CHAPTER 4

EXISTING WASTEWATER TREATMENT FACILITIES

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A review of the City of Lebanon's existing wastewater treatment facilities forms the framework for the development of a long-term plant upgrade strategy. Analysis of historical plant operating data can reveal any ongoing performance deficiencies. Identification of the design capacity of each existing unit process can indicate the need to expand facilities when compared to the projections of future flows and loads. In addition, the existing facilities information allows for the determination of how new facilities can be best integrated into the system to achieve long-term upgrade requirements.

The Lebanon Wastewater Treatment Plant (WWTP) is located near the South Santiam River at the northeast corner of the City's urban growth boundary. The original plant began operation at this site in 1954 and consisted of a grit channel, comminutor, primary clarifier, trickling filter, secondary clarifier, chlorine contact channel, digester, and sludge drying beds. The trickling filter (now serving as an aerobic digester), the primary clarifier (now serving as a secondary clarifier), and the secondary clarifier are the only remnants of the old plant.

In 1977, a major upgrade and expansion converted the plant to a conventional activated sludge process. The expansion project was designed to meet wastewater flow and loading needs through 1995. The plant upgrades constructed at that time included an additional influent sewer, a raw sewage pump station, a combined headworks-aeration basin-chlorine contact chamber, a secondary clarifier, a sludge pumping station, a pressure filtration building, sludge drying beds, a sludge storage building, control building additions, and modifications to an existing trickling filter and primary clarifier.

WWTP DESCRIPTION

The current layout of the Lebanon WWTP is presented in Figure 4-1. The site is bordered by Beaton Lane to the south and Tennessee Road to the east. Otherwise, the plant site is surrounded to the west and north by land zoned for general industrial uses. The adjacent industrial land could be a valuable asset for future plant expansions.

Figure 4-2 provides the overall plant flow schematic, while Table 4-1 outlines the design data for treatment units and major equipment. The functions of the unit processes are described in the following sections.

Table 4-1. Design Data

Description	Value
Design Flows	
Average Dry Weather (ADWF), mgd	3.0
Maximum Month Wet Weather, mgd	7.2
Peak Wet Weather (PWWF), mgd	14.5
Design Loadings	
Design Population Equivalent	15,000
BOD, lbs/day	3,300
SS, lbs/day	2,550
Old Influent Pump Station	
Raw Sewage Pumps	
Number	1
Type	Centrifugal, Dry Pit
HP (variable speed)	25
Capacity, Each, gpm	1,800
Head, feet	28
Number	1
Type	Centrifugal, Dry Pit
HP (variable speed)	50
Capacity, Each, gpm	4430
Head, feet	30
Number	2
Type	Centrifugal, Dry Pit
HP (variable speed)	75
Capacity, Each, gpm	6200
Head, feet	35
Sump Pump	
Number	2
Type	Submersible
HP (Constant speed)	0.75
Capacity, Each, gpm	52
Head, feet	27
Old Influent Force Main Diameter, inches	24
New Influent Pump Station	
Raw sewage pumps	
Number	3
Type	Submersible

Description	Value
HP (variable speed)	75
Capacity, gpm	4,500
Head, feet	51
Number	1
Type	Submersible
HP	75
Capacity, gpm, each	1,600 gpm2
Head, feet	24
New Influent Force Main Diameter, inches	
Influent Flow Metering System	
Type	Magnetic
Number of Meters	2
Diameter, inches	10, 20
Headworks Structure	
Manual Bar Screens	
Number	2
Channel Width, ft	2.5 and 3
Bar Spacing, in	1.5
Mechanical Bar Screen	
Number	1
Channel Width, ft	3
Bar Spacing, in	0.5
Maximum Flow, mgd	8.5
Screenings Washer/Compactor	
Number	1
Capacity, cubic feet/hour	35
Upper Screw, HP	2
Lower Screw, HP	5
Rotary Screens	
Number	2
Opening size, in	0.05
Capacity, gpm	5200
Influent Sampler	
Number	1
Type	Vacuum/ Pressure
Activated Sludge Aeration Tanks	
Number	2

Description	Value
Dimensions, Each Tank, ft	
Length	130
Width	43.25
Average Water Depth	11.1
Total Volume, 1,000 ft^3	125
Hydraulic Retention Time at 3 mgd, hours	7.5
Design Loading	
lb BOD/1,000 ft^3/day	27
Aeration Equipment	
Type	Surface aerators
Number	6
HP	20/11
Secondary Clarifiers	
Number	3
Dimensions, Each Tank	
Diameter, ft (No. 1)	60
Diameter, ft (Nos. 2 and 3)	55
Sidewall Depth, ft (Nos. 1, 2, and 3)	10
Performance	
Overflow, gal/ft^2/day	
ADWF (3 mgd)	400
PWWF (14.5 mgd)	1930
Detention Time at 3 mgd, hrs	4.5
Length of Weir, ft/tank (No. 1)	188
Length of Weir, ft/Tank (No. 2 and 3)	173
Weir Overflow Rate at ADWF, 1,000 gal/day/ft Weir	5.6
Collector	
Number	3
Type	Rake
Drive	
Number	3
Type	30” spur gear
Sludge Pumping Station	
Return Activated Sludge (RAS) Pumps	
Number	4
Type	Centrifugal, recessed impeller
HP, each	40

