CHAPTER 1

EXECUTIVE SUMMARY

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This facilities plan presents the results of the planning effort conducted for the City of Lebanon's wastewater treatment system. The plan summarizes the service area and wastewater characteristics, identifies the components of the existing wastewater collection and treatment system, evaluates the performance of the treatment system with respect to water quality and regulatory standards, and analyzes alternatives for improvements that will remedy system deficiencies and accommodate future growth. Based on this analysis, the facilities plan recommends specific projects for inclusion in the wastewater treatment system Capital Improvement Plan (CIP). These projects will ensure that the Lebanon plant continues to provide adequate and reliable service for the community.

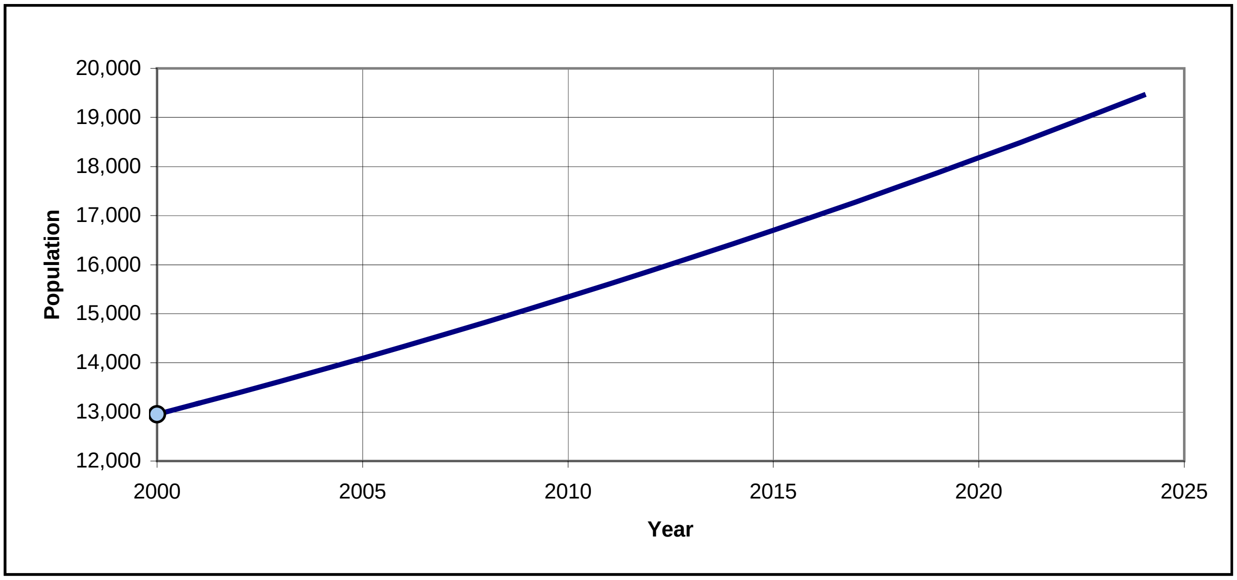
This wastewater management planning study has been conducted to ensure a cost effective and environmentally responsible approach. Planning for community growth and meeting water quality requirements were both influential factors that guided the development of the recommended plan. Since the planning period for this study is 20 years, the projections and analysis are conducted through the year 2024. Following is a summary of the planning work completed and the recommendations.

SERVICE AREA CHARACTERISTICS

The area served by the Lebanon Wastewater Treatment Plant (WWTP) is situated on the eastern edge of the central Willamette Valley in Western Oregon. The study area for the wastewater facilities plan includes land within the City of Lebanon's urban growth boundary (UGB). The city limits roughly define the portion of the study area that is currently served by the City's wastewater collection and treatment system. This area currently encompasses approximately 3,500 acres of land while the overall UGB service area encompasses approximately 6,500 acres.

The current population and projected population growth within the service area are the key parameters in projecting future sewage flows and loads. These projections are used to assess the adequacy of existing infrastructure and develop design criteria for future treatment and reuse systems. The 2000 certified population estimate for Lebanon is 12,950 people. The Linn County Planning Department projects that the population growth rate for Lebanon will be 1.71 percent per year. Figure 1-1 illustrates the resulting growth in population anticipated through the year 2024. Under this growth scenario, the Lebanon population will increase to 19,450 by the year 2024. This population projection is used to project year 2024 wastewater flow and loading rates.

