HGE INC

ARCHITECTS
ENGINEERS
SURVEYORS
PLANNERS

375 PARK AVE
COOS BAY
OREGON
97420

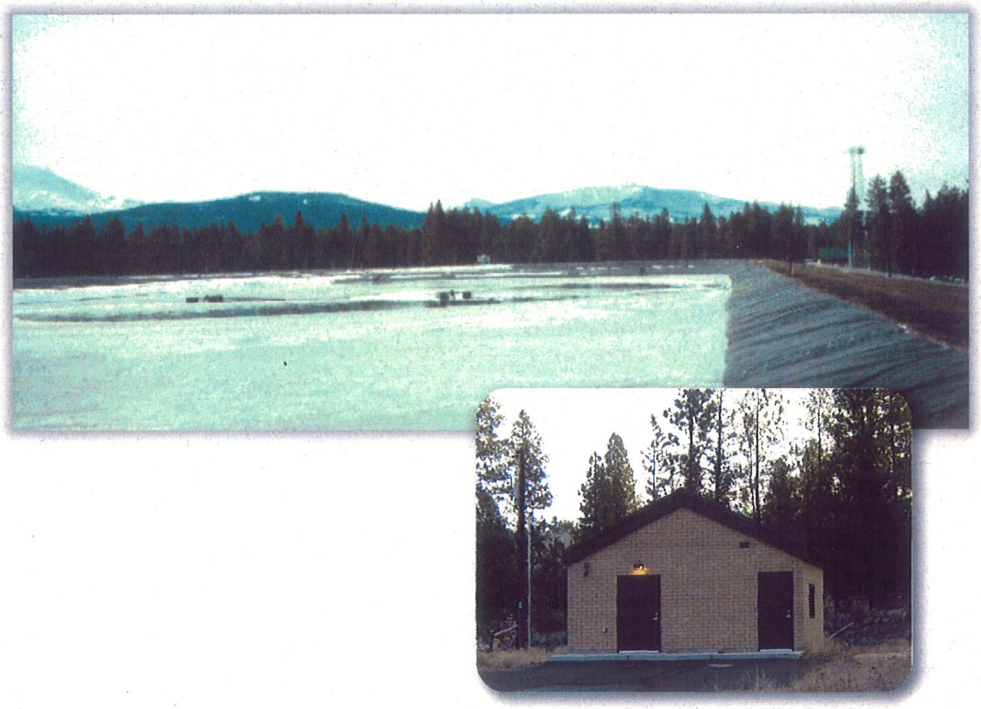
541.269.1166
FAX 541.269.1833
general@hge1.com

19 NW 5TH AVE
SUITE 300
PORTLAND
OREGON
97209

503.222.1687
FAX 503.222.2754
general@hgepdx.com

HGE PROJECT # 05.63

WASTEWATER SYSTEM CAPITAL FACILITIES PLAN - FINAL



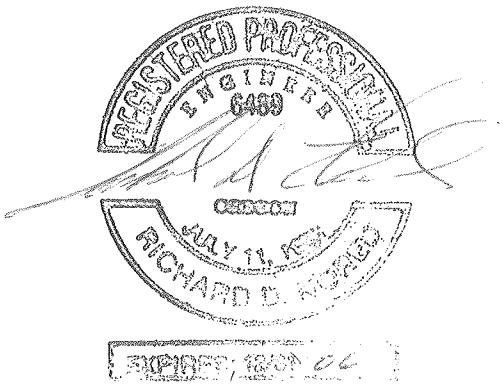
CITY OF SISTERS
DESCHUTES COUNTY
OREGON

November 2006

HGE PROJECT # 05.63

WASTEWATER SYSTEM CAPITAL FACILITIES PLAN - FINAL

CITY OF SISTERS
DESCHUTES COUNTY
OREGON



NOVEMBER 2006

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CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

EXECUTIVE SUMMARY

HGE INC

S.1 PURPOSE

The purpose of this Wastewater Capital Facilities Plan is to provide the City of Sisters with a comprehensive wastewater utility planning document through the year 2025, and to identify improvements needed to satisfy wastewater demand of a growing community, including anticipated future regulatory requirements. In addition, the Capital Facilities Plan, with Oregon Department of Environmental Quality approval, will provide the basis for funding application preparation and approval.

S.2 POPULATION AND GROWTH

Current population is estimated at 1768 residents. Year 2025 population of 3,747 residents was projected and based on both the Deschutes County Coordinated Population Forecast and in the Sisters Comprehensive Plan. This reflects an average annual growth rate in excess of 3.8% for the planning period.

S.3 EXISTING WASTEWATER SYSTEM

The City wastewater system is relatively new, with construction occurring during the period of 2000 to 2002. Gravity collection system piping varies from 6" to 24" diameter PVC wastewater mains, with three (3) wastewater pump stations. The entire system flows to Pump Station No. 1, which transmits all flow under pressure to the Wastewater Treatment Plant. The wastewater treatment plant is a 3-cell aerated lagoon system with winter holding, discharging to a dike and forest irrigation reuse system. Each of the two aerated treatment cells are 2.41 acres, providing for a capacity of 19.5 Ac. Ft. An 18-acre aerated winter holding lagoon is provided for storage, containing 213 Ac. Ft. of storage. Land reuse of the stored water is provided on 88.5 acres of natural forest and 11.8 acres of dike and lawn areas, and application is applied at agronomic rates.

S.4 WASTEWATER FLOWS

Treatment plant and reuse system design flows for the existing system are:

Summer average daily flows	395,604 gallons per day (gpd)
Winter average daily flows	291,042 gpd
Average net reuse application	16 inches per year average on site
Permitted reuse volume	178.3 Ac. Ft.

Actual and Projected Wastewater Flows

	Average Daily Flow (gpd)	Maximum Monthly Flows (gpd)	Maximum Weekly Flows (gpd)	Peak Daily Flow (gpd)	Average Reuse (in./yr applied to land)	Reuse Volume (Ac. ft.)
Summer Wastewater Flows	163,000	173,000	185,000	200,000	12.6 *	140.42
Winter Wastewater Flows	132,000	140,000	148,000	180,000		
2025 Projected Summer Wastewater Flows	420,000	440,000	470,000	500,000		383
2025 Projected Winter Wastewater Flows	340,000	350,000	380,000	450,000		

** (includes forest and dike irrigation)*

Year 2025 flow projections were based on current flows multiplied by the ratio of the projected 2025 population to the current population. This approach includes infiltration/inflow in current flows, and it is assumed that future I/I will be proportional to the existing, which is minimal.

Year 2025 flows will exceed existing wastewater treatment facility design capacities, which will require system expansion with increased population. However, the most critical concern is the lack of land area for effluent irrigation reuse, and a critical need for a location to discharge effluent waters. Sufficient land is not available at this time to receive water stored during winter months, with requirements for reuse to be applied at agronomic rates.

S.5 COLLECTION SYSTEM IMPROVEMENTS

Collection system improvements in Sisters were analyzed and found to satisfy long-term growth projections for current zoning in the City, with the exception of multi-family growth planned West of Highway 20. The analysis also assumed that public facility zoning would remain, and that higher density development would not occur in areas zoned for public usage. Our analysis utilized zoning classifications to project population and flows from each area being considered, to the limits of the current Urban Growth Boundary. Design review found that each element of the existing collection system has sufficient capacity to handle projected flows for 2025, with the exception of pumping capacity at Pump Station No.1.

Two expansions of the capabilities of Pump Station No. 1 are recommended. The first is for replacement of the impellers for the existing pumps, with impellers furnished in the original construction contract. A second requirement for system capacity at this pump station will require replacement of the existing pumps with larger pumping units.

Priority I collection system pumping improvements have a probable cost estimated at $16,875, and will need to be provided when existing pumps begin to experience capacity concerns. Priority II costs for collection system pumping improvements will be required towards the end of the planning period, assuming that population projections are accurate. Priority II improvements have a probable cost estimated at $ 88,100.

S.6 WASTEWATER TREATMENT FACILITY RECOMMENDATIONS

Wastewater treatment facility improvement will be required to satisfy increasing population demand. Based on population projections, expansion of wastewater treatment capabilities and effluent reuse facilities will be required in Priority I. Expansion needs are primarily related to a need for additional land for reuse purposes, or for a major change to the forest reuse site utilized for effluent disposal. When the existing treatment facility site was secured from the U.S. Forest Service, as an Act of Congress, an adjacent 80 acre parcel was deleted from the site due to public and environmental concerns. Initial planning anticipated a need for acquisition of this site, and consideration was given to other conceivable options that might provide a means of disposal for wastewater effluent, to meet the 2025 need for reuse capacity. Consideration was given to expansion of the existing irrigation reuse system to areas originally established as setback areas, potentially with delivery of higher quality water for disposal adjacent to existing residential areas. This approach anticipated maintenance of agronomic rates for application. Alternatives were developed for construction of a new wastewater membrane treatment system that would provide Level IV effluent for limited capacity, while maintaining existing treatment and reuse facilities in full operation. The Level IV effluent could then be utilized for land reuse of very high quality water, or for a stream discharge to Whychus Creek. Several potential reuse sites are discussed and evaluated in the plan. During development of this Wastewater System Capital Facilities Plan, a 230.98 acre parcel of the Lazy Z Ranch became available. This site is existing ranch land located almost adjacent to the treatment plant site, and has adequate land, when combined with the existing reuse site, to meet reuse needs for the 2025 planning period. The site is relatively level, and appears to meet all Oregon DEQ and ORS regulations. Consideration was given to an agreement to acquire or lease a portion of the Lazy Z Ranch during development of the wastewater treatment plant in 2000, but an agreement was not reached at that time. This alternative will provide the best long term reuse option for the City of Sisters, and will be the least cost and most citizen-friendly approach to long term effluent disposal. Recommendations of this plan are to pursue the purchase of the 230.98 acre parcel for long term reuse purposes of the City of Sisters.

Priority I wastewater treatment improvements for SCADA and security upgrades for the existing treatment facility have an estimated probable cost estimated at $ 81,000, and will

need to be developed in the near future to allow for operator control of effluent reuse distributed to the alternate reuse sites.

Priority II wastewater treatment improvements for more energy efficient aerators, biosolids removal, etc. will be required during the planning period. Total costs for Priority II wastewater treatment improvements are estimated at $ 761,000

S.7 WASTEWATER DISPOSAL SYSTEM IMPROVEMENTS

Wastewater reuse system improvements will be required in the near future to satisfy increasing resident demand. Population growth will require additional reuse capabilities in Priority I, which should include purchase of a 230.98 acre parcel of the Lazy Z Ranch, soils evaluations and coordination with DEQ for acceptance of this site. A portion of the site should also be developed for land reuse on a portion of the site, adding sufficient irrigation equipment to satisfy initial reuse needs that are beyond the capabilities of the existing reuse site. Phase I wastewater reuse needs have an estimated probable cost estimated at $ 4,945,680. This includes additional land area that will be required with growth in the community, and the initial reuse site will need to be expanded on the 230.98 acre site. Priority II wastewater reuse improvements have an estimated probable cost estimated at an additional $ 1,269,350, and should suffice through the year 2025..

Total projected Priority I and Priority II wastewater reuse improvements have an estimated probable cost of $ 6,215,030.

S.8 WASTEWATER RATES

Current usage charges are $ 39.00 per month for residential service. In the future, costs should be raised annually to account for inflationary increases, which would allow the City to stay current with wastewater system revenues.

Increased wastewater rates will be necessary over time to provide for equipment replacement and increased operation and maintenance expenses. It is recommended that the City continue initially with the $ 39.00 residential rate through January 2008, with adjustments in non-residential rates at the earliest opportunity. Non-residential rates need to be increased to create an equitable fee structure, taking into account the City's summer tourist oriented community. A simple means of adjusting for summer increases in flow, while providing credit for water utilized for irrigation, would be to determine average residential usage rates per EDU for winter and summer, and allow the identical increase of water usage per EDU for non-residential users. Future increases in wastewater rates per EDU should apply to all users of the wastewater system.

S.9 FINANCING AND RATE IMPACTS

Probable financing will likely be limited to loans (based on project scope, cost, impact on rates, and City eligibility). Loans can be obtained from several sources, with favorable terms

likely obtainable from either Rural Development (RD) or through the State Revolving Fund (SRF). RD has a longer term (40 years vs. 20 years), but the SRF program has a lower interest rate (3.57% vs. 4.5%). However, SRF requires more documentation and certifications, therefore additional administrative, legal and engineering expenses will be incurred with this program. Pursuing a traditional full faith and credit-backed financing program can also provide favorable rates. A traditional loan will require a pledge of the City's general fund, but can result in expedited financing for immediate opportunity.

After a selection of the initial project scope, the City should contact OECDD to schedule a one-stop meeting with available state and federal funding agencies, to discuss project needs. When the project is presented to all the funding agencies, each agency will evaluate their programs potential to assist with financing the needed wastewater system improvements.

It is recommended that the City initially adjust its non-residential rate structure for operations, and consider annual increases in user fees for inflationary needs. A modest increase in monthly use fees is recommended for all users on an annual basis, as previously described, beginning in January 2008. .

S.10 SYSTEM DEVELOPMENT CHARGE (SDC) RECOMMENDATIONS

The City should develop a new wastewater system SDC anticipating acceptance of the recommendations in this Wastewater Capital Facilities Plan. Wastewater SDC's are typically based on some definable indicator of relative system utilization. EDU's are a commonly used basis which have previously been utilized in Sisters for establishment of all SDC's. Improvement SDC's apply to capacity related system upgrades or expansions. Reimbursement SDC's can also be provided for principal costs that have been paid on loan costs related to a previous construction project, and would be easily developed to compensate for payback of previous development.

Growth is generating the need for expansion of wastewater facilities in Sisters, and it is recommended that improvement costs be financed by Systems Development Charges on new development. Reimbursement for previous facility costs should also be a factor in any modified SDC. It is recommended that the City utilize both types of SDC's to finance recommended improvements in Priorities I and II. SDC's of either type can and should be updated annually to account for inflation, based on an index such as the Engineering News Record Index. Construction improvements to be funded with SDC's for Priority I and Priority II have an estimated probable cost of $ 7,162,005.

SDC's are often political and will involve time for development and for public meetings that will be needed for adoption. It is recommended that a separate SDC document be developed for presentation to the City Council and the public.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 1
INTRODUCTION

HGE INC

1.1 GENERAL

Sisters is located in Deschutes County, 21 miles northwest of Bend and 20 miles west of Redmond *(Figure 1.1)*. The major transportation routes between the mid-Willamette Valley and central and eastern Oregon pass through Sisters. The City is a focal point for travelers, tourists, and part-time residents. Sisters was established along the Santiam and McKenzie Highways around 1880, and became an incorporated City in 1946.

Resident population was estimated in 2004 as approximately 1590 people, with a significant influx of retirees, tourists, travelers, part time residents and associated commercial development. Sisters has been rapidly growing since completion of a new wastewater system in 2002, which allowed for a number of residential developments to occur.

1.2 BACKGROUND

The City of Sisters owns and operates a municipal wastewater collection and treatment system. The system is relatively new, with construction extending from 2000-2002. Sisters had contemplated construction of a municipal sewer system since 1972, and residents approved bonds for $ 7,000,000 in construction funds on May 19, 1998. Construction grants and loans for construction were received from Rural Development, OECDD, EDA, Oregon Community Development Block Grants, the Rural Investment Fund, and from the Oregon Department of Environmental Quality to allow the project to proceed. Planning projections from the City of Sisters and from Deschutes County projected a resident population of 1,575 people by the year 2020, and this projection was exceeded in 2004. Oregon State funding sources were not willing to assist with major financial contributions for construction of the wastewater system, because they believed that planning projections were overly optimistic, and would not occur. It is evident at this point that growth is occurring at a much more rapid pace than was anticipated just a few years ago.

The entire City wastewater collection system was constructed of quality ASTM 3034 PVC pipe materials, with rubber ring joint connections. Construction included new service lines to connect every residence and business to the sewer system, and all lines were pressure tested. In addition, all manholes were vacuum tested, and all main lines were televised to make certain that a quality installation was achieved. Since the initial construction, similar materials have been utilized for all extensions, and all main and service line connections have been installed to City of Sisters and Uniform Mechanical Code Standards. Emphasis has been placed on maintaining a quality wastewater system and the system is in excellent condition at this point. Continual community growth will demand substantial improvements in sizing, with construction of parallel trunk mains to provide service for community expansion outside of the UGB that was in place when the system was planned in 1998.

An aerated lagoon wastewater treatment plant was constructed with two 2.41 acre cells, each holding 19.5 Ac. Ft. The treatment facility was followed with an 18-acre winter holding

lagoon containing 213 Ac. Ft. of storage for wastewater. Land reuse of the stored water is provided on 125 acres of natural forest, where application is applied at agronomic rates.

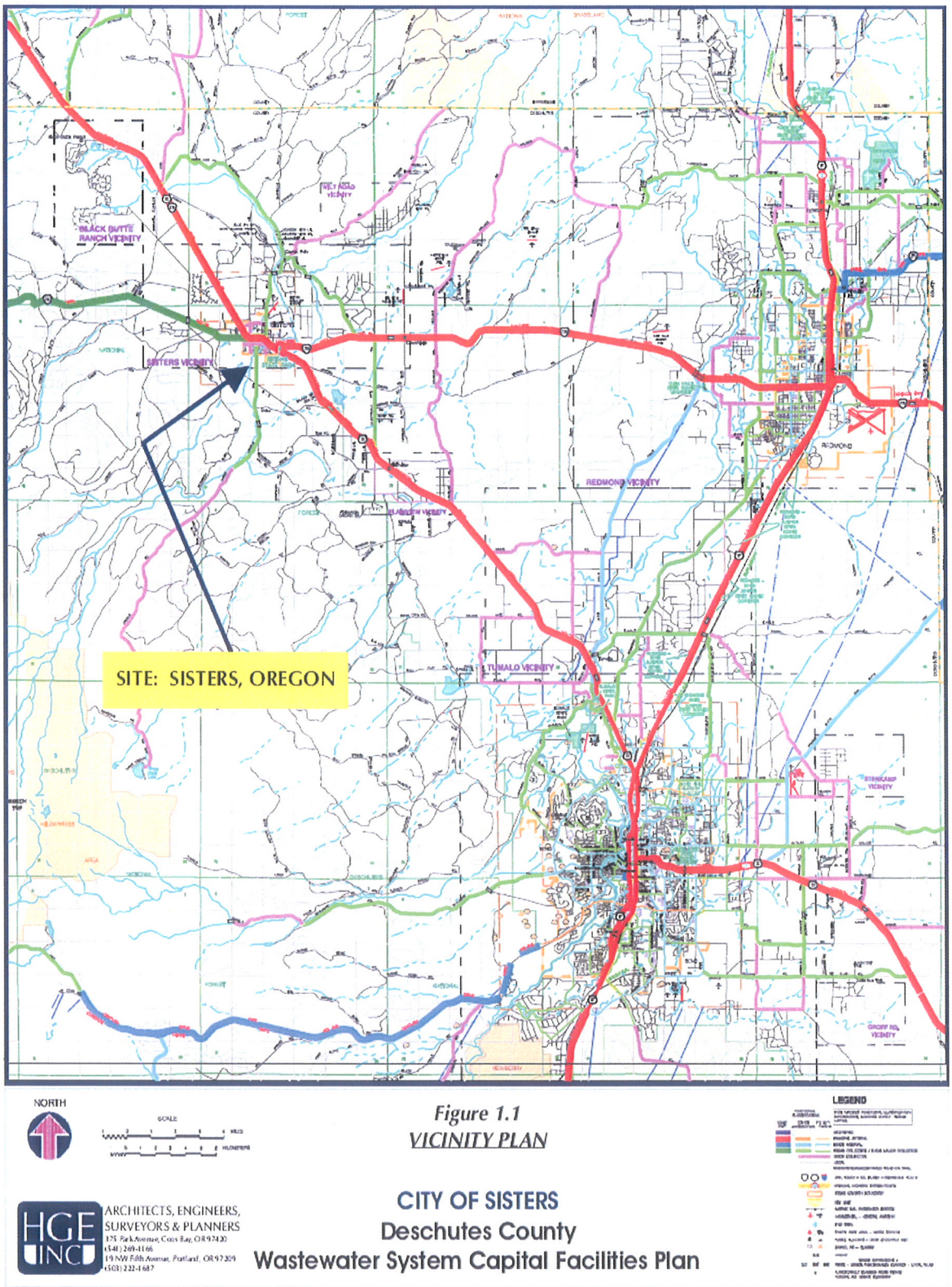


Figure 1.1
VICINITY PLAN

1.3 PREVIOUS PLANNING DOCUMENTS

Master Planning for public wastewater improvements in Sisters has occurred on a regular basis in Sisters since 1972, including the following:

1. "Comprehensive Development Plan for Sewerage Improvements," May 1972, HGE Inc., Engineers & Planners
2. "Comprehensive Wastewater Facilities Plan," 1977, HGE Inc., Engineers & Planners
3. "Sewer System Local Improvement District," 1979, HGE Inc., Engineers & Planners
4. "Phase 1 Engineering and Sewer Technical Assistance Study," 1987-1990, Century West Engineers.
5. "Wastewater System Engineering Study," 1994, HGE Inc., Architects, Engineers, Surveyors & Planners.
6. "Wastewater System Facilities Plan," 1997, HGE Inc., Architects, Engineers, Surveyors & Planners

1.4 CURRENT SITUATION

The City of Sisters is experiencing rapid growth, which has continued at more than 11% annually since 2002. This level of growth has exceeded previous planning projections, and the City needs a Wastewater System Capital Facilities Plan designed with capacity to provide for an anticipated 20-year planning period. Land availability for treatment and disposal will be a critical concern, and will be addressed in this plan.

1.5 AUTHORIZATION

The City of Sisters retained HGE Inc., Architects, Engineers, Surveyors & Planners to prepare a Wastewater System Capital Facilities Plan for current and anticipated future zoning of property within the Sisters Urban Growth Boundary (UGB). The existing agreement for consulting services was amended for HGE to develop the Wastewater System Capital Facilities Plan. The amendment for consulting services was finalized on June 9, 2005.

1.6 ORGANIZATION

The overall structure of this Wastewater System Capital Facilities Plan follows the flow of wastewater from consumers to treatment and ultimate disposal of the effluent. Separate chapters have been written to evaluate each of the following system components: wastewater collection and pumping improvements, wastewater treatment and winter holding facilities, and effluent land reuse meeting WPCF and Oregon Department of Environmental Quality Standards. Tables and figures in this report are numbered consecutively within each chapter, and they generally appear in the text of the report on the page or pages following the first reference. A complete list of tables, figures, and plates is contained in the Table of Contents.

1.7 PLANNING AREA

The planning area used in this Wastewater System Capital Facilities Plan is the area encompassed by the 2025 anticipated Sisters UGB. Areas outside these boundaries are included only to the extent that they pertain to potential new collection system construction that should be designed with capacity for anticipated future development. The planning area, including adjacent areas relevant to planned facilities outside the UGB, is shown in *Figure 1.2.*

1.8 PLANNING SCOPE

The objective of this plan is to establish a short-term and long-term wastewater system capital facilities plan for the present and future needs of the City of Sisters. Overall, the scope of work is meant to satisfy requirements for potential funding sources, although grant and low interest loan monies may be very difficult to obtain for Sisters. Needs will be addressed relative to wastewater collection, pumping, treatment and land reuse or discharge to a receiving stream. An outline of basic considerations of the facilities plan is as follows:

1. Describe the existing wastewater facilities and the area to be served. Include land use, current and estimated future population, and environmental concerns.

2. Determine existing wastewater system requirements based on estimated water consumption, and land use plans. Include estimates of average daily flows, maximum monthly flows, maximum daily flows, and peak hourly flows. Develop projected wastewater capacity needs for the next 20 years, to the year 2025.

3. Description of the existing collection, pumping, treatment, and land reuse systems, and their ability to meet existing and future wastewater system demand. Long-range system needs will also be developed by the application of growth projections into the collection system model, and with a detailed layout of future system needs within the UGB.

4. Prepare a base map and show the proposed wastewater collection system, with pumping stations. Separate mapping shall be provided for the wastewater treatment and land reuse systems.

5. Opinions of probable costs for various alternatives will be prepared and recommendations will be separated into priorities for development.

6. Recommendations will include a detailed plan for financing proposed improvements with local funds, federal financing, and/or a bonding program.

7. Preparation of a complete report of the work. Data will be presented to show various proposals, complete with supporting data, preliminary drawings or sketches, and opinions of probable costs.

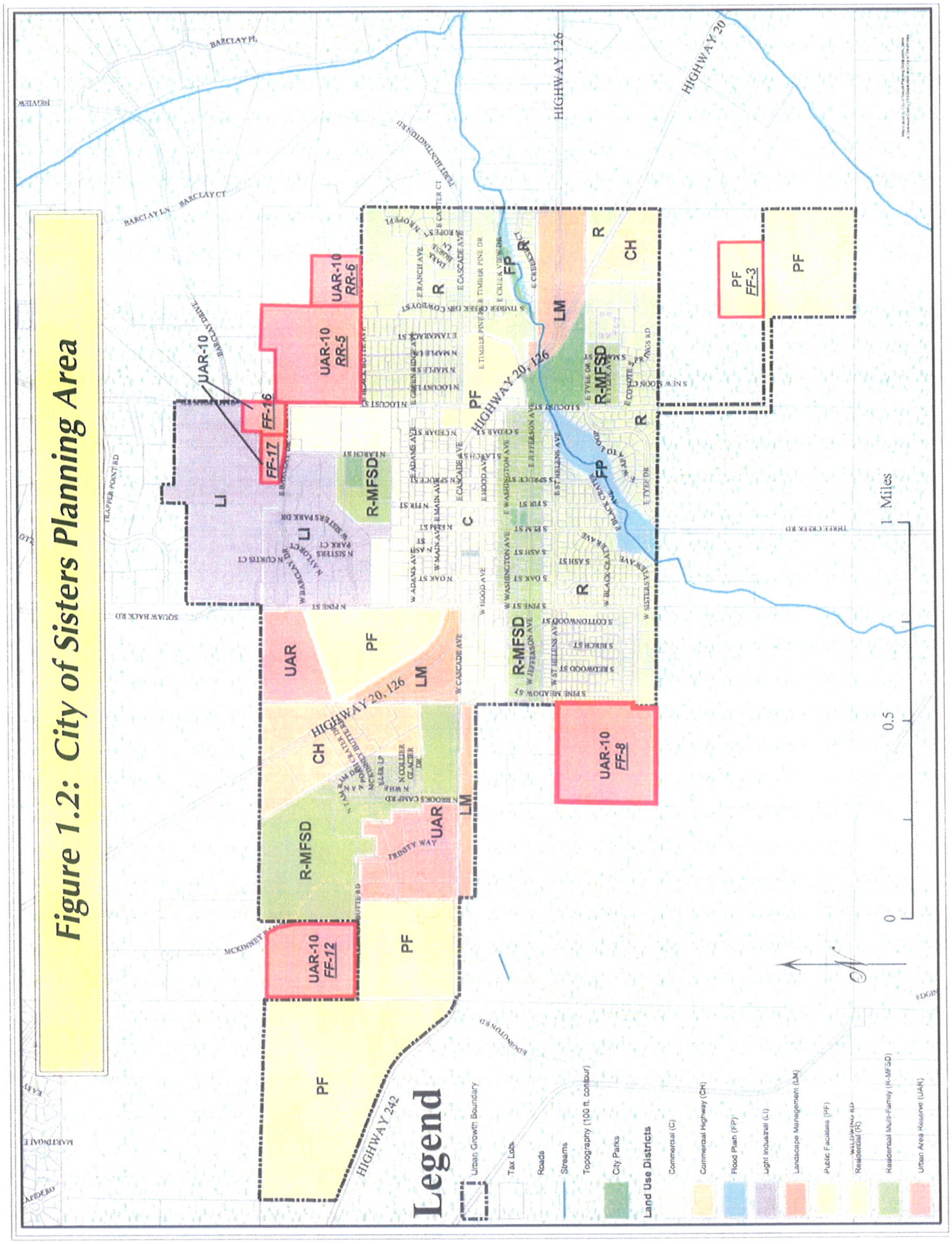


Figure 1.2: City of Sisters Planning Area

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 2
METHODOLOGY FOR WASTEWATER SYSTEM EVALUATION

SECTION 2
METHODOLOGY USED FOR WASTEWATER SYSTEM EVALUATION

2.1 GENERAL

This section of the study covers the procedure used to establish the design parameters for the upgraded wastewater system, priorities for implementation, and the method used to develop opinions of probable cost.

2.2 DESIGN PERIOD

This study is based on a 20-year planning period with future projections to the year 2025. It is felt that this time frame is adequate to allow for adaptation to future needs, while being short enough to ensure that the facilities will be effectively utilized within their economic life. System recommendations are developed for construction in phases (priorities) and all components are designed to allow future expansion. Alternate recommendations are made to future improvements which are dependent on growth patterns and other variables which cannot be accurately predicted at this time.

2.3 SYSTEM CAPACITY AND LAYOUT

Capacity requirements and consequent system sizing are based on evaluations of population, and land use. Potential wastewater system volume is estimated based on actual flows received at the wastewater treatment facility, and on company experience with facilities in other communities. System collection system layout includes an allowance for future growth to the limits of the established UGB.

2.4 REGULATORY REQUIREMENTS

Wastewater treatment in the state of Oregon must meet the requirements of the Oregon Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA).

2.5 PRIORITIES

Major wastewater system construction requires considerable financial resources. In developing a wastewater system capital facilities plan, it is necessary to consider the relative importance of the proposed improvements and to assign priorities to the development program accordingly. An advantage of the phased approach, especially in regard to collection, treatment and land reuse system expansion, is the allowance of time in which actual system usage and growth can be evaluated in order to refine the sizing of subsequent improvements.

By prioritizing the proposed improvements, construction costs can be extended over a longer period of time in an effort to remain within the financial capabilities of the community. This will allow the City to take maximum advantage of potential Federal and State grants and

loans that are available to assist small communities with major wastewater system improvements. Initial improvements should be based on the most immediate critical needs and should provide the greatest benefit at the lowest cost. Later improvements should follow the short and long-range guidelines and meet future demands as the community develops and can finance the improvements.

2.6 BASIS FOR OPINIONS OF PROBABLE COST

2.6.1 General

Opinions of probable cost presented in this study include four components, each of which is discussed separately in this section. It must be recognized that opinions of probable cost are preliminary and are based on the level and detail of planning presented in this study. As any project element proceeds forward, it may be necessary to update the costs from time to time, as more information becomes available.

2.6.2 Construction Cost

Opinions of probable construction costs in this capital facilities plan are based on actual construction bidding results for similar work, published cost guides, and other construction cost experience of the authors within the state of Oregon. Opinions of probable cost are based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials, may justify comparable changes in the opinions of probable cost presented herein. For this reason, it is common engineering practice to relate the costs to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) Construction Cost Index is most commonly used. It is based on a value of 100 for the year 1913, and the values since 1980 are shown in *Table 2.1* along with calculated annual percent increases.

All costs in this study are based on the November 2005 ENR Construction Cost Index value of 7630. Opinions of probable costs should be updated at the actual time of funding applications and a decision made as to whether loan funds will be required. Note that when the community secures financing, a "reserve factor" should be added at that time for estimated increases in cost due to inflation. Estimates can be prepared at any future date by comparing the future ENR Construction Cost Index with the index value of 7630; however, this approach is generally only considered valid for a 2- or 3-year period since construction techniques and materials change with time. If more time than this has elapsed, opinions of probable cost should be updated by an Engineer.

Table 2.1: Engineering News Record Construction Cost Index with Calculated Annual Percent Increases

YEAR	20-CITY ENR (August)	% CHANGE	YEAR	20-CITY ENR (August)	% CHANGE
1980	3,304		1997	5,854	3.6
1981	3,616	9.4	1998	5,929	1.3
1982	3,899	7.8	1999	6,091	2.7
1983	4,066	4.3	2000	6,233	2.3
1984	4,146	2.0	2001	6,389	2.5
1985	4,195	1.2	2002	6,592	3.2
1986	4,295	2.4	2003	6,733	7.0
1987	4,401	2.5	2004	7,188	6.8
1988	4,541	3.2	November 2005	7,630	6.2
1989	4,607	1.5			
1990	4,751	3.1			
1991	4,892	3.0			
1992	5,032	2.9			
1993	5,230	3.9			
1994	5,433	3.9			
1995	5,506	1.3			
Aug. 1996	5,652	2.7			
Average Annual Increase (%)					**3.5**

2.6.3 Contingencies

In recognizing that the opinions of probable cost are based on preliminary design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties that cannot be foreseen at this time, but which may tend to increase final costs. A contingency factor of 10 percent of the construction cost has therefore been added.

2.6.4 Legal and Administrative

An allowance of 5 percent of the projected construction cost has been added for legal and administration. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

2.6.5 Opinion of Probable Cost Summary

Opinions of probable costs presented in this study include a combined allowance of 35 percent for contingencies, engineering, legal, and administrative costs.

2.7 RECOMMENDED IMPROVEMENTS

The assessment of the proposed wastewater system will be summarized and a recommended plan for construction will be developed in Section 10. Financing of the construction will be considered in Section 11.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 3
EXISTING WASTEWATER SYSTEM

3.1 GENERAL

This section includes a brief description of existing wastewater facilities in Sisters. The City wastewater system is relatively new, with construction occurring during the period of 2000 through 2002. Following sections discuss components of the system in greater detail, and present recommended improvements. The current wastewater system consists of a gravity sewer system with 106,775 lineal feet of wastewater mains, three wastewater pump stations and force mains, a three-cell aerated lagoon treatment system with winter holding, and a 100.3 acre automated land reuse system. Land reuse is provided on 11.8 acres of dike and pasture grass, and on 88.5 acres of natural forest land.

System locations and sizing were developed from available as-built records in the City, and in extensive records available in HGE files. Construction plans were provided for all developments since the original wastewater system was completed, and City staff provided their knowledge of existing facilities.

