CHAPTER 10

RECOMMENDED PLAN

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This chapter recommends improvements to the wastewater treatment system based on the capacity assessment of existing unit processes and the evaluation of alternatives. Priorities for the recommended improvements are also presented in this section and are the basis for the development of a construction staging plan.

RECOMMENDED PROCESS IMPROVEMENTS

Improvements will be needed at facilities throughout the plant over the course of the planning period. These facility improvements are necessary to maintain acceptable performance and reliability of the Lebanon WWTP over the next twenty years.

A layout of the site showing the new facilities is provided as Figure 10-1. An assessment for providing additional treatment capacity at the plant through build-out has been included. Therefore, Figure 10-1 also shows the locations for future treatment units that are not required during the current planning cycle. These facilities are shown on the layout to ensure that an adequate space allowance for logical expansion of the plant is considered.

Design data for the unit processes requiring improvements are included in Table 10-1. Data for the existing system as well as the facilities needed in 2024 are shown.

The following sections summarize the recommended improvements for each unit process at the wastewater treatment plant. The discussion includes the reason for the recommendation and the relative importance of the improvements. Depending on the relative importance of the improvement, it is assigned to either the Phase 1 (targeted for completion during the period from present to 2007), Phase 2 (2007-2012), Phase 3 (2012-2018), or Phase 4 (2018-2024) improvement period.

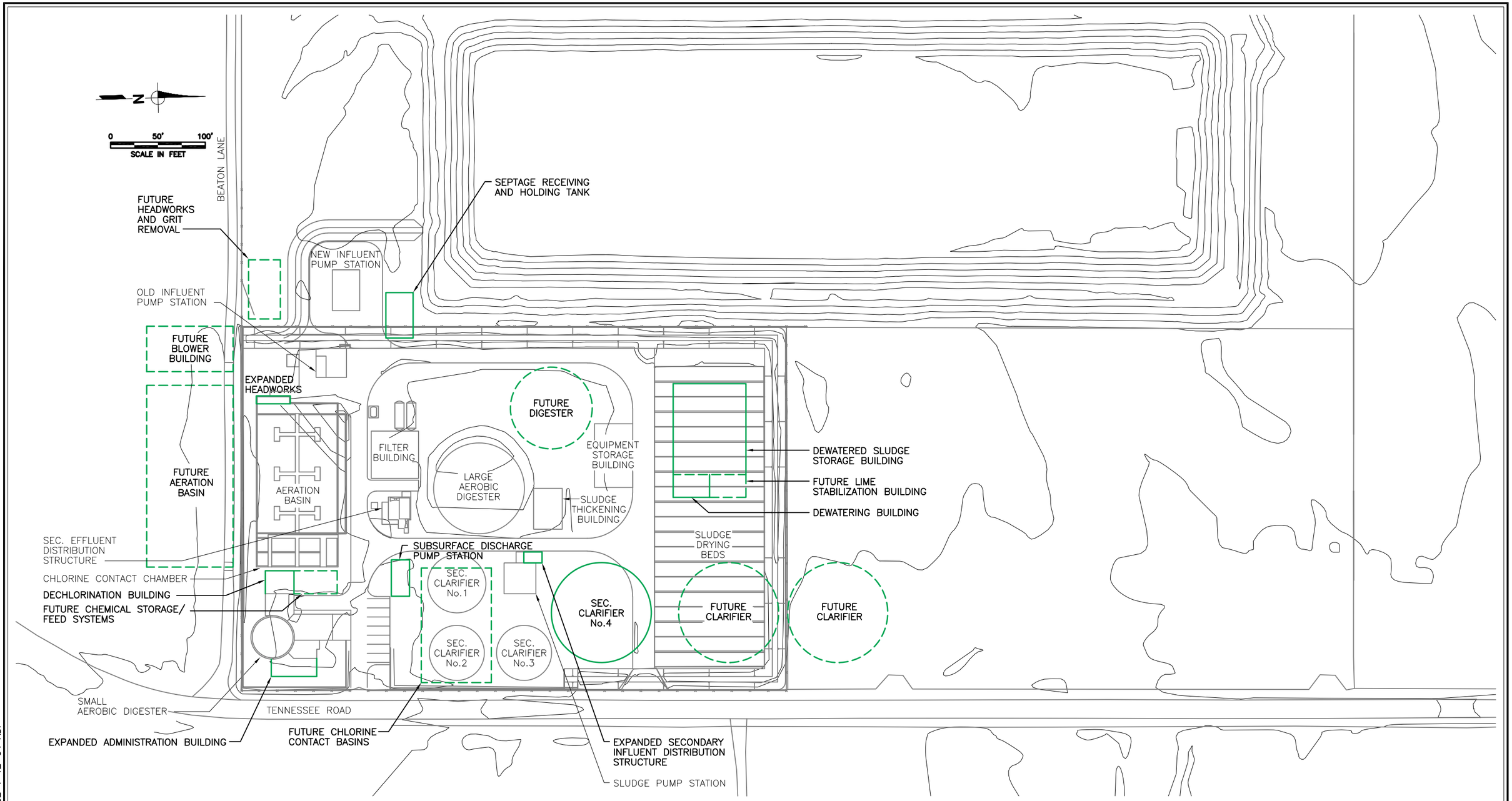
Headworks. The single existing mechanically raked bar screen has a capacity of 7 mgd. This compares to the projected year 2024 PWWF of 26 mgd. The total capacity of the headworks can be increased to 32 mgd through renovations to the structure and the addition of a second mechanical bar screen to the existing bypass channel. Continued operation without automated screening for the full peak wet weather flow or mechanical screen redundancy is likely to cause operational challenges, but the ability to do so does provide some flexibility in selecting the timing for this project. Since the plant's ability to treat peak flows will increase significantly once a new secondary clarifier comes on line, implementation of the headworks improvements will become a high priority at that time. Therefore, it is recommended that this project be coordinated with the new secondary clarifier during the Phase 2 improvement period.

