Angora Creek crossings	12	Rehabilitate/Slip line gravity sewers	$532,400
	1	Al Tahoe Pump Station	13A	Replace pumping equipment and controls when necessary	$555,000
	1	Trout Creek Pump Station	13B	Replace pumping equipment and controls when necessary	$312,300

Table 16-2. Costs of Top Priority Action Plans (continued)

District	Priority Level	Facility Description	Location	Potential Action Plan	First Cost
	1	Al Tahoe Force Main	13C	Install parallel force main for redundancy	$1,482,500
Total					**$10,623,300**
Tahoe City	1	Gravity Sewer – Laterals H, V	4	Rehabilitate/line (CIPP) gravity sewers	$913,000
	1	Coast Guard Force Main	4B	Install inspection/cleaning ports every 500 feet	$178,000
	1	Lake Terrace Gravity Sewer	6	Rehabilitate/line (CIPP) gravity sewers	$528,300
	1	Grove Street Pump Station	7	Construct new pump station	$1,539,900
	1	Sunnyside Pump Station	13	Install generator for third pump for backup power; Replace pumping equipment and controls when necessary	$346,800
	1	McKinney Force Main	23	Install inspection/cleaning ports every 500 feet	$124,900
	1	Rubicon Gold Coast Pump Station	40	Replace backup power facilities; Replace pumping equipment and controls when necessary	$222,000
	2	Gravity Sewer – Lateral A	1	Convert to grinder pump configuration	$4,309,400
Total					**$8,216,300**
North Tahoe	1	National Force Main	20	Replace and relocate 600 feet of force main along Hwy 28	$485,500
	1	Carnelian Force Main	30	Install valve and turnout appurtenances for temporary piping connections	$400,400
	1	Dollar Point Pump Station	47	Install permanent on-site backup power generator	$555,000
	4	Gravity Sewer to Secline Pump Station	5	Rehabilitate/Slip line gravity sewers	$977,800
	4	Secline Force Main	7	Replace and relocate 2,100 feet of force main along Hwy 28	$1,579,900
Total					**$3,998,600**
Total for all Sewer Districts for Top Priority Action Plans					**$29,384,000**

16.3 Recommendations

A dynamic approach to the management, operation, maintenance, rehabilitation, and replacement of the sewer systems is recommended to maintain their performance and to reduce the risk of overflows/releases. The districts are currently taking this approach in varying degrees. As stated early, the findings of this study are statements of fact or of the best available information at the time of the study. This study also provides conclusions that are the professional judgments of experts knowledgeable in sanitary sewer. The recommendations that have been listed in this study are industrial standards applied to Lake Tahoe and accepted by professionals in the sanitary sewer industry.

The recommendations include completing the following key activities:

- A regional consensus on funding, environmental regulations, and standards for the design and construction should be reached by the Lake Tahoe sanitary sewer stakeholders. A basin wide approach to a comprehensive capital improvement program (CIP) should be considered for the replacement or rehabilitation of the sewer facilities located in the environmentally sensitive areas in the Lake Tahoe basin.
- Focus initial inspection and rehabilitation/replacement activities on implementing the potential action plans identified in this study.
- Develop appropriate budgets and staffing needs for the operation and maintenance and rehabilitation and replacement of the deficient sanitary sewer facilities.
- Develop and maintain a routine preventive maintenance program designed to prevent overflows/releases and to protect the investment costs of the sewer system.
- Develop a regular inspection and cleaning schedule and take action to the results of these inspections.
- Implement annual inspections of system components that are operated and maintained within the environmentally sensitive study areas including creek crossings, export gravity sewers and force mains, and pump stations. In these areas, provisions to facilitate inspection of these sewer lines may be required including turnouts, access ports, or parallel/redundant pipelines.
- Develop and maintain an information management system that provides timely responses to and tracking of the following:
  - Emergencies
  - Problems and complaints that may lead to or have caused overflows or releases
  - The identification of deficiencies within the sewer system and prioritizing these deficiencies
  - The planning of maintenance activities and scheduling
  - The planning of capital budgets
  - Investigate of complaints, identify associated problems, and take corrective measures
  - Regular repair of deteriorating sewer facilities
  - Develop and implement a program to make certain that new sewers and connections are properly designed and constructed.
- Inspect problems that cause sewage overflows or releases and take corrective actions.

- Mapping or updating the mapping of the sewer system including; manholes, pump stations, gravity sewers and force mains, sizes, materials, etc. Digital mapping that tie into TRPA's GIS database is recommended.

Lake Tahoe's natural mountain beauty has drawn and astounded people for many years. Lake Tahoe is one of the largest and deepest in the United States and is known for the crystal clarity of its water. Even though the conditions (overflow/releases and exfiltration) are better than nationwide averages, the Lake Tahoe basin should be held to standards that preserve this "national treasure".

The age of the sewer system is 30 to 40 years old with some sewer facilities over 50 years old. A 50 year service life expectancy is typical for most sewage lines thus the sewer districts in Lake Tahoe are nearing this threshold. Sewage lines have been known to last significantly longer than 50 years, but increased monitoring and inspection is required to verify the longevity. Sewer facilities located within the environmentally sensitive areas should be evaluated immediately and an action plan developed for these problems to ensure lake clarity for years to come.

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APPENDIX A

Subject: Response to Comments – Lake Tahoe Basin Framework Study, Wastewater Collection System Overflow/Release Reduction Evaluation

This document provides the response to the comments received for the Lake Tahoe Basin Framework Study, Wastewater Collection System Overflow/Release Reduction Evaluation. Comments were received from:

US Army Corps of Engineers	December 23, 2003
Nevada Division of Environmental Protection	December 23, 2003
North Tahoe Public Utility District	January 10, 2003
Lahontan Regional Water Quality Control Board	February 3, 2003
Tahoe Regional Planning Agency (TRPA)	January 31, 2003
Kingsbury General Improvement District	January 10, 2003
Incline Village General Improvement District	January 7, 2003
South Tahoe Public Utility District	December 23, 2002
Douglas County Sewer Improvement District #1	January 10, 2003
TRPA – Scientific Advisory Group	January 22, 2003
U.S. Geological Survey	January 23, 2003
Tahoe City Public Utility District	April 3, 2003
Stakeholder's Meeting	April 1, 2003

Each comment is presented below for reference and is followed by the response in italics. Some comments were omitted if the comment regarded punctuation and/or grammar corrections. These comments were incorporated into the document.

US Army Corps of Engineers, December 23, 2002

General Comment 1: This report does not address the overarching issue of an ageing infrastructure. Though the Finding and Conclusions state that the 30-40 year old age is "relatively old", the report does not present a range of reasonable expected life for these sewers based on material, construction, service, corrosivity, etc. Capital replacement might solve some of the problems identified in this report, yet few, if any, of the districts appear to a capital replacement program. Note that in areas with less environmental sensitivity, where a little leakage is more tolerable in the context of larger issues, sewers remain in service for over 100 years. Recommend that author present a range of expected service life for basin wastewater lines based on professional judgment.

Response: *Under Section 5.4.2 Age, the generally accepted service life of sanitary sewer pipe material is 50 to 100 years. At the 50 year point, additional inspection and monitoring by the districts will determine if 50 years is reasonable.*

General Comment 2: Recommend that the Report indicate that the Shorezone sewers are EIP Project #638 in both Executive Summary and Introduction and how this report relates to the EIP project. This report is the first step in detailing sub-project scope and costs associated with this EIP project.

Response: *Concur. A statement will be included in the Executive Summary and the Introduction relating this study to the TRPA EIP Project #638. Currently, the TRPA EIP Project #638 is listed on page 1-10 under the "Environmental Improvement Program," April 2001.*

General Comment 3: Typical for all Tables detailing Summary of Alternative Measures. In several locations the alternatives include more than one "Potential Action Plan" option involving a capital expenditure, but the "First Cost" column includes a cost for only one of the items. It is not clear which Action Plan the cost is applicable, as well as the other Action Plan not having an estimate. Recommend an estimated first cost be provided for each Action Plan that involves a capital replacement or large non-annual O&M cost.

Response: *Concur. The Summary of Alternative Measures Tables typically includes an O&M component and a first cost for rehabilitation/replacement. This will be defined more clearly.*

Comment 4: Page ES-1, Executive Summary, subsection "Scope", subsection "Exfiltration", 3rd sentence: Sentence does not convey complete rationale. Recommend modification of sentence to add underlined portion to read,"No field testing was conducted for this study due to a lack of funds."