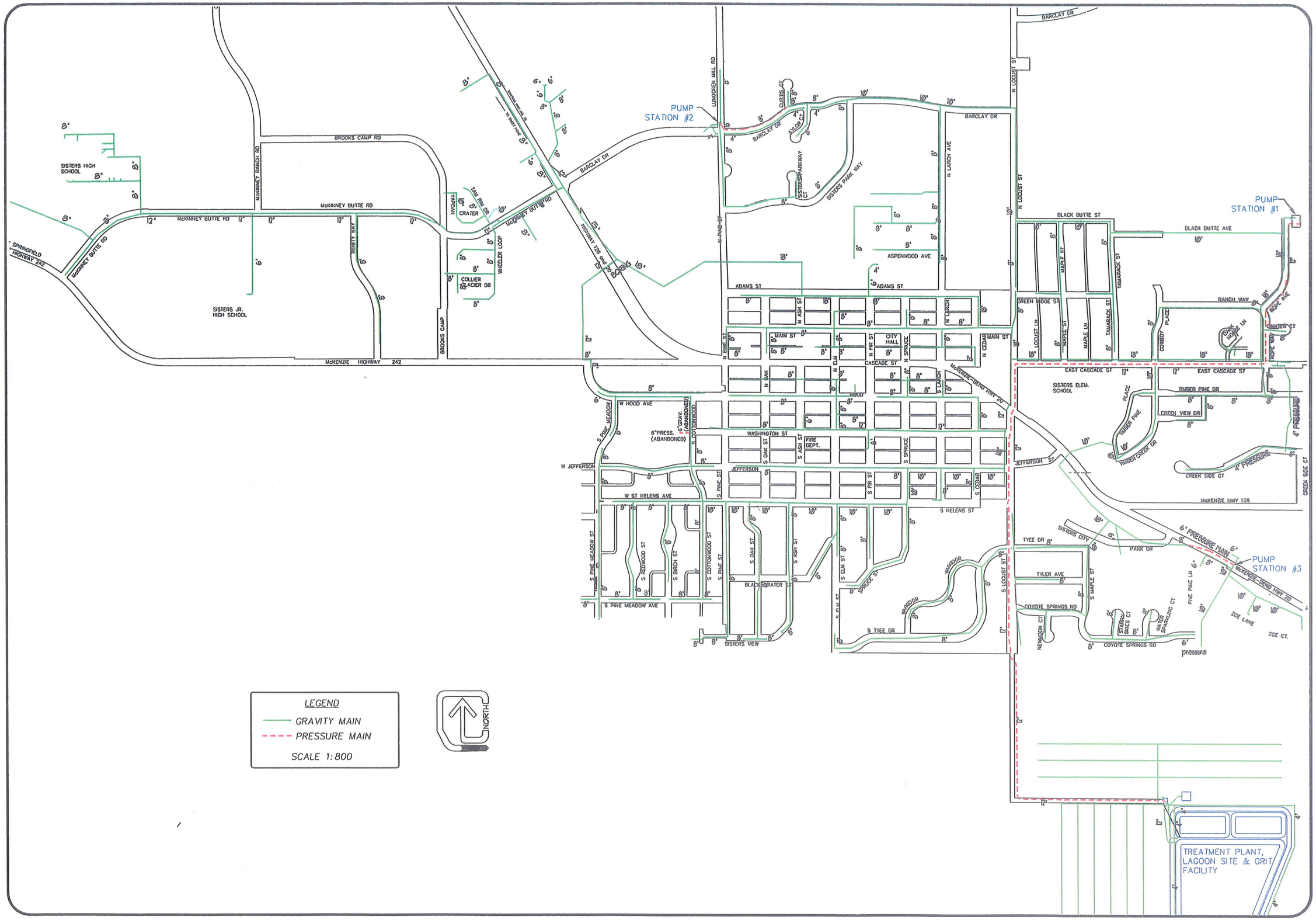
3.2 WASTEWATER COLLECTION SYSTEM

The existing wastewater collection system is shown in *Figure 3.1.* Collection facilities include 6" to 24" diameter 3034 PVC wastewater mains with 4" and 6" PVC service lines, all laid at varying grades. There are a limited number of individual semi-positive displacement grinder wastewater pump stations that provide wastewater service to residences that could not be served through the gravity collection system. Gravity conveyance facilities convey wastewater by gravity from individual users to the three wastewater pump stations. Individual developments have completed major expansions to the wastewater collection system since the original construction was completed in 2002. One of the existing wastewater pumping facilities was completed by a new private development, and numerous main extensions have been completed. All of the wastewater pump stations transmit flows through AWWA C-900 force mains of varying sizing.

In general, wastewater is conveyed to the primary wastewater pumping facilities via gravity lines. Wastewater from two of the pumping facilities is transmitted through force mains and additional gravity mains to the location of Wastewater Pump Station No. 1. All wastewater in the system is currently processed through Pump Station No. 1 and transmitted through a 12" diameter force main to the wastewater treatment facility, for ultimate land application to the forested reuse site.

3.2.1 Gravity Mains and Manholes

Mains. The collection system has 916 lineal feet of 6" gravity main, 78,114 lineal feet of 8" gravity main, 10,967 lineal feet of 10" gravity main, 4,100 lineal feet of 12" gravity main, 859 lineal feet of 15" gravity main, 8,204 lineal feet of 18" gravity main, 104 lineal feet of 21" gravity main, and 106 lineal feet of 24" gravity main. All



LEGEND

GRAVITY MAIN

PRESSURE MAIN

SCALE 1:800

NORTH

HGE INC
ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
375 Park Avenue/Coos Bay, Oregon 97420 (541) 269-1166
19 N.W. Fifth Avenue/Portland, Oregon 97209 (503) 222-1687

SHEET TITLE: EXISTING WASTEWATER SYSTEM

PROJECT: WASTEWATER FACILITY PLAN CITY, OREGON

PROJECT NO. 0562

DATE: JUNE 2005

REVISIONS

DATE	BY

DRN BY J.R.F

SHEET NO. Fig. 3.1

mains are constructed of ASTM 3034 PVC pipe. Burial depths are typically 5' - 10' deep, with 16' feet being the deepest. Layout of the collection system is shown in *Figure 3.1.*

Manholes. There are 374 precast manholes in the collection system.

Overflows/Bypasses. There are no constructed overflows or bypasses in the system

Hydrogen Sulfide. City staff regularly maintains the collection system, and they have found no evidence of hydrogen sulfide in the system.

3.2.2. Collection System Quality

Mains. The City of Sisters has worked diligently to develop a wastewater collection system that minimizes infiltration/inflow into the system. All construction has been air-tested in compliance with adopted Public Works Construction Standards for the City of Sisters, and with Oregon DEQ regulations. All gravity mains have been air-tested, and had a 95% mandrel pulled to verify that excessive deflection was not present. When all testing was completed, a television inspection was performed on the interior of all pipelines, and any deficiencies were corrected.

Manholes. All manholes have also been constructed in compliance with adopted Public Works Construction Standards for the City of Sisters, which are in excess of adopted DEQ regulations. All manholes have been vacuum tested, applying a 5 psi vacuum and limiting allowable air loss to 1 psi for a fixed period of time. This test is the best means of testing to prevent infiltration available today, and the success of the program is evident in the infiltration/inflow discussion below.

Infiltration/Inflow. Infiltration/Inflow in the Sisters wastewater system is virtually non-existent. Influent flows to the wastewater treatment facility are substantially less than water consumption within the community, which indicates that infiltration and inflow to the system are very minimal.

3.2.3. Pressure Mains

Pressure mains are shown in *Figure 3.1.* Three pressure mains exist to transmit flows from each of the existing wastewater pump stations. All of the force mains are constructed of AWWA C-900 piping, of the following lengths and sizing.

Force main for Pump Station No. 1. 9,290 lineal feet -12" inch force main.
Force main for Pump Station No. 2. 1,237 lineal feet - 4" inch force main.
Force main for Pump Station No. 3. 449 lineal feet - 6" inch force main.

3.2.4 Wastewater Pump Stations

Three wastewater pump stations currently exist in the collection system. The stations are described as follows:

Wastewater Pump Station No. 1. This station was constructed in place, and is a triplex submersible facility with a trench style wetwell. Pumping is provided with three KSB pumps initially designed with two pumps capable of providing 850 gpm @ 95' feet TDH when pumping together. The third pump is provided for redundancy. The pump manufacturer made an error in trimming the impellers for all of the pumps, and the pumps were actually installed with the capability for two pumps to provide approximately 525 gpm @ 95' feet TDH. It was determined to be in the best interests of the City to have the correct impellers provided, but that the original impellers be utilized until demand necessitates the additional pumping capacity. Continuing growth in the City will need additional wastewater pumping capacity, and the City has new impellers in storage that can be installed to provide the design capacity of 850 gpm. In the meantime, flows to the wastewater treatment plant are limited to approximately 525 gpm, which allows for longer running times and less disruption to plant operation. Normal wear is occurring to the smaller impellers. In the long term, this manufacturing problem is in the best interests of the City of Sisters.

100% of wastewater flow in the City of Sisters collection system is tributary to Pump Station No. 1. The station (constructed in 2001), is located at the north end of Rope Avenue, in the far northeast corner of the UGB. Flows from this station are conveyed via 9,290 lineal feet of 12" class 150 AWWA C-900 force main to the headworks of the WWTP. This station was constructed as a portion of the original Sisters wastewater system, and was completed in 2002.

Triplex submersible pumps located in a self-cleaning trench style wetwell are KSB, Model KRTK 100-316/294 XG, with 40 Hp motors. The station is a site-constructed submersible pump station with a block building constructed over the top. The building is insulated and has a concrete floor with drains. Pump controls are located in the building. The overall condition of the pump station is very good, and all equipment functions properly as originally constructed.

This station has a Quincy compressor, Model 340QRB, which provides compressed air to reduce the effects of hydrogen sulfide. Since hydrogen sulfide has not been noted, the compressor usage is minimal. A 135 KW diesel generator manufactured by Kohler, Model 135ROZJ is provided for standby power purposes, complete with a 400 Amp Kohler automatic transfer switch. This unit is set on a 125 gallon double wall fuel tank that provides protection against contamination.

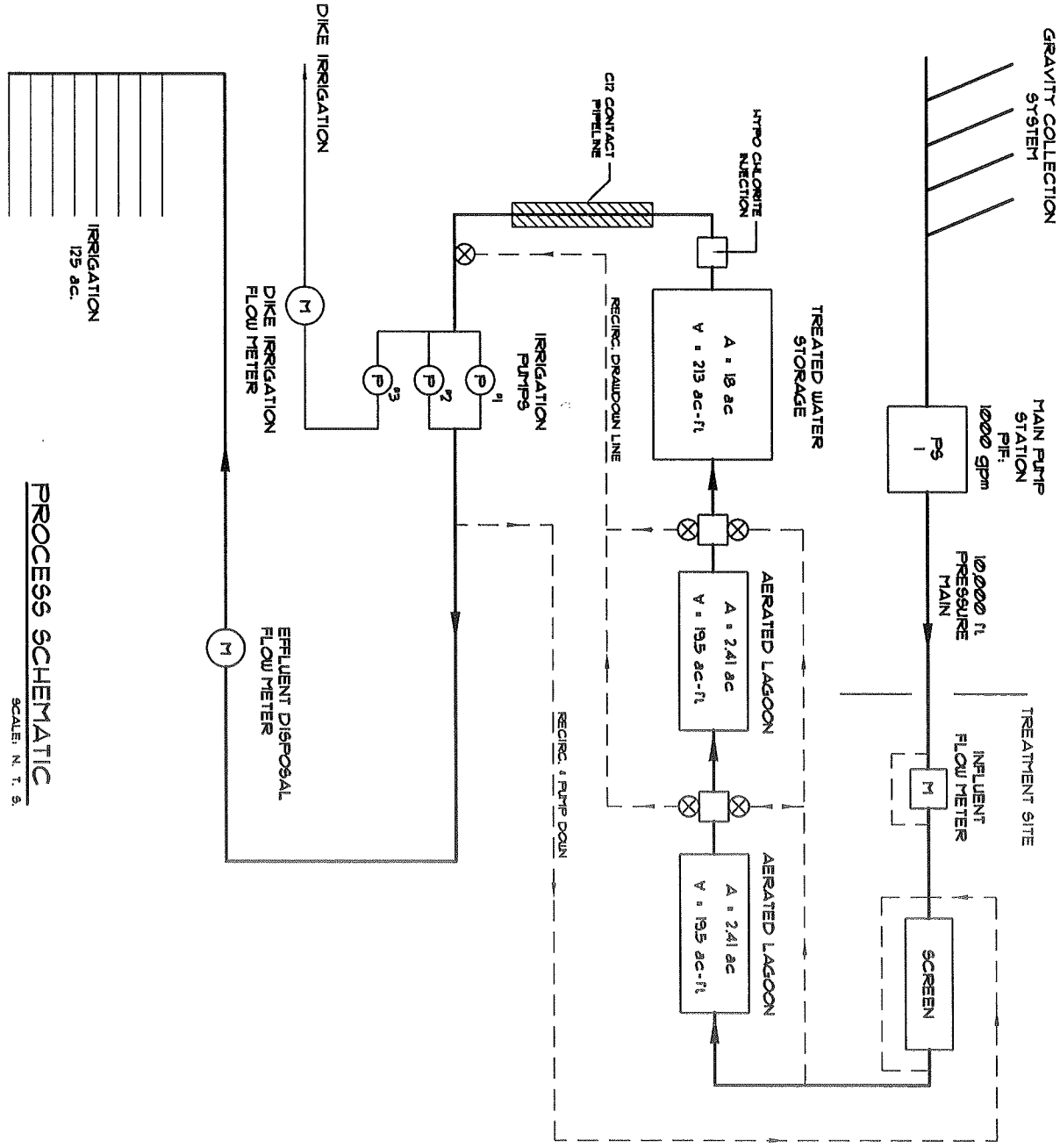
A sluice gate is provided on the influent to the station to stop the influent flows, and to allow buildup of flows for wetwell cleansing purposes. A Chatterbox dialer is utilized to call operators in the event that problems develop with station operation.

Wastewater Pump Station No. 2. This station is a package wetwell mounted vacuum lift duplex pump station by Smith & Loveless, mounted on a 5' diameter precast concrete manhole. All pumping and electrical equipment is mounted under a fiberglass structure, and is above the wetwell. The station provides service to a small portion of the industrial park, and is located on the Northwest corner of Barclay Drive and North Pine Street. Pumping is provided with two Smith & Loveless Model 4B2B pumps, each capable of pumping 150 gpm at 43' feet TDH. Motors are 5 Hp, located under the fiberglass shell, and the station includes two small compressors for creating vacuum for operation. All electrical controls are also located inside the station cover. The overall condition of the pump station is very good, and all equipment functions properly as originally constructed with the Sisters wastewater system in 2002. A Chatterbox dialer is utilized to notify operators in the event that problems develop with system operation.

Wastewater Pump Station No. 3. This station is also a package wet well mounted vacuum lift duplex pump station by Smith & Loveless, mounted on an 8' diameter precast concrete manhole. All pumping and electrical equipment is mounted under a fiberglass structure, and is above the wetwell. The station is located in the Five Pines Development, and provides service to the most easterly portion of the City, both North and South of Highway 20. Pumping is provided with two Smith & Loveless Model 4B2B pumps, each capable of pumping 260 gpm at 20' feet TDH. Motors are 3 Hp, located under the fiberglass shell, and the station includes two small compressors for creating vacuum for operation. All electrical controls are also located inside the station cover. The overall condition of the pump station is very good, and all equipment functions properly as originally constructed in 2004. This station was provided by developers in expansion of the Sisters wastewater system. A Chatterbox dialer is utilized to notify operators in the event that problems develop with system operation.

3.3 WASTEWATER TREATMENT FACILITY

The existing Sisters wastewater treatment plant (WWTP) is shown schematically in *Figure 3.2.* The wastewater treatment plant and effluent reuse site are located immediately south of the Sisters City limits on the south ½ of Section 9, T15S, 10E, W.M. Treatment is provided with two 2.41 acre aerated lagoons, followed by an 18 acre storage lagoon and 100.3 acres of land utilized for automated land reuse purposes. Design data for the existing wastewater treatment facility is provided in *Table 3.1.*



PROCESS SCHEMATIC

SCALE: N. T. S.

PROJECT:

WASTEWATER FACILITIES PLAN

PROJECT NO. :

05.63

TITLE:

T.P. SCHEMATIC

DATE:

11-02-05

Figure

3.2

HGE INC

ARCHITECTS, ENGINEERS, SURVEYORS & PLANNERS

375 Park Avenue Coos Bay, OR. 97420

(541) 269-1166

19 N.W. Fifth Avenue Portland, OR. 97209

(503) 222-1687

Table 3.1 Sisters Wastewater Treatment Facility
Design Data

Influent Flow -	**Summer, gpd**	**395,604**
	Winter, gpd	**291,042**
Waste Loadings (BOD_5 and TSS) -	**Summer, ppd**	**759**
	Winter, ppd	**607**
Effluent Requirements	**E. Coli - Shall not exceed monthly geometric mean of 126/100 ml**	
Headworks	**Type:**	**Rotary Bar Screen w/Bypass Channel**
	Spacing:	**1/4"**
	Max. Flow (gpm):	**2061**
Influent Flowmeter	**Type:**	**8" Magnetic**
Treatment	**Type:**	**Aerated Lagoons in Series**
	Number of Cells:	**3**

Pond No.	Water Depth (Ft)	Freeboard (Ft)	Surface Area (Acres)	Volume (Ac-Ft)	Number of Aerators	Total Aeration Power (Hp)
1	10'	3'	2.41	19.5	6	45
2	10'	3'	2.41	19.5	2	15
3	13'	3'	18.0	213	3	22.5

Effluent Reuse			
	Crop Data:	**Dike and Lawn Irrigation**	
		Ponderosa, Lodgepole, Sage and Bitterbrush	
	Crop Area (ac)	**11.8 acres of dike and lawn irrigation**	
		88.5 acres of ponderosa, lodgepole, sage, and bitterbrush	
Net Reuse Requirements		**Season: Dike and Lawn Reuse -**	**28.79 inches**
		Forest Reuse -	**14.3 inches**
		Peak month: Dike and Lawn Reuse -	**6.5 inches**
		Forest Reuse -	**4.27 inches**

Reuse Equipment	**Forest Reuse**	**Dike and Lawn Reuse**	
Type:	**Fixed Cannon Sprinklers**	**Fixed Sprinklers**	
Max. App. Rate (gpm):	**1000**	**125**	
Flow Meter:	**4" Magnetic**	**4" Magnetic**	
Effluent Reuse/Recirculation Pumps			
No.	**# 1**	**# 2**	**# 3**
Horsepower:	**100**	**100**	**15**
Capacity (gpm):	**1000**	**1000**	**125**
Total Dynamic Head (ft)	**200**	**200**	**75**
Chlorination Facilities			
Type:	**Sodium Hypochlorite Solution**		
Contact Chamber:	**1140' of 36" pipe**		
Volume (gal):	**60,000**		
Detention Time (min):	**60 minutes @ 1,000 gpm**		

3.3.1 Theory of Treatment Process

Aerated lagoons can be described as very lightly loaded activated sludge wastewater treatment systems. The microorganisms responsible for organic breakdown of incoming wastewater tend to be similar to those found in activated sludge systems. The process does not depend on algae and sunlight to furnish dissolved oxygen (DO) for bacterial respiration, but instead uses mechanical aeration to transfer the major portion of oxygen, and to achieve mixing of the wastewater. Because of the mixing, removal of suspended solids in the lagoon effluent is an important consideration.

The holding pond is provided for solids removal, and to further the aerobic treatment process for overall improved treatment performance. The theory of aerated lagoons involves necessity for oxygen additions in the major reactive phases of the lagoon, and mixing to improve the efficiency of the microorganisms. Transfer of oxygen into the lagoon wastewater occurs at the interface between the gas and liquid. Oxygen transfer is improved by increasing the interfacial area and by increasing turbulence through mixing. Oxygen transfer to a point of saturation or equilibrium occurs very rapidly at the interface. The interface is estimated to be only a few molecules thick. Oxygen molecules pass through this film and are diffused very gradually into the main body of liquid in the aerated lagoons.

Oxygen will transfer more readily into a liquid with low residual dissolved oxygen than when the dissolved oxygen level is at or near saturation. Therefore, mixing is required to create turbulence, so that liquid saturated with dissolved oxygen can be replaced with liquid that has an oxygen content less than saturation.

3.3.2 Influent Flow Measurement and Sampling

Influent flow measurement is provided in the pump room of the control building for the wastewater treatment plant. The meter is an 8" ASA electromagnetic flow meter which has been calibrated annually since installation. Flowmeter performance is excellent.

Influent sampling is provided by an ISCO 3710FR refrigerated sampler located in the pump room of the control building at the treatment plant. This is a 24-hour composite sampler which provides composite data for influent BOD_5 and TSS. The sampler is in excellent condition.

3.3.3 Headworks

The headworks contains a mechanical fine screen with a coarse bar screen in the bypass channel and a fine screen in the normal channel for treatment operations. Only one screen is used at a time, and normal flows are directed through the fine screen mechanism unless problems prevent its operation. The screen is a Lakeside Equipment Corporation Rotamat, with weather protection. Operation of the fine screen allows for more efficient biological treatment within subsequent treatment units. Improved treatment is accomplished by removing all solids of a size 1/4" or larger from the raw influent. An aluminum gate is provided in front of each channel to manually direct flow in the desired location. During extreme flow periods, or during emergency conditions, the gate may be overtopped with flow. This allows the bypass channel to automatically function for containment of excess flows. A spray wash system is provided on the fine screens to clean the removed screening prior to disposal.

A discharge chute, bagger and screenings collector are provided to dispose of screenings. Screenings are washed and dewatered upon deposit in the feed trough. The chute directs screenings to the bagger. Collected screenings are sent to the Deschutes County landfill for disposal.

All equipment in the Sisters Wastewater Treatment Plant is provided with control through the SCADA system provided for system operation. This unit is in excellent operating condition.

3.3.4 Aerated Lagoons

The Sisters wastewater treatment plant has three aerated lagoons which are piped to flow in series. Total acreage provided at the top of the banks is approximately 22.82 acres of lagoon surface. Pond depths are capable of running at 10 feet in Lagoons No. 1 and No. 2, but are running at 9 feet due to inlet pipe placement, and 13 feet in Lagoon No. 3. (Holding Pond), when the units are filled to capacity. Total pond volume, with 3 feet of freeboard provided, is approximately 82 million gallons.

Lagoon levels in Lagoons No. 1 and No. 2 can be independently controlled with stop logs in their effluent transfer structures. An effluent structure with sluice gates controls the flow of effluent from the holding pond to the transfer structure, and an effluent decanter is provided to draw water from below the lagoon surface. 60 mil HDPE liners are provided to prevent leakage from all of the lagoons.

All the lagoons are provided with mechanical aeration. The holding pond operates as both a holding and polishing pond, and is also provided with mechanical aeration. Chlorine is introduced for disinfection purposes into a 1,140 feet long 36" contact pipeline installed in the diking West of Lagoons No. 1 and No. 3. Disinfection occurs prior to effluent reuse.

Varying flow regimes are possible in the lagoons, utilizing transfer structures provided. The lagoons can be operated on a flow through basis, which should be the normal process, batch basis, or a combination of the treatment methods. In addition, any lagoon can be bypassed for operational or cleaning purposes.

3.3.4.1 Aerators

Lagoons No. 1 and No. 2 are equipped with eight (8) Aire-0_2 aerators; six (6) in the first lagoon and two (2) in the second. Aerators are provided for reduction of much of the setteable solids (TSS) and associated BOD_5 loading from the liquid stream before it reaches the subsequent lagoons. The holding pond has three (3) identical aerators, which operate when the depth of liquid reaches a minimum of 5 feet underneath the aerators. Aerators are of the submerged aspirator type, meaning that they pull air from above the water surface and inject and disperse it below the water surface with a propeller aspirator pump. They are arranged to cause the contents of the lagoons to flow in a circular pattern, with the pattern created being away from the motor end of the aerator. This mixing action reduces short circuiting in the lagoons, thus effectively using the entire capacity for lagoon No. 1, and the area being aerated in the remaining lagoons.

Aerators are controlled through the SCADA system with the PLC provided, and timers are available to control the length of the operating cycle and the

percentage of running time in that cycle for operation of all units. The percentage of time on can be changed with the time of year to reflect changes in BOD_5 loading to the lagoons, water temperature, amount of solar energy and related algae growth, degree of ice cover, etc. In the summer, BOD_5 loading is the highest, but natural treatment activity is also the highest because of peak sunlight and water temperature. In the winter, BOD_5 loading is the lowest, but natural activity is also lowest because of low water temperature and ice cover. Aerators should be operated enough to maintain dissolved oxygen in the water, and to produce an effluent which meets permit conditions.

Lagoon depths and surface areas are provided in *Table 3.1*. Lagoon levels are adjustable with stop logs provided in transfer structures, but generally lagoons No. 1 and No. 2 remain full depth, allowing variation in lagoon No. 3 with the season and the extent of land reuse. Control of lagoon depths can be utilized for operational flexibility, and to control the holding and biological capacity for the lagoons.

Holding capacity in lagoon No. 3 is provided to contain all flows from November 1 to May 31 when no effluent reuse is permitted. Containment is also provided when weather conditions, such as high humidity, high winds, and low ambient temperatures do not permit land reuse.

All aerators are in reasonable condition and working properly.

3.3.4.2 Transfer Structures

Transfer structures for the lagoons are equipped with wooden stop logs or slide gates to control the level in the ponds, and to provide for draining of each lagoon. An effluent decanter is attached to the effluent transfer structure to provide a means of securing quality water for land reuse purposes. A drain is also provided from lagoon No. 3 to the effluent transfer structure for draining of the final lagoon.

3.3.4.3 Disinfection Facilities

Disinfection of effluent at the Sisters plant is provided by chlorination, specifically through sodium hypo-chlorite. Equipment includes a Lightnin chemical mixer, a 500-gallon polyethylene sodium hypo-chlorite tank, a Wallace & Tiernan chemical feed pump, a Gas Mastrrr 3-hp flash mixer, 53-gallon polydrums, scales, a vacuum regulator, rate controller, automatic switchover, an ejector water supply system, and a chlorine contact pipeline. The chlorine contact pipeline is 1,140 feet of 36" PVC piping buried in the dike along the west side of lagoon # 1 and the holding pond. A Gas Mastrrr

Series 32 chlorine induction feeder-flash mixer is provided in the transfer structure from the holding pond to the chlorine contact pipeline. This unit provides a positive flash mix of sodium hypo-chlorite solution which flows through the chlorine contact pipeline toward the land reuse system. A sampling tap is provided on the effluent (reuse) piping to allow for sampling of effluent pumped from the reuse pumps to either of the two reuse systems provided. Disinfection facilities are controlled through the SCADA system with the PLC provided.

The disinfection system is in good condition and working effectively.

3.3.4.4 Effluent Flow Measurement and Sampling

Effluent flow measurements are provided in the pump room of the control building for the WWTP. Two meters are provided, with one on the dike and lawn reuse system, and one on the forest reuse system. Each meter is a 4" ASA model IF6 electromagnetic flow meter, which have been calibrated annually since installation. Grab samples are taken out of the transfer structure before the effluent enters the chlorine contact line. These samples are then tested for concentration of e. coli. Flow measurements are recorded in the SCADA system provided.

Flowmeter performance has been excellent. Operations have experienced no problems in meeting permit conditions for e-coli.

3.3.4.5 Treatment and Pumping Facility Control Building

The treatment and pumping facility control structure has functioned well, and remains in like new condition. This facility is adequate for long term operation.

3.3.4.6 General Plant Conditions

Overall conditions at this treatment facility are very good. Equipment has functioned well, and operations have been excellent. The City of Sisters should be proud of these facilities, and the general condition of existing equipment and structures is excellent.

3.4 WASTEWATER EFFLUENT REUSE

3.4.1 General

The effluent reuse facilities are intended to discharge treated and disinfected effluent for land reuse through irrigation of both forest land and lagoon dikes and lawns on

the treatment plant site. The effluent reuse system that is in place includes a holding pond for storage, a chlorine contact line for effluent disinfection, three irrigation pumps, a re-circulation system, and a sprinkler system to provide reuse on treatment plant lagoon dikes and lawn areas, and on 88.5 acres of forest land. Additional area for reuse is set aside for buffer to adjacent properties on the North, East and South boundaries of the treatment plant site, in compliance with Oregon DEQ regulations. In addition, a separate buffer area was set aside initially between the forest reuse site and the Buck Run Subdivision, and this area is potentially available for future expansion of the reuse site, utilizing Level 4 effluent. .

Prior to land reuse, the effluent is disinfected in 1,140 feet of 36" chlorine contact line, which provides for a minimum detention time of 60 minutes at peak discharge flows of 1,000 gpm. Sodium hypochlorite from the 500 gallon HDPE storage tank is mixed with effluent from Lagoon No. 3, in the chlorine contact facility. Effluent is discharged to forest land and pond dikes and lawn areas from April 1 to October 31 and stored in the holding pond during the remaining months.

3.4.2 Effluent Reuse System

The land reuse system diverts the majority of the effluent to 88.5 acres of forest land, and the remaining to the treatment plant lagoon dikes and lawn areas (11.8 acres). The effluent is pumped to these locations using three pumps. Two 100 HP, 1000 gpm capacity pumps transport effluent to the forest land, while one 15 HP, 125 gpm capacity pushes the water to the dike. The effluent is carried to the forest land in a 10" main line which branches out into 8" lines across the irrigation area. There are flow meters stationed after the pumping facility that are measuring the quantity of effluent traveling to both the forest land and dike.

Both effluent reuse systems provided for discharge from the Sisters WWTP are controlled through the SCADA system, with the PLC provided.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 4
POPULATION AND LAND USE

HGE INC

SECTION 4:
POPULATION AND LAND USE

4.1 HISTORICAL POPULATION

Sisters maintained a historical population from 600 residents to 690 residents for more than 30 years through the year 1990. Population growth was relatively stagnant between 1980 to 1990, but averaged approximately 2 percent a year from 1990 to 1996. The population reached 775 residents in 1996. Beginning in 1997, when the citizens approved construction funding for the community sewer system, growth has escalated rapidly, in similar fashion to the growth throughout all of Deschutes County. By the year 2000, population in Sisters had reached 975 residents, and growth has continued in excess of 11% per year since that time.

4.2 CURRENT POPULATION

The predicted population in 2005 for the City of Sisters is estimated at 1,768 residents in both the Deschutes County Coordinated Population Forecast and in the Sisters Comprehensive Plan.

4.3 PROJECTED FUTURE POPULATION IN 20 YEARS

The City of Sisters Planning Department and Deschutes County have estimated that population in the City will be moderate within the 20-year planning period. Population is anticipated to grow more than 5% per year between 2005 and 2011. From 2012 to 2025 population is expected to grow at 3.13% per year. Population projections by both agencies anticipate that the City will reach 3,747 residents by 2025. Assuming a 3.13% growth rate between 2010 and 2025 is a reasonable long-term growth rate similar to the long-term historical growth rate for Deschutes County, and will allow for an approximate doubling of population in 20 years.

4.4 COMPARISON WITH PREVIOUS GROWTH PROJECTIONS

Previous population projections by the City of Sisters and Deschutes County, and projections in the 1988 Water Facilities Study (Westech Engineering), and 1997 Wastewater System Facilities Plan (HGE Inc., Architects, Engineers, Surveyors & Planners) substantially underestimated the growth that has occurred in the City. The 1988 projection estimated that approximately 1,100 people would reside in Sisters by the year 2005, while the remaining projections all anticipated a population in the range of 1,000 people by the year 2005. Growth has been much more rapid than anticipated in projections during the 1980's and 1990's.

4.5 CAPITAL FACILITIES PLAN POPULATION FORECASTS

Development is rapidly occurring in Sisters and is anticipated to result in population growth of 3.8% per year between 2005 and 2025. (Source: Sisters Coordinated Population Forecast, 2005.) A population of 3,747 residents is forecast for year 2025.

4.6 ULTIMATE BUILDOUT

The aforementioned population estimates assume year 2025 buildout of vacant land inside the UGB and land proposed to be included in the UGB. Ultimate population in the Sisters UGB is difficult to estimate with continuing infill and partitioning of lots in older sections of the City. It is anticipated that many of the older residents will maintain larger lot sizing, and that future years will see a tendency toward partitioning of lots for coming generations, taking into account increasing land values. Growth projections should occur within the existing UGB, with the potential for continuing population expansion as existing land area continues to be redeveloped into smaller partitions. The Sisters Planning Department anticipates increasing occupancy rates to occur within the 20-year planning period with an average of 2.2 people per dwelling unit by 2021.

4.7 LAND USE

4.7.1 Current Land Use

Current land use is shown on *Figure 1.2* based on Sisters's Comprehensive Plan and zoning ordinances. The Urban Growth Boundary (UGB) is recommended for expansion to include land for residential expansion.

4.7.2 Comprehensive Plans and Zoning Ordinance Revisions (2005)

A newly updated Comprehensive Plan has recently been adopted by the City of Sisters. The revisions include an updated existing land use tabulation, buildable lands inventory, UGB expansion, and zoning changes.

4.7.3 General Comments

Sisters is primarily a residential community, with a significant tourist-based economy. The City has a vibrant commercial district located on either side of U.S. Highway 20, and an expanding industrial district. Historically, there has not been a clear division between residential and industrial areas. As a result, the City has developed a zoning system that restricts industrial development to designated areas, while permitting residential development in areas zoned for industrial purposes. Future industry, according to the City's Comprehensive Plan, will be encouraged to locate in areas with readily available utilities and minimal conflicts with existing development.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 5
WASTEWATER CHARACTERISTICS

5.1 INTRODUCTION

5.1.1 Definitions

The following terms are used to define seasonal differences in wastewater flow characteristics:

Dry-Weather (or Summer) Period: Generally defined as the period when precipitation is limited and stream flows are low. This period is commonly defined in the Oregon Administrative Rules (OARs) for specific basins as May 1 through October 31. Sisters' WPCF Permit does not include any specific reference to, or definition of, this parameter. It roughly corresponds, in Sisters, to the period during which irrigation takes place. "Summer" is a shorthand reference.