Figure 1-1. Lebanon Population Projections



WASTEWATER CHARACTERISTICS

The key wastewater characteristics at the WWTP are the flow, solids, and organic loadings that are treated by the facility. Analysis of historical plant influent flow and loading data allows for a characterization of the City's system under current conditions and provides the basis for developing flow and load projections for the system in the future. Table 1-1 summarizes current wastewater flows and Table 1-2 summarizes current loads.

Table 1-1. Current Wastewater Flows

Flow Parameter	Flow Rate, mgd
Average Dry Weather Flow (ADWF)	2.1
Average Wet Weather Flow (AWWF)	5.7
Maximum Month Dry Weather Flow (MMDWF)	4.4
Maximum Month Wet Weather Flow (MMWWF)	8.3
Peak Day Flow (PDF)	15.0
Peak Wet Weather Flow (PWWF)	21.0

Table 1-2. Current Plant Influent Loads

Parameter	BOD Load, lbs/day	TSS Load, lbs/day	Ammonia Load, Lbs/day
Average	2,300	2,300	700
Maximum Month	3,200	3,300	1,300
Maximum Week	3,700	4,000	1,600
Peak Day	4,700	5,000	1,900

Flow and load projections are based on current flows and loads and anticipated community growth. As noted earlier, the population of Lebanon is expected to grow at a rate of 1.71 percent per year to 19,450 by the year 2024. Assuming that land development will progress at a similar rate, Lebanon will achieve build-out of the existing UGB by the year 2056 at a population of 33,500. Using this information, Table 1-3 presents flow projections and Table 1-4 presents load projections for the year 2024 and build-out conditions. The peak flow projections account for the effect of ongoing infiltration and inflow (I/I) reduction activities as well as lower levels of I/I from future sewer system extensions.

Table 1-3. Projected Plant Flow

Parameter	Year 2024, mgd	Build-Out, mgd
Average Dry Weather Flow (ADWF)	3	5
Average Wet Weather Flow (AWWF)	8	14
Maximum Month Dry Weather Flow (MMDWF)	7	12
Maximum Month Wet Weather Flow (MMWWF)	12	21
Peak Day Flow (PDF)	20	26
Peak Wet Weather Flow (PWWF)	26	36

Table 1-4. Projected Plant Influent Loadings

Parameter[a]	Year 2024			Build-Out		
	BOD, lbs/day	TSS, lbs/day	Ammonia, lbs/day	BOD, lbs/day	TSS, lbs/day	Ammonia, lbs/day
Annual Average	3,500	3,500	1,100	6,100	6,100	1,800
Maximum Month	4,900	4,900	2,100	8,500	8,500	3,500

[a]Projections based on wet weather loading data.

TREATMENT REQUIREMENTS

While existing requirements for treatment are a starting point for planning, it is important to assess the most likely future treatment requirements as well. Water quality in the South Santiam River is the best indication of future changes in requirements.

Based on an assessment of existing water quality in the river, future treatment requirements at the plant should be similar to those contained in the existing permit. While numerous streams in Oregon are water quality limited for nutrients, data from the South Santiam River does not indicate that a nutrient limit will be necessary during the planning period of this facilities plan. An analysis of ammonia toxicity indicates a reasonable potential that the water quality criteria for ammonia is exceeded with the existing discharge system. The current permit includes an ammonia limit and the MAO provides a timetable for making improvements. Regarding water quality on the South Santiam River with respect to the temperature standard, it is unclear precisely what thermal discharge restrictions will be placed on the City's discharge. New permits being issued by DEQ for streams that are temperature limited include a heat load limit that prevents the discharge from causing a measurable increase.

Finally, the effluent mass load limits in the existing permit are likely to remain fixed. As the plant is expanded, these fixed mass loads for effluent BOD and suspended solids will result in lower allowable discharge concentrations of these constituents. There may be opportunities to obtain a waiver from the DEQ for mass load limits during a maximum month wet weather flow period since the effect of the plant's discharge on water quality is negligible at these times, but otherwise treatment performance will likely need to be enhanced as necessary to maintain compliance with the existing mass load limits.