Response: *Concur. The Executive Summary has been rewritten.*

Comment 5: Page ES-4, Executive Summary, subsection "Exfiltration Estimate", 1st sentence: This does appear to be a complete sentence or convey a complete thought. Recommend modification of sentence to add underlined portion to read "An order of magnitude estimate of exfiltration (leakage) was calculated for wastewater systems…".

Response: *Concur. The Executive Summary has been rewritten.*

Comment 6: Page ES-4, Executive Summary, subsection "Exfiltration Estimate", 2nd paragraph and bullet #1: Need to define study area. Recommend adding a sentence that clarifies that the exfiltration estimate included ALL sewers in the basin, not only sewers in the shorezone and environmentally sensitive zones.

Response: *Concur. The Executive Summary has been rewritten and now includes a sentence that states the exfiltration estimate considered the entire basin.*

Comment 7: Page ES-5, Executive Summary, subsection "Assessment of Risk", paragraph heading: Appears that heading is wrong font size. Recommend heading be same size as "Exfiltration Estimate, and "Risk Reduction Action Plans" to achieve proper hierarchy.

Response: *Concur. The font size has been corrected.*

Comment 8: Page ES-5, Executive Summary, subsection "Assessment of Risk", bullet two: Similar to Cmt 3 above, define the study area. Recommend adding text to paragraph prior to bullets clarify that risk assessment included wastewater lines in the shorezone and other environmentally sensitive areas. The definition of these areas can wait until the report proper (where it is already very well defined).

Response: *Concur. The study area has now been defined in the Executive Summary.*

Comment 9: Page ES-8, Executive Summary, bullet eight: The finding that age could increase exfiltration appears at odds with the finding stated later in the report that age may tend to seal/clog/plug exfiltration. It should be clarified how these two statements can both be true, or if both are true, how they are weighted to each other in your subsequent recommendations. See also General Comment #1.

Response: *The original exfiltration study performed in 1983 used a clogging/plugging factor for the decrease of exfiltration. The current exfiltration estimate in this study eliminated this factor to be conservative and it was noted that clogging/plugging factors are less quantifiable. As sewer systems age, natural shifting may occur (from earth movement, traffic loading, wave action, etc.), pipe materials and joints may begin to deteriorate from corrosion and erosion. With today's operation and maintenance practices, televising the critical sewer lines can identify possible deficiencies within the pipes.*

Comment 10: Acronym Page: GSP and NEPA are both listed twice. Recommend deletion of duplicate entries.

Response: *Concur. Duplicate acronyms will be deleted.*

Comment 11: Page 1-6, Section 1 Introduction, subsection 1.4: This entire paragraph appears out of place in this discussion. Either expand this discussion to indicate that the report follows a planning process that will consider a number of measures including the no-action plan or delete the paragraph. Recommend expanding the discussion as stated above and MOVING that discussion to Section 2 where the planning process is more fully discussed. Further recommend that this discussion be placed between Subparagraph 2.1 and 2.2.

Response: *Concur. The subsection 1.4 No Action Plan will be moved to Section 2 and expanded.*

Comment 12: Page 1-8, Section 1 Introduction, subsection 1.6, paragraph four: This paragraph will be confusing to people not familiar with how the scope was developed. Recommend deletion of Sentence 1.2, 3. (This was discussed directly between Phillip Brozek and Blake Johnson on December 20, 2002 by phone).

Response: *Concur. The paragraph has been rewritten for better understanding.*

Comment 13: Page 1-10, Section 1 Introduction, Reference called out as "Environmental Improvement Program "April 2001: The EIP was original developed and adopted much earlier that 2002. The report may be referring to the EIP update. Recommend including both original and revision dates

Response: *Concur. The original and revised dates to the EIP will be included.*

Comment 14: Page 2-1, Section 2 Need for and Objectives for Action, subsection 2.0, last sentence: The sentence could be more clear by substituting "This information…" with "The planning process…"

Response: *Concur. The text will be changed to include "The planning process…."*

Comment 15: Page 3-2, Section 3 Setting, subsection 3.1.3, first sentence: The sentence references a document (Corps 2000). I am pretty sure this is an error and should probably be (USDA 2000). Recommend checking the reference.

Response: *Concur. The reference will reflect the TRPA Code of Ordinances, 2001.*

Comment 16: Page 3-18, Section 3 Setting, subsection 3.3(a): The hierarchy with indentation and subsection (a) appears inconsistent with the rest of Section. Please review.

Response: *Concur. The indentation of this subsection will be modified.*

Comment 17: Page 3-18, Section 3 Setting, subsection 3.3, last sentence: The numerical citations in parenthesis are confusing. My guess is that these are CCR citations. Recommend rewriting sentence to give full citation notation of 14 CCR xxxx to insure clarity.

Response: *Concur. The full citation will be written.*

Comment 18: Page 3-21, Section 3 Setting, subsection 3.3, very last sentence: The sentence is confusing with "…feasible, if not potentially difficult". The sentence makes more sense if the word "not" is deleted. Recommend reviewing last sentence for clarity.

Response: *Concur. This last sentence will be rewritten for clarity.*

Comment 19: Page 4-2, Section 4 Exfiltration, second paragraph (on page 4-2): Reference to sewer district by acronym is contrary to the intent stated in conversations between CDM and Corps. Recommend correction to delete reference to specific PUD.

Response: *Concur. The reference to the district will be removed.*

Comment 20: Page 5-11, Section 5 Basis for Evaluation, Subsection 5.4.6, second paragraph, second sentence: Recommend deletion of plurality of word "…drains…".

Response: *Concur. The plurality has been corrected.*

Comment 21: Page 7-2, Section 7 Incline Village, Subsection 7.5, second sentence: Sentence is unclear and awkward. Reviewer is unsure if intent is "Typically the grease and grit found within the lines have not been a problem" or "The grease and girt typically found in sewer lines have not been a problem"? In either case, recommend rewriting sentence to add clarity.

Response: *Concur. Sentence has been rewritten for clarity.*

Comment 22: Page 7-2, Section 7 Incline Village, Subsection 7.5, last sentence: The idea of roots needing chemical treatment and the small magnitude of exfiltration appears to be contradictory. Recommend explanation in Section 4. See also General Comment #1 and Comment #6.

Response: *Concur. Roots typically intrude pipes at their joints. The roots usually come in through the top or side of the pipe (joint) where exfiltration is not a problem but infiltration is the issue. This is not to say that roots cannot intrude from the bottom of the pipe (joint) and cause exfiltration problems or the root intrusion (root ball) gets large enough to separate a pipe at the joint. A brief discussion will be included in the Section 4 – Exfiltration Estimate.*

Comment 23: Page 8-5.8-6, 8-7, Section 8 Tahoe Douglas: Table 8-2 Location 1A, 1B, 1C do not show up on Figure 8-2/8-3. Recommend modification of Figure(s).

Response: *Concur. Location 1A, 1b, and 1C will be included in the Figure.*

Comment 24: Page 9-4, Section 9 Round Hill: Text in Figure 9-1 in not legible. Recommend Figure text be modified to increase legibility.

Response: *Concur. Figure 9-1 will be reprinted.*

Comment 25: Page 10-2, Section 10 Douglas County, subsection 10.5, last paragraph: Text states that pump stations a usually cleaned three times a week. That level of O&M appears incredible by most any standard. Recommend checking again with district to confirm interval.

Response: *Wet wells are cleaned three times a week per the district. This has worked well for the district with no problems.*

Comment 26: Page 12-12, Section 12 South Tahoe PUD, Table 12-2, location 13A: Description includes a facility with a submersible pimp! I have used all my professional control to not include some wisecracker comment. Obviously the text should be changed to submersible pump.

Response: *Concur -thank you for the control! The wording has been changed.*

Comment 27: Page 15-3, Section 15 Benefits of Reducing Risk: The first example in subsection 15.4 is clear. The second example is less clear. Does Table 15-2 represent a typical "a" type category, or all "A" types in aggregate? Recommend clarification.

Response: *Concur. The example will be clarified to match Table 15-2. A new table has been included to show a variation in time and the loading potential. Category A is described as 80 to 1,800 dwelling units. The upper end of 1,800 dwelling units was an assumption. There could be more than 1,800 dwelling units that a particular pump station handles.*

Comment 28: Page 15-3, Section 15 Benefits of Reducing Risk: The first example in subsection 15.4 is clear. The second example is less clear. The presumption is that Table 15-2 represents a typical "A" type category. Recommend clarification.