Wet-Weather (or Winter) Period: Generally defined as the period when precipitation is greatest and stream flow is highest. This period is commonly defined in the OARs for specific basins as November 1 through April 30. It roughly corresponds, in Sisters, to the period when no irrigation takes place and all effluent is held in the wastewater lagoon. "Winter" is a shorthand reference.

The following terms are used to characterize wastewater flows:

Average Daily Flow (ADF): Total wastewater flow for a defined period divided by the number of days in the period or season.

Maximum Monthly Flow (MMF): Total wastewater flow in the month of the highest flow, within a defined period or season, divided by the number of days in that month.

Peak Daily Flow (PDF): Total flow for the day with the highest flow, within a defined period or season.

Peak Instantaneous Flow (PIF) or Peak Hourly Flow (PHF): Highest sustained one hour flow during the year. For purposes of this facilities plan, the terms are treated as synonymous.

The following subscripts are utilized to further define the flow parameters according to the period or season of interest:

A: Annual. Defines a full year period.

WW: Wet-Weather. As defined above.

DW: Dry-Weather. As defined above.

Flow parameters in this facilities plan are typically abbreviated and combined with subscripts as follows[1]:

ADF_A:	Annual Average Daily Flow
ADF_{WW}	Average Daily Wet-Weather Flow
ADF_{DW}:	Average Daily Dry-Weather Flow
MMF_{WW}:	Maximum Monthly Wet-Weather Flow
MMF_{DW}:	Maximum Monthly Dry-Weather Flow
PDF_{WW}:	Peak Daily Wet-Weather Flow
PHF_{WW}:	Peak Hourly Wet-Weather Flow

If a flow parameter is referenced without a subscript then it should be interpreted as applying equally to any season.

Flow parameters are typically abbreviated and expressed as:

mgd:	millions of gallons per day
gpd:	gallons per day
gpcd:	gallons per capita per day

Other flow rates commonly used include:

gpm:	gallons per minute
cfs:	cubic feet per second

Totalized flows are commonly referred to as:

gal:	gallons
MG:	million gallons
cf:	cubic feet
Ac-ft.:	acre feet

Water quality parameters discussed in this section include:

BOD_5:	Biochemical Oxygen Demand
TSS:	Total Suspended Solids

Water quality loadings are typically expressed as:

mg/l:	milligrams per liter

[1] Other combinations are easily formed and may be utilized for reference.

ppd: pounds per day
ppcd: pounds per capita per day

The following terms are included for clarification:

Current: Generally refers to recent condition valid for year 2005.

Design: With regard to flows, "design" refers to anticipated flows that would occur under conditions corresponding to the flow characteristics defined above. "Design" takes into account a full analysis of the flows and generally ignores current system limitation such as inadequate plant, pump station, and collection system capacities. As a result, "current design" flows may vary considerably from the record of flow currently or recently observed at the wastewater facility. Future design flows include allowances for community growth and, possibly, other changes in system characteristics. Unless qualified otherwise, future design parameters refer to projected parameters at the end of the design period. In this case, year 2025.

5.1.2 Parameters of Interest

The City's main pump station (Pump Station No. 1) transfers all of the City wastewater to the treatment facility. The primary parameter of interest is the extrapolated peak hourly flow. Headworks are also evaluated and sized according to peak hourly flow requirements.

Lagoon treatment/holding includes considerable equalization capabilities. Parameters of primary interest are averages of defined periods (winter or summer).

For mechanical treatment facilities, parameters of interest vary according to the nature of the processes involved. In general, hourly, daily, weekly, and monthly parameters may all be needed.

5.1.3 Methodology for Computing Flows

DEQ has developed guidelines for projecting wastewater flows, using relationships between wastewater flow and rainfall. These guidelines work well for estimating wastewater flows in Western Oregon, where winter rainfall often is a major contributor to the total and peak flows reaching the plant (through infiltration and inflow into the collection system). However, in Sisters these guidelines are not appropriate since rainfall does not directly have a significant impact on the amount or peaking of flow reaching the treatment facility.

Sisters' design flows will be based on flows measured at the wastewater treatment facility. Peak hourly flow for Sisters will be extrapolated using general design guidelines.

5.2 ACCURACY OF DATA

5.2.1 Influent Flowmeter and Sampler

The influent flowmeter is located in the pump room of the control building at the Wastewater Treatment Plant. The meter is an 8" ASA electromagnetic flow meter, which records all flows received from Wastewater Pump Station No. 1. and was installed in 2001 as part of the City's wastewater treatment facility. Flowmeter calibration has been verified by a factory representative on an annual basis. Flowmeter performance has not been problematic.

The influent sampler is also located in the WWTP Control Building to record composite samples of influent flows. The sampler is an ISCO 3710 FR refrigerated sampler which provides for a 24 hour composite sample. Samples are taken weekly by Paul Bertagna, Chief Operator, and all testing is provided by City staff. Sampler operation and sample handling/testing has not been problematic.

5.2.2 Bypass and Overflows

There are no constructed bypasses or overflows in the wastewater system.

5.2.3 Inflow and Infiltration (I/I)

There is no evidence of I/I in the Sisters collection system. The system itself is relatively new (constructed in 2002). Sewer lines are generally above the groundwater table. Annual precipitation is 14.42 inches; annual evaporation is approximately 36 inches (see Section 7.4.1). It is unlikely that I/I will pose a concern during the planning period.

5.2.4 Effects of Population Growth

Population growth has been very high in recent years. Growth from the 2000 Census figure of 959 persons to the Portland State Population Research Center (PSU) figure of 1,490 for July 1, 2004 averaged 11.65 percent per year. The largest growth occurred between 2002 and 2003 with an increase of 32.4 percent based on PSU figures of 1,080 and 1,430 persons respectively. Growth from 2003 to 2004 was more "moderate" at 4.2 percent (based on PSU figures on 1,430 and 1,490 respectively). The effect of such high growth rates on wastewater flows is marked; therefore, only the most recent flow data will be evaluated for the purposes of estimating current and future flow parameters.

The PSU figure of 1,490 persons will be used to estimate current per capita flows from the recent data. This will ensure a conservative design basis for recommended improvements and counter deficiencies associated with an abbreviated data set.

5.3 FLOW ANALYSIS

5.3.1 Observed Data

Observed data is summarized in *Table 5.1* for the two year period from October 2003 through September 2005. Primary source is the WPCF Discharge Monitoring Reports (*Appendix 5.1*).

Table 5.1: Wastewater Influent Flow Data

Month	2003-2004 Total (MG)	2004-2005 Total (MG)	Percent Increase
October	4.123	4.337	5.2
November	3.630	4.036	11.2
December	3.720	4.148	11.5
January	3.813	4.085	7.1
February	3.741	3.402	-9.1
March	3.906	4.227	8.2
April	3.930	4.212	7.2
May	4.247	4.749	11.8
June	4.380	5.029	14.8
July	4.836	5.373	11.1
August	4.991	5.298	6.2
September	4.740	4.992	5.3
Total	**50.057**	**53.888**	7.7
Daily Average	**0.137**	**0.148**	7.7

Table 5.1 shows the effects of population growth on flows. There was an average increase of 7.7 percent between the two years shown. Increases occurred throughout the year and in every month except February, where the 2005 total was less than the 2004 total. Because of the large flow increase associated with City growth, the flow analysis will focus on the 2004-2005 data.

Table 5.2 provides a further elaboration of flow data for the period October 2004 to September 2005.

Table 5.2: Daily Wastewater Data Summary
(October 2004 - September 2005)

Month	Monthly Average (mgd)	7-Day Maximum (mgd)	Maximum Day (mgd)	Minimum Day (mgd)
October	0.140	0.151	0.160	0.126
November	0.135	0.142	0.151	0.125
December	0.134	0.141	0.180	0.102
January	0.132	0.142	0.148	0.121
February	0.121	0.139	0.154	0.119
March	0.136	0.142	0.156	0.120
April	0.140	0.148	0.153	0.131
May	0.153	0.164	0.172	0.130
June	0.168	0.175	0.198	0.152
July	0.173	0.185	0.200	0.118
August	0.171	0.176	0.184	0.159
September	0.166	0.174	0.190	0.155
Summer	0.163	0.185	0.200	0.118
Winter	0.132	0.148	0.180	0.102
Annual	0.148	0.185	0.200	0.102

A summary of recent wastewater flow characteristics is shown in *Table 5.3.*

Table 5.3: Summary of Wastewater Flow Characteristics
(October 2004 - September 2005)

Flow Characteristics	Flow (mgd)	Flow (gpcd) [1]	Date of Occurrence
Annual:			
ADF_A:	0.148	99.3	Oct. '04-Sep '05
Summer:			
ADF_{DW}:	0.163	109.4	May-October
MMF_{DW}:	0.173	116.1	July 2005
MWF_{DW}:	0.185	124.2	July 4-10, 2005
PDF_{DW}:	0.200	134.2	July 10, 2005
Winter:			
ADF_{WW}:	0.132	88.6	November-April
MMF_{WW}:	0.140	94.0	April 2005
MWF_{WW}:	0.148	99.3	April 18-24, 2005
PDF_{WW}:	0.180	120.8	December 8, 2004

[1] Population Basis: 1,490 (Section 5.2.4)

The highest flows typically occur in the summer and are associated with the high number of seasonal visitors and tourists. Approximately 82 percent of metered water sales returned as wastewater during the period November 2004-March 2005.

5.3.2 Design Flows

Current design flows are based on data presented in Section 5.3.1. The data utilized does not appear problematic or inconsistent; therefore, there is no need for supplemental data or analyses. Current design flows are summarized in *Table 5.4.*

Peak hourly flows (PHF) are estimated using methodology described in *Recommended Standards for Wastewater Facilities, 2004 Edition* (also known as the 10 State Standards):

$$\frac{PHF}{ADF} = \frac{18 + P^{0.5}}{4 + P^{0.5}} \qquad \textit{where } P = \textit{population in thousands}$$

Future (year 2025) design flows are also shown in *Table 5.4.* Future flows, except PHF, are based on the 2005 design flows increased by the population ratio of 3,747 persons (the projected year 2025 population) and the PSU 2004 figure of 1,490 persons. PHF figures were recomputed using the projected population forecast of 3,747 persons in year 2025. It is assumed that the relative ratio of commercial and residential development will continue during the planning period. Disproportionate growth of commercial, industrial, or institutional sectors could result in design level flows occurring prior to achieving the forecasted population of 3,747 persons. The 2025 design flows represent an increase of approximately 251 percent over current conditions.

Table 5.4: Design Flow Summary

Flow Characteristic	Current 2005 Design Flow (mgd)	Future 2025 Design Flow [1] (mgd)
Annual:		
ADF_A:	0.150	0.38
Summer:		
ADF_{DW}:	0.165	0.42
MMF_{DW}:	0.175	0.44
MW_{DW}:	0.185	0.47
PDF_{DW}:	0.200	0.50
PHF_{DW}:	0.595	1.41
Winter:		
ADF_{WW}:	0.135	0.34
MMF_{WW}:	0.140	0.35
MWF_{WW}:	0.150	0.38
PDF_{WW}:	0.180	0.45
PHF_{WW}:	0.480	1.14

[1] Population Basis: 3,747

5.4 WASTEWATER QUALITY

5.4.1 Current Influent Loadings

Influent BOD_5 and TSS sampling and testing is conducted approximately four times per month. Influent BOD_5 data for the period October 2004 to September 2005 is shown in *Table 5.5*; influent TSS data for the same period is shown in *Table 5.6.*

Table 5.5: Influent BOD_5 Data
(October 2004 - September 2005)

Month	Number of Sample Events	Concentration (mg/l)			Loading (ppd)		
		Average	Max.	Min.	Average	Max.	Min.
October	4	295	310	255	333	361	300
November	4	357	490	261	395	523	311
December	3	263	332	197	288	371	219
January	4	320	342	275	351	396	321
February	4	297	344	267	347	393	322
March	4	325	375	205	371	441	243
April	4	325	378	258	383	479	286
May	4	299	366	222	385	498	307
June	4	309	382	229	447	561	317
July	5	295	361	243	437	533	381
August	4	277	352	214	394	505	303
September	4	334	380	274	456	515	391
Summer	25	302	382	214	409	561	303
Winter	23	315	490	197	356	523	219
Annual	48	308	490	197	382	561	219

Table 5.6: Influent TSS Data
(October 2004 - September 2005)

Month	Number of Sample Events	Concentration (mg/l)			Loading (ppd)		
		Average	Max.	Min.	Average	Max.	Min.
October	4	210	258	141	236	271	159
November	4	183	199	169	204	218	192
December	3	171	183	150	187	200	168
January	4	232	313	152	257	363	162
February	4	189	214	161	222	275	195
March	4	191	322	115	216	354	136
April	4	271	500	159	323	634	183
May	4	279	420	190	362	571	231
June	4	277	323	165	401	468	228
July	5	155	221	72	230	315	114
August	4	217	301	174	308	424	193
September	4	273	426	177	375	593	236
Summer	25	235	426	72	319	593	114
Winter	23	206	500	115	235	634	136
Annual	48	221	500	72	277	634	114

Influent concentration data appears reasonable and does not include very low or very high figures that would suggest sampling errors or I/I.

Per capita BOD_5 and TSS Loadings are summarized in *Table 5.7.* Average and Summer BOD_5 values are somewhat high. This is consistent with the substantial presence of visitors and tourists. TSS is relatively low throughout the year.

Table 5.7: Per Capita BOD_5 and TSS Loadings [1]

	BOD_5 (ppcd)	TSS (ppcd)
Annual:		
Average:	0.256	0.186
Monthly Maximum:	0.306	0.269
Daily Maximum:	0.377	0.426
Summer:		
Average:	0.275	0.214
Monthly Maximum:	0.306	0.269
Daily Maximum:	.0377	0.398
Winter:		
Average:	0.239	0.158
Monthly Maximum:	0.265	0.217
Daily Maximum:	0.351	0.426

[1] Population Basis: 1,490 (See Section 5.2.4)

Design BOD_5 and TSS loadings are summarized in *Table 5.8.*

Table 5.8: Design BOD_5 and TSS Loadings

	2005		2025	
	BOD_5 (ppd)	**TSS (ppd)**	**BOD_5 (ppd)**	**TSS (ppd)**
Annual:				
Average:	382	277	959	697
Monthly Maximum:	456	401	1,147	1,008
Daily Maximum:	561	634	1,413	1,596
Summer:				
Average:	409	319	1,030	802
Monthly Maximum:	456	401	1,147	1,008
Daily Maximum:	561	593	1,413	1,491
Winter:				
Average:	356	235	896	592
Monthly Maximum:	395	323	993	813
Daily Maximum:	523	634	1,315	1,596

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 6
COLLECTION SYSTEM IMPROVEMENTS

HGE INC

6.1 GENERAL

This section describes the process by which the proposed flows for the collection system were calculated as well as the impact of those results. Each branch of the gravity system was analyzed in addition to all three pump stations and their associated force mains. Some considerations were noted for expansion that might take place after the designated 20-year scope of the study.

6.2 DESIGN PARAMETERS

Design flows for the collection system were calculated on an EDU basis at build out. A specific amount of square feet was designated per EDU for each zone. The zoning can be seen in *Figure 1.2* and the square foot per EDU are displayed in *Table 6.1.* The number of EDU's serving each sewer lateral and main and the flow in each, was calculated using the following equation:

Table 6.1 - EDU Designation

Description	FT.²/EDU
Commercial	5,000
High Dens. Res.	5,000
Industrial	20,000
Low Dens. Res.	10,000
Landscape Management	20,000
City Parks	30,000
Schools	10,000
Public Facilities	2,000

$$EDU = \sum \frac{S_i}{D_i}$$

where: S is the total square foot for a given zone serving the sewer lateral or main, D is the square foot designation per EDU for that zone, and i is the summation for all the zones that are serving the given sewer lateral or main.

Once the EDU's were calculated for each sewer lateral or main they were multiplied by 125 Gallons/EDU, and increased by a peaking factor of 2.4 for a pipeline designed to run no greater than 50% full. Peak flows were then totaled for each main or lateral, including flows from upstream pipeline sections. This should be conservative for planning purposes.

The flow capacity for the gravity lines, given the slope, were calculated using Manning's equation shown below:

$$V = \frac{K}{N}(R_h)^{\frac{2}{3}}(S)^{\frac{1}{2}}$$

where V is the discharge velocity, K is the unit conversion factor, N is the Manning's coefficient, R_h is the hydraulic radius, and S is the slope of the pipe. The flow capacities were calculated with the pipes half full and can be seen in *Table 6.2.*

6.3 SYSTEM ASSESSMENT

In general each element of the existing collection system has sufficient capacity to handle the projected flows for 2025. Flows vs system capacity are shown in *Table 6.2*. Following is a list that summarizes the results of the analysis:

Table 6.2 - System Flow Capacities

Description	2025 Flow (gpm)	Capacity (gpm)
P.S. #1	850	850
Force Main #1	850	1199
P.S. #2	28.4	153
Force Main #2	28.4	308
P.S. #3	31.6	260
Force Main #3	31.6	308
8" Grav. Main	38	170
10" Grav. Main	138	609
12" Grav. Main	332	368
15" Grav. Main	362	667
18" Grav. Main	865	970
24" Grav. Main	1004	3813

1) All force mains have sufficient capacity to handle projected flows and have additional capacity for growth after 2025.

2) All gravity lines are sufficiently sized for 2025 flows and provide capacity for growth past the planning period for this study.

3) Pump capacities are well above the projected flow, with the exception of Pump Station No. 1. This is the only portion of the current collection system that will be very near it's capacity by 2025. Dependent on whether flows reach the projected levels, on a peak hourly dry weather flow (PHF_{DW}) basis, the pumps in Station No. 1 will likely need to be replaced with larger units. Costs for replacement of the pumps should be budgeted in Priority II.

There is one additional pumping change that will occur in the system within the next ten years. Currently the pumps in Pump Station No. 1 are equipped with impellers that limit the pumps to 520 gpm. As flows increase to where the pumps have difficulty in maintaining wet well levels, the existing impellers will need to be replaced with larger impellers that have already been provided for the City. These costs should be budgeted in Priority I.

Table 6.3: Capital Costs for Impeller Replacement - Priority I
Replacement of Existing Impellers Owned by City of Sisters

	Preliminary Opinion of Probable Cost
Construction Cost - Installation of New Impellers and Seals	$12,500
Engineering and Construction Observation	$ 2,500
Legal and Administrative	$ 625
Contingency (10% Construction Cost)	$1,250
Total Capital Costs	**$16,875**

Table 6.4: Capital Costs for Installation of New Pumps - Priority II
for Increased Capacity

	Preliminary Opinion of Probable Cost
Construction Cost - Installation of New Pumps in Existing Station	
Equipment	$45,000
Labor	$ 20,250
Engineering and Construction Observation	$ 13,050
Legal and Administrative	$ 3,275
Contingency (10% Construction Cost)	$ 6,525
Total Capital Costs	**$88,100**

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 7
WASTEWATER TREATMENT ANALYSIS

7.1 EXISTING FACILITIES AND GENERAL OPERATION

A description of the existing treatment facility and general operation is included in Section 3.

7.2 WPCF PERMIT

Sisters Water Pollution Control Facilities (WPCF) Permit No. 101779 recently expired on February 28, 2005. A new permit was issued by DEQ with no changes other than the expiration date. The new expiration date is February 28, 2011, and a copy is provided in *Appendix 7.1.*

Schedule A of the permit includes provisions for waste disposal. Key provisions include: a permit flows basis of, less than or equal to, 0.45 mgd monthly average daily influent flow; effluent to be disposed of in accordance with the Reclaimed Water Use Plan and sound irrigation practices; irrigation limited to 16 inches per year during the permitted April-October irrigation season. Also included are the following bacterial limits which apply to the effluent and intended uses (from Schedule A (1)(b)):

1) Prior to reuse of treated effluent for Level I beneficial purposes, the wastewater shall comply with the following effluent limitations:

Parameters	Limitations
E coli	Shall not exceed a monthly geometric mean of 126 organisms/100mls.

2) Prior to reuse of treated effluent for Level II beneficial purposes, the wastewater shall receive treatment required for Level II beneficial purposes and shall comply with the following effluent limitations:

Parameters	Limitations
Total Coliform	Shall not exceed a 7 day median of 23 organisms/100mls and no two consecutive samples shall exceed 240 organisms/ 100mls

The permit does not include other quantified effluent parameters such as BOD_5, TSS, and BOD_5 and TSS removal efficiencies.

Minimum monitoring and reporting requirements are included in Schedule B of the permit. Monitoring requirements for influent and effluent are summarized in *Table 7.1.*

Table 7.1: WPCF (Permit 101779) Minimum Monitoring Requirements

Item or Parameter	Minimum Frequency	Type of Sample
Influent		
Total Flow (mgd)	Daily	Totalizer
Flow Meter Calibration	Annually	Verification
BOD_5	Weekly	Composite
TSS	Weekly	Composite
pH	3/Week	Grab
Effluent		
Total Flow (mgd)	Daily	Totalizer
Flow Meter Calibration	Annual	Verification
pH	3/Week	Grab
E. Coli Bacteria	1/Week	Grab*
Total Coliform	1/Week	Grab*
Chlorine Residual	Daily	Grab
Amount Chlorine Used	Daily	Weight
Total P and Total N	Annually during irrigation	Grab
Annual Irrigation Rate	Annually	Calculation
Annual Nitrogen Loading	Annually	Calculation

* The permittee is only required to sample for either E. coli or total coliform, but not both. If the permittee is irrigating on crops requiring only Level I quality effluent, E. coli shall be monitored. If the permittee is reusing the effluent for Level II uses, total coliform shall be monitored.

7.3 EFFLUENT QUALITY

Effluent quality data is limited to a few parameters and is collected during active irrigation periods. Effluent TSS data is summarized in *Table 7.2* for the 2004 and 2005 irrigation seasons.

Table 7.2: Effluent TSS Data

Month	Parameter	Year 2004		Year 2005	
		TSS (mg/l)	TSS (lbs)	TSS (mg/l)	TSS (lbs)
April	Total	-	228.3	-	150[1]
	Average Day	20.0	28.5	-	30[1]
	Maximum Day	20.0	56.7	-	-
May	Total	-	1586.0	-	755.3
	Average Day	37.4	198.2	18.5	94.4
	Maximum Day	50.0	90.0	20.0	36.0

June	Total	-	1336.8	-	940.7
	Average Day	19.3	167.1	12.3	117.6
	Maximum Day	35.0	63.0	17.0	-
July	Total	-	1133.7	-	1484.0
	Average Day	20.4	141.7	13.6	185.5
	Maximum Day	39.0	93.0	27.0	211.0
August	Total	-	1304.5	-	5248.4
	Average Day	26.0	163.1	48.0	656.1
	Maximum Day	50.0	28.0	69.0	267.0
September	Total	-	585.0	-	1560.4
	Average Day	16.0	73.1	30.5	195.1
	Maximum Day	18.0	25.0	39.0	57.0
Season (183 days)	Total	-	6,174.3	-	10,138.9
	Average Day	24.0	33.7	24.6	55.4
	Maximum Day	50.0	93.0	69.0	267.0

[1] Estimated.

Total pounds of TSS increased by 64 percent over the 2004 total; however, the total volume of irrigation also increased by 53 percent over the 2004 total. Based on *Table 5.6* annual average TSS loading of 227 ppd (101,105 lbs for year), and *Table 7.2* TSS total for 2005 (10,138.9 lbs), the average TSS removal efficiency was 90 percent.

Sisters samples and tests for E. coli rather than total coliform. E. coli data and chlorine data are summarized in *Table 7.3* for the 2004 and 2005 irrigation season.

Table 7.3: Effluent E. Coli and Chlorine Data

Month	Parameter	Year 2004			Year 2005		
		E. coli (MPN)	Chlorine (lbs)	Chlorine Residual (mg/l)	E. coli (MPN)	Chlorine (lbs)	Chlorine Residual (mg/l)
April	Total	-	40.0	-	-	38.0	-
	Average Day	4.3	3.6	1.1	1.0	7.6	1.1
	Maximum Day	17	6.0	4.7	2	10.0	2.2
	Minimum Day	0	2.0	0.1	0	6.0	0.7
May	Total	-	71.0	-	-	180.0	-
	Average Day	3.4	2.0	0.4	0.3	7.5	1.6
	Maximum Day	17.5	10.5	2.1	2	16.0	4.7
	Minimum Day	0	1.5	0.1	0	2.0	0.2

June	Total	-	229.0	-	-	304.0	-
	Average Day	0.8	7.9	1.3	0.3	-	2.9
	Maximum Day	9	12.0	3.3	2	25.0	6.6
	Minimum Day	0	2.0	0.6	0	3.0	0.3
July	Total	-	471.0	-	-	441.0	-
	Average Day	0.8	15.2	1.5	0.8	14.2	1.7
	Maximum Day	4	30.0	3.3	5	31.0	3.6
	Minimum Day	0	2.0	0.0	0	3.0	0.4
August	Total	-	346.0	-	-	630.0	-
	Average Day	2	11.9	0.9	5.4	2.0	1.0
	Maximum Day	11	27.0	1.8	24	38.0	1.9
	Minimum Day	0	0.0	0.4	0	3.0	0.4
September	Total	-	174.0	-	-	379.0	-
	Average Day	1.91	7.3	0.8	2.3	14.0	0.9
	Maximum Day	9	12.0	2.1	8.6	24.0	1.8
	Minimum Day	0	0.0	0.1	0	6.0	0.3
Season (183 days)	Total	-	1331.0	-	-	1972.0	-
	Average Day	2.1	7.3	1.0	1.7	10.8	1.5
	Maximum Day	17.5	30.0	4.7	24	38.0	6.6
	Minimum Day	0	0.0	0.1	0	2.0	0.2

There was a 48 percent increase in chlorine use in 2005 over 2004; this is approximately equivalent to the 53 percent increase in irrigation volume. All E. coli results are well within permitted limits.

Effluent nutrient data for September 4, 2003 indicated the following:

Total phosphorus: 3.6 mg/l
Total Kjeldahl Nitrogen: 5.8 mg/l
Ammonia Nitrogen: 5.8 mg/l
Nitrate Nitrogen: 0.01 mg/l

Total Nitrogen was 5.62 mg/l and 4.02 mg/l in September of 2004 and 2005 respectively. Total Phosphorus was 5.28 mg/l and 6.64 mg/l in September of 2004 and 2005 respectively. Nutrient levels are reasonable and do not raise concerns regarding system performance or effluent loadings.

7.4 TREATMENT CAPACITY

7.4.1 Hydraulic Capacity

The treatment facility integrates both treatment and winter holding functions. Most treatment takes place in the first two cells; the third cell functions primarily as a storage reservoir for winter effluent holding and summer flow equalization and for storage associated with irrigation needs. Hydraulic capacity at the Sisters facility is

therefore primarily related to the volumetric (holding) capacity of the pond system in general, and the holding pond specifically. Lagoon holding cell surface areas and volumes at various depths are shown in *Table 7.4*. Volumes are included for freeboard depths of less than 3.0 feet. Generally, facilities are not operated within this range; however, it does indicate potential reserve volume that could be utilized under extraordinary conditions.

Table 7.4: Holding Pond Surface Areas and Volumes

Elevation (ft.)	Depth[1] (ft.)	Water Surface Area (ft^2.)	Water Surface Area (Ac)	Incremental Volume (ft^3)	Incremental Volume (Ac-ft)	Accumulated Volume (Ac.-ft.)
3212	20	809,019	18.57	803,685	18.45	266.62
3211	19	798,351	18.33	793,046	18.21	248.17
3210	18	787,740	18.08	782,463	17.96	229.96
3209	17	777,186	17.84	771,937	17.72	212.00
3208	16	766,688	17.60	761,467	17.48	194.28
3207	15	756,247	17.36	751,054	17.24	176.80
3206	14	745,862	17.12	740,698	17.00	159.56
3205	13	735,533	16.89	730,398	16.77	142.55
3204	12	725,262	16.65	720,155	16.53	125.78
3203	11	715,047	16.42	709,968	16.30	109.25
3202	10	704,888	16.18	699,837	16.07	92.95
3201	9	694,786	15.95	689,763	15.83	76.89
3200	8	684,740	15.72	679,746	15.60	61.05
3199	7	674,751	15.49	669,785	15.38	45.45
3198	6	664,819	15.26	659,881	15.15	30.07
3197	5	654,943	15.04	650,033	14.92	14.92
3196	4	645,123	14.81	0	0	0.00

[1] Depth at deep end. 4.0 foot depth (elev. 3196) corresponds to 0.0 foot depth at shallow end of pond.

The aerated treatment cells, cell #1 and #2, are maintained at a depth of ten (10) feet (elevation 3209 feet). Utilization of potential capacity above elevation 3209 in the holding pond would require a comparable increase in cell #1 and #2 water surface elevations because of the hydraulic interconnections; as a result, the feasibility of utilizing potential capacity above elevation 3209 feet is limited by the extent of surface agitation present in cell #1. For planning purposes, potential capacity above elevation 3209 feet will not be considered as a viable alternate to implementing capacity related improvements.

An abbreviated water balance for the period October 2004 to September 2005 is presented in *Table 7.5*.

Table 7.5: Water Balance (October 2004-September 2005)

Season	Initial Pond Depth (ft.)	Final Pond Depth (ft.)	Pond Volume Change (Ac.-ft.)	Influent Flow (Ac.-ft.)	Rain		Total Irrigation (Ac-ft)	Computed Evaporation	
					(in.)	(Ac-ft)		(in.)	(Ac-ft)
Holding (Oct.'04-Mar'05)	7.5	12.0	72.59	74.38	6.23	12.42	0.00	8.29	14.21
Irrigation (Apr.'05-Sept. '05)	11.9	6.7	-83.33	91.01	5.40	10.76	140.42	25.76	44.68
Year (Oct.'04-Sept '05)	7.5	6.7	-10.74	165.39	11.63	23.18	140.42	34.05	58.89

Notes: Pond depth at deep end.
Influent flow based in figures in *Table 5.1*.
Rainfall records from WWTP. Tributary area based on area at elev. 3212 ft. for cells 1, 2, and 3.
Irrigation totals based on DMR reported irrigation totals (in inches) for Dike and Forest irrigation.
Evaporation computed by mass balance. Evaporation from water surface of cells 1, 2, and 3.

The City maintains a weather station at the treatment facility that estimates evaporation. Evaporation estimates from the WWTP for the period reflected in *Table 7.5* total approximately 36 inches. U.S. Weather Service mapping for the United States indicates average annual evaporation from shallow lakes in the Sisters area to be approximately 32-34 inches. This provides further corroboration for the computed figure of 34 inches and suggests that all measurements associated with data in *Table 7.5* is relatively accurate.

A synthetic water balance to estimate the hydraulic capacity of the existing holding pond is presented in *Table 7.6*.

Table 7.6: Synthetic Water Balance and Estimate of Holding Pond Hydraulic Capacity

Season	Initial Pond Depth (ft.)	Final Pond Depth (ft.)	Pond Volume Change (Ac.-ft.)	Influent Flow (Ac.-ft.)	Rain		Evaporation		Total Irrigation (Ac-ft.)
					(in.)	(Ac-ft)	(in.)	(Ac-ft.)	
Holding (Oct.-March)	4	17	212	213.8	6.23	12.42	8.29	14.21	0.0
Irrigation (Apr - Sept)	17	4	-212	261.6	5.40	10.76	25.76	44.68	439.7
Year (Oct.-Sept)	4	4	0	475.4	11.63	23.18	34.05	58.89	439.7

Notes: Influent flow (holding period) based on maximum flow to fill holding pond with allowances for rain and evaporation.
Rain and evaporation data from *Table 7.5* with no changes.
Pond depth at deep end.
Influent flow (irrigation period) determined by multiplying 91.01 Ac-ft (from *Table 7.5*) by the ratio of the holding period influent flows from *Table 7.6* (213.8 Ac-ft) and *Table 7.5* (74.38 Ac-ft).
Total irrigation computed as total volume needed to complete mass balance and return the pond level to 4 feet.

Table 7.7 relates current year 2005 and future year 2025 influent flows to current holding pond capacity. For purposes of the computation, rainfall and evaporation figures are not varied from year to year, and the means or adequacy of effluent disposal is not considered.

Table 7.7: Holding Pond Hydraulic Capabilities

Season	Maximum Influent Capacity (Ac-ft)	Year 2005 Influent Volume (Ac-ft)	Year 2005 % of Maximum Capacity	Year 2025 Influent Volume (Ac-ft)	Year 2025 % of Maximum Capacity
Holding (Oct-March)	213.8	74.38	34.8	189.4	88.6
Irrigation (Apr-Sept)	261.6	91.01	34.8	229.2	87.6
Year (Oct-Sept)	475.4	165.39	34.8	418.6	88.0

The holding pond has sufficient reserve capacity to handle projected influent flows through year 2025. This assumes that the pond is managed such as to have a 4.0 foot depth at the end of the irrigation season. Currently, the end of season depth is

approximately 7 feet in order to keep the surface aerators in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

7.4.2 BOD_5 Capacity Evaluation

The treatment facility was designed to provide treatment for summer influent with an average of 759 ppd BOD_5 and for winter influent with an average of 607 ppd. Current 2005 BOD_5 loadings are 409 ppd (summer) and 356 ppd (winter). The original design did not include consideration of BOD_5 removed by the fine screen in the headworks. Allowing for a 10% reduction in influent strength would result in summer and winter BOD_5 loadings on the treatment ponds of 368 ppd and 320 ppd respectively. These considerations are reflected in *Table 7.8* which summarizes capacity and utilization for the existing treatment facility.

Table 7.8: BOD_5 Loadings and Capacity Utilization

	Influent (ppd)	Screening Reduction @ 10 percent	Net loading to ponds (ppd)	Design Capacity (ppd)	Percent Capacity Utilization
2005 Summer Average	409	40.9	368.1	759	48.5
2005 Winter Average	356	35.6	320.4	607	52.8
2025 Summer Average	1,030	103	927	759	122
2025 Winter Average	896	89.6	806.4	607	133

Based on projected system growth, winter influent BOD_5 will reach design capacity in approximately 14 years (year 2019). Summer influent BOD_5 will reach design capacity in approximately 16 years (year 2021). BOD_5 handling capabilities are directly related to the aeration provided. As the BOD_5 design capacity is approached, consideration should be given to upgrading the aeration capabilities of the system either through additional units or replacement with new equipment.