Description	Value
Capacity, Each, mgd	1.45
Head, ft	58
Waste Activated Sludge (WAS) Pump	
Number	1
Type	Centrifugal, horizontal, recessed impeller
HP	5
Capacity, gpm	100
Head, ft	25
Digested Sludge Pump	
Number	1
Type	Plunger
HP	2
Capacity, gpm	75
Head, ft	35
Scum Pump	
Number	1
Type	Centrifugal, horizontal, self-priming
HP	5
Capacity, gpm	100
Head, ft	33.6
Sump Pump	
Number	1
Type	Submersible
HP	0.75
Capacity, gpm	60
Head, ft	18
RAS Flow Meter	
Number	4
Primary Element	Magnetic
Size, inches	4
Flow Range, gpm	0-1000
Chlorine Contact Tank	
Number of Tanks	1
Number of Basins per Tank	2
Dimension, Each Basin, ft	
Length	75

Description	Value
Width	13
Average Water Depth	16.5
Dimension, Discharge Chamber, ft	
Length	29.5
Width	11
Depth	16.5
Total Volume, 1,000 ft^3	37.5
Chlorine Contact Time	
ADWF (3 mgd), min	135
PWWF (14.5 mgd), min	28
Effluent Sampler	
Number	1
Type	Vacuum/ Pressure
Disinfection System	
Type	Sodium Hypochlorite
Metering Pumps	
Number	2
Capacity, gph	8
Head, psi	60
Hypochlorite Solution Storage Tanks	
Number	1
Capacity, gallons	2500
Residual Analyzer	
Number	1
Range, mg/L	0-10
Flow Measurement	
Secondary Effluent Flume	
Number	1
Primary Element	Parshall
Size, inches	18
Flow Range, mgd	0.1-15.9
Headworks Diversion Flume	
Number	1
Primary Element	Parshall
Size, ft	24
Flow Range, mgd	0.3-21.4
Sludge Thickening Facility	
Waste Activated Sludge (WAS)	
Concentration, %	5