Response: *Comment a repeat of Comment 27.*

Comment 29: Page 15-3, Section 15 Benefits of Reducing Risk: Recommend Table 15-2 be modified to show assumptions including a 4 hour failure, an 8 hour failure, a 12 hour failure and 24 hour failure, their associated releases, associated maximum fine, associated pounds of nitrogen per release, pounds of phosphorus per release, and comparison as a percentage of that contribution to yearly lake loading. Given the minimal number of releases around Lake Tahoe historically, sewer overflows appear to be an even more minor contributor to nutrient loading than exfiltration. Even a relatively catastrophic once-a-year release of 200,000 gallons results in less than one hundredth of a percent (0.007%) of nitrogen and just over one tenth of a percent (0.013%) of phosphorus contribution to yearly nutrient load. Such an analysis may lead decision-makers to conclude that any funds programmed for this EIP project ($61 million) or recommend by this report ($30-$90 million) would be better expended on another type of nutrient reduction.

Response: *Table 15-2 will show assumption of a 4, 8, 12, and 24 hour failure with associated releases, maximum fines, and loading percentages. Based on the 10 years of spill data collected from the regulatory agencies and the sewer districts, approximately 6 spills reached Lake Tahoe, tributaries to Lake Tahoe, or storm drains. Though the data shows the sewer systems have been managed and operated quite well over the years, the fact that the overall age of the sewer infrastructure throughout the Lake Tahoe basin is not getting any younger and the possibilities of failure increase, not only for one district, but for all districts.*

Nevada Division of Environmental Protection, December 23, 2002

Comment 30: Exfiltration Rates
It is recommended that field testing of exfiltration rates and televising of the sewer lines be incorporated into the assessment of losses. While this may have been done at several of the Districts, many of the Tahoe systems did not report having such examinations.

Response: *Concur with the televising of the sewer lines. This study recommends that a field exfiltration study take a lower priority relative to other activities addressing major source of nutrient loading to Lake Tahoe. It has been recommended that televising of the sewer lines will assist in the assessment of the sewers.*

North Tahoe Public Utility District, January 10, 2003

Comment 31: Page ES-4 (Executive Summary-4) First sentence first paragraph is not a sentence.

Response: *Concur. The Executive Summary has been rewritten.*

Comment 32: Page ES-8 Fifth bullet on the page states that performance of the Lake Tahoe District Sewer Systems is comparable with Districts outside the basin. This statement conflicts with Section 5, page 6, Section 5.4.1, 3rd paragraph that states "conditions in the Lake Tahoe basin seem to be better than they are nationwide".

Response: *Concur. After further investigation with local agencies in California and Nevada, the statement "conditions in the Lake Tahoe basin seem to be better than they are nationwide" is a correct statement. The bullet in the Executive Summary and in the Findings will be corrected.*

Comment 33: Page ES- 10 First Paragraph, Line 7, Sentence starts "Table 16-2" should read "Table ES-5".

Response: *Concur. The Executive Summary has been rewritten.*

Comment 34: Page ES- 15. The bulleted item at the top of the page appears to be same as bullet #6 on page ES-14.

Response: *Concur. The Executive Summary has been rewritten.*

Comment 35: Contents Section, Acronyms, lists GSP (galvanized steel pipe) twice.

Response: *Concur. Acronym list will be corrected.*

Comment 36: Section 1, Page 8, fourth paragraph of Section 1.6 uses acronyms undefined in prior text such as HQ, SPD, SPK.

Response: *Concur. Acronyms will be defined in the text.*

Comment 37: Section 1, Page 9, Section 1.7.2 First Paragraph, first line. Insert the word "the" between "of' and "96th".

Response: *Concur. The sentence has been corrected.*

Comment 38: Section 3, Page 4 last line on the page, delete the semi-colon, insert the word "for" following the word "required".

Response: *Concur. Sentence has been restructured.*

Comment 39: Section 5, Page 7, Section 5.4.2. First paragraph states that most sewer systems in the Lake Tahoe basin were constructed in the early 1960's to the early 1970's. Speaking only regarding the California side of the north shore the earliest sewering efforts took place in the 1940's and 1950's and were extended by sewer assessment districts in the late 1960's, therefore given the earlier statement that the service life of sanitary sewer pipes is generally accepted as 50 years, many of the lines in the older portions of the communities are beyond their service life if they still exist.

Response: *Concur. This section will include a statement regarding sewer lines that are over 50 years old. The service life of sanitary sewer pipe is generally accepted as 50 years (ASCE, WEF). It will be stated that sewer pipe can have a service life well above 50 years but increased inspection and monitoring should be performed on older systems.*

Comment 40: Section 5, Page 9 Section 5.4.4. The third paragraph of this section speaks to problems with force mains being limited in capacity mainly due to underestimation of the sewage generating characteristic of the collection area. As has been noted in Paragraph 5 of this section that is not generally the cause of the problems in the Tahoe basin. It should however be noted that because facilities were overdesigned the scouring velocity in the force mains may not be maintained therefore causing debris buildup in the lower spots of force mains or in inverted siphons and there may be flow limiting cross sectional area at these locations.

Response: *Concur. These characteristics of the Lake Tahoe systems (overdesigned – debris buildup, etc.) will be stated in this study.*

Comment 41: Section 5, Page 10, Section 5.4.5. Third paragraph lists various materials of which force mains were constructed in the Lake Tahoe basin. Vitrified clay is shown as one of the materials but in fact it was only used on gravity interceptor portions of export facilities and not the pressure pipe or force main itself Conspicuous by its absence is the cement mortar lined and coated steel of which the North Tahoe P.U.D. has nearly 30,000 feet in the ground.

Response: *Concur. A discussion on cement mortar lined and coated steel will be included in the document.*

Comment 42: Section 5, Page 13, Section 5.4.9. The second paragraph states that most of the sewer districts in the Lake Tahoe basin have increased their gravity sewer cleaning schedules to once each year. I question this statement. I believe the schedules are such that gravity sewers are cleaned once every few years depending on past maintenance experience.

Response: *Concur. Most districts are on a 2 to 8 year cleaning cycle with cleaning of problems areas more frequent. This will be stated more clearly.*

Comment 43: Section 5, Page 14, second complete paragraph. Similar to the prior comment this states force main cleaning schedules have been increased to once each year by most of the sewer districts in the Lake Tahoe basin. Once again I question this statement. It may be true for some districts.

Response: *Concur. Some districts have stated the ability to clean short sections of force mains. Several districts have not cleaned their force mains since construction. This will be stated in the report.*

Comment 44: Section 6, Page 2 Section 6.2.2 last paragraph. This paragraph speaks to areas that should not be considered for construction of sewer systems and includes a blanket statement such as "any other environmentally sensitive areas such as U.S. Forest Service lands". This sentence should end after the word "areas". U.S. Forest Service lands are not universally environmentally sensitive areas and may be considered for infrastructure where appropriate.

Response: *Concur. Comments will be incorporated into the report.*

Comment 45: Section 6, Page 3, Table 6-1. Under the category of age the potential risk reduction measure listed for lines greater than 50 years old includes maintenance and then a comma with trenchless or conventional replacement following. Replacement, either trenchless or conventional, should be a separate measure for lines that are 50 years old. It should be noted that with modern testing and televising procedures lines greater than 50 years that have no structural defects, grade problems, or infiltration/inflow problems can remain perfectly serviceable without replacement and with routine maintenance.

Response: *The service life of sanitary sewer pipe is generally accepted as 50 years (ASCE, WEF). For this table, rehabilitation will also be included. It will be stated that sewer pipe can have a service life well above 50 years but increased inspection and monitoring should be performed on older systems.*

Comment 46: Section 6, Page 4, Table 6-2. Under the maintenance risk reduction measure, an additional advantage consisting of "extends useful life of existing facilities" should be added to this table. Similarly under maintenance measures, Disadvantages, where it is stated that this involves additional O&M costs, it should be noted that grouting is a fraction of the costs of other repair/rehabilitation methods.

Response: *Concur. Lower grouting costs will be included as an advantage in the tables.*

Comment 47: Section 6, Page 5, Table 6-2 continued. Under the Section "Low Pressure Pumping System risk reduction measures", an additional disadvantage should be listed as follows: "more difficult spill prevention because of the number of facilities involved". Under the risk reduction measure entitled "Rehabilitation", for both slip lining and lining categories a disadvantage should be listed "laterals can be problematic". On the risk reduction measure Section titled "Manholes" an additional disadvantage for cured in place relining should be the "toxicity of process" and/or "release of toxic fumes".