7.5 RECOMMENDATIONS

Assuming adequate irrigation opportunities can be provided and/or development of a stream discharge so as to utilize all net flows generated, the existing facility has sufficient hydraulic capacity to meet projected year 2025 demands and sufficient BOD_5 handling capabilities to meet loading projected through year 2019.

Existing aeration equipment is operating nearly continuously, and will need extensive maintenance or replacement during the planning period to year 2025. In addition, energy costs are becoming progressively more expensive, and power supply in Sisters is known to be limited. Solar and wind powered aerators with electrical power assists are proving successful for similar facilities. It is recommended that the existing units be upgraded with energy saving aeration devices as the units require replacement. Aeration equipment recommendations are described further in Section 10.

If water quality improvements are needed to allow other effluent disposal opportunities, such as stream discharge or less restrictive irrigation, then treatment improvements or alternate facilities will be needed. These should be developed consistent with the needs of the disposal scenarios considered. Other disposal opportunities are discussed in Section 8.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 8
WASTEWATER DISPOSAL

8.1 INTRODUCTION

8.1.1 Current Status

Sisters currently holds all effluent over winter and irrigates all effluent on sites adjacent to the treatment facility. The 100.3 acre irrigation site currently includes: 88.5 acres of forest with an annual application limit of 14.3 inches, and 11.8 acres of grass-covered dikes with an annual application limit of 28.79 inches (the overall average application rate is 16.00 inches[1]). Current (2005) application (reported) totals are: forest - 15.69 inches, and dikes - 25.13 inches. These totals did not include a correction for irrigation evaporation. The overhead sprinklers have an approximate 75% efficiency; therefore, *actual 2005 application totals were: forest - 11.77 inches, and dikes - 18.85 inches.*

With current rapid City growth, the City must pursue expansion of irrigation opportunities (such as acquiring new irrigation sites or contracting with farmers) or development of alternative disposal options (such as stream discharge). At the projected growth rate, Sisters must have new disposal options completed by 2009. However, current approved subdivision plans are in place at this time for much more rapid growth in the short term. An ultimate decision on a disposal alternative must necessarily be in place by 2007, or the City should consider a limitation on growth until new effluent disposal alternatives are completed.

8.1.2 Disposal Alternatives - Preliminary Considerations

The 1994 Wastewater System Engineering Study (WSES) included consideration of numerous effluent disposal alternatives including: year-round discharge to Whychus (formerly Squaw) Creek, wetlands polishing, winter holding and summer land irrigation, summer land irrigation and winter discharge to Whychus Creek, effluent filtration, and a subsurface drainfield. Treatment options were considered for Level 1 to Level 3 discharges. Subsequent discussions with DEQ indicated that Whychus Creek was considered to be a high quality water as (then) defined in OAR 340-41-026 and that stream discharge at any location would not be a viable option for Sisters. Moderate rate infiltration, which allows a controlled rate of subsurface percolation, was also considered to be a viable option. The City of Redmond was also pursuing a similar option at the time. Due to regulatory reservations and the great expense of demonstrating no adverse impact to groundwater, the subsurface disposal option was not deemed to be a viable option for Sisters. During preparation of the 1997 Wastewater System Facilities Plan (WSFP) it became apparent that winter holding and summer irrigation was the only option practicable at that time. The City's present system was developed against this background and history.

[1] [(88.5 acres)(14.3 inches) + (11.8 acres)(28.79 inches)]/100.3 acres = 16 inches

Whychus Creek, which has reportedly gone dry at times through Sisters, is expected to have minimum flows of 20 cfs or more, through the City, as a result of recent projects, exchanges, and negotiations. Creek flows at this level could easily accept a stream discharge from the a level 4 treatment facility from the Sisters wastewater treatment plant. Flows above the Wychus Creek irrigation canal, approximately 4.25 miles upstream from Sisters, has a USGS stream gage in use. This stream gage has recorded flows since 1906, and irrigation water is diverted into the canal below the stream gage. At the stream gage, the average annual flow is 105 cfs and the 7Q10 (7 consecutive day low-flow with a recurrence interval of 10 years) is 31 cfs. Fish biologists have identified 20 cfs as a minimum year-round threshold for viable restoration of steelhead runs and preservation of redband trout habitat below the Wychus Creek irrigation canal. *The Nugget* newspaper reported (October 5, 2005) that Whychus Creek may be restored by next summer (2006)[2].

8.2 REGULATORY REQUIREMENTS

8.2.1 General Regulatory Requirements

General regulatory requirements related to wastewater disposal are described in:

- OAR Chapter 340, Division 40 (Groundwater Quality Protection)
- OAR Chapter 340, Division 41 (Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon)
- OAR Chapter 340, Division 55 (Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants).

The rules include numerous provisions and exceptions, but in general reflect a concern with preservation or enhancement of receiving surface waters or groundwater. This is expressed in the OAR's as an antidegradation policy.

8.2.2 WPCF Permit Requirements

Schedule A of Sisters' WPCF Permit includes the following provisions:

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2 This information was verified in a recent (May 1, 2006) telephone conversation with Scott McCaulou, Program Manager, Deschutes River Conservancy. Mr. McCaulou indicated that 20 cfs minimum flow corresponds to the State's instream water right and that biologists vary on the acceptance of the figure as sufficient. The actual minimum needed is likely to be approximately 20-30 cfs. Restoration of Whychus Creek by summer 2006 is still a reasonable target; however, this is based on the inclusion of temporary water leasing. Permanent instream flows may be 10 years further into the future.

1. The permittee is allowed to construct, operate and maintain a wastewater collection, treatment and land application system constructed in accordance with plans and specifications approved by the Department and in accordance with the following conditions:

   a. The wastewater collections, treatment and land application system shall not be hydraulically or organically loaded in excess of their respective, Department approved design capacities. At full build-out, however, the monthly average daily influent flow shall not exceed 0.45 MGD.

   b. No discharge to state water is permitted. All wastewater shall be treated and stored for disposal by land irrigation. The quality of effluent irrigated shall not exceed:

      (1) Prior to reuse of treated effluent for Level I beneficial purposes, the wastewater shall comply with the following effluent limitations:

Parameters	Limitations
E. coli	Shall not exceed a monthly geometric mean of 126 organisms/100mls.

      (2) Prior to reuse of treated effluent for Level II beneficial purposes, the wastewater shall receive treatment required for Level II beneficial purposes and shall comply with the following effluent limitations:

Parameters	Limitations
Total Coliform	Shall not exceed a 7 day median of 23 organisms/ 100 mls and no two consecutive samples shall exceed 240 organisms/ 100 mls.

   c. All effluent that is irrigated shall be distributed on land for dissipation by evapo-transpiration and controlled seepage by following sound irrigation practices so as to prevent:

      (1) Prolonged ponding of treated reclaimed water on the ground surface;

      (2) Surface runoff or subsurface drainage through drainage tile to surface waters;

      (3) The creation of odors, fly and mosquito breeding or other nuisance conditions;

      (4) The overloading of land with nutrients, organics, or other pollutant parameters; and

(5) Impairment of existing or potential beneficial uses of ground water.

d. Effluent reuse shall comply with all provisions of a Reclaimed Water Use Plan approved by the Department pursuant to OAR 340-55.

2. Unless otherwise approved in writing by the Department, irrigation shall only occur during the period from April through October. In addition, the average application of treated effluent shall not exceed 16 inches per irrigation season.

3. The permittee shall, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

8.2.3 Deschutes Basin Water Quality Standards

Basin specific water quality standards for the Deschutes Basin are described in detail in OAR Chapter 340, Division 041, Sections 0130 to 0135. Stream discharges in the vicinity of Sisters would be, directly or indirectly, to Whychus Creek. Whychus Creek is tributary to the Deschutes River at river mile 121.7. According to OAR 340-041-0135(5), the minimum design criteria for wastewater treatment facilities discharging treated effluent to this stretch of the river basin is:

(A) During periods of low stream flows (approximately April 1 to October 31): Treatment resulting in monthly average effluent concentrations not to exceed 10 mg/l of BOD_5 and 10 mg/l of SS or equivalent control;

(B) During the period of high stream flows (approximately November 1 to March 31): A minimum of secondary treatment or equivalent and unless otherwise specifically authorized by the Department, operation of all waste treatment and control facilities at maximum practicable efficiency and effectiveness so as to minimize waste discharges to public waters.

Other specific limits include maintenance of pH between 6.5 and 8.5, and total dissolved solids equal to or less than 500 mg/l. TMDLs for the Deschutes Basin are anticipated to be completed in 2006; consequently, there are no TMDL related criteria included in the requirements described above. It should be expected that temperature limitations will be imposed for any discharges into Wychus Creek, given current regulations of the National Pollutant Discharge Elimination System (NPDES) permit.

8.3 CURRENT DISPOSAL PRACTICES

8.3.1 Effluent Water Quantity and Quality

Quantity. Based on computations in *Table 7.5*, a total of 140.4 Ac-ft of effluent was recently produced.

Water Quality. Effluent quality is discussed in Section 7.3. There are no parameters of concern. Effluent is classed as Level 1. (*Appendix 8.1* includes "*Table 1: Treatment and Monitoring Requirements for Use of Reclaimed Water (OAR 340-55-015)*". The table lists requirements by level of treatment achieved.) Level 1 is the most restrictive in terms of application and use.

8.3.2 Irrigation Site

Irrigation Site. The wastewater treatment facility and reclaimed water use irrigation site is a 160 acre site immediately south of the Sisters City Limits on the South ½ of Section 9, T 15S, 10 E, W.M. Irrigation of the lagoon dikes provide for approximately 11.8 acres of grass irrigation, and irrigation of a natural forest provides for another 88.5 acres of irrigation area. Site elevation is approximately 3200 feet above mean sea level. *Appendix 8.2* includes the treatment and irrigation site plan from the recent (2000) construction project.

Soils. Soils in the existing wastewater treatment and irrigation site were exhaustively sampled (84 drilled holes and 16 test pits) and evaluated in 1997 by Wert & Associates, Inc. Soils are generally well drained and consist of a fine sand or loamy fine sand top layer (4" to 20" deep) followed by brown sand to a depth of 35"-60". Gravels and sands form the lowest layer sampled. Detailed descriptions are included in the City's *Wastewater Reclaimed Water Use Plan*, HGE, Inc, April 2002.

8.3.3 Irrigation System

The existing irrigation site surrounds the wastewater treatment and holding ponds. Two separate irrigation systems are provided. The forest irrigation site is served by two separate 10-inch diameter PVC irrigation headers from the effluent pumps located in the control building. The dike irrigation system is fed through a looped 4-inch diameter irrigation system. A marking ribbon is buried with each pipe to indicate non-potable water. Two alternating 100 Hp pumps are provided to deliver treated reclaimed water to the forest irrigation system, and a single 15 Hp pump is utilized for the dike irrigation system.

8.3.4 Crops

"Crops" are limited to 88.5 acres of ponderosa pine - lodgepole pine - sage and bitterbrush forest, and 11.8 acres of pond dikes planted with grass.

8.3.5 Effluent Application

Application Totals. Irrigation application totals for the season ending in 2005 are presented in *Table 8.1* for the existing irrigation site.

Table 8.1: Effluent Irrigation Application Totals (2005)

	Irrigation Volume (Ac-ft)	Irrigated Acreage (Ac)	Net Application[1] (in.)	Permitted Application (in.)	Percent of Permitted Application
Dike	24.71	11.8	18.85	28.79	65.5
Forest	115.71	88.5	11.77	14.3	82.3
Total	**140.42**	**100.3**	-	-	-

[1] @75% efficiency.

The dike and forest irrigation systems are operated independently.

8.3.6 Access, Setbacks, and Aerosol Drift

Access and Setbacks. Public access is prevented from entry into the existing area by barb wire fences around the irrigation site, a 6-foot chain link site with barb wire around the treatment plant site, and locked gates for both. Signs are posted around the perimeter of the irrigation field to indicate the water is not safe for drinking and that effluent is being applied as irrigation. Site buffers include 10 feet from open waterways, 50 feet from the property boundary, on all except the North boundary, where the USFS required a buffer of 250-300 feet in the environmental assessment for utilization of this site for reclaimed water use. At the present time, the setback from the North boundary of the treatment site is approximately 550 feet. Remaining acreage of 18.2 acres should be utilized for reuse purposes to the 250 foot provision in the Environmental Assessment, and this should be agreeable to residents in the area.

Aerosol Drift. Adequate control of aerosol drift is now a regulatory requirement. Research in pesticide drift, for which studies and data are relatively abundant, indicate that drift is not linearly related to wind speed, but rather increases significantly as wind speeds reach approximately 15 mph. Guidelines for pesticide application (Clemson University Pesticide Information Program) recommends no application at times when wind speed exceeds 15 mph. Ontario, Oregon has used 15 mph as an upper limit in determining when effluent irrigation should be stopped.

Wind direction is also a factor, since wind blowing in a direction of potentially greater human contact increases potential exposure and compromises the adequacy of the aerosol control. The primary area of potential human contact in the vicinity of the irrigation site is along the North boundary; the prevailing NW and WNW winds blow toward the irrigation site, thereby significantly reducing this risk. In addition, the very large setback also significantly reduces any risks. Lastly, trees in the forest irrigation area also provide a barrier to wind drift of aerosols.

During the irrigation season, the prevailing wind direction is WNW and NW and the average wind speed is 8.8 mph. Monthly average wind data is summarized in *Table 8.2*. *Table 8.2* is based on Oregon Climate Service data for Redmond Airport.

Table 8.2: Irrigation Season Wind Data - Summary (Redmond Airport)

Month	Prevailing Direction (From)	Average Speed (mph)	Percent of Time Exceeding	
			12 mph	19 mph
April	WNW	9.2	18.9	2.4
May	NW	9.2	18.2	1.7
June	NW	9.0	16.9	1.5
July	NW	8.7	14.5	0.8
August	NW	8.3	11.3	0.7
September	NW	8.2	10.8	0.9
October	SSE	9.0	9.8	0.8
Average	**NW**	**8.8**	**14.3**	**1.3**

The City maintains a weather station on site. The system automatically terminates irrigation operations if winds are excessive. To date, excessive aerosol drift has not been noted and there is no proven need for a 250-300 foot buffer on the north side of the site that is in excess of the buffer stipulated by permit and the environmental assessment. The existing SCADA system shuts down operations for the forest irrigation reuse system at 15 mph wind speed. Future expansion of the irrigation site should include an additional irrigation line along the North side of the forest reuse site to reduce the buffer to the 250 foot limit provided by the environmental assessment and the WPCF Permit. This will provide for an additional 18.2 acres of available forest reuse site on the existing site.

In the future, usage may also require irrigation of the 250 foot buffer against the Coyote Springs subdivision, which is stipulated in the WPCF permit. Residents in this area expect continuance of the buffer strip, and usage of this area would require Level 4 treatment, and a lawn type irrigation system.

8.4 COMPLIANCE EVALUATION

In general, the City is in compliance with its WPCF Permit and Reclaimed Water Reuse Plan. It should be noted, however, that to date, City reported irrigation totals have not included a reduction for irrigation efficiency. As can be seen from *Table 8.1*, effluent application totals are within permitted limits.

8.5 FUTURE IRRIGATION REQUIREMENTS

8.5.1 Water Quantity and Quality

Water Quantity. Projected year 2025 irrigation water disposal needs will be 383 Ac.ft., representing a 243 Ac.ft. increase over the current total of 140 Ac.ft. This estimate includes the assumption that precipitation and evaporation totals will be comparable and proportional to those indicated in *Table 7.6*[3].

Water Quality. No significant change in water quality is anticipated over the design period. However, new business proposals with high strength wastewater discharges, including water from commercial or industrial processes, should be evaluated by an engineer to determine the potential impact on treatment and disposal. It may be necessary to require pretreatment of some business wastewater prior to discharge to the public sewer.

8.5.2 Irrigation Acreage Needed

The current irrigation systems, when utilized to the DEQ permitted applications, taking evaporation into account, will allow for irrigation of 178.32 Ac-ft of reuse water. Additional buffer is provided on the North side of the treatment plant site, for a total 18.2 acres of usable land that could be utilized for reuse purposes, in addition to the buffer required in the WPCF permit. If land irrigation is to remain as the primary means of effluent reuse, approximately 115 acres of new irrigation site[4] would need to be acquired to accommodate year 2025 projected growth (In addition to full usage of the existing site). This land area assumes continued application of Level 1 effluent. The 115 acres is the net quantity, and any parcels considered will need to be sufficiently larger to accommodate set-backs, unsuitable areas, and areas that cannot be irrigated with the type of irrigation system selected. Overall, new land area or other alternatives must be made available for disposal of 204.68 Ac-ft of reuse waters, in addition to maximum utilization of the existing systems.

8.5.3 Expansion Sites

On-site expansion possibilities include:

- 18.2 acres of potential (new) forest irrigation is available on the North side of the site, although negotiations are presently underway to

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3 Net evaporation is 35.7 Ac.ft., approximately 9.3 percent of the irrigation figure (383 Ac.-ft.) noted above.

4 The 115 acres is in addition to the existing 11.8 acres of dike irrigation and 88.5 acres of forest irrigation

transfer control of 4 acres of this property to the Sisters-Camp Sherman RFPD. Utilization of the remaining 14.2 acre parcel would still leave a 250-foot buffer along the North boundary. This 14.2 acre additional irrigation parcel could allow for reuse of 18.93 Ac-ft of reuse waters at an annual application rate of 16" for the forested site.

- The remainder of the existing buffer could accommodate 18.93 Ac.ft. of effluent, based on 16 inches applied and 75 percent irrigation efficiency. To use this buffer, treatment would need to be improved to Level 4 effluent. This would allow the effluent to be applied up to the property boundary.

- Conversion of the forest reuse site to a orchard grass hay operation on a portion of the reuse site is possible, but would be in violation of the original environmental assessment. This could provide orchard grass hay in the areas cleared around each sprinkler line, and in the forest surrounding the cleared areas. The hay would allow for a higher uptake of nitrogen and for a higher need for water. In addition, there is very little data on forest irrigation, and records from Sisters should form the basis for evapotranspiration from the forest area. Many irrigation systems are developing around Sisters for irrigation in areas supporting pine forests, and it is reasonable to assume that Pine trees will thrive and consume higher levels of irrigation than was originally projected. It is obvious in viewing the forest that the Pine trees are thriving with the addition of effluent waters, and it is reasonable that the rate of application be increased for forest reuse. If orchard grass was planted as suggested in the City's 2002 Wastewater Reclaimed Water Use Plan, application in the grass hay areas could be increased to 36.4 inches annually from the current application rate of 16 inches annually. This could allow for 1.70 Ac-ft of additional effluent to be applied per acre on areas so converted. (3.03 Ac-ft of total effluent per irrigated acre), for Level 1 effluent. Assuming that 1/3 of the site would have orchard grass hay that would be harvested annually, we believe it is prudent to increase the effluent reuse to an annual average application rate of 21.55" for the forest site, again assuming continuance of Level 1 effluent application. Effluent applied in this means to the existing site, with the addition of the total remaining buffer strip on the North side of the property, would total 205.58 Ac-ft, plus the dike irrigation of 37.75 Ac-ft, for a total application of 243.28 Ac.-ft. The Oregon Department of Environmental Quality would require substantial study before this alternative could be approved, and a means of quantifying the level of evapotranspiration by the mixed use site would be required.

Installation of orchard grass on portions of the reuse site would add considerably to the operation and maintenance of the reuse site. The orchard grass will need to be farmed and removed from the site on a regular basis, and the City Council would need to determine whether additional City staff would be hired, or whether farming would be contracted to an outside contractor.

If all the trees were removed from the forest reuse site, and the entire site was planted with orchard grass, at an application rate of 36.4 inches annually, 419 Ac.-ft of irrigation could be utilized on site. This alternative would require a combination of Level 1 and Level 4 effluent reuse for the site. Conversion of the entire reuse site to orchard grass, with removal of all existing timber, would provide for agronomic application of all projected 2025 effluent flows.

- Additional buffer strips are available surrounding the existing reuse site, if Level 4 water could be provided. This would allow for a potential additional usage on the existing site. Utilization of the buffers on the remainder of the existing reuse site, at an average application rate of 21.55" for combined grass-forest irrigation, would allow an additional irrigation of 5.2 Ac.-ft.

- Utilization of the existing forested site, with orchard grass in cleared areas, and with usage of the buffer strips, as described above, could possibly provide for a total reuse capability of 248 Ac-Ft of the total 383 Ac-ft of irrigation needed to dispose of 2025 flows. New land or other alternatives must be provided for reuse or disposal of a minimum of 135 Ac-ft of water.

Off-site expansion possibilities include:

- The original project identified an additional 80 acres of land for reuse purposes. This land lies West of the existing reuse site, extending to Three Creeks Lake Road, and was withdrawn from initial availability to the City of Sisters following the local environmental assessment process. However, congressional approval of this site was received for wastewater treatment and effluent reuse purposes. As of 2002, all parties were in agreement that the additional property was needed for future effluent reuse by the City. If the land could be acquired, it would accommodate 1.33 Ac-ft to 3.03 Ac-ft per acre utilized, using the analogy provided for a combination forest irrigation-orchard grass reuse application. Assuming 80 percent utilization (64 acres), and an average application rate of 22.1" average for the site, a total of 112.53 Ac.-ft. of effluent could be accommodated. However, with the level

of projected growth in Sisters, the addition of this 80 acre parcel of land to the reuse site would be inadequate for effluent reuse needs projected to the year 2025, and further growth would require the purchase of additional land.

- Advantages of acquiring the 80 acre site are that it has already received congressional approval, is adjacent to the existing plant and effluent reuse site, and the existing reuse system could easily be expanded onto the site. It would also provide an alternate access point to the treatment plant from Three Creeks Lake Road, which would reduce the impact of the current access through a quality residential area. The concern of expanding onto this site is that there are well traveled bike paths through the site, and public opposition was expressed to abandoning or relocating the bike paths to allow for effluent reuse.

- The original project considered reuse on adjacent farm lands, such as portions of the Lazy Z Ranch. However, ownership of the land at that time was opposed to effluent reuse, and none of the Lazy Z was made available for reuse purposes. Several alternative reuse sites were considered, but owner's were hesitant to commit lands for use over an extended period of time, or required other considerations such as future development guarantees. Several alternatives were again pursued in development of this Capital Facilities Plan, but all were remote from the treatment plant site and each desired Level 4 water for application.

  During development of this Capital Facilities Plan, an opportunity became available for purchase of 230.98 acres of the Lazy Z Ranch, in close proximity to the wastewater treatment facility. Land area is available for effluent reuse on this site for the planning period, and the site appears to meet all of the Oregon statutes for effluent reuse with Level 1 effluent. This site is immediately accessible from the existing wastewater treatment plant and effluent reuse site, contains adequate land area for required buffers to meet Oregon DEQ regulations, and topography is conducive to installation of automated type reuse systems. The land has been farmed for many years, and it should be relatively easy to contract with an outside contractor for continued farming of the site. Initial consideration was given to automated circle type irrigation systems for reuse purposes, and the site would accommodate approximately 138.5 acres of effluent reuse with circle type irrigation equipment, maintaining buffers required by statutes (configuration of the site and required buffers will reduce the acreage that can be effectively irrigated with automated irrigation

equipment). The City of Sisters would need to retain a qualified soil scientist to perform a site evaluation to consider the potential for reuse of treated wastewater, focusing on soils, potential crops, and yearly volumes of water available for reuse purposes.

This alternative should be a definite consideration. *Figure 8.1* shows the proximity of potential reuse and disposal sites described in this plan.

8.5.4 Disinfection System

The existing hypochlorite system is designed to provide 60 minutes of contact time at the capacity of the irrigation pumps (1000 gpm). The average irrigation rate needed to accommodate year 2025 irrigation volumes is 475 gpm. Allowing for higher mid-summer application rates, and potential downtime for wind, the system should be adequate for projected year 2025 needs.

8.5.5 Irrigation System

Any new irrigation areas developed will need irrigation works constructed and connected to the existing system. Existing effluent pumps should be adequate. However, new irrigation areas that contribute to increases on the head experienced by the pumps at the effluent pump station, may require new effluent pumps or other design modifications to accommodate the changed system demands.

8.5.6 Crops

At this time, crop options are dependent on the accepted effluent disposal alternative; forest and grass irrigation is likely to continue indefinitely into the future, with the existing forest and grass irrigation installation. If Level 4 effluent is provided, more of the existing site could be utilized for reuse. If the alternative to remove tress from the existing site is chosen, with conversion to orchard grass as a crop, the existing irrigation equipment would likely be replaced with more farm friendly equipment. Utilization of the existing site for reuse must continue under any of the potential alternatives.

If the adjacent site on the Lazy Z Ranch could be purchased, area should be available for effluent reuse, without modifications to the existing reuse site, for the design period for this Capital Facilities Plan. Crop choices remain to be determined, but land area is available for reuse application at a similar rate to the average for the existing site, for the planned design period. Public acceptance of this proposal would appear to be much easier than any suggestions to utilize buffer areas and setbacks on the existing site, even with installation of a Level 4 treatment facility. In addition, acquisition of the 80 acres of USFS property would necessitate relocation of a very popular recreational trail.

Figure 8.1 - City of Sisters Effluent Alternatives

8.6 STREAM DISCHARGE (ALTERNATIVE)

As noted is Section 8.1.2, limited discharges to Whychus Creek are a potential alternative to expanded irrigation opportunities. DEQ has noted the possibility, based on comparable scenarios involving other communities and high quality streams, for discharges of up to one percent of the minimum flow. If a 20 cfs (minimum) flow is established in Whychus Creek, below the Whychus Creek irrigation canal, then effluent discharges of up to 0.2 cfs could be made. If agreement could be reached for transferring Level 4 reuse water some 4.25 miles South to above the diversion for the canal, effluent discharges of 0.3 cfs would be possible. Costs of pumping and transmission to this location would add substantially to developed costs, but would be an excellent long term disposal alternative. This assumes the effluent is well treated and capable of consistently meeting all discharge standards. Specific requirements, based on Deschutes Basin Standards for this area (OAR 340-041-0135(5), is for BOD_5 and TSS concentrations to not exceed 10 mg/l (monthly average basis) for the period April 1 to October 31. Other parameters of potential significance include temperature, level of disinfection achieved, and limitations on other parameters (such as nutrients) that may be required as a result of the TMDL study scheduled for completion in 2006. The possibility of these other parameters significantly affecting discharges is relatively small as long as discharges are at or below one percent of the receiving stream flow.

Water quality of the existing treatment system is not high enough to meet the existing and evolving water quality limits and goals necessary for a stream discharge. Development of an alternative treatment/disinfection pathway (such as membrane filtration and UV disinfection) could markedly improve effluent water quality and significantly improve the chances of public and regulatory approval.

A discharge of 0.2 cfs (89.8 gpm; 129,250 gpd) is equivalent to a daily volume of 0.397 Ac-ft, or 144.8 Ac-ft. on an annual basis. Assuming forest irrigation and 75 percent irrigation efficiency, this is equivalent to an effluent disposal acreage of approximately 91 acres, which would suffice for projected year 2025 flows, if full utilization of the existing reuse site was developed. If discharge could be increased in winter months when stream flows are high, to approximately 50% of the projected plant flows, the requirement for land reuse area would be substantially reduced. Discharge to a point above the Wychus Creek irrigation canal could increase discharge volumes to 0.3 cfs (134.6 gpm; 193,875 gpd), which would provide for a longer term disposal alternative.

The City currently and historically has applied all its wastewater effluent on irrigation sites at agronomic rates. Given this fact, it may be possible to develop an exchange arrangement where the City provides high quality effluent discharges to Whychus Creek and in return obtains a groundwater permit that is in some manner conditioned by the volume of effluent discharged (in the previous year, for example). Such an arrangement would: benefit the stream through enhanced flow, provide "water rights" for ground water to supplement peak summer demands, and create an economic incentive for construction of the enhanced treatment/disinfection facility (because of the value of the groundwater obtained).

8.7 RECOMMENDATIONS

Effluent disposal recommendations are summarized below:

- Continue with forest and dike irrigation up to the maximum allowed.
- Install orchard grass in cleared areas on forest irrigation site.
- Pursue development of a stream discharge to Whychus Creek, with DEQ and other interested parties.
- Discuss with DEQ the possibility of higher forest irrigation rates.
- Pursue development of the existing 14.2 acre buffer site that is not required by the WPCF permit, on the north side of the existing treatment/irrigation, into a new forest irrigation site.
- Pursue development of remaining buffer strips on the treatment/irrigation site, utilizing Level 4 treatment and reuse requirements.
- Clear the current forest irrigation site and convert to orchard grass or other farmed crops utilizing high water agronomic rates.
- Acquisition of the additional 80 acres West of the existing treatment/reuse site should be a definite consideration. The City of Sisters would need to utilize a public hearing process to consider alternative reuse options of Level 1 or Level 4 water for this site, and for potential future treatment/reuse system expansion. Recreational usage of the proposed 80 acre site is extensive, and residents may demand Level 4 reuse and irrigation at night, if this site is to be utilized for reuse purposes.
- Alternatives to utilization of the additional 80 acre forest service site should be pursued. These should include properties such as the 230.98 acre portion of the Lazy Z Ranch, Pine Meadow Ranch, or other US National Forest Service sites. However, the Oregon DEQ and good planning will dictate that any disposal site be developed for long term reuse purposes. (50 years or more). This requirement may discourage application on private properties, particularly with the rapid changes that are occurring in the Sisters area.

  The potential purchase of the 230.98 acre site from the Lazy Z would assure the City of a long term reuse site, with immediate accessibility to the existing wastewater treatment plant. This site appears to meet all of the Oregon Department of Environmental Quality effluent requirements for Level 1 reuse application, assuming that soils are acceptable for irrigation purposes, and this has been demonstrated through many years of irrigation and farming

practices. If Level 1 reuse on this site proves feasible, this alternative would be much more cost effective over the long term than alternatives utilizing higher levels of treatment. This site would readily provide capacity for effluent flows from the projected 2025 population from the planning area.

Discharge to Whychus Creek at the location shown in Figure 8.1, or to an alternative location some 4.25 miles South of the treatment plant site should be pursued. Any discharge alternative will require Level 4 effluent form the treatment plant, and this will require a minimum of the recommended treatment improvements. Either of the Wychus Creek alternatives, coupled with expanded usage of the current forest reuse site, would provide for year 2025 population projections for the planning area.

If a discharge is not permittable to Whychus Creek, expanded land reuse will be required under all possible alternatives. An additional reuse site is recommended for long term benefit of the City, under one of the alternatives discussed. One alternative to acquisition of additional land for effluent reuse is to remove all timber from the current reuse site, and to plant this site in orchard grass or other crops with a high affinity for water. This alternative will be required if other reuse alternatives are not approvable by regulatory agencies and the public, but would be in violation of the environmental assessment provided for the site. Continued growth in Sisters will require an additional means of effluent disposal offsite from the existing City property.

The most cost effective disposal recommendations are disclosed in Section 10. Other disposal alternatives discussed in this section are feasible, but will require additional capital for construction, and would require a combination of alternatives to meet the increased disposal need for 243 Ac.ft. of reuse disposal. The City should immediately pursue a potential purchase of the 230.98 acre parcel of the Lazy Z Ranch. An alternative would be for the City to pursue a discharge to Whychus Creek. A discharge above the Whychus Creek irrigation canal would offer long term benefit for residents of the City of Sisters. We also recommend that the City pursue acquisition of the additional 80 acre USFS site for future benefit of the City, if agreement is not possible for the Lazy Z site, even with approval of a Whychus Creek discharge permit and public approval of this alternative. Effluent quality and cost/benefit alternatives can be considered when the site is required for reuse purposes, but the City must plan for long term disposal of wastewater effluent from the expanding community.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 9
BIOSOLIDS MANAGEMENT

HGE INC

9.1 INTRODUCTION

Biosolids contain beneficial nutrients and soil conditioning properties for vegetation; however, they also contain viruses, parasites, and other disease-causing organisms (pathogens) considered potentially dangerous to human health and the environment. Biosolids are not stabilized when removed from the waste stream and must be handled and disposed of properly. Biosolids management practices are therefore needed to reduce the biological activity of the sludge and make it a relatively benign material for final disposal.

9.2 GENERAL REGULATORY REQUIREMENTS

Regulations for biosolids use and disposal were promulgated on February 19, 1993, as 40 CFR Part 503 (Subpart D). The regulation protects public health and the environment through requirements designed to reduce the potential for contact with disease-bearing microorganisms (pathogens) in wastewater biosolids applied to the land or placed on a surface disposal site. Wastewater biosolids cannot be applied to land or placed on a surface disposal site unless it has met the following two requirements:

- Requirements for pathogen reduction.
- Requirements to reduce the potential of the sewage to attract vectors (rodents, birds, insects, and other organisms that can transport pathogens).

Compliance with these two requirements must be demonstrated separately, which allows for some flexibility in biosolids management practice. The basic concepts for implementation of these rules are to understand potential routes of exposure to biosolids, both direct and indirect contacts. Direct and indirect contacts are defined as:

Direct Contact:

- Inadvertent contact with wastewater biosolids.
- Walking through an area (i.e. field, forest, or reclamation area) shortly after wastewater biosolids application.
- Handling soil and raw produce from fields or home gardens where wastewater biosolids has been applied.
- Inhaling microbes that become airborne (via aerosols, dust, etc.) during wastewater biosolids spreading or by strong winds, plowing, or cultivating the soil after application.

Indirect Contact:

- Consumption of pathogen-contaminated crops grown on wastewater biosolids amended soil or of other food products that have been contaminated by contact with these crops.

- Consumption of pathogen-contaminated milk or other food products from animals grazing in pastures or feed crops grown on wastewater biosolids amended fields.

- Ingestion of drinking water or recreational waters contaminated by runoff from nearby land application sites or by organisms from wastewater biosolids migrating into groundwater aquifers.