LIQUID STREAM ALTERNATIVES

The liquid stream treatment facilities at the Lebanon WWTP are currently able to satisfy most of the requirements set forth in its National Pollutant Discharge Elimination System (NPDES) permit. For those permit requirements that the plant currently does not meet, the City follows the requirements of a Mutual Agreement and Order (MAO) with the Department of Environmental Quality (DEQ). However, some process improvements are necessary in the near term to maintain regulatory compliance. In addition, long term upgrades are necessary to ensure that the facilities can handle increased flows and loads from Lebanon's growing population and improve treatment as dictated by potentially more restrictive future permit requirements.

Liquid Stream Improvement Alternatives by Unit Process

Several of the liquid stream unit processes at the Lebanon WWTP will require improvements over the next twenty years. For each unit process requiring improvement, the following sections identify the alternatives considered along with the results of the evaluation.

Headworks. The alternatives considered for improvement of the headworks included the following:

- Renovation of the existing headworks.
- Construction of a new headworks.

Renovation of the existing headworks is clearly the least expensive alternative for providing the necessary screening capacity through the year 2024. After the year 2024, the City will eventually need to expand capacity at both the headworks and downstream aeration basins. At that time, construction of a new headworks will likely be required.

Aeration Basins. The alternatives considered for improvement of the aeration basins included the following:

- Replacement of the existing surface aerators.
- Conversion to fine bubble diffusers.

Replacement of the existing surface aerators is the most cost-effective alternative for providing the required aeration capacity through the end of the planning period. The considerable expense of converting to fine bubble diffusers and constructing a new blower facility is not justified because there is little gain in aeration efficiency due to the relatively shallow depth of the aeration basins. In addition to replacement of the aerators, the aeration basins should be modified to allow for operation in sludge reaeration mode. The capability to operate in sludge reaeration mode is important since it significantly enhances the ability of the existing aeration basins to handle peak flows and allows the City to postpone expansion of the basins.

Secondary Sedimentation. The alternatives considered for improvement of the secondary sedimentation facilities included the following:

- Construction of an additional secondary clarifier.
- Construction of multiple ballasted sand sedimentation units.

At this time, Lebanon's NPDES permit requires full secondary treatment of peak wet weather flows. Based on this requirement, the less expensive ballasted sand sedimentation alternative is not a viable option. However, the EPA may consider ballasted sand sedimentation systems to be equivalent to secondary treatment and ongoing evaluations of the process are underway at various locations in Oregon. Depending on the results, the alternative may become viable in the future. Therefore, for the time being, the City should continue planning for full secondary treatment through the addition of a new secondary clarifier. Meanwhile, the City should monitor the ongoing evaluations of the ballasted sand system since it may represent an opportunity for some capital cost savings.

Disinfection System. The alternatives considered for improvement of the disinfection system included the following:

- Minor chlorination system improvements and dechlorination.
- Chlorine disinfection expansion and dechlorination.
- Conversion to UV disinfection.

Minor chlorination system improvements and dechlorination was clearly the most cost-effective approach due to the avoided capital costs associated with capacity expansion and process conversion. Adequate treatment performance with the existing system can be assured by using a control system to increase chemical dosage rates as necessary during periods of high flow/low contact time. It is recommended that the City defer major investments in additional chlorine contact basins until after the year 2024.

Strategies for Treating Dry Weather Flows

Strategies for the treatment of wastewater during the dry weather season must account for the following considerations:

- The WWTP's current dry weather mass discharge limits will not change, but influent flows and loads will increase.
- Compliance with the temperature standard will likely require Lebanon to mitigate the thermal impact of the discharge to the South Santiam River.

These issues can be addressed through either the addition of treatment processes or curtailment of direct discharges to the river. This facilities plan compares three dry weather treatment strategies that address the above considerations: effluent reuse, filtration and cooling, and subsurface discharge to the river.