Response: *Concur. These comments will be incorporated into the document.*

Comment 48: Section 6, Page 6, Table 6-3. Risk reduction measure for Redundancy Item 3 may have an additional measure listed as "change operating levels to allow for emergency storage".

In the same Redundancy section, condition 4, where “no portable generator as backup” is listed the risk reduction measure says make provisions for onsite backup power. Due to the size of facilities and the service area flowing into specific sewer pump station onsite power may not be needed.

Response: *Concur. Provisions for on-site backup power may include a portable generator located at the maintenance yard that is designated to several satellite pump stations. The provision for backup power is that there should be enough generators to power several pump stations in the event of power loss.*

Comment 49: Section 6, Page 7, Table 6-4. Risk reduction measure “Relocate Facility”. An additional disadvantage of this risk reduction measure is that “cumulative environmental impacts may exceed benefit”‘.

Response: *Concur. Comment will be added to the document.*

Comment 50: Section 6, Page 8, Table 6-5. Structural condition No. 1 lists as a reduction measure “conversion to low pressure pumping system (grinder pumps)”. The only way to change the pressure of a force main is to change the hydraulics. Conversion to grinder pumps will not necessarily lower the pressure unless the pump station’s force main is totally abandoned in favor of individual grinder pumps at each property. This comment should more appropriately be part of a mitigation measure for pump stations rather than for the sanitary sewer force main.

In The Operations and Maintenance section of this table under “cleaning” where a pig launching facility is not provided it lists add pig launching facilities under “Measures”. I believe pigging may not be possible due to fittings incorporated in some force mains. If the designers were not providing cleaning facilities for the force mains they took more liberal use of angle points in the force mains to avoid conflicts or make highway crossings.

Response: *Concur with statement regarding the low pressure pumping system. This was included for purposes of giving several alternatives and may be part of a mitigation measure or may be part of a lower cost alternative for areas located in the shorezone where construction equipment may need to be barged to the site. Grinder pumps have been included under both pump stations and force mains.*

Concur with second statement regarding pig launching. Pigging facilities may not be a solution for force mains depending location and fittings. Again, this was added as a possible alternative, we did not want to eliminate any alternatives that may be feasible.

Comment 51: Section 6, Page 9, Table 6-6. Under the measure titled “obtain easements”, a disadvantage should be listed as “willingness of donors”.

In the same table under the trenchless replacement category, a disadvantage is listed as “service connections can be problematic”. I believe this comment should be deleted as service connections are not usual on sewer force mains.

In the same table under Rehabilitation and Maintenance measures, redundant barrel and appurtenant structures for siphons are listed as a measure. A disadvantage should be added "usually requires work in SEZ".

An additional measure under Rehabilitation and Maintenance should be "directional drilling".

Response: *Concur with easement comment. This will be included in the table.*
Concur with other statements – will "remove service connections can be problematic" and add "working in SEZ's". Directional drilling will be included as trenchless replacement.

Comment 52: Section 6, Page 14, Section 6.2.6. First paragraph. The fourth line refers to "closed caption" television. By definition this should be closed circuit television.

Response: *Concur. This typo has been corrected.*

Comment 53: Section 6, Page 16 Section 6.2.9.2. Add to the end of the first sentence "or it is desirable to provide emergency response time".

Response: *Concur. This sentence will be added.*

Comment 54: Section 6, Page 17, Second complete sentence on the page. As stated elsewhere in these comments I do not concur with the recommendation that all pump stations should have onsite generators.

Response: *This sentence will be clarified; portable generators are an acceptable measure for backup power.*

Comment 55: Section 6, Page 17, Section 6.2.9.6. Sentence should have the following words added to the end: "or other operating plans in place."

Response: *Concur. This statement will be included.*

Comment 56: Section 6, Page l7, Section 6.2.10. Last paragraph. It may be worthy of note that providing parallel force mains frequently conflict with other agencies goals, such as a California Department of Transportation's goal to locate facilities as close to the edge of right of way as possible (see Section 3.2.3.5) where the edges of the rights of way are already crowded. California Tahoe Conservancy and U.S. Forest Service policies may also make construction difficult for lands under their control.

Response: *Concur with comments. Minimum requirements were stated in Section 3 – Setting, for both state and federal agencies. Requirements from both state and federal agencies vary from project to project and to list these requirements or constraints might be a document itself.*

Comment 57: Section 6, Page 19, Section 6.3.2. More a question than a comment, do the slip lining or other lining techniques cost estimates assume any specific number of service dig ups as a part of the overall cost estimation?

Response: *The costs do not include dig ups. We did not want to assume the number of service laterals at this point.*

Comment 58: Section 6, Page 23, Table 6-12. The costs reflected in this table do not appear to include bypass costs, which can be quite significant depending upon the length and location of the force main.

Response: *Concur. These costs are estimated first costs. The design phase would need to identify these and other associated costs.*

Comment 59: Section 6, Page 23, Table 6-13. The costs do not appear to include the potentially high administration/legal costs to convert existing users to pump services.

Response: *Concur. If grinder pumps became a feasible alternative, additional cost estimates will be required to determine true cost, both administrative and the modifications to the existing system.*

Comment 60: Section 14, Page 3, Section 14.6., third sentence. The initials TDD should be replaced with NTPUD. Fourth sentence, first word, should read "Figures", the word "identifies" should be "identity" and the last word of the sentence, "facility" should read "facilities".

Response: *Concur. Initials and text will be modified.*

Comment 61: Section 15, Page 2. The discussion on CMOM regulations includes an EPA estimate that for 19,000 municipal systems, the potential costs of this program are between $93.5 and $126.5 million dollars. This equates to only an average cost of $4,921 to $6,658 per system. Obviously this refers to the overhead and reporting costs to implement the CMOM program and does not, as your report states, base these costs on physical improvements to the municipal systems

On this page the third to last word should be "and" as opposed to "an"

Response: *Concur. The EPA is currently updating costs. Text will be modified.*

Comment 62: Section 15, Page 3, Section 15.4. The hypothetical releases discussed in this section bear little relationship to actual events. Vactor trucks, emergency pumps, and/or other means to limit sewage generated during times of an emergency can and will be used to prevent long duration escapes of sewage. All the Lake Districts both in California and Nevada are signatory to the Emergency Contingency Plan which allows for the sharing of resources, both manpower and equipment, for these events.

To say that a spill cannot or would not enter Lake Tahoe would fly in the face of common sense, but assuming that a power outage spill would be allowed to last for 24 hours is also beyond the realm of common sense. If it is important to quantify potential pounds of nutrient release from sewer spills, the numbers presented in this section should be significantly reduced to reflect real conditions.

Response: *Concur with these statements. This hypothetical release will include more realistic time frames along with the 24 hour occurrence.*

Comment 63: Section 16, Page 1. On this page the sixth bullet has been commented upon previously (Comment #2).

Response: *Concur. Bulleted comment regarding the sewer systems in the Lake Tahoe basin will be stated as being in better shape than other districts outside the basin based on spill/overflow records.*

Comment 64: On this page, the final bullet I would recommend that the words "without proper operation, maintenance, and replacements will" be placed after the word "system" in the first sentence. Both this section and section 4 should be annotated to reflect the fact that the data is 20 years old and the subject Districts have modified maintenance activities to further limit exfiltration.

Response: *Concur with statement.*

Lahontan Regional Water Quality Control Board, February 3, 2003

Comment 65: The age of the sewer systems (30-40 years with an estimated maximum life of 50 years) is disturbing. POTWs should assess the real probable lifetime of their sewer systems and formalize an appropriate capital improvement program to plan for pipeline replacement and other sewer system improvements suggested in Sections 5 and 6. Note that much of the existing sewer line is located in sensitive meadows in close proximity to surface water tributaries of Lake Tahoe. Soil and ecosystem disturbance during replacement is a potential problem. An alternative that should be considered is re-siting the lines in less sensitive locations, possibly upland areas.

Response: *The estimated service life expectancy is approximately 50 years. Again, many sewer lines throughout the country are 100 years old or older. At 50 years there should be a plan to start rehabilitating or replacing lines that will fail. A thorough inspection and monitoring program should be in place to identify those lines that are starting to fail. With regards to the comment concerning soil disturbance near sensitive areas, it would be a plus if a sewer facility can be relocated outside of these sensitive areas. The problem with this is that a majority of the infrastructure may need to be reconstructed for a very small portion of sewer line to be relocated. The hydraulics of the sewer system would need to be re-evaluated.*
It might be quite difficult to relocate sewer and export lines without constructing many pump stations.