- Consumption of inadequately cooked or uncooked pathogen-contaminated fish from water contaminated by runoff from a nearby land application site.

- Contact with wastewater biosolids or pathogens transported away from the land application or surface disposal site by rodents, insects, or other vectors, including grazing animals.

Understanding routes of potential exposure allows for development of an overall strategy to protect public health and the environment. The biosolids rules were developed to implement this strategy. The overall strategy is described as follows:

- Reduce the number of pathogens in wastewater biosolids through treatment and/or environmental attenuation.

- Reduce transport of pathogens by reducing the attractiveness of the sewage wastewater biosolids to disease vectors (insects, rodents, birds, and other living organisms that can transport pathogens).

- Limit human and animal contact with the wastewater biosolids through site restrictions to allow natural die-off to reduce pathogen levels to low levels.

A detailed discussion of pathogen reduction requirements, vector attraction reduction requirements, and land application for biosolids disposal, is included as *Appendix 9.1.*

9.3 WPCF PERMIT REQUIREMENTS

Schedule D of Sisters' WPCF Permit (No. 101779) includes the following special condition:

> Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50.

This permit may be modified to incorporate any applicable standard for sewage biosolids use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

9.4 CURRENT BIOSOLIDS TREATMENT AND DISPOSAL

Sisters retains all biosolids in its aerated lagoon treatment and holding facilities. The City has not yet perceived a need to dredge and dispose of accumulated solids, nor has it been required to do so by any regulatory authority.

Untreated solids, separated from the raw wastewater by means of the fine screen at the headworks, are collected, bagged, and sent to the Deschutes County Landfill.

9.5 ACCUMULATED BIOSOLIDS

9.5.1 Quantity

Solids accumulations in pond systems can vary considerably based on overall facility sizing and relative BOD_5 loading rates. As long as a facility is not overloaded (with BOD_5), solids tend to be digested over an extremely long retention time. It is quite common for such facilities to go well beyond their initial design life prior to needing solids removal. The original design provided additional depth in the lagoon system to provide an allowance for solids accumulation, without impacting the effective hydraulic capacity of the facility under normal hydraulic regimes, and this will allow for accumulation over time.

Because of the potential variability in real-world solids accumulations, the most reliable means of determining accumulations and, potentially, accumulation rates, is by physically sampling with a device called a "sludge-judge". Sisters Wastewater Treatment Facility has been in operation for only a few years,and there is no need in the near future for measuring biosolids accumulations. As average BOD_5 influent loadings approach that of the facilities design, sampling should be undertaken to determine the amount of accumulated solids. Recommendations for handling the accumulated solids, or recommendations for future sampling, can be made at that time.

Increased loading to this facility will ultimately create a need for some level of solids removal, and planning to the year 2025 should make provisions for removal and disposal of biosolids in compliance with an approved biosolids management plan. Cost projections for biosolids removal are provided in Section 10.

9.5.2 Quality

No sampling or testing of accumulated solids has been conducted to date. Typical test parameters for any given treatment facility are fairly extensive. Testing is primarily conducted to verify compliance with pathogen reduction requirements, vector attraction reduction requirements, and constituents that may potentially limit application, site usability, and longevity. Small rural, primarily residential, communities typically generate biosolids that comply with all regulatory requirements - assuming proper sizing and operation of the treatment facility. Sampling and testing is not needed at this time. Future timing and need for biosolids removal will necessarily be based on results of sampling and measurement of accumulated solids (as discussed in Section 9.5.1).

9.6 COMPLIANCE EVALUATION

Sisters is basically in compliance with requirements of its WPCF Permit. The City has not yet developed a need for a biosolids management plan.

9.7 RECOMMENDATIONS

At this time, there are no specific time related recommendations with regard to biosolids management. As the treatment facility approaches its design BOD_5 capacity, the City should sample accumulated solids in the cells to determine accumulation depths and to determine if removal of the solids is warranted. Planning for development of a disposal site and a biosolids management plan, in full conformance with Oregon DEQ requirements, should be anticipated within five (5) years. Anticipated costs for a biosolids management plan and for biosolids removal from the existing lagoon system are provided in Section 10.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 10
IMPROVEMENT RECOMMENDATIONS

HGE INC

10.1 TREATMENT/DISPOSAL SYSTEM IMPROVEMENT ALTERNATIVES - PRELIMINARY DISCUSSION

10.1.1 No Improvement Alternative

In terms of treatment and holding, the no improvement alternative may appear tenable. There is adequate hydraulic and treatment capabilities to extend far into the planning horizon. In terms of disposal, however, there is a critical need for expanded disposal options. Offsite disposal options, such as provision of water to farmers or to a stream discharge, would likely require effluent of higher quality than the Level I effluent currently generated. Improving the level of treatment for a surface water discharge, acquisition of a long term lease, or purchase of additional property for land reuse offer definite possibilities. The option to purchase and irrigate a portion of the Lazy Z, however, will allow continued reuse of Level 1 effluent. Costs for offsite disposal options will be substantial, but feasible. It should be noted that the City has amassed SDC monies that can be used to implement the improvements; consequently, the City is in a position to develop a comprehensive and long-term strategy to address local effluent disposal needs. The no improvement alternative is not considered to be a viable option for Sisters.

10.1.2 Irrigation Only Improvements

As noted in Section 10.1.1 above, disposal options off-site are likely to require a higher level of treatment to avoid the use restrictions associated with Level I effluent, or acquisition of property through a land purchase or a long term lease. The option for purchase of the 230.98 acre parcel of the Lazy Z, however, would allow continued disposal of Level 1 effluent under Oregon Administrative Rules (OAR's). There are 32.4 acres on-site that could potentially be developed. Expanding grass irrigation between and among the forest trees[1] or with removal of the forest trees entirely, could also increase on-site utilization of effluent. Such options will assist in effluent disposal but do not, in and of themselves, constitute a long-term solution to overall effluent disposal needs. Purchasing additional land for effluent disposal should be pursued to increase capacity for land reuse, under any of the alternatives discussed. Land in Sisters is becoming progressively more expensive, and there are conflicting uses with most available sites. However, effluent reuse will continue to be required, and a minimum goal for land acquisition should be to acquire a portion of the Lazy Z Ranch, to provide a permanent additional site for reuse application, or to pursue acquisition of the additional 80 acre parcel set aside by Congress for the City of Sisters. Other possibilities would be to acquire a long term lease for land to utilize for reuse purposes. Irrigation only improvements are the most cost effective means of effluent disposal, and should be pursued if possible.

[1] This would entail the removal of some trees and the mixed shrub and herb understory.

10.1.3 Treatment Improvement Alternatives

The existing treatment/holding facility provides adequate treatment for established, on-site irrigation and it is only a few years old. Therefore, a replacement facility is not needed - rather a new facility is needed to, primarily, treat that fraction of the flows that cannot be accommodated through land reuse with irrigation. While many types of mechanical treatment and polishing technologies exist, only one is focused on here: membrane filtration. Reasons for this focus include:

- Wastewater membrane technology has advanced considerably in recent years and costs on equipment and replacement parts have dropped substantially. This technology is rapidly becoming a dominant technology in newly constructed (potable) water treatment plants. In wastewater applications, the technology is reliable and yields very high quality effluent.

- Effluent from well designed membrane plants is extremely high quality and should meet Level IV criteria. Level IV effluent has no buffer requirements, can be used on food crops and in parks, playgrounds, cemeteries, schoolyards, and golf courses with contiguous residences[2]. In short, it gives the City the widest range of disposal options, including stream discharge (if approved) and irrigation of the buffer zone on-site.

- There are current efforts to augment flows in Whychus Creek and reestablish fish runs. Discharges to the Creek will need to be as high a quality as is practicably obtainable in order to mollify public concerns needed to secure regulatory approval. Membrane treatment facilities produce the highest quality effluent of the standard technologies available.

In short, a membrane filtration (treatment) facility would give the City state-of-the-art technology, very high quality effluent, and maximum flexibility in developing new disposal alternatives. Membrane filtration would allow effluent to be discharged to Whychus Creek, or utilized for irrigation in buffer areas or for other purposes, since Level 4 effluent has few restrictions. Any alternative for effluent reuse will necessarily involve public participation, and a lengthy review process should be anticipated for this alternative.

10.1.4 Treatment Improvements and Irrigation (Only) Effluent Disposal

Implementing improvements to enhance effluent quality, and expanding irrigation opportunities on existing and needed land to be acquired or developed, would allow the City to meet its treatment and disposal needs through the projected 2025 design year, without expanding effluent holding capacity. This assumes that land area will

[2] There is a restriction that effluent cannot be sprayed within 100 feet of where food is prepared or served, or where drinking fountains are located.

be available for effluent reuse, to limit the lagoon depth to 4 feet at the end of each irrigation season. At that point, however, holding capacity will need to be expanded or an outfall developed. Expanding the holding pond, or adding new cells, will require utilization of some additional irrigated acreage.

10.1.5 Treatment Improvements and Whychus Creek Outfall

The combination of treatment and land improvements described in Section 10.1.4 and an outfall to Whychus Creek would provide a quality long-term disposal solution for the City of Sisters. As noted in Section 8.7, a stream discharge of up to 0.2 cfs (1 percent of streamflow during the summer/fall low flow period) is likely to be acceptable to DEQ. This is equivalent to approximately 91 acres of irrigable forest acreage at current loading rates and even more if discharges are increased during higher streamflow periods. Reuse into Whychus Creek would be approximately 3/4 of the projected 2025 needs for additional irrigation acreage. Consequently, with this alternative, additional irrigation acreage would still be required toward the latter quarter of the planning horizon.

10.1.6 Treatment Improvements, Outfall, and Expanded Irrigation

This alternative includes all the separate components and benefits discussed in Section 10.1, and makes provisions for future capacity with recommended land acquisition. Expanded irrigation would also provide for the latter portion of the planning horizon. In addition, reuse irrigation can be initially developed where it offers minimal conflict with residential neighborhoods, or recreational usage for portions of the needed land. Leasing of additional offsite land may not be cost effective or reliable over time. Acquisition of a portion of the Lazy Z Ranch would offer many advantages, including offering the City alternative areas for land reuse, and adequate area for effluent land reuse through the 2025 design year. Expanding irrigation opportunities or loadings in the near term would allow the City to more comfortably operate the existing wastewater treatment facility, while analyzing long term reuse opportunities.

10.1.7 Recommendations

Recommendations for detailed study and development include:

- Additional irrigation opportunities with an emphasis on near-term and on-site expansions, or increased loading rates, to allow sufficient time for design and construction of irrigation alternatives and the installation of irrigation equipment.

- Purchase of the planned 80 acre parcel set aside by Congress for Sisters wastewater treatment and disposal. This site is immediately West of the

existing wastewater site, and will provide direct access to the entire parcel from Three Creeks Lake Road.

- Purchase of the 230.98 acre site from the Lazy Z Ranch. This site is just East of the existing wastewater treatment plant site, and has access available across small parcels which have been purchased by other investors.

- A wastewater membrane filtration facility that would treat a portion of the influent flowstream.

- An outfall in Whychus Creek.

- Provide upgrades to operating software, and installation of on-site cameras for monitoring of the wastewater treatment facility.

- Replacement of aeration equipment in the existing wastewater treatment facility with new more energy efficient equipment.

- Develop a biosolids management plan within ten (10) years, and plan for removal and disposal of biosolids.

10.2 COLLECTION SYSTEM IMPROVEMENTS

Collection system improvements are discussed in Section 6.3. There are no near-term collection system improvement recommendations. Replacement of impellers in Pump Station No. 1 is anticipated to be needed at some point within the next 10 years. A current preliminary opinion of probable cost (OPC) for this work is $16,875. Replacement of Pump Station No. 1 pumps with larger pumps will likely be needed toward the end of the 20-year planning horizon. A current OPC for this is $88,100.

10.3 TREATMENT FACILITY IMPROVEMENTS

10.3.1 Concept

The basic concept and rationale for the recommended membrane treatment facility is discussed in Section 10.1. The primary intent is to treat the wastewater to the highest extent practicable and discharge to Whychus Creek. It is also intended to function as an "expansion" of the existing treatment/holding/irrigation system to allow the effective utilization of the membrane facility. This will reduce the need for future holding and irrigation facilities.

In addition to installation of a new membrane treatment facility, treatment improvements to the year 2025 will include removal and disposal of biosolids from existing treatment lagoons No. 1 and No. 2.

10.3.2 Process and Design

A membrane treatment facility consists of the following key process elements[3]:

- Influent delivery and control. Influent options: raw wastewater, pond cell 1 effluent, pond cell 2 effluent, and pond cell 3 effluent will be evaluated in predesign. At this time it is believed that effluent from pond cell 1 or 2 will result in the best treatment and in minimizing the size of the aeration basin at the membrane facility. Flow control to the membrane facility will be required via control valves or pumping.

- Influent screening (2mm perforated drum screen).

- Flowmeter

- Coagulant addition after screening (to be evaluated in predesign). Coagulation is a technical requirement of level IV treatment. However, it is unclear as to whether coagulants will provide a measurable improvement with membrane filtration.

- Anoxic basin to facilitate nutrient (nitrogen) removal.

- Aeration basin with submerged membrane bioreactor. (Note: 3 separate basins, each with a 65,000 gpd capacity). The membrane system is suspended in the aeration basin. Mixed liquor suspended solids is very high (15,000 mg/l). The process unit combines traditional wastewater unit operations of aeration, secondary clarification, and filtration in a single unit. All particulate matter greater than 0.1 um is removed at the membranes surface. Cleaning procedure requires periodic soaking in sodium hypochlorite (1,500 ppm) or 2% (w/w) citric acid. Cleaning procedures and equipment are integrally designed by the manufacturer. The 3-basin design allows the City to operate one basin initially (65,000 gpd; 0.1 cfs) and increase, incrementally, to full capacity (195,000 gpd; 0.3 cfs). Anticipated maximum summer capacity for Whychus Creek outfall is 0.2 cfs - equivalent to the operation of two units. Waste sludge will be pumped back to pond cell #1. No digester will be required. Sizing of the aeration basins, and anoxic zones if provided, will be dependant on influent strength and flow variability. This, in turn, relates to the source and strength of influent which, as noted above, will be determined in predesign.

- Effluent flowmeter and sampler.

- Ultraviolet (UV) disinfection.

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[3] Variables and options noted will be addressed with pilot study and in predesign.

- Effluent pumped to proposed Whychus Creek outfall. Note: possible future use of effluent for irrigation may require additional facilities to provide flow equalization and irrigation pumping capacity appropriate for the intended use.

- Redundancy in design should not be necessary since the plant could be taken off-line for maintenance or repairs while the aerated lagoon system receives all wastewater flows. For similar reasons, emergency power is not provided.

- The conceptual design provides for a building to cover and house the treatment facility.

10.3.3 Location

Site location will be determined in pre-design, after pilot testing, to determine the best source of influent to the plant. The most probable location, at this time, is immediately west of lagoon cell #1.

10.3.4 Pre-design Considerations

Pre-design considerations include:

- Determination of source of influent for the membrane facility. Pilot testing is recommended to evaluate effectiveness of system using dilute influent with high algae content versus raw or potentially treated wastewater influent.

- Determine means of transferring and controlling influent to the membrane facility.

- Size aeration basin (and anoxic zones) to be compatible with influent characteristics.

- Determination of system performance and effluent characteristics. Incorporate pilot study findings and effluent parameter concentration goals.

- Determine facility location and layout.

- Refine building sizing.

- Develop plan, profile, process diagrams.

- Refine opinion of probable cost.

- Develop detailed O&M requirements. O&M requirements for a membrane facility include: power requirements for blowers and pumps, chemical costs

(for cleaning filters), and labor costs for sampling, periodic cleaning, monitoring plant operations, maintenance of mechanical equipment, and eventual membrane replacement. An order of magnitude estimate is $50,000 per year in additional O&M related to the facility. This figure will be refined in preliminary design.

10.3.5 Preliminary Opinion of Probable Cost

A preliminary opinion of probable cost for the membrane treatment facility is provided in *Table 10.1*. Costs indicated are very preliminary in nature and will be refined in pre-design.

Table 10.1: Membrane Treatment Facility Preliminary Opinion of Probable Cost

	Preliminary Opinion of Probable Cost
Mobilization	$140,000
Site Work	$ 40,000
Concrete (250 CY @ $800/CY)	$200,000
Metals	$ 50,000
Facility Building (2400 Sq-ft.@$150/sq-ft)	$360,000
Equipment (Phase I)	$934,000
Equipment (Phase II)	$ 73,000
Equipment (Phase III)	$ 73,000
UV System	$ 50,000
Mechanical/Piping/Plumbing	$100,000
Electrical	$120,000
Startup and Testing	$ 40,000
Construction Subtotal	$2,180,000
Contingencies (@10%)	$218,000
Geotechnical	
Engineering and Construction Observation	$436,000
Legal and Administrative (@5%)	$109,000
Pilot testing	$ 30,000
Permitting	$ 5,000
Total	**$2,978,000**

10.3.6 Existing Treatment Facility Improvements

A budget allowance of $60,000 is recommended for upgrades of Wonderware operating software and the provision of on-site cameras to allow remote viewing and control of operations. The upgrades will also facilitate coordination between the existing facility and the proposed membrane treatment facility.

Replacement of existing aerators with improved energy efficient aeration equipment is recommended by year 2025. Biosolids planning, design, removal and disposal should also be anticipated. A preliminary opinion of probable cost for existing treatment facility improvements is provided in Table 10.2. Biosolids estimates assume disposal in reasonable proximity to Sisters, which could potentially be applied to the proposed reuse site through the effluent irrigation system. Costs will be refined in pre-design.

Table 10.2: Existing Treatment Facility Improvements
Preliminary Opinion of Probable Cost

	Preliminary Opinion of Probable Cost
Mobilization	$ 39,000
Biosolids Removal and Disposal	$200,000
Remove Existing Aerators and Install New Energy Efficient Units	$295,000
Software and Security Upgrades	$ 60,000
Startup and Testing	$ 15,000
Construction Subtotal	$609,000
Contingencies (@10%)	$ 60,900
Biosolids Management Plan	$ 20,000
Engineering and Construction Observation	$121,800
Legal and Administrative (@ 5%)	$ 30,300
Total	**$842,000**

10.4 DISPOSAL SYSTEM IMPROVEMENTS

10.4.1 Whychus Creek Outfall

A stream discharge to Whychus Creek is discussed in Section 8.6. This alternative assumes construction of a membrane filtration treatment facility. It's benefits include a reduction in irrigation acreage needed and a reduction or elimination of future effluent holding capacity expansions. It is estimated that a discharge of up to 0.2 cfs (during periods of low flow) is practicable. A tentative outfall location has been identified for general planning purposes: from the treatment facility, east to the edge of the UGB, then north, crossing Highways 20 and 126, to Whychus Creek. Approximately 5,900 lineal feet of 6 or 8-inch forcemain will be needed. The outfall itself will extend into the creek to ensure submergence. A multi-port diffuser will likely be needed to ensure adequate mixing of effluent with stream water in the designated mixing zone.

At 135 gpm (195,000 gpd), headloss associated with a 6" pipe is approximately 8 feet (c=140). Velocity at 135 gpm is 1.53 fps. Because of the effluent's minimal solids content, this should not be problematic. Overall forcemain profile is downhill with a cumulative loss in elevation of approximately 40 feet. Depending on the overall pipeline profile and mixing requirements, and headlosses associated with the outfall diffuser, it may be possible to construct the outfall with minimal or even no pumping requirements. This will be evaluated in predesign.

Since there is no existing outfall, there will likely be an involved predesign effort needed to provide the detail and data necessary for regulatory review and permitting. Predesign efforts will include: route survey, creek survey (cross-sections), mixing zone analysis (computer model), environmental evaluation, consultations/discussions with agencies involved (DEQ, Water Resources, Fish and Wildlife, Corps of Engineers, etc.), and identification of needed easements. The quality of effluent discharge should improve public perceptions for a discharge to Whychus Creek, and will increase creek flows during critical low water periods. Locating the outfall within City limits should avoid the need for a conditional use permit (or other requirement) from Deschutes County. Level 4 water should be readily permittable by all public and agency groups, for discharge to Whychus Creek. To provide an outfall location that would be most acceptable to the public, it is recommended that it be located close to the Easterly UGB. A bridge is currently planned for providing access to the Timber Creek development, and it is recommended that the outfall be located in close proximity to the downstream side of the bridge, potentially anchored to the abutments and protected by shore protection provided for the bridge. Public education will also be important since many people do not understand or appreciate how well treated and clean the membrane facility's effluent will be. An opinion of probable cost for the outfall line is presented in *Table 10.3*.

Table 10.3: Whychus Creek Outfall Preliminary Opinion of Probable Cost

	Qty	Unit	Unit Cost	Preliminary Opinion of Probable Cost
Mobilization	1	LS	$20,000	$ 20,000
Pressure Line (6" or 8")	5,900	LF	$50	$295,000
Outfall/diffuser	1	LS	$30,000	$ 30,000
Highway boring	70	LF	$300	$ 21,000
Surfacing and misc.	1	LS	$10,000	$ 10,000
Construction Subtotal				$376,000
Contingencies				$ 37,600
Geotechnical				$ 10,000
Engineering and Construction Observation				$ 75,200
Legal and Administrative				$ 18,800
Environmental and Permitting				$ 50,000
Land (easement, appraisals, etc. allowance)				$ 20,000
Total				**$587,600**

10.4.2 Expanded Irrigation Opportunities

Irrigation opportunities are discussed in Section 8.5. The alternative for a purchase of 230.98 acres of the Lazy Z Ranch would offer the opportunity for long term effluent disposal through land reuse. Purchase of this site would remove many of the environmental obstacles that have been expressed for purchase of the additional 80 acre site from the United States Forest Service (USFS), and would allow the City to maintain buffers on the existing reuse site through the 2025 planning period. Unlike many capital improvements (such as treatment facility expansion), irrigation reuse expansions can often be accomplished in an incremental manner, adding additional capacity as needed to accommodate growth, without adverse cost impacts relating to economy of scale.

Sisters is currently approaching full capacity of its existing irrigation-reuse system. A minimum time frame for design, construction and permitting of the membrane treatment facility and Whychus Creek outfall is on the order of three years. A comparable time frame should be expected for purchase of the additional 80 acre USFS site, and there is no guarantees of public approval for either option.

The potential for purchase of the 230.98 acre Lazy Z site will provide an immediately accessible site for development of an effluent reuse system for land irrigation. A site evaluation by a qualified soil scientist will be required to consider the potential site capabilities to accept reuse waters. This evaluation would focus on soils, potential crops, and yearly volumes of water available for reuse purposes. The Oregon Department of Environmental Quality (DEQ) would also need to approve the site and the site evaluation, but the land should have very similar characteristics to the adjacent and existing reuse site. The Lazy Z site also will provide compliance with all published DEQ regulations and ORS statutes, which should allow for permitting to occur in one year or less.

The **Priority I irrigation improvement recommendation** is for the City to seek approval from DEQ for reuse application on the Lazy Z property, and to make arrangements for purchase of the property if DEQ approvals appear to be forthcoming. If necessary during an interim time period for construction of a reuse system on a portion of the Lazy Z, it may be necessary to seek approval from DEQ to exceed the current irrigation loading rate until the new Lazy Z reuse system is operational. Permission, if granted, is likely to be conditional and may require enhanced monitoring and reporting. While this may appear to be a no cost option, a budget allocation of **$ 25,000** for a site evaluation on the Lazy Z property, and **$10,000** for potential consultant needs for the existing site is recommended to allow for consultant coordination with DEQ and for additional monitoring/reporting. Exceedence of the current irrigation rates on the existing site are not anticipated to be significant or excessive; and this approach is recommended primarily to protect the City from the potential of violating its WPCF permit and to eliminate the need and cost of expanding its irrigation acreage prematurely.

Priority II irrigation improvements are presented here, not as specific and sequenced improvements, but rather as a menu from which options can be selected and implemented as needed to keep ahead of capacity demands. Priority II recommendations include:

a. Identify other off-site irrigation options, such as nearby ranches, and the described 230.98 acre parcel on the Lazy Z Ranch. Construct facilities as needed to convey and regulate effluent flows to the property, and install cross fencing on the site to allow full usage of the property for grass production and grazing purposes. Level I effluent should be compatible with proposed usage of the property, anticipating that livestock will be moved in conjunction with DEQ regulations and the statutes.

   Offsite irrigation options should not be considered unless the recipient is prepared to enter into a longer term (50 + years) contract with the City. Conveyance facilities are expensive and facilities constructed to serve one property may be poorly situated to serve another. The City will want to ensure continual usage by the benefitted property. Since the objective is effluent disposal, the contract should also specify the minimum volume of effluent to be delivered to, and accepted by, the benefitted property. Costs are highly variable, depending on the length and diameter of the transmission main and the extent of pumping modifications/additions and controls required. A minimum construction budget allowance of $400,000 is recommended[4]. The benefitted property owner will probably need to construct a pond and pump station on their own property to provide flow equalization and pumping capabilities that match their needs and hydraulic requirements. The pond and pump station would conservatively cost $ 250,000. Costs could substantially exceed the $ 400,000 conveyance estimate noted above if the pipeline must be extended further or if there are unusual pumping or control requirements. An engineer should be involved in evaluating specific proposals and in developing costs and apportioning costs, if warranted, between the City and the benefitted property owner.

b. Develop 14.2 acres (north side of treatment/irrigation site) into forest irrigation to receive either Level I effluent (current) or Level IV effluent (from membrane treatment facility) if required for permitting.

   The project could be constructed as an expansion of the existing irrigation system without extensive new transmission mains or effluent pumping modifications. At current irrigation loadings, the site could accommodate 18.93 Ac-ft of effluent. An opinion of probable construction cost for the project is **$63,000**. A critical part of this approach (with Level I effluent) is the regulatory approval to reduce the north buffer to 250 feet. It may be

[4] Assumes one mile of 6" forcemain and minimal pumping modifications.

necessary, depending on regulatory decisions, to provide Level IV effluent to part of the 14.2 acres. As such, option (c), below would be increased by acreage equal to that denied in option (a).

c. Convert existing northwest 250-foot width of the treatment/irrigation site buffer into irrigation area using Level IV effluent.

This would result in an additional 14.2 acres of irrigation area accommodating, at current forest effluent loading limits, 18.93 Ac-ft. of effluent. An opinion of probable construction cost for the irrigation area portion of the project is **$55,500**. An additional **$50,000** should be budgeted for effluent transmission (to the site) and effluent pump station modifications. Project construction total is estimated at **$105,500**.

d. Convert existing forest irrigation to mixed forest/hay irrigation.

This applies to the existing 88.5 acres of forest irrigation. Based on computations and considerations in Section 8.5.3, converted acreage would accommodate an additional 0.58 Ac.-ft. of effluent per acre for a total (on the 88.5 acre site) of 51.33 Ac.-ft. of additional effluent. If the 18.2 acres identified in option (a) above was so constructed or converted, an additional 10.56 Ac.-ft. of effluent could be accommodated. While this option has obvious benefits, it nevertheless carries with it a substantial increase in O&M requirements since the grass would need to be maintained and harvested. The presence of trees would likely hinder normal field operations and efficiencies; consequently, it is difficult to predict actual O&M requirements in terms of hours required. The option would be most efficient if clear swaths could be cut such that relatively straight grass rows could be established. Trees and natural vegetation could be maintained between the rows. The relatively straight rows would facilitate normal agricultural operations. This option requires approval of DEQ. The agency will need to be satisfied that waters applied will not contaminate groundwater.

A preliminary opinion of probable construction cost (allowance) is $2,000 per acre converted. For the 88.5 existing forest acreage, the project construction total is estimated at **$177,000**.

e. Evaluate the described 80 acre parcel (USFS) set aside by Congress. Install forest irrigation system on 80 acre USFS site, provide new access road, and install fencing on site. An opinion of probable cost for development of this site for irrigation reuse purposes is provided in *Table 10.4.*

Irrigation improvement options are summarized in *Table 10.4.*

Table 10.4: Irrigation Improvement Options Summary

	Effluent Accommodated [1] (Ac-ft.)	Preliminary Opinion of Probable Cost	
		Construction Cost	Project Cost [2]
Priority I Improvement			
a) Seek DEQ approval to exceed existing irrigation hydraulic loadings as needed while new WWTP and outfall is being constructed.	NA [3]	-	$10,000
b) Develop 14.2 acres of new forest irrigation.	18.93 Ac-ft	$ 63,000	$85,000
c) Purchase 80 acre site for forest irrigation.			$432,500
d) Purchase 230.98 acre parcel from Lazy Z			$ 3,695,680
e) Soils evaluation and consultant coordination with DEQ for Lazy Z			$ 35,000
Priority II Improvements			
a) Develop 80 acre site with forest irrigation.	80 Ac-ft.	$550,000	$742,500
b) Develop northernmost 14.2 acres of buffer into forest irrigation.	18.93 Ac-ft.	$105,500	$142,500
c) Convert existing 88.5 acres to mixed forest/hay irrigation.	51.33 Ac-ft.	$177,000	$239,000
d) Develop off-site irrigation option.	varies [4]	$650,000(+)	$877,500(+)
e) Develop 230.98 acre parcel from Lazy Z Ranch	258.45 Ac-ft [4]	$ 1,840,250	$ 2,484,350

[1] Refers to new, or additional, irrigation volume.
[2] Includes construction cost plus 35 percent for contingencies, engineering, and administration. Results rounded to nearest $1,000.
[3] Unknown - depends on City growth and time to design, construct, and permit new treatment facility and outfall.
[4] Depends on irrigation site average and crop(s).

10.5 COST EFFECTIVE ALTERNATIVE EVALUATION

Alternatives for treatment and effluent disposal have been presented in this section. Options for treatment and disposal could involve considerable environmental, regulatory and citizen opposition for some of the options, and it is necessary to evaluate cost effectiveness to satisfy

treatment and disposal needs for alternatives developed. The Lazy Z alternative will involve purchase of a 230.98 acre parcel and Level 1 effluent reuse on the site. This alternative can accommodate all projected needs through 2025. Alternatively, to accommodate wastewater generated from projected population demands, a combination of treatment and effluent reuse alternatives must be considered for other reuse alternatives. It is important to realize that all of the improvements in Table 10.6 must be implementable in order to provide capacity for projected 2025 effluent disposal needs for the City of Sisters. A cost effective evaluation follows in *Tables 10.5* and *10.6*.

Table 10.5: Lazy Z Improvement Alternatives to the City of Sisters Effluent Reuse System

	Effluent Accommodated[1] (Ac-ft.)	Preliminary Opinion of Probable Cost	
		Construction Cost	Project Cost[2]
Priority I Improvement			
a) Purchase 230.98 acre parcel from Lazy Z Ranch	258.45 Ac-ft[4]		$ 3,695,680
b) Soils evaluation and consultant coordination with DEQ for Lazy Z site			$ 35,000
c) Develop Portion of 230.98 acre parcel from Lazy Z Ranch		$ 900,000	$ 1,215,000
Total Priority I Improvements	258.45 Ac-ft[4]		**$ 4,945,680**
Priority II Improvements			
a) Develop Portion of 230.98 acre parcel from Lazy Z Ranch		$ 940,250	$ 1,269,350
Total Priority II Improvements	258.45 Ac-ft[4]		**$ 1,269,350**
Total Projected Cost Lazy Z Alternative		$ 1,840,250	**$ 6,215,030**

[1] Refers to new, or additional, irrigation volume.
[2] Includes construction cost plus 35 percent for contingencies, engineering, and administration. Results rounded to nearest $1,000.
[4] Depends on irrigation site average and crop(s).

Table 10.6: Combined Level 4 Treatment, Whychus Creek Outfall, Effluent Reuse Improvements

	Effluent Accommodated[1] (Ac-ft.)	Preliminary Opinion of Probable Cost	
		Construction Cost	Project Cost[2]
Priority I Improvement			
a) Seek DEQ approval to exceed existing irrigation hydraulic loadings as needed while new WWTP and outfall is being constructed.	NA[3]	-	$10,000
b) Develop 14.2 acres of new forest irrigation.	18.93 Ac-ft	$ 63,000	$85,000
c) Purchase 80 acre site for forest irrigation.			$432,500
d) Membrane Treatment Improvements			$ 2,978,000
e) Whychus Creek Outfall Improvements			$ 587,600
Total Priority I Improvements			**$ 4,093,100**
Priority II Improvements			
a) Develop 80 acre site with forest irrigation.	112.93 Ac-ft.	$550,000	$742,500
b) Develop northernmost 14.2 acres of buffer into forest irrigation.	18.93 Ac-ft.	$105,500	$142,500
c) Convert existing 88.5 acres to mixed forest/hay irrigation.	51.33 Ac-ft.	$177,000	$239,000
d) Develop off-site irrigation option.	varies[4]	$650,000(+)	$877,500(+)
Total Priority II Improvements		**$ 1,482,500**	**$ 2,001,500**
Total Projected Cost Level 4 Treatment, Whychus Creek Outfall, Effluent Reuse Alternatives		**$ 1,545,500**	**$ 6,094,600**

1 Refers to new, or additional, irrigation volume.

2 Includes construction cost plus 35 percent for contingencies, engineering, and administration. Results rounded to nearest $1,000.

3 Unknown - depends on City growth and time to design, construct, and permit new treatment facility and outfall.

4 Depends on irrigation site average and crop(s).

Total costs for the developed alternatives are within 2% of each other. The Lazy Z alternative should reduce many potential environmental and citizen concerns that have been expressed for some of the options. In addition, if any of the options outlined in Table 10.6 are not approvable, the City would need to pursue other options for disposal. The Lazy Z alternative also eliminates the current need for utilization of the existing site buffer areas, that could require higher standards of treatment and potential concerns for neighborhood residential areas. There are many factors which make the Lazy Z choice attractive, including current availability, location of a sizable site in a single parcel, current proximity to the City limits and the wastewater treatment plant, and the potential for expedited DEQ approval because of the site proximity to the existing effluent reuse site. The buffer areas would still be available for future utilization or growth in excess of the Year 2025 projections. Based on all the factors involved, it is recommended that the City of Sisters pursue the Lazy Z alternative, and purchase and develop this site for effluent reuse.