Table 10-1. Design Data for the Recommended Improvements

Description	Value	
	Current	Year 2023
Headworks		
Mechanically cleaned bar screens		
Number	1	2
Channel width, ft	3	3, 4
Maximum flow, each, mgd	6.9	9, 23
Manually cleaned bar screens		
Number	2	2
Channel width, ft	2.5, 3	2.5, 3
Maximum flow, mgd	11.4, 13.7	14, 17
Aeration Basins		
Number	2	2
Dimensions, each		
Length, ft	130	130
Width, ft	43	43
Average depth, ft	11.1	11.1
Volume, total, 1,000 cu ft	125	125
Aeration Equipment		
Number of Surface Aerators	6	6
Power, HP	20	50
Secondary Clarifiers		
Number	3	4
Dimensions, each		
Diameter, ft	60, 2 @ 55	60, 2 @ 55, 1 @ 110
Depth, ft	10	3 @ 10, 1 @ 18
Overflow rate		
Maximum flow, gpd/sq ft	1,200	3 @ 1,200, 2 @ 1,850
Total Design Flow, mgd		
RAS Pumps		
Number	4	6
Capacity, each, mgd	1.45	4 @ 1.45, 2 @ 2.5
Dechlorination System		
Sodium bisulfite		
Storage tanks	-	1
Metering pumps	-	2
Residual analyzer	-	1
Subsurface Discharge Pumping Station		
Capacity, mgd	--	26
Large Aerobic Digester		
Dimensions, ft		
Diameter	95	95
Depth	10	10
Total volume, 1,000 ft^3		71

Description	Value	
	Current	Year 2023
Mechanical aerators		
Number		4
HP		20
Dewatering System		
Type		Belt filter press
Number		1
Belt width, meters		1
Feed rate, gpm		30
Dewatered sludge concentration, %		18
Polymer feed system		
Number		1
Type		Liquid
Digested sludge feed pumps		
Number		2
Type		Positive displacement
Dewatered sludge conveyance system		
Number		1
Type		Belt conveyor
Dewatered Biosolids Storage		
Existing storage building		
Area, ft^2	2,800	
Storage depth, feet	6	
Storage volume, yd^3	600	
New storage building		
Area, ft^2		4,100
Storage depth, feet		6
Storage volume, yd^3		900
Total storage volume, yd^3	600	1,500
Land Application Equipment		
Front-end loader		
Number		2
Dewatered sludge trucks		
Number		2
Tractor		
Number		1
Manure spreader		
Number		1
Septage Receiving Station	-	1

Grit Removal. The addition of grit removal facilities to the WWTP is not necessary at this time. Continued annual cleaning of the aeration basins should be an adequate technique for managing grit at the plant. The addition of grit removal will make more sense in the next planning period when the aeration basins require expansion.