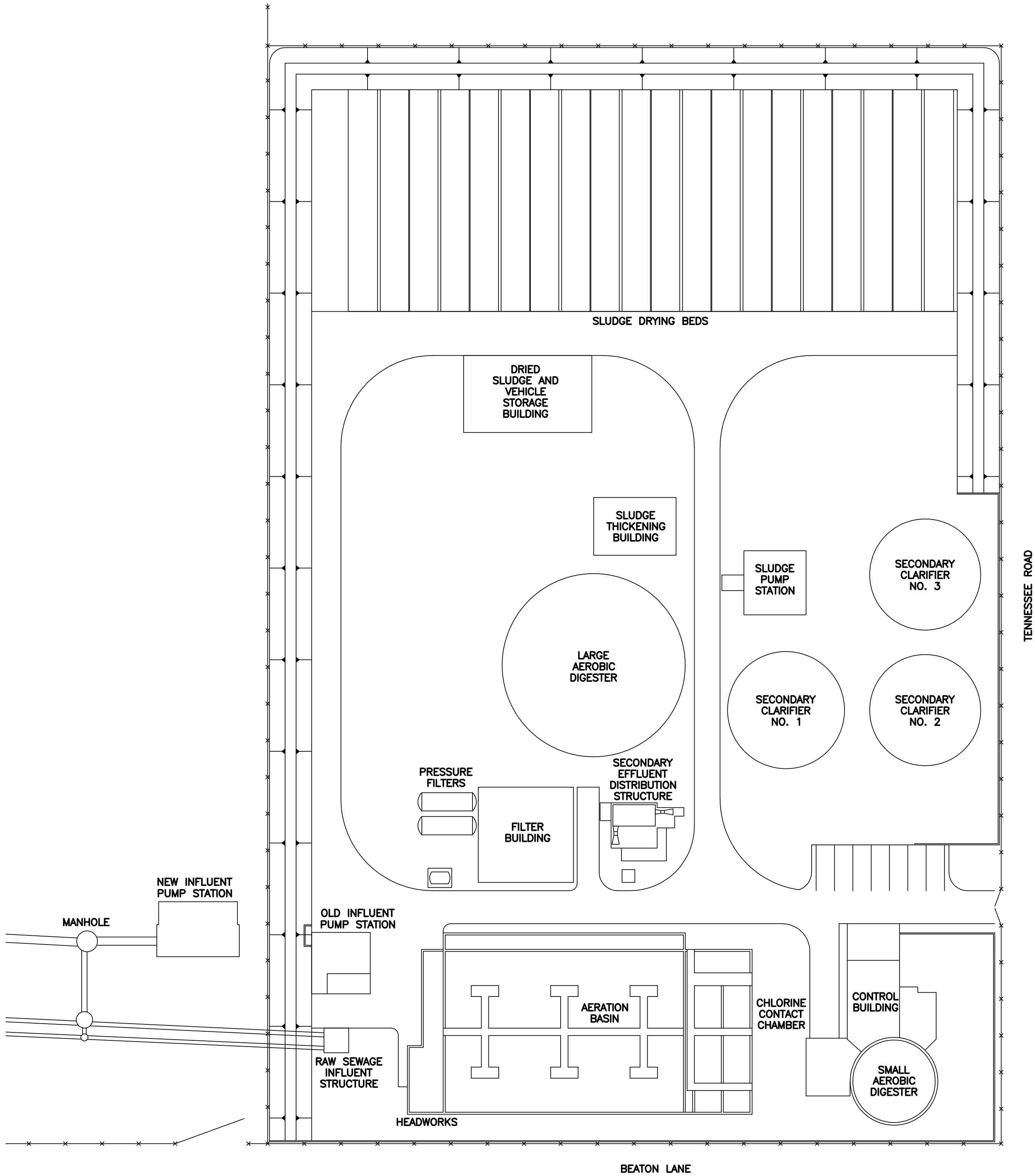
Description	Value
Gravity Belt Thickener	
Number	1
Belt Width, meters	2
Capacity, gpm	400
Sludge Concentration, %	Up to 8%
Polymer Storage Tanks	
Number	2
Type	Barrel
Volume, gal	55
Polymer Transfer Pump	
Number	1
Type	Diaphragm
Capacity, Each, gph	8
Head, psi	60
Polymer Feed Pumps	
Number	1
Capacity, gph	60-1000
Grinder	
HP	3
Sludge Booster Pump	
Number	1
Type	Centrifugal
HP	5
Capacity, gpm	160/290/400
Thickened Waste Activated Sludge Pump	
Number	1
Type	Progressive Cavity
HP	10
Capacity, gpm	100
Filtrate Pumps	
Number	2
Type	Centrifugal, Submersible
HP	0.25
Capacity, Each, gpm	30
Head, ft	12
High Pressure Washer	
Number	1

Description	Value
Type	Portable, gas powered
HP	11
Capacity, gpm	4.5
Head, psi	3000
WAS Flow Meter	
Number	1
Primary Element	Sonic
Size, inches	6
Flow Range, gpm	0-500
TWAS Flow Meter	
Number	1
Primary Element	Magnetic
Size, inches	4
Flow Range, gpm	0-200
Large Aerobic Digester / Holding Tank	
Number	1
Dimensions, ft	
Diameter	95
Working Depth	10
Total Volume, 1,000 ft^3	71
Mechanical aerators	
Number	3
HP	25
Small Aerobic Digester	
Sludge Holding Tank	
Number	1
Diameter, ft	45
Working Depth	20
Volume, 1,000 ft^3	35
Holding Tank Sludge Pump	
Number	1
Type	Plunger
HP	2
Capacity, Each, gpm	75
Head, ft	25
Aeration Equipment - Blower	
Type	Positive displacement
HP	60
Capacity, scfm	700

Description	Value
Pressure, psi	12
Diffusers	
Type	Fine bubble
Diameter, inches	9
Number	544
Sludge Drying Beds	
Number	20
Total Area, ft^2, 1,000	37.2
Pressure Filter System	
Mixed Media Filters	
Type	Pressure
Number	2
Area, ft^2, each	280
Design flow (each), mgd	1.5
Peak flow each, mgd	3
Application rate, gpm/ ft^2	3.75
Filter influent pumps	
Number	2
Type	Vertical turbine
HP	75
Capacity, mgd, each	3
Head, ft	105
Final Effluent Pumps	
Number	4
Type	Vertical Turbine
HP (3 variable speed, 1 constant speed)	50
Capacity, mgd	7.5
Head, feet	38
Number	1
Type	Vertical turbine
HP (constant speed)	20
Capacity, mgd	3.5
Head, feet	38
General Utilities	
Plant Water Pump	
Number	1
Type	Centrifugal, horizontal end suction
HP	20