10.6 TOTAL PRIORITIZED IMPROVEMENTS

A summary of prioritized improvements to the City of Sisters Wastewater System appears in *Table 10.7.*

Table 10.7: Summary of Prioritized Improvements to the City of Sisters Wastewater System

	Preliminary Opinion of Probable Cost
Priority I	
Collection System Improvements	$ 16,875
Purchase 230.98 Acre Parcel from Lazy Z Ranch	$ 3,695,680
Soils Evaluation and Consultant Coordination with DEQ for Lazy Z Site	$ 35,000
Develop Portion of 230.98 Acre Parcel from Lazy Z Ranch	$ 1,215,000
SCADA and Security Upgrade for Existing Treatment System	$ 81,000
Total Priority I Improvements	**$ 5,043,555**
Priority II	
Collection System Improvements	$ 88,100
Existing Treatment Facility Improvements	$ 761,000
Develop Portion of 230.98 acre parcel from Lazy Z Ranch	$ 1,269,350
Total Priority II Improvements	**$ 2,118,450**
Total System Capital Costs	**$ 7,162,005**

10.7 FUNDING FOR PRIORITIZED IMPROVEMENTS

Need for Priority I improvements will be required in the near future. All costs should be eligible for funding with Systems Development Charges. The City of Sisters has a current balance in the Systems Development Fund of $ 2,015,000, and $ 632,000 from the Capital Outlay Fund, which can be applied to construction immediately after adoption of this Wastewater System Capital Facilities Plan, and adoption of a new Systems Development Charge Ordinance. It is recommended that construction of Priority I improvements be implemented at the earliest possible opportunity, with needed funding through one of the programs described in Section 11. .

Priority II improvements will be dependent on funding which is not available at this time. It is recommended that funding be obtained through one of the programs discussed in Section 11, utilizing Systems Development Charges to the maximum extent possible. . This will provide for construction with current dollars, and repayment at very favorable rates that are available through several programs. In the long term, residents of the City of Sisters will receive the greatest benefit from this approach, at the least possible cost. Repayment of any needed loans should be from Systems Development Charges, as discussed in Section 11 and Section 12.

Table 10.8: Priority I Capital Costs and Recommended Funding Sources

	Preliminary Opinion of Probable Cost
Capital Cost of Priority I Improvements	**$ 5,043,555**
Capital Costs Eligible for Systems Development Charges	**$ 5,043,555**
SDC and Capital Outlay Funds Available in 2006 for Construction	**$ 2,000,000**
Needed Construction SDC Funds for Completion of Priority I	**$ 3,043,555**

Table 10.9: Priority II Capital Costs and Recommended Funding Sources

	Preliminary Opinion of Probable Cost
Capital Cost of Priority II Improvements	**$ 2,118,450**
Capital Costs Eligible for Systems Development Charges	**$ 2,118,450**

Table 10.10: Total New-Funded Capital Costs and Recommended Funding Sources - Priority I and Priority II

	Preliminary Opinion of Probable Cost
New Funds Capital Wastewater System Needs	**$ 5,162,005**
Total SDC Eligible Costs	**$ 5,162,005**

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 11
FINANCE OPTIONS

11.1 INTRODUCTION

The funding of needed wastewater improvements for the City of Sisters may utilize one or more of the following funding sources:

- Sale of Bonds by Acquiring Federal or State Grants and/or Loans
- Special Assessments
- Local Improvement Districts
- Serial Levies
- Capital Improvements (Sinking) Funds
- Systems Development Charges

The most successful financing plans utilize state or federal grants and/or loans that best address the characteristics of needed improvements. It is difficult to finance improvements with grant funding alone, and grant funding in general is becoming very limited. Some level of local funding or borrowing from available loan programs is usually necessary, although some cities accumulate sufficient reserves for construction. Funding programs vary in terms of their economic impact on the community, and often are created with specific program focuses. Some programs are available to create and retain jobs or benefit areas of low to moderate income families. Other programs provide for specific types of infrastructure improvements, such as improvements to address wastewater related compliance issues.

A thorough consideration of applicable state and federal funding programs, in addition to a potential means of securing local funding, is needed to minimize the long-term cost of wastewater system improvements, while providing quality construction.

If the City decides to pursue agency funding for recommended projects, it should contact the Oregon Economic and Community Development Department *(OECDD)* for information and scheduling of a one-stop meeting. One-stop meetings are held in Salem (and several other locations). These meetings bring together staff from the various agencies that could potentially contribute funds, and representatives of the community, to discuss the project and funding needs.

This section is intended to provide a general overview of recently available programs. **Agency and program policies are continually evolving and specifics may vary if funding of improvements is delayed to any major extent.**

11.2 PUBLIC WORKS FINANCING PROGRAMS

Four grant programs and five loan/bond sale programs, which have the potential to provide funding for the City, are listed below.

Grants

Federal	• Economic Development Administration • Rural Development
Federal Administered by State	• Oregon Community Development Block Grants
State	• Special Public Works Fund • Water/Wastewater Financing Program

Loans/Bond Sales

Federal	• Rural Development
State	• Special Public Works Fund • Water/Wastewater Financing Program • Revolving Fund Loan Program • Small Scale Energy Loan Program

Each of the available grant and loan programs varies in terms of the extent and complexity of the application process. In all cases, it is extremely important to communicate the program needs to the funding agency at the earliest possible date. A close working relationship with the potential grantor or lending agency can optimize the timing and amount of the grant and/or loan assistance. A brief overview of potential public works financing programs and an assessment of their availability follows.

11.2.1 Economic Development Administration

The emphasis of the Economic Development Administration (*EDA*) grant program is on projects which create permanent jobs, especially in economically depressed areas. Results from a survey of businesses must demonstrate that the creation of jobs will occur, in sufficient number, by virtue of building the improvements. There is a higher chance of receiving the grant if the community can demonstrate that the existing system is at capacity; for example, if there is a moratorium on new connections. Sisters utilized this program for collection system improvements in the Industrial Park during construction of the wastewater system.

Grants require a local match, usually in the 40% to 50% range of the project cost, although local match can be as low as 20%.

11.2.2 Rural Development

The Water and Wastewater Disposal Grants and Loans program is under the administration of U.S. Department of Agriculture, Rural Development *(RD)*, under the old guidelines of Farmers Home Administration *(FmHA)*. The program is limited to rural communities which have a population of less than 10,000 people; community population must not be likely to decline in the foreseeable future. The City meets these criteria.

RD Grant Program

RD utilizes "MEDIAN HOUSEHOLD INCOME" *(MHI)* in their computations for determining eligibility. This allows for single-person households to count as family-type households.

RD is currently basing its grant and loan determination on 2000 census data. Availability of grants from the RD is dependent on the *(MHI)*; projects are competitive with one another on the basis of community needs.

Maximum grant availability based on MHI from the 2000 census data is as follows:

Less than $27,756 ..... 72% maximum grant
Greater than $27,756 ..... Ineligible for grant

The City of Sisters has a MHI *(2000 Census)* of $35,000 that no longer makes the City eligible for grant funding under this program. In addition, RD has a limited amount of grant funding available at the state and federal levels and requirements of the Safe Drinking Water Act and Clean Water Act have dramatically increased the current number of applications from Oregon communities. RD also requires eligible communities to finance the project with loans up to the extent of the communities' ability to pay; the grant is then available to cover the remainder. The actual formula to determine the maximum burden per household is quite complicated, and costs for commercial users are typically higher. RD determines the debt burden required in each case. Sisters previously utilized this program for water and wastewater system construction throughout the community.

RD Loan Program

The City falls within the established criteria for loans. Please note that this is an excellent financial assistance program. Items which determine a borrower's eligibility are listed below.

- Unable to obtain needed funds from other sources at reasonable rates and terms.

- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.

- Be financially sound and able to manage the facility effectively.

- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs, including costs that pertain to operation and maintenance. Furthermore, it must be shown that debts will be retired and financial reserves maintained.

RD loans currently have a 4.5 % interest rate. The maximum term for all loans to cities is 40 years. However, no repayment period can exceed any local statutory limitation on obligations.

11.2.3 Community Development Block Grant Program

The State of Oregon Economic and Community Development Department administers the Community Development Block Grant *(OCDBG)* program. This program is funded by the U.S. Department of Housing and Urban Development. Funds allocated under the heading of this grant program are provided for projects designed specifically to improve the conditions of low and moderate income housing areas. The maximum grant for a water or wastewater project is $1,000,000 which includes planning, engineering and construction.

To qualify for an OCDBG, the project must meet at least one of the following three national objectives of the federal OCDBG program. The primary national objective is one that limits OCDBG assistance to projects that principally benefit low and moderate income persons. OCDBG funds may be used to develop projects that are needed to benefit current residents, however, they must be built to include limited capacity for future development.

The current policy is that at least 51% of a city's population must have low and moderate incomes to be eligible. Grant awards will be based on the 2000 Census data or an OECDD recognized income survey. Sisters' low to moderate percentage, based on OECDD information, is 49.9%. At present, the City does not qualify for OCDBG Funding, unless a special income survey was completed that demonstrates a higher low and moderate income percentage. This program was utilized for funding of individual private service laterals in the wastewater project.

11.2.4 Special Public Works Fund (SPWF)

The State of Oregon Economic and Community Development Department *(OECDD)* administers the Oregon Special Public Works Fund *(SPWF)* program. The SPWF program is capitalized through biennial appropriations from the Oregon Lottery

Economic Development Fund, through Oregon Bond Bank Fund sales for dedicated project funds, through loan repayments and other interest earnings. Applications may be submitted throughout the year. Loans and grants may be made available for infrastructure construction projects related to economic development and for the retention or creation of jobs.

Projects must build public infrastructure to assist a business expanding, thus creating jobs, or build needed infrastructure capacity for future economic growth in the community. OECDD has separated the program into three categories:

- Firm business commitment for permanent job creation.
- Capacity building, high probability of job creation or retention.
- Capacity building for severely affected communities.

Revenue bonds are limited obligations of the state of Oregon payable solely from, and secured by, the loan repayments and other revenue pursuant to agreements between the state of Oregon acting by and through its OECDD, and specific benefitted municipalities. The Oregon Bond Bank Fund pools municipal loans into one bond issue and provides small communities affordable access to the financial markets. Bonds are repaid by local revenues and at interest rates lower than what is available to most Oregon communities. The Oregon Bond Bank Fund also pays the cost of issuance and funds the debt service reserve.

The Oregon Bond Bank Fund substantially increases funds available through the SPWF program to assist Oregon municipalities, and offers communities a viable financing alternative. Revenue bonds sold through the Oregon Bond Bank Fund are not subject to the State Treasurer's moratorium on the issuance of new general obligation or certificates of participation debt. OECDD expects to regularly issue bonds to provide permanent financing for SPWF program applicants. Interest rates are anticipated to range from 5% to 6.5%. For bond-funded projects, the interest rate is often estimated at 6.5% with actual interest passed on to the applicant at the time of the bond sale.

OECDD plans to pass the exact interest rate allotted to the state for this program directly to borrowers. The state will pay for all debt reserve costs, bond issuance costs and attorneys' fees. This is a loan program where the City could acquire funding directly from the state without the necessity for revenue or general obligation bonding.

A discussion of the three OECDD categories of the SPWF *(Bond Funds)* Program follow:

Firm Business Commitment (Bond Funds)

Grants of up to $500,000 are available for projects which have a firm commitment from a business(es) to create permanent jobs if the project is constructed. The grant is dependent on the number of jobs which would potentially be created with maximum assistance of up to $10,000 per job.

Capacity Building, High Probability of Job Creation/Retention

This category of the SPWF program finances only loans up to $10,000,000.

Capacity Building for Severely Affected Communities

SPWF has loans to $10,000,000 and grants up to $250,000 for severely affected communities. Communities are able to apply for grants of up to $250,000 from this fund even if they don't have a waiting business that needs the infrastructure. This provides communities who are seeking to attract business growth, the chance to prepare in advance for these opportunities.

Sisters would need to demonstrate that a project is necessary to create and/or retain jobs in the industrial sector. SPWF staff emphasize that the program is primarily a loan program and that applicants should not be overly optimistic about securing maximum grant dollars.

11.2.5 Water/Wastewater Financing Program

The 1993 State Legislature created a Water Fund through Senate Bill 81 to provide financing for local governments to construct and improve public drinking water systems and public wastewater collection systems. The legislation was primarily intended to assist local governments meet regulations for the Safe Drinking Water Act and the Clean Water Act. In that respect, the Water/Wastewater Fund may assist both municipal drinking water projects and municipal wastewater collection and treatment projects. Program eligibility is limited to projects necessary to ensure that municipal water and wastewater systems comply with the requirements of the following:

1. Current drinking water quality standards administered by the Department of Human Services *(DHS)*, previously known as the Oregon Health Division *(OHD)*.

2. Wastewater quality statutes, rules, orders, or permits administered by the Oregon Department of Environmental Quality *(DEQ)*.

The Water/Wastewater Fund is capitalized through a biennial appropriation from the Oregon Lottery Economic Development fund, bond sales for dedicated project funds, loan repayments, and interest earnings. The Fund is administered by the OECDD, Community Development Programs Section.

Loans and grants may be awarded for eligible projects. Loans will be based on a reasonable and prudent expectation of the City's ability to repay the loan, which is extremely favorable.

Grants may be awarded only if a loan is not feasible due to the following:

1. Financial hardship to the local government as determined by OECDD.

2. Special circumstances of the project.

Loans up to $10,000,000 and grants up to $500,000 (includes non-cash grants for issuance costs and debt service reserve) are available for projects financed with bond funds. Loan term is 20 years at a 5% - 6.5% interest rate. Loans and grants up to $500,000 are available to projects financed with direct lottery funds.

11.2.6 State Revolving Fund

The State Revolving Fund (SRF) loan program provides low-interest rate loans to public agencies for the planning, design and construction of water pollution control facilities, as well as for some publicly-owned estuary management and non–point source control projects. This funding program is administered by DEQ. Recent interest rates for loans are 2.68% for facility plans and 3.57% for design and/or construction. These interest rates are subject to change, but will remain below market rates. Priority is given to projects addressing documented water-quality problems and health hazards

11.2.7 Oregon Department of Energy - Small Scale Energy Loan Program

Funds could be made available under this program as a demonstration project or as a conventional energy savings or conservation program. The Department of Energy's Small Scale Energy Loan Program *(SELP)* offers help to anyone who wants to save money on energy costs. SELP was created by Oregon voters in 1980, and has financed more than $150 million in projects since that time. This is a self-supporting program that operates without tax funds. A finished project must at least break even in power costs with the pre-study and improvement program. The pre-design phase would be utilized to generate data that would show power savings or creation for recommended improvements. This is a loan program repayable at 8% interest over a 15-year repayment period. A fee of one-tenth of one percent of the loan request is required at the time of application. Loan closing costs and fees vary.

11.3 LOCAL FUNDING SOURCES

A significant portion of a project may need to be financed with local funding sources. Local funding sources are listed below:

General Obligation Bonds
Revenue Bonds
Improvement Bonds *(Local Improvement District)*
Serial Levies
Sinking Funds
Ad Valorem Tax
System User Fees
Assessments
System Development Charges *(SDC's)*

The 1991 legislature clarified and defined the impact of Ballot Measure 5 on municipal finance in several special ways. Cities, counties, and special districts need to clearly understand, and follow these rules, when they consider bonding for the financing of needed improvements.

The following information was provided in part by Howard A. Rankin, retired Bond Counsel:

1. Chapters 287 and 288 of the Oregon Revised Statutes describe the borrowing and bonding of counties, cities, and special districts, generally.

2. The advance sheets of the Laws of 1991 indicate that the general bond limitations of ORS 287.004 are still in force. Except with regard to the old 3% limitation on all issued and outstanding bonds, on true-cash value of all taxable property within the city's boundaries, has been changed to a 3% limitation on "real market value" as determined by the County Assessor.

3. The above limitation still does not apply to bonds issued for water, sanitary or storm sewers, sewage disposal plants; nor to bonds issued to pay assessments for improvements in installments under statutory or charter authority (i.e., revenue bonds).

4. The City would need to check the charter for any additional impacts or limitations on bonding capabilities.

A description of each of the preceding listed funding sources follows.

11.3.1 General Obligation Bonds

Financing of wastewater improvements by General Obligation *(G.O.)* Bonds is accomplished by the following procedures:

1. The Consulting Engineer prepares a detailed cost estimate to determine the total monies required for construction.

2. An election is held.

3. When voter approval is granted (by a majority of the registered voters), bonds are offered for sale. The money for detailed planning and construction is obtained prior to preparation of final engineering plans and the start of project construction unless interim financing has been developed.

G.O. bonds are backed by the full credit of the issuer and authorize the issuer to levy ad valorem taxes. The issuer can make the required payments on the bonds solely from the new tax levy or may instead use revenue from assessment, user charges, or some other source.

Oregon Revised Statutes limit the maximum term of G.O. bonds to 40 years for cities and 25 years for sanitary districts. Except in the event that RD purchases the bonds, the realistic term for which general obligation bonds would be issued is 15 to 20 years.

Ballot Measure 5 has limited the ability of communities to levy property taxes. Capital improvement projects, such as the proposed wastewater system improvements, are exempt from property tax limitations if an election is held and new public hearing requirements are met.

Cities, counties and special districts (all non-school taxing entities) must be very careful when seeking approval from the voters for a general obligation bond, new tax base, annual budget levy, or special levy. The current law now requires that all non-school taxing entities, including cities, counties, and special districts, hold a special public hearing more than 30 days before filing the election statement with the County Clerk. Notice of this special public hearing must be sent to all other non-school taxing entities with overlapping taxing jurisdictions no later than 10 days before the special public hearing. This special public hearing offers the opportunity for all overlapping taxing entities to determine the compaction impact of the proposed election on their respective assessment capability. Effectively, the municipality proposing the election measure must be thoroughly prepared with notice of special public hearing published no later than 41 days before a final public hearing and filing of the election statement.

If the special public hearing procedures are not followed, and no certificate is included in the filing that attests that the special public hearing was conducted pursuant to law, the County Clerk is required to reject the filing for an election. This results in additional unnecessary delays. Consideration should be given to hiring a

competent Bond Counsel before proceeding with a General Bond Election. This action will insure that all requirements of current law are met.

Since bonding requirements are very stringent, most recent municipal improvements have been financed with either revenue bonds or one of the state financing programs which can be accomplished outside of bonding requirements.

11.3.2 Revenue Bonds

A revenue bond is one that is payable solely from charges made for the services provided or from collection of Systems Development Charges, although the City would need to be very careful that SDC's would be collectible. Such bonds cannot be paid from tax levies or special assessments, and their only security is the borrower's promise to operate the wastewater system in a way that will provide sufficient net revenue to meet the obligations of the bond issue. Revenue bonds are most commonly retired with revenue from user fees.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Normally there are no legal limitations on the amount of revenue bonds to be issued, but excessive bond issue amounts are generally unattractive to bond buyers because they represent high investment risk. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods for billing and collection, rate structures, and the degree to which forecasts of net revenues are realistic. RD will fund revenue bonds in which user rates are committed for the repayment of the bonds.

Under the provisions of the Oregon Uniform Revenue Bond Act (ORS 288.805-288.945), municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate. In this case, certain notice and posting requirements must be met including a mandatory 60-day waiting period. A petition signed by 5% of the municipalities' registered voters may cause the issue to be referred to an election.

Laws enacted by the 1991 legislature have eliminated the limitation on revenue bonds. The law formally required that the revenues pledged for payment of the bonds have a direct relationship to the services financed by the bonds. Current law now allows revenue bonds to be paid with any revenue pledged for "any public purpose," without the relationship restriction.

11.3.3 Improvement Bonds (Local Improvement District)

Improvement bonds may be issued to assess certain portions of wastewater improvements directly against the parties being benefitted. An equitable means of

distributing the assessed cost must be utilized so that all property, whether developed or undeveloped, receives the assessment on an equal basis. Cities are limited to improvement bonds not exceeding 3% of true cash value. For a particular improvement, all property within the assessment area is assessed on an equal basis, regardless of whether it is developed or undeveloped.

Improvement bond financing requires that an improvement district be formed, the boundaries established, and that benefitted properties and property owners be determined. The engineer usually determines an approximate assessment based on a square-foot, a front-foot basis, or a combined basis. Property owners are then given an opportunity to remonstrate against the project. The assessment against the properties is usually not levied until the actual total cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. It is common practice to issue warrants, which are paid when the project is completed, to cover debts.

The primary disadvantages to this source of revenue (improvement bonds) are described below:

1. The property to be assessed must have a true cash valuation at least equal to 50% of the total assessments to be levied. This may require a substantial cash payment by owners of undeveloped property.

2. An assessment district is very cumbersome and expensive when facilities for an entire community are contemplated.

3. The project is impacted by Measure 5 tax limitations because the improvement bonds are backed or guaranteed by the city's authority to raise revenue via taxation. If the city is in compaction, then a general election (same procedures as for a general obligation bond) is required. If the city's property taxes are not under compaction, then the city can proceed with a L.I.D. as in the past; however, the project cost will count against the $10.00 limitation for non-school taxes.

This program should not be considered for improvements to satisfy the City's needs in general, but could be a definite consideration for specific projects benefitting an area of the community.

11.3.4 Serial Levies

Under Oregon Revised Statutes, if approved by the voters, the City can levy taxes for a fixed period of time to construct new facilities and maintain existing facilities. Generally, when a serial levy is presented to the voters, it is based upon a specific program and listing of planned improvements.

Since the time frame required for construction of the needed wastewater improvements is quite limited, it is doubtful that residents could afford a serial levy of sufficient size to provide for needed construction revenues.

11.3.5 Sinking Funds

Sinking funds can be established by budget for a particular capital improvement need. Budgeted amounts, from each annual budget, are carried in a sinking fund until sufficient revenue is available for the needed project. Funds can also be developed with revenue derived from system development charges or serial levies. The City's wastewater system financial needs can be met with a sinking fund, although the cost of needed facilities will be higher after funds are collected than if revenues are utilized to repay a loan for construction in the near term.

11.3.6 Ad Valorem Tax

Many communities utilize an ad valorem tax as the basis for repaying general obligation bonds for system expansions, and provide partial or full repayment through means of additional wastewater use charges. This means of financing reach all properties to be ultimately benefitted by the wastewater system, whether the property is presently developed or not. Construction costs are more equally distributed among all property owners and the program does not impose a penalty on existing residential or business development. However, with Oregon tax limitations and the public's perception of taxes, this means of securing funds would not be popular.

11.3.7 System User Fees

Monthly charges are made to all residences, businesses, etc., that are connected to the wastewater system. Wastewater use charges are established by resolution, and can be modified as needed to serve increased or decreased operating costs. Rates are established depending on the various classes of users and the metered demand through their connection. By establishment of proper use charges, the City could repay the local share of bond amortization without imposition of property taxes. An increase in user fees could finance portions of the wastewater system that are maintenance related, particularly if done in conjunction with a revenue bond.

11.3.8 Assessments

In some cases the beneficiary of a public works improvement can simply be assessed for the cost of the project. It is not uncommon for an industrial or commercial developer to provide up-front capital to pay for a community administered improvement which serves the development.

11.3.9 System Development Charges

System Development Charges *(SDC's)* are charges assessed against new development to recover the costs incurred by local government who provide the capital facilities required to serve the new development. SDC's apply to new developments that generate revenue for the expansion or construction of facilities located outside the boundaries of new development. When capital improvements increase usage, SDC's can be billed for water, wastewater, drainage and flood control, transportation, and parks or recreational facilities.

11.4 PROPOSED FINANCIAL PROGRAM

Initially it appears that either Rural Development or Water/Wastewater funding may be the most applicable since there are no outstanding compliance issues or anticipated commercial growths that will result in family wage jobs. Funding is likely to be predominantly loan, under any of the available funding programs.

A combination of increased user fees and systems development charges are recommended for funding of needed system improvements. Systems Development Charges should fund system improvements either through repayment of loans, or potentially by utilizing sinking funds to pay for improvements as monies become available. As discussed, utilization of sinking funds will cost substantially more for the recommended construction. Increased user fee revenues should be utilized for maintenance related issues. After selection of the initial project scope, the City should contact the OECDD to schedule a one-stop meeting with available state and federal funding agencies, to discuss project needs. When the project is presented to all funding agencies, each agency will evaluate their program's potential to assist with financing the needed wastewater system improvements, and the City can determine how construction can best be implemented.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

SECTION 12
WASTEWATER RATES AND FINANCING

HGE INC

12.1 WASTEWATER FUND BUDGET

Table 12.1 includes recent wastewater fund budgets. *Table 12.2* provides the information in summary form with a focus on ordinary revenue and expenses.

Table 12.1: Recent Wastewater Fund Budgets

Description	*Actual FY 02-03*	*Actual FY 03-04*	*Adopted FY-04-05*	*Adopted FY 05-06*
Revenues				
Wastewater Receipts	$527,287	$536,681	$555,000	$614,000
Interest Earned	$8,816	$17,025	$14,000	$24,400
Sewer Lateral Reimbursement	$91,638	$41,422	$40,000	$15,000
User Fees	$0	$67,890	$0	$0
Plan Check Fees	$0	$0	$1,000	$0
Engineering/New Development Fees	$1,689	$5,590	$6,000	$6,000
Spectrasite Cell Tower Lease	$18,694	$0	$0	$0
Overnight Park Sewer Receipts	$1,602	$6,856	$5,000	$10,000
Miscellaneous	$2,591	$71,079	$1,000	$2,000
Wastewater System Connections	$175,452	$105,580	$90,000	$90,000
Construction Inspection Fees	$0	$0	$16,016	$10,000
RUS Bonded Debt # 6 Reserve	($12,948)	$12,948	$12,948	$0
RUS Bonded Debt # 4 Reserve	($18,080)	$18,080	$18,080	$0
Total Revenues	**$796,741**	**$883,151**	**$759,044**	**$771,400**
Cash Carry Forward	$0	$0	$1,226,020	$1,127,619
Transfers In	$1,681,217	$0	$0	$0
Total Resources	$2,477,958	$883,151	$1,985,064	$1,899,019
Expenditures:				
Personal Services				
Salaries and Expenses	**$72,160**	**$107,439**	**$126,858**	**$96,590**
Total Personal Services	$72,160	$107,439	$126,858	$96,590
Materials & Services:				
Total Expenses	$91,302	$166,479	$156,071	$154,825
Total Materials & Services:	$91,203	$166,479	$156,071	$154,825
Capital Improvements:				
Capital Outlay	$12,792	($83,703)	$575,622	$237,305
Fleet Leasing - Computer Hdwr	$1,032	$0	$0	$0
Computer Hdwr & SF	($3,150)-	$0-	$15,000	$15,000
IBM Computer HDR & SWR	$4,307	$3,915	$0	$0
Wastewater Lateral Reimbursement	($4,293)	$83,402	$40,000	$15,000
Construction Inspection	$0	$0	$14,560	$10,000

Description	*Actual FY 02-03*	*Actual FY 03-04*	*Adopted FY-04-05*	*Adopted FY 05-06*
Equipment/Vehicle Reserves	$0	$0	$60,500	$105,000
System Reserves	$0	$0	$0	$165,000
Total Capital Improvements:	$10,688	$3,614	$705,682	$547,305
Debt Service				
Total Debt Service and Reserves	$319,856	$309,738	$505,613	$531,554
Transfers				
Total Transfers	$0	$22,000	$147,000	$122,000
Depreciation	$153,238	$253,969	$160,000	$230,000
Operating Contingency	$0	$0	$183,840	$216,745
Total Water Fund Expenditures:	$647,145	$863,239	$1,985,064	$1,899,019

Table 12.2: Wastewater Fund Budget Summary
Ordinary Revenue and Expenses

Description	*Actual FY 02-03*	*Actual FY 03-04*	*Adopted FY-04-05*	*Adopted FY 05-06*
Revenue:				
Total Revenue	$2,477,958	$883,151	$1,985,064	$1,899,019
Total Revenue:	**$2,477,958**	**$883,151**	**$1,985,064**	**$1,899,019**
Total Expenses:	$647,145	$863,239	$1,985,064	$1,899,019

Reference to these Tables are made in sub-sections that follow.

12.2 WASTEWATER SYSTEM REVENUE

12.2.1 Current Wastewater Rates

Residential usage charges of $39.00 per month were adopted by the City Council for repayment of the original bond issues, and for needed operation and maintenance revenues. All residential rates are based on 1 Equivalent Dwelling Unit (EDU) per residence or equivalent dwelling unit. All other system users are charged on an equivalent residential or dwelling unit basis, at the identical cost per EDU.

12.2.2 Current Rate Revenue

Potential rate revenue, based on projected service connections, is anticipated to equal $ 614,000 in the adopted 05/06 fiscal budget.

12.2.3 Property Taxes

Currently wastewater system revenue includes no property tax component.

12.2.4 "Other" Revenue

Other revenue may include such revenue as wastewater connections, lateral connection fees, interest, carry over funds, grants, etc. These sources, typically, contribute a relatively small portion of overall revenue and may vary considerably from year to year. Grant funding revenue may be significant; however, it is typically obtained and obligated for specific projects or purposes. Lateral connection fees are generally developed to cover the actual cost of making a new connection. System development charges (SDCs) can only be used for adding system capacity and cannot be used for general operating and maintenance expenses.

12.3 WASTEWATER SYSTEM EXPENSES

12.3.1 Debt Service

The wastewater system had outstanding bonds of $ 6,902,198 in accordance with the approved audit, on June 30, 2004.

12.3.2 Operations and Maintenance (O&M)

Operations, maintenance, and administrative costs are summarized in *Table 12.1.* Current expenditures appear to approximate revenues in both actual and adopted budgets. There is a cash carry forward fund to cover the costs of major equipment or facility replacements, a capital outlay fund, and a contingency. Good fiscal planning would maintain the contingency fund for emergency purposes. Sisters has a relatively simple wastewater system, but replacements and maintenance are necessary. Mechanical equipment should be repaired or replaced as needed.

12.4 CURRENT RATES - ANALYSIS AND RECOMMENDATIONS

A simple formula for budget viability is: *Revenue - Expenses* ≥ 0. At the present time, with a minimum level of reserves for emergencies, and contingencies, the budget is in balance, with the exception of the cash carry forward fund and the capital outlay fund. These funds include monies obtained from grant reimbursements from the original wastewater construction project, and are available for facility expansion. Available budget revenues for future construction total approximately $ 632,000.

The current rate structure is very simple and easy to apply. A specific reserve fund is probably not required, since unplanned expenses should not exceed the budgeted reserve and contingency amounts. However, rates may need to be adjusted for equipment replacement and increased operation and maintenance expenses addressed in the Capital Improvement Plan provided in Section 11.

12.5 FUTURE RATES

Usage fees are currently based on EDU's derived from winter water consumption for all users. This approach was originally adopted such that summer irrigation was not a factor in establishing usage fees for non-residential users. However, with a substantial tourist based economy, many commercial users are not paying fairly for sewer service, and water meter records are available to indicate overall summer peak usage.. It is recommended that the rate structure be modified for non-residential users to charge equitably for flows contributed to the sewer system, on the basis of metered flows to the user. A primary factor in wastewater treatment plant design is peak flow volumes, and capacity is limited as described thoroughly in this Capital Facilities Plan.

For consideration of commercial flow contributions to the wastewater system, calculation of EDU's must take into account flows on a monthly basis throughout the year, rather than for 3 winter months as originally provided for residential evaluation purposes. Many commercial establishments do not provide landscape irrigation during summer periods, and the majority of their water usage generally enters the wastewater system throughout the year. Commercial usage should be considered separately on a monthly basis, based on total metered water usage averaged per day and equated to average residential usage. An equivalent number of EDU's should be calculated monthly for each non-residential user, and monthly service fees based on the current adopted monthly service fee per EDU. It is recommended that a minimum of 1 EDU per commercial user be maintained in establishment of monthly service fees.

12.6 CAPITAL IMPROVEMENTS PLAN

12.6.1 Capital Improvements

Recommended Capital improvements are addressed in detail in the Wastewater Capital Improvement Recommendations provided as Section 10. Costs are itemized in both priorities and by funding sources. It is recommended that available revenues from capital outlay funds be combined with available SDC funds to finance needed wastewater system improvements. It is recommended that bonds be issued for both Priority I and Priority II Improvements, in order to minimize capital costs and to maintain rates at the lowest possible level. Capital costs which are eligible for Systems Development Charges total $ 7,162,005.

12.6.2 Financing

A general discussion of financing options is presented in Section 11. Probable financing is limited to loans (based on project scope, cost, impact on rates, and City eligibility). Loans can be obtained from either Rural Development (RD) or the State Revolving Fund (SRF). RD has a longer term (40 years vs 20 years), but a higher interest rate (4.5% vs 3.57%). Application and environmental reporting requirements are similar, but the SRF program has additional reports that will be required. However, with the interest rates that are available

from SRF sources, this program should offer the best opportunity for Sisters if funds can be made available.

12.7 SYSTEMS DEVELOPMENT CHARGES (SDCs)

System Development Charges (SDCs) can be charged to all users of transportation, water, sewer, storm drainage, and parks and recreation facilities. The fee is usually charged as each piece of property is developed in the future and goes into a capital construction fund to pay for improvements required by growth in the community. The Oregon System Development Charges Act, House Bill 3224, became effective in 1991. Legislation requires that capital improvement plans be developed, and that methodology used to compute SDCs be documented and reviewed by the community before SDCs can be charged.

The Oregon System Development Charges Act permits two types of charges: 1) a reimbursement fee, and 2) an improvement charge. A reimbursement fee is a charge for unused capacity in existing capital improvements. An improvement charge is associated with capital improvements to be constructed, which creates new capacity. Improvement fees will likely need to be utilized for needed improvements to the Sisters Wastewater System. In addition, a reimbursement fee should be considered for eligible portions of the existing wastewater system that will benefit new development.