LEGEND

- EXISTING FACILITIES
- FACILITIES NEEDED BY 2024
- FUTURE FACILITIES NEEDED FOR BUILD–OUT

FIGURE 10-1

RECOMMENDED PLANT LAYOUT

WEST YOST & ASSOCIATES

516-00-02-FIG-10-1 4MV-FULL.PC2 4-12-04 ADP

Aeration Basins. The important improvements at the aeration basins during the next planning period are replacement of the surface aerators with higher capacity units and renovation to allow for operation in sludge reaeration mode. Replacement of the existing aeration equipment will provide sufficient oxygen transfer capacity to satisfy aeration basin oxygen demands through the year 2024. By renovating the basins for sludge reaeration, the existing aeration basin volume will be sufficient for handling peak wet weather flows without excessive loss of solids. Since analysis of the plant loading data indicates that the existing aerators may reach capacity in a few years, replacement of this equipment will be necessary in the near term future. Renovations for sludge reaeration mode will not be necessary until the secondary treatment capacity is expanded.

Secondary Clarifiers. The existing secondary clarifiers are currently operating at or above their design capacity of 12 mgd during peak wet weather events. However, the addition of a chemical coagulant upstream of the clarifiers has allowed them to maintain adequate performance even under the peak flow conditions. In order to treat the projected year 2024 peak wet weather flow of 26 mgd, a new 110-foot clarifier will be required. Construction of the secondary clarifier is needed soon, but could be deferred until the second phase of improvements.

Disinfection System. The existing disinfection system is adequately sized for the projected peak wet weather flows, but must be modified to include a dechlorination system to eliminate chlorine residual in the effluent. Since the WWTP is required to address the problem of excessive chlorine residuals as part of their Mutual Agreement and Order (MAO), this improvement is a high priority project that should be targeted for completion in Phase 1. Additional minor improvements may be required during the planning period to upgrade chlorination capacity and performance.

Aerobic Digester. The existing aerobic digesters will have adequate capacity to stabilize solids for the duration of the planning period. The only improvement project recommended for the digesters is the addition of a fourth surface aerator for the large aerobic digester. This aerator will improve mixing and reduce the risk of odor problems. This project should be targeted for completion in the first improvement period along with the solids management improvements described below.

> Solids Dewatering and Storage. The plant is currently lacking adequate solids storage capacity which causes significant operational challenges. The recommended improvements include construction of a sludge dewatering facility and a major expansion of dewatered solids storage capacity. Since the storage capacity deficiency has presented ongoing problems at the plant, these improvements are recommended for the first improvement period.

Odor Control. Other than ensuring that the treatment plant equipment is adequately sized to meet oxygen demands at the aeration basins and aerobic digester, the next most important action the City can take at this time with respect to odor control is to ensure that the plant is surrounded by an adequate buffer. The presence of buffer lands around the plant will ensure that nuisance odors related to the headworks or occasional plant upsets will be minimized. Therefore, the City should look for opportunities to continue purchasing or otherwise improve control over development in buffer lands throughout the planning period.

I/I Removal and Rehabilitation. Collection system rehabilitation work is necessary to correct system deficiencies identified during the City's ongoing inspections of the system. The City will be responsible for rehabilitating deficiencies in the public system (e.g. connected catch basins, leaking sewer pipes and manholes, etc.) and will need to notify property owners of their responsibility to repair deficiencies in private sewer laterals. Completion of the rehabilitation work should be targeted for the first and second improvement periods. For the rest of the planning period, the City should maintain an annual budget for collection system rehabilitation.