If possible, rehabilitation of the sewer lines may have the least damaging effects on the environment.

Tahoe Regional Planning Agency (TRPA), January 31, 2003

Comment 66: My main concern is for sewer lines and pump stations that are in the foreshore (between high and low water Lake Tahoe elevation). The precision of information on location varies between TCPUD and NTPUD sections. More of NTPUD locations are stated as in or near the shorezone. The high water elevation should be fairly easy to determine especially for pump stations. It is not that any of the exfiltration test in the 1983 study were done on any of the nearshore sections of gravity line since that was a high Lake level period, so the entire discussion on exfiltration in section 4 may not apply to those situations. Perhaps the correction factor in Table 4-3 for groundwater conditions should have been applied to those sections of sewer line in estimation of potential exfiltration. Shorezone risk although listed under access in table 5-4 might be considered high rather than medium in order to account for these uncertainties.

Response: *The 1983 study studied a representative sample of the sewer lines including shorezone locations. Exfiltration would not be of concern during high water conditions – infiltration would be the concern.*

The shorezone, stream environment zones, and other sensitive areas were all considered a risk. It was the risk criteria/key conditions that placed them at high, medium, or low risks.

Comment 67: In or after section 4.5.2, page 4-11 you might consider adding a brief discussion of pump station alarms and response times, and force main leak detection capabilities and response (shut down) times and volumes of potential spills. This would be relevant to the discussion since exfiltration per se does not seem to be an issue for these portions of the sewer districts systems. The nutrient load would be expected to be higher on a volume basis in effluent export force mains than in collection or untreated export force mains. Section 5.4.1, page 5-6, last sentence of first paragraph after "...discharge of raw and untreated sewage" add for accuracy: or treated sewage effluent.

Response: *These comments are addressed under each district, Sections 7-14, and in Section 6.2.9.4 – Motor Sensors and Alarms with Telemetry. A sentence will be included at the end Section 4.5.2 regarding alarms and response times. The statement "or treated sewage effluent" will be added to Section 5.4.1.*

Comment 68: (1) Section 15.2 on page 15-1; it appears that there is missing information with respect to TRPA's role in pursuing regulatory penalties. As you may be aware, Article IV of the Compact contains provisions for penalties of up $5,000 per day per violation. Please amend this section to reflect this information.

Response: *Concur. This information will be included in the document.*

Comment 69: (2) I would suggest that Section 15.2 be amended and expanded to further clarify Measures of Progress (MOPs) and/or Units of Benefit relative to this study.

Response: *Concur. We are aware that new Units of Benefits are being addressed, but have not seen the results. As for the existing Units of Benefits, they are confusing for the rehabilitation of sanitary sewer systems.*

Comment 70: (3) Section 15.4; if you are trying to illustrate a worse case scenario, you may want to consider the following for discussion purposes. Give examples of additional Pollutants of Concern (POC) such as Escherichia coli and locate the hypothetical release to occur adjacent to the drinking water intake line for the Incline Village General Improvement District near Burt Cedar Beach, for example.

Response: *Concur. A discussion will be included hypothetical look at a sewage spill near a water intake line will be included in Section 15 – Benefits of Reducing Risk.*

Comment 71: (4) Further articulate or provide a proposal to solve the issues identified in the 5th bulleted item on page 16-2; i.e., "Key conditions/problems were found to exist within the sewer system of each district that pose a medium to high degree of risk that could potentially lead to an overflow/release to Lake Tahoe".

Response: *Disagree. Descriptions of key conditions/problems are discussed in Section 5 – Basis for Evaluation of Risk.*

Kingsbury General Improvement District, January 10, 2003

Comment 72: Page 4-10, Table 4-5. Change Kingsbury GID's length of gravity sewer to 33 miles. Also, based on this change, correct remaining tables in this chapter.

Response: *Concur. These corrections will be made.*

Comment 73: Page 11-1. Length of gravity mains is 33 miles
Service connections is 2,300
2001 average daily flow was 477,000 gallons
2001 peak daily flow was 756,000 gallons

Response: *Concur. These corrections will be made.*

Comment 74: Page 11-2, Section 11.5. There has been one reported spill during the last ten years. It is estimated that an average of one spill per year will occur according to KGID personnel.

Response: *Concur. This statement will be included.*

Comment 75: Page 11-4, Table 11-2. Location 1A, KGID Pump Station. Generator scheduled to be replaced in 2003. Controls and pumps have been replaced within last ten years.

Location 2A, Pump Station, Kingsbury Palisades. Pumps and control panel scheduled for replacement in 2003.

Location 3A, Pump Station, Kingsbury Village. This pump station is outside the Tahoe Basin. Pumps and control panel replaced in 2001.

Response: *Concur. Tables will identify this information and will probably lower the risk level.*

Incline Village General Improvement District, January 7, 2003

Comment 76: 4-10, In situ exfiltration rates.
It is stated that the sewer systems in Lake Tahoe basin were constructed during the same time, using predominantly the same material and installation methods. Yet, the in situ exfiltration rates are different. If all the systems are predominantly the same, the rates should be the same. It does not make sense to have different rates.

Response: *Disagree. Since there was no data for the Nevada sewer districts from the 1983 exfiltration study, an average in situ unit exfiltration rate was used based on the California data. The data from California was actual field data, therefore different between the California districts.*

Comment 77: 4-14, Findings, Limitation, and Recommendations.
A definite limitation is that the model assumes that all of the nutrients that are carried by the assumed exfiltration reach the lake. Various studies have shown the reduction of nutrients and bacteria in the ground from existing organisms in the soil.

Response: *Concur with this statement. The soil matrix was not accounted for in the 1983 exfiltration study or this estimate. It can be logically assumed that the nutrient loading to Lake Tahoe would be less than the estimate in the study.*

Comment 78: 5-3, Table 5-3, Age
The age criteria should be tied to a specific year for risk factor. In the mid 1950s gasketed joints replaced mortar joints. This significantly reduced infiltration into sewers. The next big leap was from AC to plastic pipe which increased pipe lengths and tighter joints. A sample would be

Pipes Older than 1955	High
Pipes 1955 to 1980	Medium
Pipes 1980 to present	Low

Response: *Concur with statement that the differences in newer materials have increased the reliability of the sewer systems. In general our numbers agree accept at the low risk age. Our medium risk level of 11 to 50 years old applies to those sewer lines located within the environmentally sensitive areas and it is our professional opinion that these lines should be* *inspected more frequently to ensure failure does not occur. We agree with your numbers for the sewer lines outside of these sensitive areas.*

Comment 79: 5-3, Table 5-3, Operation and Maintenance, Cleaning
A sewer District typically assigns sewer cleaning levels based on the need for that line to be cleaned so it remains free of debris, roots and grease. A line with a more frequent cleaning interval is typically at higher risk for overflowing. Sewers are designed to be low risk for overflowing. The subcategories for cleaning could be:

Cleaned < 1 year	High
Cleaned 1-3 years	Medium
Cleaned > 3 years	Low
No Cleaning Program	High

Cleaning also accelerates deterioration of pipes. A frequent cleaning program on pipes that do not need frequent cleaning can lead to long term problems. The category cleaned only when problem occurs provides no information unless the cleaning program is only on a reactive basis than the risk level is high because there is no preventative maintenance.

Response: *Concur with your statement that a line that needs a higher frequency of cleaning is generally at higher risk of overflowing. ASCE (EPA 832-F-99-031) suggests cleaning approximately 30% of a sewer system per year.*

Cleaning (jetting) may accelerate deterioration in some pipe materials. Inspecting and monitoring these pipes are critical for longevity and establishing the appropriate cleaning schedule.

Comment 80: 5-3, Table 5-3, Operation and Maintenance, Televising. Similar to cleaning, frequent CCTV work is performed for problematic areas and other CCTV work is random. The televising risk should be based on the existence of a CCTV program. A District that televises is proactive in preventative maintenance and will tend to have a lower risk to overflows than a District that is reactive.

Response: *Concur with statement. Each district should have a cleaning and CCTV program.*

Comment 81: 5-4, Table 5-4, Wet well Capacity
The criterion specified is inadequate. The key criteria for a wet well concerning overflow risk is if there is adequate volume to allow proper response based on certain flow conditions. If from the time of notification of pumping station failure to overflow at ADWF is only three minutes, the risk of overflow is high. Failures at pumping stations are various and a response criterion is independent of the failure mode and concentrates on the goal which is to reduce the risk of an overflow. Other critical criteria are addressed in the other sections such as pumping capacity and standby power.