Inflation does continue at a rapid pace, and all construction projections are based on an Engineering News Record Index (ENR) of 7,630. This index of construction costs is updated monthly, and it is recommended that the ENR be utilized to provide for inflation on an annual basis. Beginning in January 2007, we recommend that the City update SDC values by the appropriate percentage increase of the ENR value on January 1, 2007, divided by the ENR value of 7,630 utilized for construction estimates in the Wastewater System Capital Facilities Plan.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

APPENDIX 5.1
WPCF DISCHARGE MONITORING REPORTS
(OCTOBER 2003 - SEPTEMBER 2005)

HGE INC

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: 10/1/03

DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: 10/31/03

System Type: Domestic Sewage Lagoons | Population Served: 1080 | County: Deschutes

Collection sys. class: I | Operator Certification | Certification No. & grade: 9804 III

Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

Principal operator name (print): Paul Bertagna

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location:														
		MGD X / GPD	BOD Grab / Comp. X		TSS Grab / Comp. X		BOD Grab / Composite			TSS Grab X / Composite			NUTRIENTS Grab X / Composite				CHLORINE		COLIFORM MPN / MF	MPN / MF	MPN X / MF
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.130															3	.5			6
	2	.136															3	.8			0
	3	.136															3	3.8			0
	4	.131	234	256	280	306				49	83%	21	3.6	5.8		5.8	3	.4			2
	5	.132															8	.9			
	6	.136															8	2.1			C
	7	.129															6	.9			O
	8	.128															6	.9			
	9	.129															6	.9			
	10	.145	296	358	190	230				82	57%	32					6	1.3			
	11	.147																OFF	For the Winter		
	12	.151																			
	13	.136																			
	14	.130																			
	15	.143																			
	16	.141																			
	17	.148	337	416	214	264															
	18	.140																			
	19	.129																			
	20	.133																			
	21	.131																			
	22	.131																			
	23	.125																			
	24	.116																			
	25	.128	349	373	220	235															
	26	.128																			
	27	.128																			
	28	.123																			
	29	.119																			
	30	.137																			
	31	.137																			
TOTAL		4.126	1216	1403	904	1035				131		53	3.6	5.8		5.8	52	13			8
DAILY MIN.		.119	234	256	190	230				49		21	"	"		"	3	.5			0
DAILY MAX.		.151	349	416	280	306				82		32	"	"		"	8	3.8			6
WKLY. AVG. MAX.		.989	349	416	280	306				82		32	"	"		"	40				8
MTHLY. AVG.		.133	304	351	226	259				65		27	"	"		"	5	1.3			1
DAILY LIMITS																					
WKLY. LIMITS																					
MTHLY. LIMITS																					

09/03/97

DMRSHPG1.DOC

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J Bertagna — Authorized Signature — 11/1/03 Date

Paul Bertagna — Name (print)

Notes: Shut-down All Irrigation on 10/11/03 for the winter.

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

October 03

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)								LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth Pond 1		Secondary Depth Pond 2	Holding Pond 1	Perimeter Inspection	Quanity Irrigated Ck	Forest	Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
	Feet		Feet	Feet		In./Acre	In./Acre	Gal.	Hrs.									
1	9.2		9.2			.06	.03					X				X		
2						.06	.03					X				X		
3						.06	.03					X				X		
4						.07	.02				X	X				X		
5						.06	.02					X				X		
6						.06	.03					X				X		
7						.06	.03				X	X				X		
8						.06	.03					X				X		
9						.04	.03					X				X		
10						.02	.03					X				X		
11												X						
12												X						
13												X						Winterized Irrigation Systems
14												X						
15												X						
16												X						
17												X						
18												X						Did Maintenance on Headworks + Irr. pump
19												X						
20										X		X						Hauled Screenings to Knott Landfill
21												X						
22												X						
23												X						
24												X						
25												X						
26												X						
27												X						
28												X						
29												X						
30												X						
31												X						
						.55	.28											TOTAL
						.02	.02											DAILY MINIMUM
						.07	.03											DAILY MAXIMUM
						.30	.17											WEEKLY AVERAGE MAXIMUM
						.06	.03											MONTHLY AVERAGE
																		DAILY LIMITS
																		WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: 11/1/03
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: 11/30/03
System Type: Domestic Sewage Lagoons | Population Served: 1080 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III
Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:*														
		MGD X / GPD	BOD Grab / Comp. X		TSS Grab / Comp. X		BOD Grab / Composite			TSS Grab / Composite			NUTRIENTS Grab / Composite				CHLORINE		COLIFORM MPN / MF		
Month November	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.119																			
	2	.125																			
	3	.182																			
	4	.122																			
	5	.121																			
	6	.120																			
	7	.118	224	220	145	143															
	8	.122																			
	9	.120																			
	10	.130																			
	11	.125																			
	12	.127																			
	13	.118																			
	14	.121	237	239	159	160															
	15	.115																			
	16	.124																			
	17	.127																			
	18	.122																			
	19	.129																			
	20	.121																			
	21	.122	419	426	186	189															
	22	.110																			
	23	.115																			
	24	.115																			
	25	.128																			
	26	.121																			
	27	.107																			
	28	.119																			
	29	.119																			
	30	.130																			
TOTAL		3.628	880	885	490	492															
DAILY MIN.		.107	224	220	145	143															
DAILY MAX.		.130	419	239	186	189															
WKLY. AVG. MAX.		.856	419	426	186	189															
MTHLY. AVG.		.121	293	295	163	164															
DAILY LIMITS																					
WKLY. LIMITS		/	/	/	/	/															
MTHLY. LIMITS																					

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Bertagna — Authorized Signature — 12/8/03 — Date

Paul Bertagna — Name (print)

Notes: We Missed Doing Lab Work on Thanksgiving Week, Ops ran 2 sets of tests that following week (They will be on December DMR

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS.[1] BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							
	Primary Pond #1 Depth		Secondary Pond #2 Depth	Pond #3	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Headworks Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank	Inspect Aerators	LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Feet		Feet	Feet		In./Acre		Gal.	Hrs.									
1	9.2'		9.1'									X					X	
2												X					X	
3												X					X	
4												X					X	
5												X					X	
6												X					X	
7												X					X	Worked on Oil Drip at Headworks Gear Box
8												X					X	
9												X					X	
10												X					X	
11												X					X	
12												X					X	
13												X					X	
14												X					X	
15				8' Deep End								X					X	Turned on Aerators in Po
16												X					X	#3 (Deep Enough)
17												X					X	
18												X					X	Had Lab Equipment
19												X					X	Calibrated
20												X					X	
21												X					X	
22												X					X	
23												X					X	
24												X					X	
25												X					X	Pulled & Repaired Pump #3
26												X					X	
27												X					X	
28												X						
29												X						
30				Approximately 5' Shallow End								X					X	
												X					X	
																		TOTAL
																		DAILY MINIMUM
																		DAILY MAXIMUM
																		WEEKLY AVERAGE MAXIMUM
																		MONTHLY AVERAGE
																		DAILY LIMITS
																		WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters
DEQ Permit No.: 101799
System Type: Domestic Sewage Lagoons
Phone Number: (541) 549-6981
DEQ File No./Facility ID: 81850
Population Served: 1080
From - Month & Year: Dec. 1 2003
To - Month & Year: Dec. 31 2003
County: Deschutes

Collection sys. class: I
Treatment sys. class: I
Operator Certification
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9804 III
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location:															
		MGD X / GPD	BOD Grab / Comp. X		TSS Grab / Comp. X		BOD Grab / Composite			TSS Grab / Composite			NUTRIENTS Grab / Composite				CHLORINE		COLIFORM MPN / MF		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.120																			
	2	.122	241	245	196	199															
	3	.116																			
	4	.115																			
	5	.115																			
	6	.111																			
	7	.120	331	331	209	209															
	8	.118																			
	9	.110																			
	10	.136																			
	11	.121	298	301	128	129															
	12	.119																			
	13	.128																			
	14	.123																			
	15	.118	312	307	173	170															
	16	.121																			
	17	.126																			
	18	.122																			
	19	.127																			
	20	.118	408	402	185	182															
	21	.113																			
	22	.123																			
	23	.123																			
	24	.112																			
	25	.094																			
	26	.123																			
	27	.137	376	430	148	169															
	28	.129																			
	29	.130																			
	30	.122																			
	31	.123																			
TOTAL		3.733	1966	2016	1039	1058															
DAILY MIN.		.094	241	245	128	169															
DAILY MAX.		.137	408	430	209	209															
WKLY. AVG. MAX.		.255	408	402	209	209															
MTHLY. AVG.		.120	328	336	173	176															
DAILY LIMITS																					
WKLY. LIMITS																					
MTHLY. LIMITS																					

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Val J. Beaty — Authorized Signature — Date

Val J Beaty — Name (print)

Notes: Some flow is shown on the Effluent meters because we had all meters calibrated this month & they needed flow based data to calibrate

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)								LOG Regarding breakdowns, bypassing, odors, complaints, etc.
Primary Pond #1 Depth		Secondary Pond #2 Depth	Pond #3	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Pods	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
Feet		Feet	Feet		In./Acre		Gal.	Hrs.									
9.1		9.2									X						
											X						
											X						
			Pond 1														
			Pond 2														
											X						
			Pond 3														
											X						
			Pond 4														
											X						
			Shallow								X						
			Aug.														
											X						
			Approx.														
											X						
																	TOTAL
																	DAILY MINIMUM
																	DAILY MAXIMUM
																	WEEKLY AVERAGE MAXIMUM
																	MONTHLY AVERAGE
																	DAILY LIMITS
																	WEEKLY LIMITS
																	MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters
Phone Number: (541) 549-6981
From - Month & Year: Jan 05
DEQ Permit No.: 101799
DEQ File No./Facility ID: 51850
To - Month & Year: Feb. 05
System Type: Domestic Sewage Lagoons
Population Served: 1080
County: Deschutes

Operator Certification

Collection sys. class: I
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9804 III
Treatment sys. class: I
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location														
		MGD [X] / GPD	BOD Grab	BOD Comp. [X]	TSS Grab	TSS Comp. [X]	BOD Grab	BOD Composite		TSS Grab	TSS Composite		NUTRIENTS Grab	NUTRIENTS Composite			CHLORINE		COLIFORM MPN / MF	COLIFORM MPN / MF	COLIFORM MPN / MF
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.131																			
	2	.138																			
	3	.148																			
	4	.132																			
	5	.130																			
	6	.128																			
	7	.128	328	350	152	162															
	8	.130																			
	9	.139																			
	10	.134																			
	11	.134																			
	12	.131																			
	13	.122																			
	14	.121	334	337	253	255															
	15	.131																			
	16	.137																			
	17	.140																			
	18	.137																			
	19	.123																			
	20	.130																			
	21	.130																			
	22	.140	275	321	211	246															
	23	.140																			
	24	.125																			
	25	.125																			
	26	.123																			
	27	.123																			
	28	.139	342	396	313	363															
	29	.126																			
	30	.133																			
	31	.137																			
TOTAL		4.062	1279	1404	929	1026															
DAILY MIN.		.121	275	321	152	162															
DAILY MAX.		.148	342	396	313	363															
WKLY. AVG. / MAX.		.934	342	396	313	363															
MTHLY. AVG.		.132	320	351	232	257															
DAILY LIMITS																					
WKLY. LIMITS		/	/	/	/	/															
MTHLY. LIMITS																					

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DMRSHPG1.DOC

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X [signature] Authorized Signature

2/11/05 Date

Paul Bertagna Name (print)

Notes:

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
Primary Depth		Secondary Depth	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
Feet		Feet	feet		In./Acre		Gal.	Hrs.									
9.2		9.1															
↓		↓															
↓		↓															
			Outlet														
			8'														
			Inlet														
			Shallow End														
			5'														
																	TOTAL
																	DAILY MINIMUM
																	DAILY MAXIMUM
																	WEEKLY AVERAGE MAXIMUM
																	MONTHLY AVERAGE
																	DAILY LIMITS
																	WEEKLY LIMITS
																	MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters
DEQ Permit No.: 101799
System Type: Domestic Sewage Lagoons
Phone Number: (541) 549-6981
DEQ File No./Facility ID: 81850
Population Served: 1490
From - Month & Year: Feb. 2005
To - Month & Year: March 2005
County: Deschutes

Operator Certification
Collection sys. class: I
Treatment sys. class: I
Principal operator name (print): Paul Bertagna
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9804 III
Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:*																
		MGD [X] / GPD	BOD Grab [ ] Comp. [X]		TSS Grab [ ] Comp [X]		BOD Grab [ ] Composite			TSS Grab [ ] Composite			NUTRIENTS Grab [ ] Composite				CHLORINE		COLIFORM MPN / MF		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.132																			
	2	.128																			
	3	.119																			
	4	.127	304	322	204	216															
	5	.124																			
	6	.132																			
	7	.123																			
	8	.131																			
	9	.135																			
	10	.149																			
	11	.154	272	349	214	275															
	12	.122																			
	13	.136																			
	14	.134																			
	15	.136																			
	16	.145																			
	17	.132																			
	18	.145	267	323	161	195															
	19	.144																			
	20	.135																			
	21	.129																			
	22	.131																			
	23	.130																			
	24	.136																			
	25	.137	344	393	177	202															
	26	.136																			
	27	.137																			
	28	.147																			
TOTAL		3.797	1187	1387	756	888															
DAILY MIN.		.119	267	323	161	195															
DAILY MAX.		.154	344	393	214	275															
WKLY. AVG. MAX.		.972	344	393	214	275															
MTHLY. AVG.		.136	297	347	189	222															
DAILY LIMITS																					
WKLY. LIMITS		/	/	/	/	/															
MTHLY. LIMITS																					

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Burtagna
Authorized Signature

3/14/05
Date

Paul Burtagna
Name (print)

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
Primary Depth		Secondary Depth		Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
Feet		Feet	Feet		In./Acre		Gal.	Hrs.									
9.2		9.2															
↓		↓	Approximately 4'														
			7'														
			2'														
			11'														
			at Stallion + Deep End														
																	TOTAL
																	DAILY MINIMUM
																	DAILY MAXIMUM
																	WEEKLY AVERAGE MAXIMUM
																	MONTHLY AVERAGE
																	DAILY LIMITS
																	WEEKLY LIMITS
																	MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: March 05
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: April 05
System Type: Domestic Sewage Lagoons | Population Served: 1490 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III
Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location															
		MGD X / GPD	BOD Grab / Comp X		TSS Grab / Comp X		BOD Grab / Composite			TSS Grab / Composite			NUTRIENTS Grab / Composite				CHLORINE		COLIFORM MPN / MF		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.127																			
	2	.124																			
	3	.133																			
	4	.134	357	399	210	235															
	5	.136																			
	6	.133																			
	7	.142																			
	8	.142																			
	9	.140																			
	10	.134																			
	11	.132																			
	12	.134																			
	13	.138																			
	14	.132	363	400	322	354															
	15	.120																			
	16	Computer Down																			
	17	Computer Down																			
	18	.109 (Short day)																			
	19	.141	375	441	118	139															
	20	.132																			
	21	.140																			
	22	.145																			
	23	.143																			
	24	.156																			
	25	.136																			
	26	.133																			
	27	.135																			
	28	.137																			
	29	.142	205	243	115	136															
	30	.141																			
	31	.131																			
TOTAL		4.029	1300	1483	765	864															
DAILY MIN.		.120	205	243	115	136															
DAILY MAX.		.156	375	441	322	354															
WKLY. AVG. MAX.		.985	375	441	322	354															
MTHLY. AVG.		.139	325	371	191	216															
DAILY LIMITS																					
WKLY. LIMITS																					
MTHLY. LIMITS																					

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Bertagna — Authorized Signature

4/4/05 — Date

Paul Bertagna — Name (print)

Notes:

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)								LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth		Secondary Depth		Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank			
	Feet		Feet	Feet		In./Acre		Gal.	Hrs.										
1	9.2		9.2																
2				8															
3	↓		↓																
4				5															
5				2															
6				1															
7				1															
8				1															
9				1															
10				1															
11				1															
12				1															
13				1															
14				1															
15				1															
16				1															
17				1															Power Outage caused
18				1															around 10:00 blow in PLC
19				1															PLC Back on-line
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			
31																			
																			TOTAL
																			DAILY MINIMUM
																			DAILY MAXIMUM
																			WEEKLY AVERAGE MAXIMUM
																			MONTHLY AVERAGE
																			DAILY LIMITS
																			WEEKLY LIMITS
																			MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: April 05

DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: May 05

System Type: Domestic Sewage Lagoons | Population Served: 1490 | County: Deschutes

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III

Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

Operator Certification

EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:*

DATE		INFLUENT					EFFLUENT														
		MGD [X] GPD [ ]	BOD Grab [ ] Comp. [X]		TSS Grab [ ] Comp. [X]		BOD Grab [ ] Composite [ ]			TSS Grab [ ] Composite [ ]			NUTRIENTS Grab [ ] Composite [ ]				CHLORINE		COLIFORM MPN [ ] MF [ ]		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.133																			
	2	.133																			
	3	.132																			
	4	.141																			
	5	.137																			
	6	.133																			
	7	.137																			
	8	.139	331	384	176	204															
	9	.153																			
	10	.141																			
	11	.135																			
	12	.140																			
	13	.131																			
	14	.143																			
	15	.133	258	286	247	274															
	16	.138																			
	17	.148																			
	18	.151																			
	19	.151																			
	20	.135																			
	21	.141																			
	22	.152	378	479	500	634															
	23	.152																			
	24	.152																			
	25	.143																			
	26	.131																			
	27	.142															10	1.2			
	28	.140															10	2.2			0
	29	.143															6	1.1			
	30	.138	334	384	159	183											6	.4			2
																	6	.7			
TOTAL		4.205	1301	1533	1082	1295															
DAILY MIN.		.131	258	286	159	183											38	5.6			2
DAILY MAX.		.153	378	479	500	634											6	.4			0
WKLY. AVG. MAX.		1.024	378	479	500	634											10	2.2			2
MTHLY. AVG.		.140	325	383	271	323											38	5.6			2
DAILY LIMITS																	8	1.1			2
WKLY. LIMITS		/	/	/	/	/											/	/			126
MTHLY. LIMITS																					

09/03/97

DMRSHPG1.DOC

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul D. Bertsch
Authorized Signature

5/10/05
Date

Paul Bertsch
Name (print)

Notes: Started Irrigating System for the Effluent Disposal.

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							
	Primary Depth #1		Secondary Depth #2	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Feet		Feet	Feet		Dike In./Acre	Forest In/Acre	Gal.	Hrs.									
1	9.2		9.3	11.9														
2																		
3	↓		↓	↓														
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26						.09	.05											
27						.13	.07											
28						.13	.03											
29						.14	.03											
30						.15	.03											
						.64	.21											TOTAL
						.09	.03											DAILY MINIMUM
						.15	.07											DAILY MAXIMUM
						.64	.21											WEEKLY AVERAGE MAXIMUM
						.13	.04											MONTHLY AVERAGE
																		DAILY LIMITS
																		WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: May 2005

DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: June 2005

System Type: Domestic Sewage Lagoons | Population Served: 1490 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III

Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location:										CHLORINE		COLIFORM		
		MGD X / GPD	BOD Grab / Comp X		TSS Grab / Comp X		BOD Grab / Composite			TSS Grab X / Composite			NUTRIENTS Grab / Composite						MPN / MF	MPN / MF	MPN X / MF
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.154															off	off			
	2	.153															6	2.2			
	3	.145	326	394	317	383											8	2.1			0
	4	.146															8	2.4			
	5	.146															2	1.2			
	6	.145															0	.4			2
	7	.145															off	off			
	8	.140															off	off			
	9	.130															3	1.8			0
	10	.146	280	341	190	231											6	.8			
	11	.145															8	.7			
	12	.141															3	1.3			
	13	.149															6	1.0			0
	14	.159															off	off			0
	15	.163															0	1.2			
	16	.150															6	1.2			
	17	.152															3	.3			0
	18	.150															3	2.3			
	19	.148															5	1.9			
	20	.168															2	.4			
	21	.166	222	307	190	263				20	89%	24					2	.2			
	22	.160															8	.2			
	23	.152															6	.2			
	24	.149															16	1.3			81
	25	.150															16	1.9			0
	26	.163															9	1.8			
	27	.163	366	498	420	571				17	96%	36					6	.61			
	28	.171															6	2.1			
	29	X															X	X			
	30	.172															14	3.2			0
	31	.156															16	4.7			0
TOTAL		4.389	1194	1540	1117	1448				37		60					180	—			3
DAILY MIN.		.130	222	307	190	231				17		24					0	0			0
DAILY MAX.		.172	366	498	420	571				20		36					16	4.7			2
WKLY. AVG. MAX.		1.108	366	498	420	571				20		36					67	8.1			2
MTHLY. AVG.		.142	299	385	279	362				18		30					6	1.4			1.1
DAILY LIMITS																					126
WKLY. LIMITS		/	/	/	/	/				/		/					/	/			
MTHLY. LIMITS																					

INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Bertagna
Authorized Signature

6/13/05
Date

Paul Bertagna
Name (print)

5/29 – We lost our pH probe at the end of the month, we ordered a new one and have resumed pH monitoring. Our PLC tripped a breaker & we lost our Hach

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth		Secondary Depth	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
						Dike	Forest											
	Feet		Feet	Feet		In./Acre	In./Ac	Gal.	Hrs.									
1	9.2		9.3	11.9		off	off											
2						.14	.03											Rain (Irr. off)
3	↓		↓			.14	.05											
4	↓		↓			.06	.06											
5				↓		.06	.05											
6						.07	0											
7				↓		off	off											
8						off	off											Rain (Irr. off)
9						.06	.05											Rain "
10						.06	0											
11						.12	.03											
12						.12	.06											
13						.12	.07											
14						off	off											
15						.17	.08											
16						.17	.04											
17						.17	.08											
18						.06	.07											
19						.17	.04											
20						.06	.05											
21						.17	.05											
22						.17	.05											
23						.15	.07											
24						.15	.12											
25						.17	.15											
26						.17	.08											
27						.12	.04											
28						.10	.01											
29						off	off											
30						.15	.08											PLC shut down
31				11.2		.17	.09											
						3.27	1.6											TOTAL
						.06	0											DAILY MINIMUM
						.17	.15											DAILY MAXIMUM
						1.03	.6											WEEKLY AVERAGE MAXIMUM
						.12	.06											MONTHLY AVERAGE
																		DAILY LIMITS
						6.19"	3.34"											WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters
Phone Number: (541) 549-6981
From - Month & Year: June 05
DEQ Permit No.: 101779
DEQ File No./Facility ID: 81850
To - Month & Year: July 05
System Type: Domestic Sewage lagoons
Population Served: 1490
County: Deschutes

Operator Certification

Collection sys. class: I
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9804 III
Treatment sys. class: I
Principal operator name (print): Paul Bertagna
Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location:														
		MGD X / GPD	BOD Grab / Comp. X		TSS Grab / Comp X		BOD Grab / Composite			TSS Grab X / Composite			NUTRIENTS Grab / Composite				CHLORINE		COLIFORM MPN X / MF		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.159															8	3			
	2	.165															6	3.2			
	3	.170	324	459	323	458				10	97%						5	5.1			
	4	.165															5	1.6			2
	5	.159															5	2.2			
	6	.172															6	2.0			
	7	.166															16	4.3			0
	8	.165															25	3.1			
	9	.165															9	2.3			
	10	.180	299	449	300	450				10	97%						6	2.1			0
	11	.198															9	1.7			
	12	.182															9	1.8			
	13	.170															5	3.6			
	14	.159															14	1.4			0
	15	.165															9	6.6			
	16	.163															3	2.0			
	17	.166	229	317	165	228				17	90%						9	2.3			
	18	.164															9	5.9			
	19	.153															13	2.1			
	20	.159															13	4.3			0
	21	.163															13	1.5			
	22	.152															13	4.0			0
	23	.170															8	2.6			
	24	.172															13	2.1			
	25	.176	382	561	319	468				—	—						14	5.7			
	26	.165															13	1.8			
	27	.178															11	4.3			
	28	.172															9	3.6			0
	29	.165															13	2.4			
	30	.171															9	.3			
	31																				
TOTAL		5.029	1234	1786	1107	1604				37							304	88.1			2
DAILY MIN.		.158	229	317	165	228				10							3	.3			0
DAILY MAX.		.198	382	561	323	468				17							25	6.6			2
WKLY. AVG. MAX.		1.205	382	561	323	468				17							87	23.4			2
MTHLY. AVG.		.168	309	447	277	401				12							10	2.9			1.1
DAILY LIMITS																					126
WKLY. LIMITS		/	/	/	/	/				/							/	/			
MTHLY. LIMITS																					

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Bertagna
Authorized Signature

Date

Paul Bertagna
Name (print)

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth #1		Secondary Depth #2	Holding Pond	Perimeter Inspection	Quanity Irrigated Dike	Quantity Irrigated Forest	Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
	Feet		Feet	Feet		In./Acre	In./Acre	Gal.	Hrs.									
1	9.2		9.2	11.2		.17	.07											
2						.17	.09											
3						.17	.16											
4						.17	.02											
5						.17	.15											
6						.18	.14											
7						.17	.17											
8						.17	.11											
9						.17	.11											
10						.17	.12											
11						.18	.12											
12						.17	.15											
13						.07	0											
14						.14	.16											
15						.10	.10											
16						.15	0											
17						.22	.12											
18						.22	.12											
19						.22	.08											
20						.13	.12											
21						0	.17											
22						0	.11											
23						.09	.06											
24						.22	.09											
25						.22	.10											
26						.22	.11											
27						.20	.11											
28						.22	.12											
29						.22	.11											
30				10.0		.23	.08											
						4.83	3.17											TOTAL
						0	0											DAILY MINIMUM
						.23	.17											DAILY MAXIMUM
						1.21	.92											WEEKLY AVERAGE MAXIMUM
						.16	.11											MONTHLY AVERAGE
																		DAILY LIMITS
																		WEEKLY LIMITS
						7.54"	4.22"											MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6081 | From - Month & Year: July 05
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: August 05
System Type: Domestic Sewage Lagoons | Population Served: 1490 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III
Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - Identify outfall number (e.g. 001, 002) or sampling location:															
		MGD [X] / GPD [ ]	BOD Grab [ ] Comp [X]		TSS Grab [ ] Comp [X]		BOD Grab [ ] Composite [ ]			TSS Grab [X] Composite [ ]			NUTRIENTS Grab [ ] Composite [ ]				CHLORINE		COLIFORM MPN / MF		
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli	
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml			
	1	.177	361	533	210	310				17	92%	53					9	1.7				8.5
	2	.176															13	1.5				
	3	.180															16	2.1				
	4	.166															16	3.6				
	5	.182															14	4.6			0	8.2
	6	.182															5	1.7				
	7	.189															6	1.3				8.5
	8	.192	243	389	189	303				9	95%	27					3	1.7			4	8.7
	9	.200															14	1.6				
	10	.183															14	1.7				
	11	.118															8	1.9			3	8.8
	12	.160															6	1.6				
	13	.175															19	1.9				
	14	.186															20	1.0				
	15	.178															9	.3			0	
	16	.171	318	454	221	315				1	99%	3					13	.8			2	8.1
	17	.182															13	1.4				8.1
	18	.176															16	1.3				8.3
	19	.163															8	.4			0	
	20	.166															8	.8			0	
	21	.173															22	2.4				
	22	.175															17	2.0				9.1
	23	.180	385	428	72	108				14	81%	80					23	2.1			0	
	24	.171															25	1.4				
	25	.165															31	2.1			0	
	26	.163															19	1.9				9.1
	27	.164															19	1.6				8.1
	28	.168		381													16	1.4				
	29	.169	270	~~330~~	81	114				27	67%	211					13	1.8			0	8.1
	30	.165															13	1.5			0	
	31	.178															13	1.4				
TOTAL		5.373	1477	2185	723	1150				68		374					441	52			9	
DAILY MIN.		.163	243	381	72	114				1		3					5	.3			0	
DAILY MAX.		.200	361	533	221	315				27		211					31	4.6			4	
WKLY. AVG. MAX.		1.228	361	533	221	315				27		211					134	15			5	
MTHLY. AVG.		.173	295	437	155	230				14	87%	75					14	1.7			1.3	
DAILY LIMITS																					126	
WKLY. LIMITS		/	/	/	/	/				/	/	/					/	/				
MTHLY. LIMITS																						

FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul J. Bertagna
Authorized Signature

8/8/05
Date

Paul Bertagna
Name (print)

NOTES:
July 11, The PLC Shut-down so we didn't get an accurate Influent Flow for that day. PLC has been operating Fine since then.

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth #1		#Secondary Depth #2	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
	Feet		Feet	Feet		In./Acre	Ft. 4or	Gal.	Hrs.									
1	9.2'		9.3'	10.0		.23	.13											
2						.23	.15											
3						.23	.12											
4						.23	.16											
5						.23	.08											
6						.23	.06											
7						.22	.11											
8				V		.20	.13											
9						.21	.11											
10						.21	.02											
11						.12	.06											
12						.15	.23											
13						.21	.23											
14						.21	.10											
15						.21	.13											
16						.21	.12											
17						.21	.10											
18						.21	.12											
19						.21	.18											
20						.22	.19											
21						.20	.14											
22						.21	.14											
23						.21	.27											
24						.20	.14											
25						.21	.15											
26						.21	.16											
27						.21	.12											
28						.21	.18											
29						.20	.37											
30						.21	.18											
31				8.4'		.21	.20											
						6.46	4.58											TOTAL
						.12	.02											DAILY MINIMUM
						.23	.37											DAILY MAXIMUM
						1.46	1.21											WEEKLY AVERAGE MAXIMUM
						.21	.15											MONTHLY AVERAGE
																		DAILY LIMITS
						9.30	6.10											WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: (541) 549-6981 | From - Month & Year: August 2005
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: September 2005
System Type: Domestic Sewage Lagoons | Population Served: 1490 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: III 9804
Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: III 9805

DATE		INFLUENT					EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:*														
		MGD ☒ / GPD ☐	BOD Grab ☐ Comp. ☒		TSS Grab ☐ Comp ☒		BOD Grab ☐ Composite ☐			TSS Grab ☒ Composite ☐			NUTRIENTS Grab ☐ Composite ☐				CHLORINE		COLIFORM MPN ☐ MF ☐	COLIFORM MPN ☐ MF ☐	COLIFORM MPN ☒ MF ☐
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml		
	1	.178															38	1.1			
	2	.164															31	1.2			
	3	.165															20	.6			9.
	4	.165															20	1.9			0
	5	.169	243	342	301	424				69	77%	267					38	1			8.
	6	.175															22	1.4			
	7	.179															9	1.6			
	8	.181															19	.5			24 8.
	9	.167															19	1			
	10	.168															19	1.2			
	11	.174															19	.9			9
	12	.172	352	505	255	366				39	85%	148					9	1.			6 9 9
	13	.169															16	1.2			8
	14	.179															19	1.3			
	15	.164															25	.9			
	16	.176															28	1			
	17	.166															13	.8			2 9
	18	.178															28	.8			5 e
	19	.170	299	424	136	193				40	71%	135					28	.9			9
	20	.176															20	1			
	21	.179															16	.9			
	22	.184															19	.7			
	23	.162															19	.5			5 9
	24	.166															28	1			
	25	.173															16	.9			c
	26	.170	214	303	174	247				44	75%	114					16	1			1 9
	27	.168															19	1			
	28	.169															19	1			
	29	.159															16	.8			
	30	.167															19	.9			9
	31	.166															3	1.1			0
TOTAL		5.281	1108	1574	866	1230				192		664					630	31.2			43
DAILY MIN.		.159	214	303	174	193				39		114					3	.5			0
DAILY MAX.		.184	352	505	301	424				69		267					38	1.9			24
WKLY. AVG. MAX.		1.034	352	505	301	424				69		267					161	7.4			30
MTHLY. AVG.		.170	277	394	217	308				48		166					20	1			3
DAILY LIMITS																					126
WKLY. LIMITS																					
MTHLY. LIMITS																					1

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X _____ Authorized Signature

Date

Paul Bertagna Name (print)

Notes:

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth		Secondary Depth	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
						Dike	Forest											
	Feet		Feet	Feet		In./Acre	In./Ac.	Gal.	Hrs.									
1	9.2		9.2	8.4		.21	.20											
2						.21	.13											
3						.21	.17											
4						.21	.15											
5						.21	.17											
6						.20	.18											
7						.21	.15											
8						.21	.21											
9						.21	.15											
10						.21	.16											
11						.21	.14											
12						.21	.17											
13						.21	.15											
14						.21	.18											
15						.21	.18											
16						.21	.17											
17						.21	.15											
18						.21	.17											
19						.21	.14											
20						.21	.18											
21						.21	.14											
22						.21	.17											
23						.21	.18											
24						.14	.16											
25						.21	.13											
26						.19	.11											
27						.13	.09											
28						.13	.05											
29						.13	.10											
30						.08	.11											
31				6.0		.13	.11											
						6.02	4.65											TOTAL
						.08	.05											DAILY MINIMUM
						.21	.21											DAILY MAXIMUM
						1.47	1.13											WEEKLY AVERAGE MAXIMUM
						.19	.15											MONTHLY AVERAGE
						1	1											DAILY LIMITS
						7.26	4.11											WEEKLY LIMITS
																		MONTHLY LIMITS

WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

acility Name: City of Sisters | Phone Number: (541) 549-6081 | From - Month & Year: Sep. 2005

EQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: Oct. 2005

ystem Type: Domestic Sewage lagoons | Population Served: 1490 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9804 III

Treatment sys. class: I | Principal operator name (print): Paul Bertagna | Certification No. & grade: 9805 III

DATE		INFLUENT					EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location*															
		MGD X / GPD	BOD Grab / Comp. X		TSS Grab / Comp. X		BOD Grab / Composite			TSS Grab X / Composite			NUTRIENTS Grab / Composite				CHLORINE		COLIFORM MPN / MF	MPN / MF	MPN X / MF	
Month	Day	Flow	Concentration	Loading	Concentration	Loading	Concentration	Removal	Loading	Concentration	Removal	Loading	Total Phosphorous	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Used	Total Residual	Total	Fecal	E.coli	
			mg/L	lbs.	mg/L	lbs.	mg/L	%	lbs.	mg/L	%	lbs.	mg/L				lbs.	mg/L	CFU/100 ml			
	1	.165															15	1.2			1	9.8
	2	.168															23	1.1			1	
	3	.158	311	410	251	331				39	84%	57					24	1.0				8.7
	4	.161															24	1.1				
	5	.167															24	1.0				
	6	.177															20	.7				
	7	.163															20	1.0				
	8	.171	274	391	238	340				29	88	41					21	.9			0	9.5
	9	.170															18	.4				
	10	.167															6	1.1				
	11	.190															12	.9				
	12	.179															12	.8				
	13	.168															12	1.8				
	14	.161															9	1.0				
	15	.156															15	1.2			0	9.1
	16	.167	370	515	426	593				27	94%	33					9	1.2			3	
	17	.171															9	.9				
	18	.166															12	1.0				
	19	.175															12	1.2				
	20	.167															12	1.1				
	21	.169															12	1.0				
	22	.161															9	.3				
	23	.160	380	507	177	236				27	85%	41					9	.3			8.6	9.1
	24	.160															17	.6				
	25	.186															9	.4				
	26	.166															off	OFF				
	27	.156															off	OFF				
	28	.155															16	1.1			0	
	29	.155															0	.27				
	30	.157															18	.85			5.2	
TOTAL		4.992	1335	1823	1092	1500				122		172					379				19	
DAILY MIN.		.155	274	391	177	236				27		33					13				0	
DAILY MAX.		.190	380	515	426	593				39		57					24				8.6	
WKLY. AVG. MAX.		1.192	380	515	426	593				39		57					133				8.6	
MTHLY. AVG.		.166	334	456	273	375				31		43									1.8	
DAILY LIMITS																					126	
WKLY. LIMITS																						
MTHLY. LIMITS																					1	

INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Paul D. Bertagna
Authorized Signature

10/14/05
Date

Paul Bertagna
Name (print)

Irrigation is shut-down for the Season

Mail Original To: Oregon DEQ, Bend Office
2146 NE 4th, #104
Bend, OR 97701

	LAGOON AND POLISHING POND					RECLAIMED WATER Outfall ____		SEWER SYS. BYPASS			MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION)							LOG Regarding breakdowns, bypassing, odors, complaints, etc.
	Primary Depth Pond 1		Secondary Depth Pond 2	Holding Pond	Perimeter Inspection	Quanity Irrigated		Flow	Duration	Solids Transported to Other WWTF	Test Dosing Pumps/Alarms	Inspect Pump Screens	Check Pumps for Accurate Cycle	Inspect Monitoring Ports	Inspect & Maintain Dist. Mechanisms	Inspect Dosing Tank		
	Feet		Feet	Feet		Dike In./Acre	Forest In./Ac	Gal.	Hrs.									
1	9.2		9.2			.14	.11											
2						.14	.11											
3						.14	.13											
4						.14	.11											
5	↓		↓			.14	.11											
6						.14	.11											
7						.14	.11											
8						.14	.06											
9						.14	.03											
10						.13	.06											
11						.11	.05											
12						.17	.05											
13						.14	.05											
14						.14	.05			X								
15						.14	.05											Took Screenings to Knott Landfill
16						.08	.05											
17						.06	.06											
18						.14	.05											
19						.14	.05											
20						.19	.05											
21						.19	.05											
22						.19	.07											
23						.13	.06											
24						.17	.06											
25						.06	.06											
26						off	off											
27						off	off											
28						.13	.07											
29						.12	.07											
30						.12	.06											
						3.91	2.03											TOTAL
						0	0											DAILY MINIMUM
						.19	.13											DAILY MAXIMUM
						.15	.59											WEEKLY AVERAGE MAXIMUM
						.13	.07											MONTHLY AVERAGE
																		DAILY LIMITS
						5.61	2.64											WEEKLY LIMITS
																		MONTHLY LIMITS

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

APPENDIX 7.1
WATER POLLUTION CONTROL FACILITIES PERMIT (WPCFP)
and
EVALUATION REPORT FOR WPCFP

HGE INC

WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
2146 NE 4th Street, Suite 104, Bend, OR 97701
(541) 388-6146
Issued pursuant to ORS 468B.050

ISSUED TO:

City of Sisters
P.O. Box 39
Sisters, OR 97759

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Method of Disposal
Domestic Sewage	Land Irrigation

SYSTEM TYPE AND LOCATION:

Domestic Sewage Lagoons

Sisters, Oregon

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: Upper Deschutes
Hydro Code: 25D-SQUA 3 N
County: Deschutes

Treatment System Class: I
Collection System Class: I

Nearest surface stream which would receive waste if it were to discharge: Squaw Creek

Issued in response to Application No. 990045 received 8/9/99

This permit is issued based on the land use findings in the permit record.