Description	Value
Capacity, gpm	175
Head, ft	235
Standby generator	
Capacity	1,250 kW
Fuel storage	2,000 gallons
Transfer switch	Automatic
Backwash Pump	
Number	1
Type	Horizontal, split case
HP	75
Capacity, gpm	5,600
Head, ft	40
Surface Wash/Irrigation Pump	
Number	1
Type	Centrifugal, horizontal end suction
HP	15
Capacity, gpm	200
Head, ft	175
Polymer Metering Pump	
Number	1
Type	Positive displacement
Capacity, gph	200
Head, psi	15
Coagulant Metering Pump	
Number	1
Type	Positive displacement
Capacity, gph	8
Head, psi	60
Portable Dewatering Pump	
Number	1
Type	Horizontal, self-priming, gas engine
Capacity, gpm	500
Head, ft	100
Water Booster Pump	
Number	1

Description	Value
Type	Centrifugal, inline
HP	7.5
Capacity, gpm	150
Head, ft	116
Air Compressors	
Number	1
Type	Two-Stage
HP	7.5
Capacity, scfm	26
Pressure, psi	200
Air Pressure Tanks	
Type	Vertical
Number	1
Capacity, gallons	250



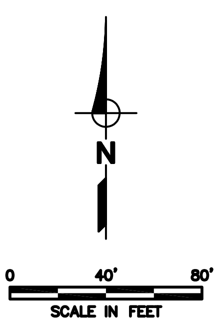


Figure 4-1

CITY OF LEBANON
WASTEWATER TREATMENT PLANT

LAYOUT

WEST YOST & ASSOCIATES

CAD FILE: 516-00-02-FIG_4-1 CFG FILE: 4MV-FULL.PC2 DATE: 4-1-04 VLF

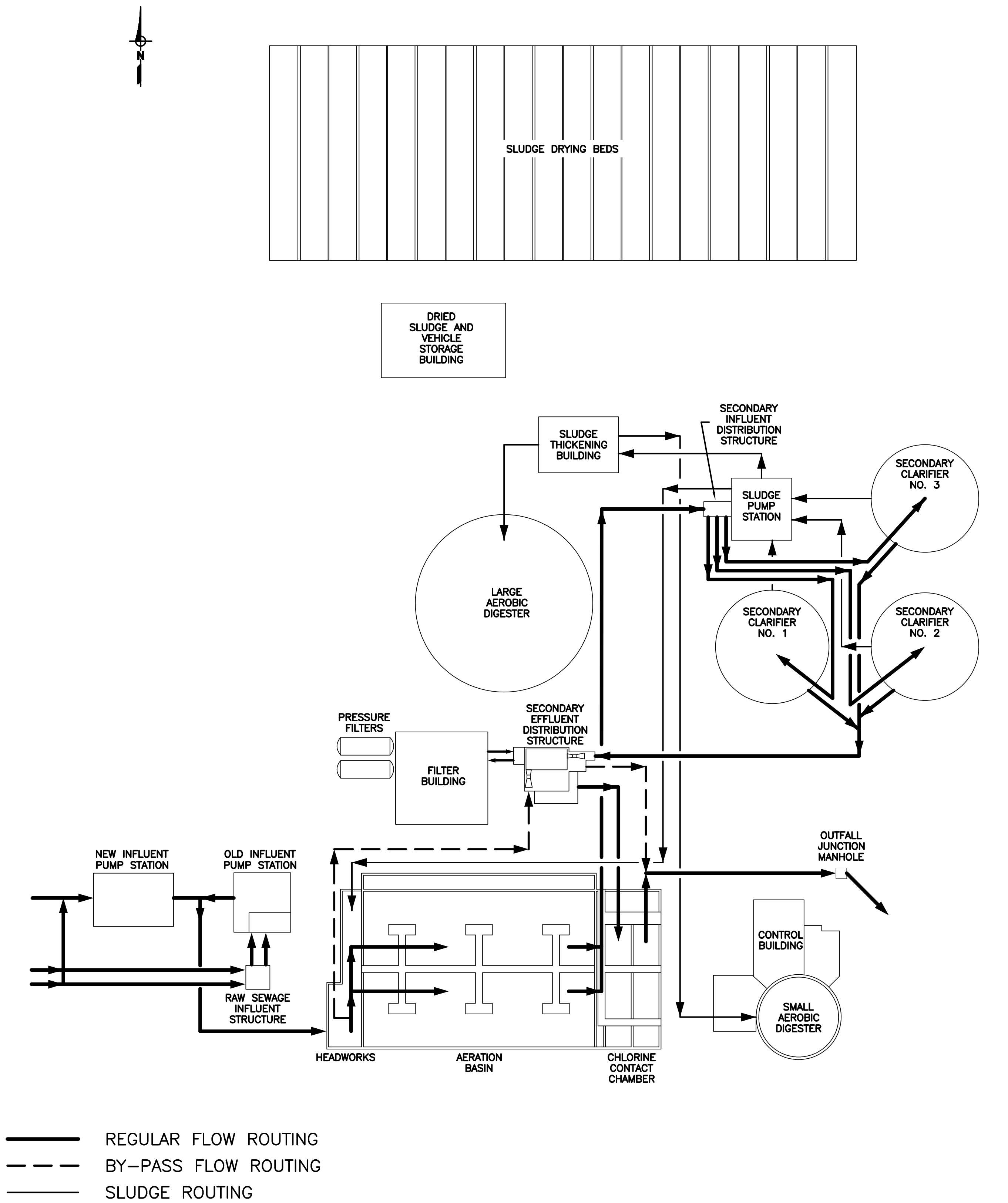


Figure 4-2

CITY OF LEBANON
WASTEWATER TREATMENT PLANT
FLOW SCHEMATIC

WEST YOST & ASSOCIATES

CAD FILE: 516-00-02-FIG_4-2 CFG FILE: 4MV-FULL.PC2 DATE: 4-14-04 ADP

Influent Structure and Pump Stations

Parallel 24-inch and 27-inch interceptor sewers converge at a raw sewage influent structure on the WWTP site. This influent structure also receives water from the plant drain lines that are used to dewater the various unit process tanks as well as filtrate from the gravity belt thickener. The influent structure then directs flow to the old influent pump station through a short pair of 30-inch diameter lines.

The old influent pump station has a wet pit/dry pit configuration with two wet wells, each fed by one of the 30-inch sewers. The station is equipped with four mixed flow centrifugal pumps with intermediate shafting. Two pumps are 75 HP, one is 50 HP, and the fourth is 25 HP. All of the pumps are equipped with variable speed drivers. The station has a firm capacity of 18 mgd with the largest pump out of service and total pumping capacity of approximately 21 mgd.

A new, separate influent pump station conveys wastewater from the new West Side Interceptor to the plant headworks. This interceptor will ultimately serve new developments on the west and north side of Lebanon as well as intercept flows from the existing Harrison Street Pump Station. The West Side Interceptor terminates at the new influent pump station with a 54-inch sewer. The new station has an initial pumping capacity of 12 mgd and will have a build-out capacity of 37 mgd. A diversion manhole on the East Side Interceptor allows for the ability to divert all system flow to the new pump station.

Headworks