Response: *Disagree with statement. Most wet wells are sized for pump starts, not necessarily for overflow protection. Sizing a wet well incorrectly can lead to excessive wear and tear and odor.*

Comment 82: 5-6, 5.4.1, paragraph 3.
IVGID disagrees with the statement that, "All of these facts indicate that the overflow were problems that may be fixed by routine maintenance." The facts show that the overflows were non-repeating isolated incidents. A routine maintenance program can not address these random events. A routine maintenance program targets likely areas and mitigates risks.

Response: *Concur with statement. This paragraph will be rewritten for better clarification.*

Comments from South Tahoe Public Utility District (STPUD) and Douglas County Sewer Improvement District No. 1 (DCSID) were received via phone conversation and have been addressed in the report.

TRPA – Scientific Advisory Committee, January 22, 2003

Comment 83: Authors should describe the USEPA, ASTM, and TCPUD test conditions (e.g., what field pressure is assumed?) and comment on whether the conditions are similar to those of the 1983 field test.

Response: *Concur. A brief description of some of the test methods will be included.*

Comment 84: 25% of the 1983 data indicated exfiltration rates were 1,400 gallons/day/inch-diameter/mile and thus not within the norm expected. Such a high rate indicates either experimental error in measurements or a serious breach in the integrity of the sewer line. If the latter is the case, one wonders whether this breach in integrity applies to a significant portion of the sewers in the Tahoe basin or if this was just an outlier pipe section. Hopefully, a plan of increased monitoring and subsequent corrective action was developed after the 1983 study.

Response: *According to the authors of the 1983 exfiltration study, sections of lines were severely damaged or corroded. It was stated that these lines had been repaired (pg. 4-6). Inspection, monitoring, and cleaning have increased since 1983. Deteriorating lines can be identified and monitored more readily and an action plan can be implemented so that a failure does not occur.*

Comment 85: <u>I reject Scenario 1 as not justifiable. I think the estimates from it should not be included on Table 4-4, 4-5, 4-6, and 4-7 nor in the Executive Summary.</u> First, the validity of the actual values assigned as correction factors is highly questionable (no basis is given for them in the report and I doubt that any exists in the literature). In fact the values assigned are really just guesses of numbers between some very small but non-zero number and 1, given the actual data base available to quantify the impact of clogging, groundwater conditions, sewer slopes, and buildout. Second, many of those correction factors are inter-related. For instance the first, fourth, and fifth factors listed on Table 4-3 essentially all get at the fact that the sewer is not flowing full or under surcharged conditions. A simple adding of the factors as was done in Scenario 1 is not justified. The co-dependency of the factors has not been quantified in the literature. The authors themselves come to the same conclusion that these multitude of correction factors are not quantitatively justifiable (bottom of page 4-9) and yet the estimates derived from their use are still prominently shown on four main tables (Table 4-4, 4-5, 4-6, and 4-7) of this section and are used to estimate N (123 lb/yr) and P (33 lb/yr) loadings reported in the Executive Summary without any disclaimer. I think those estimates should be removed from the Executive Summary and replaced with the results of a sensitivity analysis as discussed in Comment 5 below.

Response: *The correction factors are based on engineering judgment, research literature, and specific information provided by the sewer districts. The correction factors for hydraulic head, wetted perimeter, and flow are based on engineering equations. The correction factor for clogging is based on several literature references. The correction factors for groundwater conditions and buildout are based on specific information provided by the sewer districts. The reader is referred to the 1983 exfiltration study for further detail. However, the 1983 exfiltration study was reviewed and approved by the Lahontan Water Quality Control Board.*

Comment 86: In Scenario 2, the field rates are divided by only 16.7 instead of 526 (by using the mid value, 0.06, of the range 0.002 to 0.11 from Table 4-3). This smaller correction factor (based on hydraulic head only) increases the estimate of N and P loadings (3,850 and 1,030 lb/yr, respectively). I certainly concur with the authors that some reduction of the field rates is necessary to account for the fact that the sewers do not typically operate under the 1 foot surcharge test conditions. However, the choice of the range (0.002 to 0.11) and the selected value of the correction factor (0.06) was not justified in the report and seems pretty arbitrary. Given the importance of this correction, the authors should provide a better review of the topic and the basis for the values reported as well. Relevant literature should be cited as well. A more complete sensitivity analysis of the impact of the selection of the correction factor should also be included as per Comment 5.

Response*: The correction factors are based on engineering judgment, research literature, and specific information provided by the sewer districts. The correction factors for hydraulic head, wetted perimeter, and flow are based on engineering equations. The correction factor for clogging is based on several literature references. The correction factors for groundwater conditions and buildout are based on specific information provided by the sewer districts. The reader is referred to the 1983 exfiltration study for further detail. However, the 1983 exfiltration study was reviewed and approved by the Lahontan Water Quality Control Board.*

Comment 87: The authors claim on page 4-13 that a 'sensitivity analysis' of the impact of correction factor on the estimate of N and P loading was conducted. However, what was actually done was to arbitrarily (as explained in Comment 3 and 4 above) set the range of correction factor values to 0.0019 (i.e., divide the field test rates by 526) and 0.06 (i.e., divide the field test rates by 16.7). On the basis of this range of values they then estimate a nitrogen and phosphorus loading range of 123 to 3,850 lb/yr and 33 to 1,030 lb/yr, respectively and report this estimate range throughout the Executive Summary without acknowledging the extreme uncertainty of the range itself. I agree with the authors that IF the 'true' correction factor is less than 0.06 (as they assume) then N and P loadings are insignificant compared to other reported sources of N and P. But what if the 'true' correction factor is instead between 0.06 and 1 as shown below?

Lumped Correction Factor	N (lb/yr)	% of other sources	P (lb/yr)	% of other sources
approx. 0.0019	123	0.01	33	0.03
approx. 0.06	3850	0.42	1030	1.02
0.1	6417	0.70	1717	1.7
0.5	32083	3.48	8583	8.5
1.0	64167	7.0	17167	17
Other sources:	922,000		101,000	

This sensitivity analysis, as compared to the authors', indicates the upper bound of the exfiltration load of N and P. The load could be as much as 7 and 17% of the total load if no correction factor were applied which I agree is overly conservative. However, the authors have not justified the use of factors less than 0.06 either.

In summary, the finding that "exfiltration does not appear to be a major source of the loading of N and P in the Tahoe basin" is predicated on 1) the validity of the small 1983 study to represent current sewer conditions in the entire basin and 2) the validity of the selection of a correction factor. Unfortunately, neither assumption can be validated without further field studies and such field studies are not justified unless exfiltration is thought to be a major source of N and P. Perhaps the best approach at this point in the study would be for the authors to attempt a more rational justification of a correction factor that they end up using (0.06).

Response: *Again, please see above responses. Operation and maintenance practices have improved since 1983 with closed circuit television, cleaning techniques, and inflow and infiltration monitoring. The regulatory agencies have not been able to identify areas of concern for exfiltration. The correction factor of 0.06 (from the 1983 exfiltration study) will be discussed further. No additional field studies were performed for this new exfiltration estimate, but considering the insignificant growth in the Lake Tahoe basin, the hydraulic head factor (wetted perimeter) should not change significantly.*

Comment 88 (minor): I believe the weighted average equations on pg 4-10 are not written correct. Typically a weighted average would be written as:

$$\frac{\Sigma(\text{In situ unit rate of each risk category x length of pipe in each risk category})}{\Sigma(\text{Total length of pipe in each district})}$$

In other words, the authors are missing a summation sign and a few parentheses in both equations on pg 4-10. However, the equations are stated in words properly in the text and I assumed they were used properly. The error is likely just in the typing of the document.

Response: *Disagree. The equations on page 4-10 are written correctly. The denominator in each equation is a constant. Therefore, it can be written inside of or outside of the summation sign.*

U.S. Geological Survey, January 23, 2003

Comment 89: No reference to the local geology or soil type is made when discussing the risks of the exfiltration from sewer facilities. The effect of leaking sewage into the subsurface will be highly dependent on the surrounding substrate. Two extreme examples would be fractured granitic rock and organic-rich peat deposits. Both of these types of substrate exist in the Tahoe Basin and sewage facilities are located within them. In a fractured rock setting, the sewage may travel intact at rapid rates down gradient to the lake. In an organic-rich peat deposit, the sewage may travel at much slower rates and undergo many changes, such as denitrification, before it reaches the lake.