Richard J. Nichols, Manager
Bend WQ Section
Eastern Region

Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

All direct a discharge to surface waters is prohibited.

SCHEDULE A

Waste Disposal Limitations

1. The permittee is allowed to construct, operate and maintain a wastewater collection, treatment and land application system constructed in accordance with plans and specifications approved by the Department and in accordance with the following conditions:

   a. The wastewater collections, treatment and land application system shall not be hydraulically or organically loaded in excess of their respective, Department approved design capacities. At full build-out, however, the monthly average daily influent flow shall not exceed 0.45 MGD.

   b. No discharge to state water is permitted. All wastewater shall be treated and stored for disposal by land irrigation. The quality of effluent irrigated shall not exceed:

      (1) Prior to reuse of treated effluent for Level I beneficial purposes, the wastewater shall comply with the following effluent limitations:

Parameters	Limitations
E. coli	Shall not exceed a monthly geometric mean of 126 organisms/100mls.

      (2) Prior to reuse of treated effluent for Level II beneficial purposes, the wastewater shall be receive treatment required for Level II beneficial purposes and shall comply with the following effluent limitations:

Parameters	Limitations
Total Coliform	Shall not exceed a 7 day median of 23organisms/100mls and no two consecutive samples shall exceed 240organisms/ 100 mls.

   c. All effluent that is irrigated shall be distributed on land for dissipation by evapo-transpiration and controlled seepage by following sound irrigation practices so as to prevent:

      (1) Prolonged ponding of treated reclaimed water on the ground surface;

      (2) Surface runoff or subsurface drainage through drainage tile to surface waters;

      (3) The creation of odors, fly and mosquito breeding or other nuisance conditions;

      (4) The overloading of land with nutrients, organics, or other pollutant parameters; and

      (5) Impairment of existing or potential beneficial uses of groundwater.

   d. Effluent reuse shall comply with all provisions of a Reclaimed Water Use Plan approved by the Department pursuant to OAR 340-55.

2. Unless otherwise approved in writing by the Department, irrigation shall only occur during the period from April through October. In addition, the average application of treated effluent shall not exceed 16 inches per irrigation season.

3. The permittee shall, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements

The permittee shall monitor the operation and efficiency of all treatment and disposal facilities. Unless otherwise agreed to in writing by the Department of Environmental Quality, data collected, and submitted shall include but not necessarily be limited to the following parameters and minimum frequencies:

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Recording Totalizer
Flow Meter Calibration	Annually	Verification
BOD_5	Weekly	Composite (See note 1/)
TSS	Weekly	Composite
pH	3/Week	Grab

b. Outfall Number 001 (Wastewater Irrigation)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Recording Totalizer
Flow Meter Calibration	Annually	Verification
pH	3/Week	Grab
E. coli Bacteria	1/Week	Grab*
Total Coliform	1/week	Grab*
Chlorine Residual	Daily	Grab
Amount Chlorine Used	Daily	Weight
Total P and Total N	Annually during irrigation	Grab
Annual Irrigation Rate (in./year)	Annually	Calculation
Annual Nitrogen Loading (#/yr.)	Annually	Calculation

*The permittee is only required to sample for either E. coli or total coliform, but not both. If the permittee is irrigating on crops requiring only Level I quality effluent, E. coli shall be monitored. If the permitee is reusing the effluent for Level II uses, total coliform shall be monitored.

2. Reporting Procedures

a. Monitoring results shall be reported on Department approved forms. Except for groundwater monitoring, the reporting period is the calendar month. Reports must be submitted to the Department's Eastern Region Bend office by the 15th day of the following month.

b. State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on page one of this permit.

c. Monitoring reports shall also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

SCHEDULE C

Compliance Conditions and Schedules

1. Prior to start-up of the sewerage facilities covered by this permit, the permittee shall provide the Department with necessary documentation demonstrating that the facilities will be supervised by a certified operator as required in Schedule D, condition 3 of this permit.

2. Ninety days prior to start-up of the irrigation system serving the sewerage facilities covered by this permit, the permittee shall submit a reclaimed water use plan that complies with all requirements of Oregon Administrative Rule (OAR) 340-55.

3. Prior to start-up of the sewerage facilities covered by this permit, the permittee shall provide the Department with a certification by a registered professional engineer that the facilities were constructed in accordance with plans and specifications approved by the Department.

4. Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent shall only be reused on Level I beneficial uses.

5. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director or his authorized representative may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by the Department. After approval of the plans, all construction shall be in strict conformance with the plans unless otherwise approved in writing by the Department.

2. Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50.

   This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

3. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and /or treatment) of the system to be supervised as specified on page one of this permit.

   Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

   b. The permittee's wastewater system may not be without supervision (as required by Special Condition 3a above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified in the proper classification and at grade level I or higher.

   c. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

   d. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or re-designation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program at 811 S.W. Sixth Avenue, Portland, Oregon 97204. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

e. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by 3b above.

4. The permittee shall notify the DEQ Bend office (503) 388-6146, in accordance with the response times noted in the General Conditions of this permit, of any malfunction so corrective action can be coordinated between the permittee and the Department.

5. The permittee shall meet the requirements for use of reclaimed water under Division 55, including the following:

a. All reclaimed water shall be managed in accordance with the approved Reclaimed Water Use Plan. No substantial changes shall be made in the plan without written approval of the Department.

b. No reclaimed water shall be released by the permittee to another person, as defined in Oregon Revised Statute (ORS) 468.005, for use unless there is a valid contract between the permittee and that person that meets the requirements of Oregon Administrative Rule (OAR) 340-55-015(9).

c. The permittee shall notify the Department within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-55. When the Department offices are not open, the permittee shall report the incident of non-compliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

d. No reclaimed water shall be made available to a person proposing to recycle unless the person certifies in writing that they have read and understand the provisions in these rules. This written certification shall be kept on file by the sewage treatment system owner and be made available to the Department for inspection.

6. Upon written approval from the Department, the permittee may construct and operate portions of the sewerage facilities provided all conditions of this permit are met. Operation of a portion of the facilities is considered an interim practice pending completion of the entire system.

SCHEDULE F

General Conditions

SECTION A. STANDARD CONDITIONS

1. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws, or regulations.

2. Liability

The Department of Environmental Quality, its officers, agents, or employees shall not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities because of this permit.

3. Permit Actions

After notice by the Department, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any term or condition of this permit, any applicable rule or statute, or any order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

4. Transfer of Permit

This permit shall not be transferred to a third party without prior written approval from the Department. Such approval may be granted by the Department where the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of this permit and the rules of the Commission. A transfer application and filing fee must be submitted to the Department.

5. Permit Fees

The permittee shall pay the fees required to be filed with this permit application and to be paid annually for permit compliance determination as outlined in the Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times maintain in good working order and properly operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

2. Standard Operation and Maintenance

All waste collection, control, treatment, and disposal facilities shall be operated in a manner consistent with the following:

a. At all times, all facilities shall be operated as efficiently as possible and in a manner which will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge shall be disposed of in a manner approved by the Department such as to prevent any pollutant from such materials from reaching any waters of the state, creating a public health hazard, or causing a nuisance condition.

c. Bypassing of untreated waste is generally prohibited. No bypassing shall occur without prior written permission from the Department except where unavoidable to prevent loss of life, personal injury, or severe property damage.

3. Noncompliance and Notification Procedures

In the event the permittee is unable to comply with all the conditions of this permit because of surfacing sewage, a breakdown of equipment or facilities, an accident caused by human error or negligence, or any other cause such as an act of nature, the permittee shall:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department's Regional office, so that an investigation can be made to evaluate the impact and the corrective actions taken and determine additional action that must be taken.

c. Within 5 days of the time the permittee becomes aware of the circumstances, the permittee shall submit to the Department a detailed written report describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

4. Wastewater System Personnel

The permittee shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance, and monitoring requirements to assure continuous compliance with the conditions of this permit.

SECTION C. MONITORING AND RECORDS

1. Inspection and Entry

The permittee shall, at all reasonable times, allow authorized representatives of the Department of Environmental Quality to:

a. Enter upon the permittee's premises where a waste source or disposal system is located or where any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy any records required to be kept under the terms and conditions of this permit;

c. Inspect any treatment or disposal system, practices, operations, monitoring equipment, or monitoring method regulated or required by this permit; or

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

2. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean, except for bacteria which shall be averaged as specified in the permit.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures specified in the most recent edition of **Standard Methods for the Examination of Water and Wastewater**, unless other test procedures have been approved in writing by the Department and specified in this permit.

4. Retention of Records

The permittee shall retain records of all monitoring and maintenance information, including all calibrations, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. The Director may extend this period at any time.

SECTION D. REPORTING REQUIREMENTS

1. Plan Submittal

Pursuant to Oregon Revised Statute 468B.055, unless specifically exempted by rule, no construction, installation or modification of disposal systems, treatment works, or sewerage systems shall be commenced until plans and specifications are submitted to and approved in writing by the Department. All construction, installation or modification shall be in strict conformance with the Department's written approval of the plans.

2. Change in Discharge

Whenever a facility expansion, production increase, or process modification is anticipated which will result in a change in the character of pollutants to be discharged or which will result in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. No change shall be made until plans have been approved and a new permit or permit modification has been issued.

3. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified by the official applicant of record (owner) or authorized designee.

SECTION E. DEFINITIONS

1. BOD_5 means five-day biochemical oxygen demand.
2. TSS means total suspended solids.
3. FC means fecal coliform bacteria.
4. NH_3-N means Ammonia Nitrogen.
5. NO_3-N means Nitrate Nitrogen.
6. NO_2-N means Nitrite Nitrogen.
7. TKN means Total Kjeldahl Nitrogen.
8. Cl means Chloride.
9. TN means Total Nitrogen.
10. mg/L means milligrams per liter.
11. ug/L means micrograms per liter.
12. kg means kilograms.
13. GPD means gallons per day.
14. MGD means million gallons per day.
15. The term "bacteria" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
16. Total residual chlorine means combined chlorine forms plus free residual chlorine.

17. Grab sample means an individual discrete sample collected over a period of time not to exceed 15 minutes.

18. Composite sample means a combination of samples collected, generally at equal intervals over a 24-hour period, and apportioned according to the volume of flow at the time of sampling.

19. Week means a calendar week of Sunday through Saturday.

20. Month means a calendar month.

21. Quarter means January through March, April through June, July through September, or October through December.

EVALUATION REPORT FOR WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
2146 NE 4th Street, Suite 104, Bend, OR 97701
(541) 388-6146
Issued pursuant to ORS 468B.050

ISSUED TO:

City of Sisters
P.O. Box 39
Sisters, OR 97759

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Method of Disposal
Domestic Sewage	Land Irrigation

SYSTEM TYPE AND LOCATION:

Domestic Sewage Lagoons

Sisters, Oregon

RIVER BASIN INFORMATION:

Basin: Deschutes
Sub-Basin: Upper Deschutes
Hydro Code: 25D-SQUA 3 N
County: Deschutes

Treatment System Class: I
Collection System Class: I

Nearest surface stream which would receive waste if it were to discharge: Squaw Creek

Issued in response to Application No. 990045 received 8/9/99

This permit is issued based on the land use findings in the permit record.

Background:

The City of Sisters is proposing to construct and operate a municipal sewerage facility to serve the city. Currently, sewage is treated and disposed of by individual on-site sewage disposal systems. Many of the residential on-site sewage systems are older and substandard. In addition, the city has a substantial contingency of commercial operations also operating on sewage disposal systems. The City, at the urging of both Deschutes County and the Department of Environmental Quality, has determined that a community system is needed to prevent future public health problems and groundwater contamination and to better serve new development in and around the city.

The proposed sewerage facility will consist of a conventional gravity collection system with one main pump station and two small pump stations, aerated lagoons with winter storage and land irrigation in the growing season. Irrigation would likely be on forest land with an application rate of about 16 inches per season.

The City has not previously operated a sewerage facility and, as a result, has not had a prior enforcement record.

Schedule A:

Effluent will be treated in aerated lagoons, stored through the non-irrigation season and irrigated on forest land during irrigation season. Effluent will be disinfected with chlorine prior to irrigation. The Department is proposing to allow enhanced level I quality effluent which is allowed for irrigation on forest land. The proposed limits for an enhanced level I is 126 E. coli per 100 mls. In order to treat to this rather minimum level of disinfection, public access to the irrigation site must be restricted by fencing and signing.

The City is considering, at some future point, to upgrade its treatment and disinfection facilities to meet Level II effluent reuse. The proposed permit has been written to allow the city the option to go to Level II upon approval of an updated Reclaimed Water Use Plan.

This schedule of the permit includes normal conditions for facilities treating and disposing of effluent by irrigation. The proposed permit will limit monthly average influent flow to no more than 0.45 MGD.

Effluent will be irrigated at agronomic rates and only during the irrigation season. In addition, the lagoon cells will be lined to prevent leakage. Based upon this, the Department believes the proposed facility will have no adverse impact on groundwater quality and therefore complies with the Department's groundwater protection regulations in OAR 340-40.

Schedule B:

Proposed monitoring requirements in this schedule is consistent with other facilities of similar size and type. Effluent monitoring is limited to bacteria which is a consistent monitoring practice for the use of reclaimed water. The proposed permit will also require monitoring of irrigation to ensure that application of water and nutrients is consistent with desired loading rates for forest land.

Schedule C:

This schedule contains 3 conditions. The first requires the city to provide DEQ that they have obtained the services of a certified operator to supervise operation of the sewerage facility as required by the permit and state law. The second requires that the city provide DEQ with an approved reclaimed water use plan 90 days prior to start-up of the facilities. This is to ensure that the operation of the irrigation system will be consistent with the regulations for the use of reclaimed water. The third condition requires that a registered engineer certify that the facility has been constructed in accordance with approved plans. This condition is consistent with Department regulations concerning the construction of new or modified wastewater control facilities.

Schedule D:

This schedule contains the normal conditions for facilities that reuse reclaimed water. The Department is not requiring a biosolids management plan at this time since the system will not routinely remove, treat and dispose of biosolids. A plan will be required, however, at such time as biosolids need to be removed from the system.

Relative to operator certification, the Department has determined that the following operator levels is needed for the proposed facility:

Treatment Class: I
Collection Class: I

The system is classed for collection as a level I because the City serves less than 1500 people.

The treatment class designation is based upon:

Population < 2000	1.0	Point
Approved dry weather flow (0.45 MGD)	1.5	Points
Unit Processes:		
Comminution:	1.0	Point
Influent pump station	2.0	Points
Stab. Lagoon 2 or more cells With primary aeration	7.0	Points
Liquid chlorine disinfection 2.0 Points		
Effluent – secondary only	2.0	Points
Sampling		
BOD/TSS (outside lab)	2.0	Points
Bacteria (outside lab)	1.0	Points
Nutrients (outside lab)	3.0	Points
TOTAL	22.5	Points

Treatment Class is Level I if total points are less than 30.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

APPENDIX 8.1
TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER
(TABLE 1 OF OAR 340-55-015)

HGE INC

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER*
(OAR 340-55-015)

NOTE: *This table specifies the allowable beneficial purposes for various levels of quality of reclaimed water. If reclaimed water is to be applied to a specific beneficial purpose, all requirements except advisory notices, but including footnotes, listed for that level of reclaimed water and use must be met.*

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Biological Treatment	X	X	X	X
Disinfection		X	X	X
Clarification				X
Coagulation				X
Filtration				X
Total Coliform (organisms/100 ml):				
Two Consecutive Samples	N/L	240	N/L	N/L
7-Day Median	N/L	23	2.2	2.2
Maximum	N/L	N/L	23	23
Sampling Frequency	N/R	1 per week	3 per week	1 per day
Turbidity (NTU):				
24-Hour Mean	N/L	N/L	N/L	2
5% of Time During a 24-Hour Period	N/L	N/L	N/L	5
Sampling Frequency				Hourly
GENERAL				
Public Access	Prevented (fences gates, locks)	Controlled (signs, rural or nonpublic lands)	Controlled (signs, rural or nonpublic lands)	No direct public contact during irrigation cycle

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Buffers for Irrigation:	Surface: 10 ft. Spray: site specific	Surface 10 ft. Spray: 70 ft.	10 ft.	None required
Agricultural:				
Food Crops	N/A	N/A	N/A	Unrestricted
Processed Food Crops	N/A	1	1	Unrestricted
Orchards and Vineyards	N/A	2	2	Unrestricted
Fodder, Fiber, and Seed Crops not for Human Ingestion	3	1	1	Unrestricted
Pasture for Animals	N/A	4	4	Unrestricted
Sod	N/A	1	1	Unrestricted
Ornamental Nursery Stock	N/A	1	1	Unrestricted
Christmas Trees	N/A	1	1	Unrestricted

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Firewood	N/A	1	1	Unrestricted
Commercial Timber	3	1	1	Unrestricted

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

CATEGORY	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Parks, Playgrounds, Schoolyards, Golf Courses with Contiguous Residences	N/A	N/A	N/A	5,6
Golf Courses without Contiguous Residences	N/A	5,7	5,7	5,6
Cemeteries, Highway Medians, Landscapes without Frequent Public Access	N/A	5,7	5,7	5,6
Industrial or Commercial Use	N/A	9,10,11,12	9,10,11,12	9,10,12
Construction Use	N/A	9,10,11 12,13	9,10,11 12,13	9,10, 12,13
Impoundments:				
Unrestricted	N/A	N/A	N/A	8,10
Restricted	N/A	N/A	8,10,14	8,10
Landscape Impoundments	N/A	8,10,14	8,10,14	8,10

*DEFINITIONS:

Surface: Surface irrigation where application of reclaimed water is by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

Spray: Spray irrigation where application of reclaimed water to crops is by spraying it from orifices in piping.

Processed Food Crops: Those which undergo thermoprocessing sufficient to kill spores of Clostridium botulinum. Washing, pickling, fermenting, milling or chemical treatments are not sufficient.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

*DEFINITIONS: (Continued)

N/A: This level of reclaimed water not allowed for this use.

N/L: No limit.
X: Required treatment for this treatment level.
N/R: Not required.

FOOTNOTES:

1 Advisory Notice Only: The Oregon State Health Division recommends that there should be no irrigation of this level of effluent for 3 days prior to harvesting.

2 Surface irrigation where edible portion of crop does not contact the ground, and fruit or nuts shall not be harvested off the ground.

3 The Department may permit spraying if it can be demonstrated that public health and the environment will be adequately protected from aerosols. Advisory Notice Only: The Oregon State Health Division recommends that there should be no irrigation of this level of effluent for 30 days prior to harvesting.

4 Surface or spray irrigation: No animals shall be on the pasture during irrigation.

5 Signs shall be posted around the perimeter of the facility's perimeter and other locations indicating that reclaimed water is used for irrigation and is not safe for drinking, and in the case of effluent quality Levels II and III for body contact (e.g., for Level IV, ATTENTION: RECLAIMED WATER USED FOR IRRIGATION DO NOT DRINK . ATENCION: RECLAMADO DESPERDICIO DE AGUA USADO PARA LA IRRIGACION NO BEBA EL AGUA; for Levels II and III, ATTENTION: RECLAIMED WATER USED FOR IRRIGATION AVOID CONTACT DO NOT DRINK . ATENCION: RECLAMADO DESPERDICIO DE AGUA USADO PARA LA IRRIGACION EVITE EL CONTACTO NO BEBA EL AGUA).

6 Reclaimed water shall be applied in a manner so that it is not sprayed onto areas where food is pre-pared or served or onto drinking fountains.

7 Reclaimed water shall be applied in a manner so that it is not sprayed within 100 feet from areas where food is prepared or served or where drinking fountains are located.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

8 Signs shall be posted around the perimeter and other locations indicating that reclaimed water is used and is not safe for drinking, and in the case of effluent quality Levels II and III for body contact (e.g., for Level IV, ATTENTION: RECLAIMED WATER DO NOT DRINK . ATENCION: RECLAMADO DESPERDICIO DE AGUA NO BEBA EL AGUA; for Levels II and III, ATTENTION: RECLAIMED WATER AVOID CONTACT DO NOT DRINK . ATENCION: RECLAMADO DESPERDICIO DE AGUA EVITE EL CONTACTO NO BEBA EL AGUA).

9 The Department may impose more stringent limits on the use of reclaimed water if it believes it is necessary to protect public health and the environment.

10 There shall be no disposal of reclaimed waters into surface or groundwaters without authorization by an NPDES or WPCF permit.

11 Use of reclaimed water in evaporative cooling systems shall be approved only if the user can demonstrate that aerosols will not present a hazard to public health.

12 Members of the public and employed personnel at the site of the use of reclaimed water shall be notified that the water is reclaimed water. Provisions for how this notification will be provided shall be specified in the reclaimed water use plan.

13 Unless decontaminated in a manner approved in writing by the Oregon Health Division, tanker trucks or trailers that transport and/or use reclaimed water shall not be used to transport potable water intended for use as domestic water. A tanker truck or trailer used to transport and/or use reclaimed water shall have the words "NONPOTABLE WATER" written in 6-inch high letters on each side and the rear of the truck. The words "NONPOTABLE WATER" shall not be removed until decontamination as approved by the Health Division has occurred.

14 Aerators or decorative fixtures which may generate aerosols shall not be used unless approved in writing by the Department. Approval will be considered if it can be demonstrated that aerosols will be confined to the area of the impoundment or a restricted area around the impoundment.

TABLE 1: TREATMENT AND MONITORING REQUIREMENTS FOR USE OF RECLAIMED WATER* (Continued)

(Numbers in the Table refer to Footnotes)

ADVISORY NOTICE ONLY:

The Oregon State Health Division recommends that persons who must handle irrigation or other equipment for reclaimed wastewater or who are exposed to reclaimed water should be fully advised of any hazards associated with such exposure and should be provided with necessary protective clothing.

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

APPENDIX 8.2
IRRIGATION SITE PLAN

HGE INC

VARIABLE
200' MIN. - 250' MAX. SPACED TO PROVIDE 50' MIN. SEPARATION FROM TREES.

155'±

155'±

VARIABLE
200' MIN. - 250' MAX. SPACED TO PROVIDE 50' MIN. SEPARATION FROM TREES.

R = 155' TYP.

6" PVC TYP.

8" PVC TYP.

LATERAL CONNECTION SEE DETAIL 3/M6

200'

200'

210'±

10" PVC IRRIGATION HEADER

64'

DIKE IRRIGATION MAINS 4" SCH 40 PVC. TYP.

SOUTH 00°25'49" EAST, 2646.92'

160'±

225'±

VARIABLE
200' MIN. - 250' MAX. SPACED TO PROVIDE 50' MIN. SEPARATION FROM TREES.

NORTH 00°30'37" WEST, 2645.87'

R = 15' TYP.

DIKE IRRIGATION LATERALS & HEADERS 2" SCH 40 PVC. TYP.

DIKE SPRINKLER HEADS, SPACED EQUALLY AS SHOWN. (TYPICAL) SEE DETAIL 4/M6 6/M6

IRRIGATION LATERALS 2" SCH 40 PVC. TYP. LOCATE AS SHOWN.

SMALL SPRINKLER HEADS, SPACED EQUALLY AS SHOWN. (TYPICAL) SEE DETAIL 4/M6 6/M6

LGE SPRINKLER ASSY. TYP. SEE DETAIL 1/M6

SCALE: 1" = 100'

CONTOUR INTERVAL = 1'

DIKE IRRIGATION MAINS 4" SCH 40 PVC. TYP.

IRRIGATION LATERALS 2" SCH 40 PVC. TYP. LOCATE AS SHOWN.

NORTH 89°40'40" WEST, 2642.74'

9 10 16 15

ARCHITECTS, ENGINEERS, SURVEYORS, & PLANNERS
375 Park Avenue/Coos Bay, Oregon 97420 (541) 269-1166
19 N. W. Fifth Avenue/Portland, Oregon 97209 (503) 222-1687

SHEET TITLE: IRRIGATION SITE PLAN

PROJECT: WASTEWATER TREATMENT PLANT
CITY OF SISTERS
DESCHUTES COUNTY, OREGON.

REGISTERED PROFESSIONAL ENGINEER 6488 OREGON JULY 11, 1989 RICHARD D. ROMEO EXPIRES 12-31-00

PROJECT NO. 9811
DATE: DEC. 1999
DRAWN BY: T.J.S.

SHEET NO. App. B.2

CITY OF SISTERS
WASTEWATER SYSTEM
CAPITAL FACILITIES PLAN - FINAL

APPENDIX 9.1
SUMMARY FOR PATHOGEN REDUCTION REQUIREMENTS, VECTOR ATTRACTION REDUCTION REQUIREMENTS, and LAND DISPOSAL of BIOSOLIDS

HGE INC

Pathogen Reduction Requirements

Pathogen reduction requirements are divided into two categories: Class A and Class B. The goal of Class A requirements is to reduce the pathogen levels to non-detectable levels. Class B requirements are to ensure pathogen reduction to levels considered unlikely to pose a threat to public health or the environment under the specific use conditions, such as land application. Site restrictions apply to use of Class B sludge. Sludge produced by the City will only need to meet Class B requirements for land application.

The overall objective of the Class B requirement is to ensure that pathogenic bacteria and enteric viruses are adequately reduced in density, as demonstrated by a fecal coliform density in the treated sludge of 2 million MPN or CFU per gram total solids sewage sludge (dry weight basis). Viable helminth ova are not necessarily reduced in a Class B sludge. Class B requirements apply to bulk sewage sludge that is applied to agricultural land, a forest, a public contact site, or a reclamation site. Class B sewage sludge and domestic septage also must meet a vector attraction reduction requirement. Class B pathogen reduction requirements can be met by three different alternatives as follows:

Alternative 1: Monitoring of Fecal Coliform [§503.32(b)(2)] - Alternative 1 requires that seven samples of treated sewage sludge be collected at the time of use or disposal, and that the geometric mean fecal coliform density of these samples be less than 2 million CFU of MPN per gram of sewage sludge solids (dry weight basis).

Alternative 2: Use of PSRP [§503.32(b)(3)] - Alternative 2 provides continuity with the 40 CFR 257 regulation. Under this alternative, sewage sludge is considered to be Class B if it is treated in one of the "Processes to Significantly Reduce Pathogens" (PSRP) listed in Appendix B of Part 503. The PSRP's are listed below:

1.	Aerobic Digestion:	Solids retention time (SRT) of 40 days at 20°C (68°F) or 60 days at 15°C (59°F).
2.	Air Drying:	Sludge dried on sand beds or on paved or unpaved basins for a minimum of 3 months, of which 2 of the 3 months ambient temperature is above 0°C (32°F).
3.	Anaerobic Digestion:	SRT of 15 days at 35°C to 55°C (131°F) or 60 days at 20°C (68°F).
4.	Composting:	Composting where temperature is raised to 40°C (104°F) or higher for 5 days.
5.	Lime Stabilization:	Lime is added to sludge to raise the pH to 12 after 2 hours of contact.

Alternative 3: Use of a Process Equivalent to PSRP [§503.32(b)(4)] - Under Alternative 3, sewage sludge treated by any process determined to be equivalent to a PSRP is considered to be a Class B sewage sludge.

Site restrictions for agricultural land application are also defined in the regulations. The following restrictions would be relevant to sludge disposal by the City:

Animal Grazing [§503.32(b)(5)(v)] - Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

Public Access [§503.32(b)(5)(vii)] - Public access to land with a low potential for public exposure shall be restricted for 30 days after application of the sewage sludge.

Vector Attraction Reduction Requirements

Vectors are any living organisms capable of transmitting a pathogen from one organism to another. Transmission may occur by physically transporting the pathogen, or by biologically playing a specific role in the pathogen's life cycle. Vectors for sewage sludge pathogens generally include insects, birds, and rodents. The vector attraction reduction requirements were therefore developed to reduce the possibility of pathogen transport. The 40 CFR 503 regulations provide 12 options for demonstrating reduced vector attraction. They are designed to either reduce the attractiveness of sewage sludge to vectors or to prevent vector contact with the sludge.

Seven of the 12 options may be applicable to small community sludge management needs. Three options are relevant to the aerobic digestion process, three options are relevant to further conditioning beyond digestion, and the seventh option is concerned with the land application practices. These options are discussed below:

Option 1: Reduction in Volatile Solids Content - Vector attraction reduction is achieved if the mass of volatile solids in the sewage sludge is reduced by at least 38% during sludge treatment.

Option 3: Additional Digestion of Aerobically Digested Sewage Sludge - An aerobically digested sewage sludge with 2% or less solids has achieved vector attraction reduction if it loses less than 15% additional volatile solids when it is aerobically batch-digested in the laboratory in a bench-scale unit at 20°C (68°F) or higher for an additional 30 days.

Option 4: Specific Oxygen Uptake Rate (SOUR) for Aerobically Digested Sewage Sludge - Vector attraction reduction is demonstrated if the SOUR of the sludge is equal to or less than 1.5 mg of oxygen per hour per gram of total sewage sludge solids at 20°C(68F).

Option 5: Aerobic Treatment of Sewage Sludge - Aerobic treatment of sewage sludge for at least 14 days at over 40°C with an average temperature of over 45°C (113°F); appropriate for composted sewage sludges.

Option 6: Addition of Sufficient Alkali - Addition of sufficient alkali to raise the pH to at least 12 at 25°C (77°F) and maintain a ph ≥12 for 2 hours and pH ≥ 11.5 for 22 more hours. Alkalies include lime, fly ash, kiln dust, and wood ash.

Option 7: Percent Solids ≥ 75% - Percent solids ≥ 75% prior to mixing with other materials; appropriate for sludges treated by aerobic and anaerobic processes in which the sludge does not contain unstabilized solids generated in primary wastewater treatment.

Option 10: Incorporation of Sewage Sludge into the Soil - Sewage sludge applied to the land must be incorporated into the soil within 6 hours of application to the land.