The WWTP headworks is part of a multipurpose structure that also contains the aeration basins and the chlorine contact tank. Raw sewage from the influent pump station enters the headworks via a 24-inch force main. The headworks was initially equipped with a comminutor, two manually raked bar racks, and a pair of rotary screens. The rotary screens are intended for operation during peak flow conditions when it is necessary to bypass the secondary treatment processes. Although the headworks was originally designed to initiate bypassing of the secondary treatment processes at a flow rate of 8 mgd, the plant routinely sends up to 16 mgd through the secondary treatment process.

Mechanically raked bar screen and washer/compactor.

The headworks was renovated in 1998 when the comminutor was replaced by a 3-foot wide mechanically raked bar screen. Bar spacing is ½-inch on the mechanically raked screen and 1½ -inch on the manual screen. Debris collected by the mechanical bar screen is deposited into a screenings washer and compactor, then discharged to a dumpster. Downstream of the bar screens, return activated sludge is mixed with the raw sewage just before entering the aeration basins.

Activated Sludge Aeration Basin

Aeration basin and surface aerators.

The aeration basin consists of two tanks, each 130 feet long and 43 feet wide, with a total volume of 125,000 cubic feet or 935,000 gallons. Mixed liquor from the headworks enters the aeration basin at the upstream end of each tank. Each aeration tank is equipped with three surface aerators that mechanically transfer oxygen to the mixed liquor. The six surface aerators are capable of transferring oxygen to the tanks at a rate of approximately 6,000 pounds per day with one unit out of service. The aeration basin configuration provides for a complete-mix operation. Flow leaves the aeration basin via an overflow weir at the downstream end of each aeration tank. As flow leaves the aeration basin, a coagulant (aluminum hydrochloride) is added to the wastewater to aid settling. The aeration basin outlet channel then discharges to a 30-inch line leading to the secondary clarifiers. Grit is manually removed from the aeration basins on a regular basis when low flow rates allow one of the tanks to be taken out of operation and drained.

Secondary Clarifiers

The WWTP has two 55-foot-diameter secondary clarifiers and one 60-foot diameter clarifier. The basic clarifier configuration consists of a center-feed line with perimeter overflow weirs and a 10-foot side water depth on all three clarifiers. The clarifier mechanisms scrape sludge into a central pit where pump suction lines draw off the return activated sludge (RAS). The clarifiers are served by a sludge pumping station equipped with four centrifugal, recessed impeller RAS pumps.

Secondary clarifiers.

The clarifiers were originally designed to handle a peak day flow of approximately 8 mgd. However, the peak day flows to the clarifiers occasionally approach 12 mgd during high flow events. In order to improve performance at the higher flow rates, the clarifiers were retrofitted with baffles in 1998. Operators have passed up to 16 mgd through the clarifiers for brief periods.