Dry Weather Strategy 1—Effluent Reuse. Under an effluent reuse strategy, the WWTP would produce Level III reclaimed water which is suitable for irrigation of non-food crops. For irrigators, reclaimed wastewater represents an inexpensive source of water that can satisfy a portion of a crop's nutrient requirements, thus providing a savings in fertilizer expenses. For the City, the ability to direct effluent toward crop irrigation allows for the reduction or elimination of discharges to the South Santiam River during the dry weather season. In this way, a reuse program would mitigate the impact of plant discharges on river temperature as well as improve the plant's ability to meet seasonal mass discharge limits.

Dry Weather Strategy 2—Advanced Treatment. Another strategy for maintaining compliance with in-stream standards is to provide filtration and cooling during the dry weather season. This approach includes the installation of chillers to cool the effluent and additional filters to comply with the existing mass discharge limits for BOD and TSS.

Dry Weather Strategy 3—Subsurface Discharge. Indirect discharge to the river by means of subsurface infiltration would also achieve compliance with the in-stream temperature standard by using the earth to cool the effluent before it reaches the river. As discussed later, the City has identified a promising candidate site where this discharge strategy could be implemented.

Evaluation of Alternatives. Selection of an appropriate dry weather treatment strategy depends significantly on how the regulators implement the temperature standard as well as how they permit an innovative approach such as the subsurface discharge strategy. Evaluation of the alternative strategies on the basis of costs indicates that the subsurface discharge strategy should be selected as the preferred approach. The higher capital costs and ongoing operational costs associated with a mechanical cooling system indicate it is not an appropriate approach. Although the effluent reuse strategy has become an increasingly common approach for dry weather treatment in recent years, the required capital costs for implementing a reuse program and the ongoing operation and maintenance costs are high relative to the subsurface discharge alternative that is available to the City of Lebanon.

Strategies for Treatment of Peak Flows

The WWTP has a current PWWF treatment capacity of approximately 12 mgd as determined by an evaluation of the existing secondary clarifiers; this compares to an estimated existing peak flow of 21 mgd and a projected year 2024 PWWF of 26 mgd. Two peak flow treatment alternatives were evaluated: peak flow attenuation through storage in lagoons and provision of additional secondary treatment capacity.

Peak Flow Strategy 1—Peak Flow Attenuation Through Storage in Basins. Under this alternative, peak flows in excess of the WWTP treatment capacity would be diverted to holding basins for temporary storage. The stored wastewater would be routed back to the WWTP after high influent flows subside. By attenuating peak wet weather flows in this manner, the required hydraulic capacity of many unit processes at the WWTP would be reduced, thus eliminating of postponing the need for certain capacity expansions. Unit processes that are sized for peak flow conditions include the headworks, clarifiers, disinfection system, and outfall.

Peak Flow Strategy 2—Conventional Treatment. Under this strategy, the treatment facility will be expanded so the entire peak flow is provided with secondary treatment. Each unit process would be upgraded to allow for the treatment of the full year 2024 peak wet weather flow of 26 mgd.

Evaluation of Alternatives. Comparison of capital cost estimates shows that there is a tremendous expense associated with constructing a sufficient volume of raw sewage storage facilities to provide temporary storage of peak wet weather flows. While the total expense of plant capacity expansions required for full conventional treatment is also considerable, it is still less than half the cost of raw sewage storage. Therefore, it is recommended that the City plan to provide treatment for the peak wet weather flow of 26 mgd.

SOLIDS PROCESSING ALTERNATIVES

There are numerous process combinations available for solids management which are capable of providing effective solids treatment prior to disposal. In addition to aerobic digestion, anaerobic digestion or lime stabilization could be used to meet the regulatory requirements for pathogen and vector attraction reduction. Since there is no compelling reason to replace the existing process, the most economical approach is to maintain the existing aerobic digestion system.

Based on a review of system capacity and performance and the regulatory conditions that govern the solids management program, alternatives for storing biosolids during the wet season need to be considered. With adequate storage facilities available, the existing system can process the projected volumes of biosolids for the duration of the planning period. Either liquid or solids storage is feasible and both were considered.