Response: *Concur with the assessment that the substrate could impact the rate of sewage travel to Lake Tahoe, but budget constraints limited the study to the use of existing data and to estimate what may actually leak from the sewer system.*

Comment 90: USACE estimates exfiltration from sewage systems and concludes that the contribution to the lake's nutrient input budget is minor on a percentage basis.
The estimates presented are maximum possible inputs to the lake; the actual input likely is much less. These "order of magnitude" estimates ignore some major factors. Travel time to the take from the exfiltration point will be highly dependent on the transmissivity of the soil and/or rock the sewage must travel through as well as distance to the lake. Some alluvial deposits in the basin are well sorted and coarse grained and would transmit sewage at a rapid rate. Other deposits are fine grained and may not transmit water at all. Thus, location of the leak is important.

Response: *Concur with statement. This exfiltration estimate only evaluated sewage leaving the pipe and then estimated the nutrient loading. The soil matrix was not considered due to funding constraints. The original study evaluated a representative sample of the sewer system, i.e. near the shorezone, at higher elevations, etc. This exfiltration estimate considered the entire Lake Tahoe basin for the Corps Groundwater Study.*

Comment 91: When discussing sewer backups or overflows, no consideration of location was mentioned. The risks of spilled sewage flowing directly into a stream would be much different than if the spill occurred in a location where it all infiltrated into the soil.

Response: *Disagree. This was discussed in Section 5.4.1 - Reported Overflows/Releases within the Last 10 years. It was stated that most overflows were outside the shorezone and stream environment zones.*

Comment 92: Degradation processes need to be considered in the risk equations. Denitrification of nitrate and sorption of phosphorus are two that cannot be ignored.

Response: *Concur with statement but due to budget constraints, this was not evaluated.*

Comment 93: Chapter 1: Suggest provide a summary table, by District, of sewer operations in the Basin, pulling together data that is provided in each chapter. Map Es-1,1.1, and 4.1 are all the same. Suggest adding other related details, like out of basin export line locations, recent spill locations, etc. to make them different. Note USGS and other Basin maps are available on USGS Lake Tahoe Clearinghouse web page (tahoe.usgs.gov).
A wider literature search could possibly be done to improve this document. For example, there are no USGS documents cited in this report, and a few of these reports could provide more

valuable information. I have provided a current listing of the 58 USGS 'Lake Tahoe' reports (except Water Resources Data Reports), which is available off of the 'Nevada.usgs.gov' web site.

Response: *Chapters 7 through 14 provide detail of each district. The study area included the shorezone, stream environment zones, and other environmentally sensitive areas. The entire basin was not considered in this study. Spill locations were identified per records from the regulatory agencies. No mapping was provided by these agencies. The geology and soils will be a factor in the design and placement of new or rehabilitated sewer facilities.*

Comment 94: Chapter 3: Need to explain Lake Tahoe datum = U.S. Bureau of Reclamation (BoR) Datum and how that differs from mean sea level datum (-1.14 ft). Lake surface has ranges beyond the 'usable storage' of 6,223-6,229.1 ft (BoR datum).Note that USGS Lake Tahoe gage height record shows a range of 6,220.26(November 30,1992) to 6,231.26 (July 14, 15, 17, 18, 1907) for the period of record - April 1900 to current year (USGS Water Resources Data - Nevada, water year 2001, Garcia and Others, 2002).
Provide Lake Tahoe Basin area of 506 sq miles, lake 192 sq mi, and watershed 314 sq mi (according to USGS Report by Cartier and others, 1995).Note the USGS report, 'The Lake Tahoe Basin, California and Nevada', by Crippen and Pavelka, 1970, would be an excellent source for introduction.

Response: *Concur with the statement, but disagree with adding these statements to the document. These statements would not add clarification to this sewer risk evaluation.*

Comment 95: In the Ground water section, mention current USGS-TRPA Ground water sampling network and covered by USGS reports by Thodal, 1 997 and Rowe &Allander, 2000. In Surface water section mention current USGS-TRPA LTIMP monitoring and streamgage network, covered by USGS reports by Rowe, 2000and Rowe and others, 2002, etc.

Response: *Concur with the statement, but disagree with adding these statements to the document. These documents far exceed the needs and extents of this chapter.*

Comment 96: In Transportation section mention main highways in/out of basin, number of paved road miles, unpaved road miles, and airports and other types of transportation available in basin.

Response: *Concur with the statement, but disagree with adding these statements to the document. These statements do not add clarification to this sewer risk evaluation.*

Tahoe City Public Utility District, April 3, 2003

Comment 97: Page ES-14, Last bullet item: in addition to rehab and replacement, enhanced maintenance access in sensitive areas should be considered. Briefly discussed on Page 2-2.

Response: *Concur with statement. Existing easements should be monitored for encroachment and regulatory agencies and districts should realize the necessity to monitor and maintain the existing sewer facilities wherever they are located.*

Comment 98: Table 5-4, Age of a pump station is difficult to assign risk level as stations can undergo retrofits, and upgrades which improve reliability, not altering overall age.

Response: *Concur. Most pump stations are not replaced, but do undergo retrofits and upgrades as problems come along. A pump station could be at higher risk of significant failure if no retrofits or upgrades have been performed in 10 to 30+ years.*

Comment 99: Table 5-5, The frequency and risk levels of cleaning and TV appear very similar to gravity lines. Is there any data on frequency of force main TV and cleaning locally or nationwide? Typically an infrequent activity when sufficient velocities exist and typical residential sewage is encountered.

Response: *New design and construction may allow for inspection ports of force mains. There is no nationwide data regarding frequency of force main cleaning, only that it is recommended. Local sewer agencies (outside of the Lake Tahoe basin) vary from a 1 to 3 year schedule to no inspection/cleaning schedule at all. It is our professional judgment that force mains in the environmentally sensitive areas should be inspected on a 3 year basis (if possible).*

Comment 100: Section 5.4.4, Large capacity wet wells, or stations with secondary storage facilities (horizontal storage or large diameter influent lines) can also provide significant storage time. This time can allow an operator to respond and correct pump station failures, remedy power failures, and allow intensive maintenance activities prior to a pump station caused SSO.

Response: *Concur with statement.*

Comment 101: Table 6-2, Grouting manholes and pipes sometimes provides only temporary repairs. Disadvantage?

Response: *Concur. Grouting may be a temporary fix, but it can also provide a longer term solution to joint problems (10 to15 year increase in life expectancy).*

Comment 102: Table 6-2, CIPP rehabilitation may not solve infiltration issues (disadvantage)

Response: *Concur. CIPP may not solve all infiltration problems (manholes, laterals, etc.), but typically solves pipe and joint related infiltration.*

Comment 103: Table 6-2, Manhole lining, at least in our experience, has an insignificant effect on manhole diameter. Cost of manhole relining is significantly higher than stated in Table 6-8 and should be considered a disadvantage.

Response: *Concur. Costs will be updated.*

Comment 104: Table 6-2, Maintenance of existing manhole cover o-rings and seals is important.

Response: *Concur. This will be added to text.*

Comment 105: Table 6-4, Wet Well enlargement, or increasing storage provides advantage discussed above.

Response: *Concur but may also create increased odor and wear and tear on pumping equipment.*

Comment 106: Section 6.2.5, Watertight reinstatement of laterals is also critical to the success of any lining project involving mains with service laterals.

Response: *Concur. This will be included in Section 6.2.5.*

Comment 107: Section 6.2.7, Inverted siphons are often difficult to TV if they have no provisions to be drained.

Response: *Concur with statement.*

Comment 108: Section 6.2.8, Frost heave is a factor in this climate and should be considered when choosing a manhole rehabilitation method. Chimney seals and wedge seals provide a flexible yet watertight means of sealing chimneys and lower barrel joints. Methods that provide some elasticity should be considered.

Response: *Concur. A statement regarding frost heave will be included.*

Comment 109: Table 6-7, No mention of 4" service laterals (in whole report). They do exist in sensitive areas, and can be problematic, though typically only serve one or two dwelling units (low impact).

Response: *Concur with statement. Many of the 4" laterals are maintained by property owners and not the sewer districts (varies from district to district). Cost of replacing the 4" lateral is similar to the 6" lateral listed in Table 6-7.*

Comment 110: Table 6-8, Manhole relining by CIP not mentioned? If covered by "liner Insert", the cost is way too low. Typical manhole CIP liner cost based on depth and complexity (ladder rungs, heavy I&I, drop inlets). Cost can range from $2,000 to $5,000 and must be custom made for each individual manhole.