Pressure Filtration System

Pressure filtration system.

The filtration system includes two pressure filter tanks served by two filter pumps. The filters are operated in parallel with one filter out of service at a time for backwash. The filters are designed to produce an effluent with a composite suspended solids concentration of 10 mg/L or less at a design flow rate of 1.5 mgd and peak hydraulic capacity of 3 mgd. The pressure filtration system has not been used in recent years since the addition of a coagulant provides adequate solids removal, but it is maintained for standby use. The last major use of the filters took place during a storm period in November 1998.

Secondary Effluent Distribution Structure

Vertical turbine effluent pumps.

Flow enters the secondary effluent distribution structure from either the secondary clarifiers or the high flow diversion at the headworks. From this point, secondary effluent can be directed via pumps to the chlorine contact chamber or to the pressure filters. Flow from the secondary clarifiers can be sent directly to the chlorine contact chamber or indirectly by way of the pressure filter. Influent flow diverted from the headworks must go directly to the chlorine contact chamber. A chlorine solution is added to the flow at this structure just prior to pumping to the chlorine contact chamber.

The distribution structure is equipped with three constant speed and two variable speed, vertical turbine pumps with a firm capacity of 26 mgd. In addition, there are two pressure filter pumps are rated at 3 mgd each. In the event that the effluent pump system fails, the secondary effluent distribution structure has an overflow to the plant outfall.

Chlorine Contact Chamber

The WWTP uses sodium hypochlorite to disinfect the plant effluent. The hypochlorite solution is introduced to the wastewater at the secondary effluent distribution structure just before pumping to the chlorine contact chamber. The chamber consists of four interconnected basins, each

6.5-feet wide and 75 feet long. There are two entrances to the chamber and an isolation sluice gate midway along the basins such that the chamber can be divided in two halves. This configuration allows for operation of one side at a time as required for achieving the necessary contact time or periodic cleaning. Each half of the chamber provides approximately one hour of contact time at the design ADWF of 3 mgd. The contact time for the whole chamber at the design PWWF of 14.5 mgd is 28 minutes.

Chlorine contact tanks.

Outfall

Shoreline discharge outfall.

Plant effluent leaves the chlorine contact chamber through a 36-inch line that connects to an outfall junction manhole. From this junction manhole, the outfall pipeline continues for approximately 1,200 feet as a 30-inch line to a shoreline-discharge outfall on the South Santiam River. The outfall system normally operates under surcharged conditions during peak flow events. Since the manholes on the outfall pipeline are sealed structures with watertight lids, the chlorine contact tank overflow weir provides the maximum hydraulic gradient for the system.

Waste Activated Sludge Thickening

The WWTP has been thickening waste activated sludge (WAS) since 1992. A WAS pump located in the sludge pumping station conveys WAS to the gravity belt thickener (GBT). A booster pump in the GBT building can increase the sludge flow rate as necessary. The system consists of a polymer injection system and GBT with a 2 meter wide belt that thickens the WAS to a concentration of 3 to 8 percent solids. Filtrate from the GBT drains back to the influent pump station. A progressive cavity pump then conveys the thickened WAS (TWAS) to the aerobic digesters.

Gravity belt thickener.

Aerobic Digestion

Aerobic digestion takes place in two stages at the WWTP. The plant has a large aerobic digester that is 95 feet in diameter and has a maximum operating depth of 10 feet and a smaller aerobic digester that is 45 feet in diameter. The large digester is equipped with three mechanical surface aerators which float on stainless steel supporting rafts. The small digester is equipped with a fine bubble aeration system. The digesters are generally able to provide the required final volatile solids reduction. However, in the event that the targeted 38 percent volatile solids reduction is not achieved, plant staff can add lime to the small digester to complete stabilization.

Large aerobic digester with surface aerators.

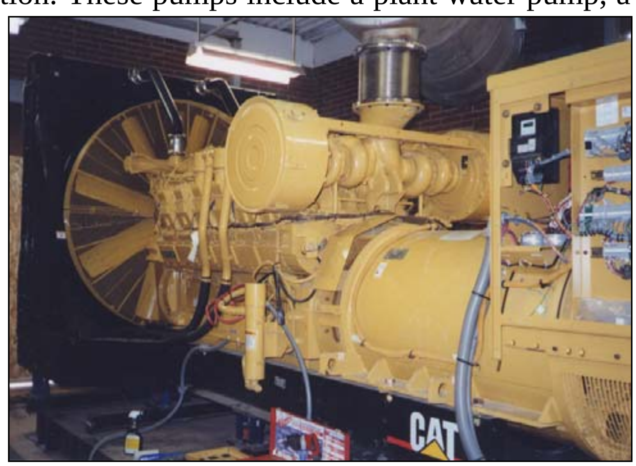
Biosolids Drying

Biosolids removed from the aerobic digesters can be spread on approximately 37,200 square feet of drying beds. Drainage water from the drying beds is directed back to the influent pump station. Due to odor and operational issues, the drying beds are rarely used and most sludge is directly transferred to the tanker truck for application to agricultural fields. However, the drying beds do provide a storage alternative when weather conditions do not allow access to agricultural lands. Both the liquid and dried biosolids are applied to agricultural land as a soil amendment at agronomic rates.