Alternative 1—Lagoon Storage. One of the most cost effective and operationally flexible storage systems used is a facultative lagoon. These lagoons are sized based on the volatile solids loading and are operated with a water cap above the solids to provide an aerobic zone above the anaerobic solids. The solids stored in a facultative lagoon can be either aerobically or anaerobically digested, although the risk of odor issues is considered to be higher when storing solids from aerobic digesters. It is anticipated that the City's existing lagoons could be upgraded to serves as sludge lagoons. Improvements would include new levees to create two lagoons; a dredge for sludge removal; piping improvements; surface aerators to ensure an aerobic upper water level; and a synthetic membrane liner.

Alternative 2—Dewatered Solids Storage. By dewatering the solids after digestion, the volume of storage required is reduced by a factor of six. Dewatered solids can be stored in a covered area similar to the solids storage building that is on site. The dewatering alternative would require construction of a new dewatering facility including a building, belt filter press or centrifuge, related pumping systems, conveyor system to move the dewatered solids, chemical feed systems, and polymer storage. For the land application program, new field application equipment would be needed along with a front end loader to load solids at the plant site, a dump truck, tractor, manure spreader, and front-end loader at the biosolids application site.

Alternative 3—Lime Stabilization. Lime stabilization is a treatment process that could be used to generate either Class A or Class B biosolids, depending on the specific process used. In general, producing a Class A product requires higher temperatures and extended times at high pH levels. Major components of a typical lime stabilization system include: sludge grinders; a belt filter press to dewater the sludge; belt filter press ancillary systems, such as polymer feed system and sludge feed pumps; a dewatered sludge screw conveyor; a lime storage silo and feed system; a sludge/lime mixer; and a belt conveyor. The system is very similar to Alternative 2, with the addition of the lime storage and mixing systems.

Evaluation of Alternatives. The solids processing alternatives were evaluated according to both economic and non-economic factors. Based on these evaluations, dewatered sludge storage was selected as the preferred alternative. This alternative could also be considered to be the first phase of a lime stabilization system since the dewatered sludge storage facilities will provide all of the necessary equipment with the exception of the lime storage and mixing.

RECOMMENDED PLAN

Based on an assessment of the capacity of existing unit processes and alternatives for improvements, recommendations are made for the wastewater treatment system CIP. Estimated costs for the recommended improvements are summarized in Table 1-5. These costs are all shown at year 2004 cost levels and need to be adjusted when planning for projects that will be implemented in the future. CIP projects are organized according to the anticipated improvement period.

Table 1-5. Recommended Plan Cost Summary
(2004 Dollars at ENR CCI 7,000)

Description	Cost, $1,000			
	Construction	Contingency	Engineering and Administration	Total
Phase 1 Improvement Projects Present-2007				
I/I Removal and Rehabilitation	990	198	238	1,426
Subsurface Discharge Program	2,420	484	581	3,484
Aerobic Digester Surface Aerator	54	11	13	78
Dewatered Sludge Storage System	2,082	416	500	2,998
Dechlorination System	275	55	66	396
West Side Interceptor	1,698	339	407	2,444
Phase 2 Improvement Projects Year 2007-2012				
Headworks Renovation	482	96	115	693
Aeration Basin Equipment Replacement	446	89	107	642
Aeration Basin Modifications Sludge Reaeration	241	48	58	347
Secondary Clarifier	2,400	480	576	3,456
Chlorination Improvements	75	15	18	108
Holding Tank and Septage Receiving Station	154	31	37	222
Administration Building Expansion	174	35	41	250
Old Influent Pump Station VFDs and Controls	200	40	48	288
West Side Interceptor	3,258	652	782	4,692
Odor Control – Buffer Land Acquisition	--	--	--	600
I/I Removal and Rehabilitation	456	91	109	656
Phase 3 Improvement Projects Year 2012-2018				
Odor Control – Buffer Land Acquisition	--	--	--	300
West Side Interceptor	3,962	793	951	5,706
Facility Plan Update	--	--	--	100
Phase 4 Improvement Projects Year 2018-2024				
West Side Interceptor	2,206	441	529	3,176
Facility Plan Update	--	--	--	100
Total Cost	21,573	4,314	5,176	32,162