Response: *Concur with statement. This will be added to Table 6-8.*

Comment 111: Section 13.5, TCPUD has a maintenance goal of hydro cleaning (high pressure) all accessible gravity sewers annually. Lines inaccessible by the Vactor machine are annually flushed and inspected during flushing activities manhole to manhole. This maintenance goal has been met the last three years. In addition, the district maintains a strict frequent clean schedule that requires certain gravity sewers be cleaned more frequent than annually. This is due to restaurant grease or defects that are not easily correctable, such as minimal slope. The program to televise all gravity sewers every **five years** was implemented in 1997. Beginning in 2003, Gravity lines in shore zone and stream areas are to be televised every two years. Remainder of lines to be televised every 5 years. In addition to grouting, root intrusions and structural defects are repaired by spot repair based on priorities such as potential to cause blockage, severity, and accessibility.

Response: *Concur. These statements will be added to Section 13.5.*

Comment 112: Table 13-2 and 13-3, Location 4A, Pumping equipment and controls were replaced in 1991.

Response: *Changes will be made to the tables.*

Comment 113: Table 13-2 and 13-3, Location 10A, Pumping equipment and controls were replaced in 1991, Standby Generator replaced in 1994.

Response: *Changes will be made to the tables.*

Comment 114: Table 13-2, Location 13, Total pumping capacity 3400 GPM (1200, 1200, 1000).

Response: *Changes will be made to the tables.*

Comment 115: Table 13-3, Location 5A, Major station retrofit 1989, new controls 2002.

Response: *Changes will be made to the tables.*

Comment 116: Table 13-3, Location 9A, Recent ultrasonic level control upgrade.

Response: *This pump station received a relative low ranking (Level 6 – continue O&M) compared to others. The ranking does not change.*

Comment 117: Table 13-3, Location 13A, 16" DIP force main was installed in 1998.

Response: *Changes will be made to tables.*

Comment 118: Table 13-3, Location 23, Standby Generator replaced in 1998.

Response: *This will not change the ranking (Level 4 – continue O&M).*

Comment 119: Table 13-3, Locations 13, 17, 23, and 31, Pumps and controls updated in 1991.

Response: *Changes will be made to tables.*

Comment 120: Table 13-3, Location 40, 2 sets of 2 in series pumps, total capacity of 700 gpm (350 each set). Pumps and controls scheduled for replacement fall 2003.

Response: *Changes will be made to tables.*

Comment 121: Table 13-3, Locations 30, 32, 36, 37, 40A, Identified as "X". Does TCPUD need to identify?

Response: *The "X" indicated the diameter of pipe is unknown. For costing purposes, an 8" line was assumed. TCPUD will need to identify diameters in potential follow up studies/designs.*

Lake Tahoe Stakeholders Meeting, South Lake Tahoe, April 1, 2003

Comment 122: Make clear in the document that Lake Tahoe is a national treasure and that even though the conditions (spills/overflows and exfiltration) are better than nationwide averages, the Lake Tahoe basin should be held to higher standards.

Response: *Concur. These statements will be included in the document and the Executive Summary.*

Comment 123: Include a description of the 2001 Jones and Stokes document - an evaluation for the regulatory process that includes recommendations for programmatic EIP implementation.

Response: *Concur. Programmatic EIP implementation will be referenced in Section 1.7.1 – U.S. Army Corps of Engineers.*

Comment 124: Remove Kingsbury General Improvement District's identified projects (first two on the priority listing) that have been completed by the District (noted from original response from KGID on Jan. 10, 2003).

Response: *Concur. These projects have been removed.*

Comment 125: Discuss possible failure of shorezone sewer facilities in relation to drinking water quality impacts and the many intake lines maintained by the Districts and private ownership.

Response: *Concur. This problem will be discussed in Section 15 – Benefits for Reducing Risk.*

Comment 126: Discuss basin-wide approach or an integrated approach for implementation of sewer system improvements. This brings all sewer districts and regulatory agencies together to agree on projects and approaches.

Response: *Concur. The report includes as a major recommendation that implementing and regulatory agencies work together to develop an integrated approach within the basin to define the next steps in the process to insure ongoing protection from overflows and releases. Convening this group is not within the scope of work under this contract. However, the Federal Advisory Committee has expressed an interest in facilitating this discussion. The Corps will assist the Federal Advisory Committee to the extent possible in this effort.*

Comment 127: Refer to 2001 Desert Research Institute's (DRI) shorezone soil type study. High erosion areas along the shorezone have been identified in this study. This could effect the placement of sewer facilities. Also, those projects located in high erosion areas would receive a higher priority for implementation in the future. Areas of significant soil instability need to be considered in the prioritization process.

Response: *Concur. A brief description of the report has been added to Section 3.1.2 – Geology and Soils. However, the level of detail presented in the DRI report goes beyond the programmatic level of detail specified for this Corps report. The DRI document will be referenced for use in possible future project level analysis.*

Comment 128: Comment was raised regarding use of pipe material type that is suitable for the different soil types along the shorezone.

Response: *Concur in general. However, this level of detail goes beyond the programmatic level of detail specified for this Corps report. Material and soil type will need to be investigated during possible future project level analysis.*

Comment 129: Comments regarding the interrelationship between the Lake Tahoe Framework Studies (5 elements) was raised. How will they relate to each other and how the study relates to future project implementations for Lake Tahoe?

Response: *Concur. Text will be added to the Executive summary 'Purpose' section. 'This Overflow/Release Reduction Evaluation is a portion of the Lake Tahoe Framework Implementation Report that Congress directed the US Army Corps of Engineers to complete. The Framework Report will present alternatives for improvement of environmental quality at Lake Tahoe by enhanced implementation of projects. Basin Stakeholders identified the effort presented in this Overflow/Release Reduction Evaluation as a critical missing element to presenting any alternatives for improvement of environmental quality. A summary of recommendations from the Overflow/Release Reduction Evaluation will be included in the report to Congress. Results from the exfiltration portion of this Overflow/Release Reduction Evaluation will be incorporated into another separate portion of the Framework Report that includes an evaluation of impacts to basin groundwater.'*

Comment 130: Accessibility to sewer facilities has been a major issue. Issues include private landowners encroaching on sewer easements and complications in obtaining the necessary permits to enable lake-side access to shorezone sewers.

Response: *Concur. However, invoking easements is a sewer district issue. This is easier said than done. Districts, counties, and cities need to work together to make sure encroachment is curtailed. Access from the lake-side is a little more difficult. There are many environmental regulations that must be followed. A basin wide permit might be an idea for all sewer districts to access shorezone sewers. Easement encroachment could also be an issue addressed by any comprehensive basin-wide strategy.*

Comment 131, from Corp: If any federal agency is involved with project implementation, NEPA requirements will be followed. Projects in California will also adhere to CEQA.

Comment 132, from Corps/CDM: To facilitate federal implementation, it is best that any resultant proposed actions show clear consensus among the stakeholders.

Comment 133: The report is fine in regard to the approach used for identifying and prioritizing sewer system improvement projects. However, the next step needs to develop project-specific requirements including environmental constraints that will be addressed when considering actual project implementation.

Response: *Concur. The report includes as a major recommendation that implementing and regulatory agencies work together to develop an integrated approach within the basin to define the next steps in the process to insure ongoing protection from overflows and releases. Convening this group is not within the scope of work under this contract. However, the Federal Advisory Committee has expressed an interest in facilitating this discussion, which can include specific environmental constraints. The Corps will assist the Federal Advisory Committee to the extent possible in this effort.*

Comment 134: Information system management needs to be integrated with current effort by TRPA and others.

Response: *Concur. However, this integration is beyond the scope of this report. Districts should be made aware of TIIMS efforts through basin wide TIIMS outreach.*

Comment 135: Is the 1983 data set all that was used for the Exfiltration Study?

Response: *The 1983 field testing results were the only field data used, however, it is believed that information is still applicable. The application of that 1983 data was modified in this report based on professional judgment and empirical evidence.*

Comment 136: Was overflow included in the current Exfiltration Study?

Response: *No. For information, however, the 1983 study estimated the amount to be very low, on the order of less than 5 percent of total estimated release from exfiltration and overflow.*

Comment 137: How many spills have reached Lake Tahoe?

Response: *Approximately 6 spills have reached Lake Tahoe or tributaries to Lake Tahoe over the last 10 years.*