Plant Utilities

The WWTP has the following utility systems:

- **Plant Water Pumps.** Four pumps provide high pressure plant effluent for sprays, washdown stations, and landscape irrigation. These pumps include a plant water pump, a water booster pump, a backwash pump, and an irrigation pump.
- **Service Air.** A compressor supplies compressed air to various locations around the plant site to assist with maintenance functions.
- **Standby Power.** A 1,250 kW generator with 2,000 gallons of fuel storage capacity is available for use in the event of a power outage. This generator was installed in 2002 and has an automatic transfer switch such



Standby generator system.

that any power supply interruptions to the treatment plant will immediately activate the standby power system. The new generator has sufficient capacity to power the entire treatment plant for the duration of the planning period.

UNIT PROCESS CAPACITY

The capacities of each unit process was estimated based on calculations and information available in equipment specifications and operating manuals and are summarized in Table 4-2.

The following sections provide additional information on the capacity evaluation for each unit process.

Influent Pump Stations

Pump stations are rated according to their firm capacity, which is the capacity of a station with the largest pump out of service. With three of the four pumps operating, the influent pump station is capable of pumping approximately 18 mgd. This estimate is based on the reported rated capacity of each pump as opposed to analysis of the pump station system curve and individual pump curves.

New influent pump station.

The construction of the new influent pump station for the West Side Interceptor significantly increased the plant's influent pumping capacity. The initial equipment installed in the West Side Interceptor station added 12 mgd of firm pumping capacity. This new pump station has a below-grade, trench style wet well with submersible pumps.

Table 4-2. Unit Process Capacity Summary

Unit Process	Basis for Capacity	Design Criteria	Total Capacity
Old influent pump station	PWWF[a]	Firm capacity	18 mgd PWWF
New influent pump station	PWWF	Firm capacity	12 mgd PWWF
Effluent pump station	PWWF	Firm capacity	26 mgd PWWF
Bar screen	PWWF	Screen headloss	8.5 mgd PWWF
Aeration basins	SRT[b] at Max Month Load HRT[c] at MMWWF[d]	4 days solids retention 4 hours hydraulic retention	5,900 ppd BOD 5.6 mgd MMWWF
Aeration equipment	BOD Loading	1.1 lb oxygen/lb BOD 2.5 lb oxygen/hp-hr	5,500 lbs/day BOD
Secondary clarifiers	PWWF	1,200 gal/ft^2/d per clarifier	9.1 mgd PWWF[e]
Pressure Filter	Mass Load Limits	Firm capacity	3 mgd
Chlorine contact basin	PWWF	15 minute contact time	27 mgd PWWF

Unit Process	Basis for Capacity	Design Criteria	Total Capacity
Outfall	PWWF	100-year flood elevation of 336 feet	21 mgd PWWF
RAS pumping	25% PWWF	Firm capacity	4.4 mgd RAS
Gravity belt thickener	Solids Loading	400 gpm WAS @ 1% SS	45,000 lbs/day WAS[f]
Aerobic digester[g]	SRT Volatile Solids Reduction	60 day detention at max month; VSR[h] of 38%	6,000 lbs/day BOD
Digester aeration equipment	VSS[i] Loading	2 lb oxygen/lb VSS 2.5 lb oxygen/hp-hr	1,500 lbs/day VSS
Drying beds	Annual average Solids Loading, lbs	40 tons/acre/yr[j]	26 tons/yr

[a]Peak wet weather flow.
[b]Solids retention time.
[c]Hydraulic retention time.
[d]Maximum month wet weather flow.
[e]Clarifiers are able to operate at approximately 12 mgd through the addition of a chemical coagulant upstream of the clarifiers.
[f]Based on Gravity Belt Thickener running 95 percent of the time.
[g]Includes both aerobic digesters. Due to limited aerobic digestion performance, the plant occasionally meets sludge treatment requirements through lime stabilization.
[h]Volatile Solids Reduction.
[i]Volatile Suspended Solids.
[j]Capacity based on one application at 9 inches deep per year at 3 percent solids content.