Other Improvements. In addition to the unit processes described, other improvements will be required at the WWTP. These recommended improvements include the following:

- Construction of a holding tank and septage receiving station to meet local septage disposal needs.
- Expansion and renovation of the administrative building to provide additional space for control system equipment, laboratory facilities, offices, conferencing and lunchroom/kitchen facilities.
- VFD and control system upgrades at the old influent pump station to replace aging equipment.
- Extensions of the new West Side Interceptor to serve growth within the UGB.

CAPITAL IMPROVEMENT PLAN

The Capital Improvement Plan (CIP) provides a road map for the City of Lebanon that identifies the location, timing, and estimated cost of the recommended improvement projects that are necessary to maintain reliable operation of the WWTP. The CIP is based on the recommended improvements developed in Chapters 7 and 8 and summarized above. The following sections summarize the details of the recommended CIP.

Basis for Cost Estimates

The cost estimates presented in this report are planning level estimates. Such estimates are approximate and made without detailed engineering design data. Construction and operating costs for the improvement projects are based on preliminary layouts. Estimates were prepared using the construction costs of similar plants when possible. When these costs were not available, construction costs were obtained from available cost curves and EPA process design manuals. Since these cost estimates are based on conceptual design data, they may change as more detailed design information is developed.

Costs can be expected to undergo long-term changes in keeping with corresponding changes in the national economy. One of the best available barometers of these changes is the *Engineering News-Record* (ENR) construction cost index. It is computed from the prices for structural steel, portland cement, lumber, and common labor, and is based on a value of 100 in the year 1913.

The costs developed in this report are based on the current ENR 20-city index of 7,000 which was the index in April 2004. The costs presented here may be related to those at any time in the past or future by applying the ratio of the then-prevailing cost index to 7,000.

Because of the limitations of cost estimates based on planning information, cost estimates must allow for unanticipated improvements, variation in final quantities, adverse construction conditions, and other unforeseeable difficulties that will increase the final construction cost. Therefore, the total construction cost includes a contingency allowance of 20 percent of the estimated cost.

The cost of engineering services for major projects typically includes special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, construction management, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 12 to 20 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects and to projects that involve extensive remodeling of existing facilities. For the Lebanon plant, where new projects will involve both expansion of an existing plant and some construction of new systems, it is anticipated that total engineering costs will average 15 percent of the contract cost.

The City of Lebanon has its own administrative costs associated with any major construction project. These include internal planning and budgeting, the administration of engineering and construction contracts, legal services, and liaison with regulatory and funding agencies. For a typical project similar in size to the works described in this report, the city's administrative costs are estimated at 5 percent of the contract cost.

The combination of engineering and administrative costs is 20 percent and is applied to the total construction cost.

Capital Cost Summary

Estimated costs for the recommended improvements are summarized in Table 10-2. These costs are all shown at year 2024 cost levels and need to be adjusted when planning for projects that will be implemented in the future. Projects are organized according to the anticipated improvement period.

Based on the general outline of capital improvement plan projects identified in Table 10-2, Table 10-3 provides a recommended implementation schedule for the capital improvement plan over the full planning period.

Table 10-2. 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

Table 10-3. Recommended CIP Implementation Schedule (2004 Dollars at ENR CCI 7,000)

Project Description	Fiscal Year																				
	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
Subsurface Discharge Program	814	2,670																			3,484
Dechlorination System	66	330																			396
Aerobic Digester Surface Aerator		13	65																		78
Dewatered Sludge Storage System		500	2,498																		2,998
Odor Control – Buffer Land Acquisition				300			300		300												900
I/I Removal and Rehabilitation		778	648			656															2,082
Headworks Renovation				115	578																693
Aeration Basin Equipment Replacement				107	535																642
Aeration Basin Sludge Reaeration Modifications				58	289																347
Secondary Clarifier				576	2,880																3,456
Chlorination Improvements				18	90																108
Holding Tank and Septic Receiving Station						37	185														222
Administration Building Expansion/Renovation								250													250
Old Influent Pump Station VFDs and Controls								288													288
West Side Interceptor			2,444		2,193			2,499			3,689			2,017			3,176				16,018
Facility Plan Update										100										100	200
Total	880	4,291	5,655	1,174	6,565	693	485	3,037	300	100	3,689	0	0	2,017	0	0	3,176	0	0	100	32,162