Headworks

The WWTP headworks consists of one mechanical bar screen and two manual bar screens. However, the capacity of a headworks is typically calculated based on the mechanical bar screens only with the manual bar screens are reserved for back-up service. This convention is derived from the dramatically different screening performance provided by mechanical and manual screens. Due to the wider bar spacings on manual screens relative to mechanical screens (1.5-inches compared to 0.5-inches in Lebanon), more debris is able to pass downstream through a manual screen. Since such a reduction in screening performance often causes equipment maintenance and clean-up problems throughout the rest of the plant, manual screen operation is generally only acceptable on a temporary basis. Operator observations and hydraulic calculations indicate that the mechanical bar screen alone can pass approximately 8.5 mgd of flow with one foot of head loss through the bars before the overflow weir directs wastewater to the headworks bypass channel.

Also, the bar screens are currently not performing at their optimum level due to the absence of a downstream flow control. The bar screen channels are located at a much higher elevation than the hydraulic grade line of the downstream aeration basins. As a result, backwater from the aeration basins does not control flow through the bar screens even during peak wet weather flow. Without a downstream flow control, there is a free discharge from the bar screen channels to the aeration basins. This free discharge condition allows water velocities through the screen to reach high enough levels (5 to 6 feet per second) to diminish the effectiveness of the screens. The reduced effectiveness means that more debris passes through the bar screens, creating the potential for downstream problems. A downstream flow control element such as wing walls would maintain bar screen velocities within the recommended range of 1 to 4 feet per second. With proper flow control and the resulting lower velocities through the bar screen, the capacity of the mechanical bar screen would be reduced from 8.5 mgd to 6.9 mgd.

Aeration Basins

We used the activated sludge computer model BioWin to estimate the capacity of the aeration basins. Plant operating data for the months of March 1999 and October 1999 were used to calibrate the model. The calibration criteria for each month were comparable.

Aeration basins that treat municipal wastewater are typically sized based on solids retention time (SRT) and, to a lesser extent, hydraulic retention time (HRT). It should be noted that plant operators calculate SRT differently than the BioWin model. Plant operators include the solids in the aeration basins and the secondary clarifiers in determining total solids inventory. Conversely, BioWin considers only the solids in the aeration basins. When calculating solids inventory in this manner, an SRT of 4 days at maximum month load is appropriate. If the solids in the secondary clarifiers are included in the solids inventory, a higher design SRT criteria should be used.

HRT is secondary design criteria that serves as a check of the SRT. In general, a 4-hour HRT at maximum month wet weather flow (MMWWF) is considered reasonable. However, HRTs of as low as 3 hours at MMWWF are acceptable provided the SRT is within limits.

To maintain an SRT of 4 days at a mixed liquor suspended solids (MLSS) concentration of 2,500 milligrams per liter (mg/L), the influent BOD load would be approximately 5,900 lbs/day. An influent flow of 5.6 mgd yields an HRT of 4 hours.

Aeration basins can typically accommodate short-duration peak flows. However, high peak flows transfer solids out of the aeration basins and into the secondary clarifiers. High solids loading rates can impair the performance of the clarifiers. The solids loading to the clarifiers was not included as part of the aeration basin capacity evaluation.

Aeration Equipment

The capacity of the aeration equipment is based on its estimated oxygen transfer rate and the oxygen requirements of the wastewater. Also, since the capacity should be based on the firm capacity of the aeration equipment, the calculation assumes that only five of the six surface aerators are in operation. Based on an oxygen transfer rate of 2.5 pounds of oxygen per horsepower per hour and oxygen requirements of 1.1 pounds of oxygen per pound of BOD, the aeration equipment capacity is 5,500 pounds per day of BOD.

Secondary Clarifiers

The maximum PWWF hydraulic overflow rate was the criteria considered for the secondary clarifier capacities. The clarifiers were originally rated at 1,060 gal/ft^2/d, or 8 mgd total. However, the clarifiers were retrofitted with baffles in 1998 which allows for an increase in their capacity rating. The hydraulic capacity for this evaluation was based on a PWWF overflow rate of 1,200 gal/ft^2/d, or 9.1 mgd total. Operators occasionally operate the clarifiers at a rate of 16 mgd during peak wet weather events, but the addition of a chemical coagulant upstream of the clairifers is a critical factor in the ability to treat high flows. The coagulant is only added during the relatively rare high flow periods. Performance problems become a risk at these high hydraulic loading rates. For the rest of this report, it is generally assumed that the total capacity of the existing secondary clarifiers is 12 mgd.

Pressure Filter System

Each pressure filter tank has a peak hydraulic capacity of 3 mgd. Since one filter is out of service for backwash at any given time, the total capacity of the filters is also 3 mgd.

Effluent Pump Station

As with the influent pump station, the effluent pump station is rated according to its firm capacity. With four of the five pumps operating, the station is capable of pumping approximately 26 mgd. This estimate is based on the reported rated capacity of each pump as opposed to analysis of the system curve and individual pump curves.

Chlorine Contact Basin

The capacity evaluation of the chlorine contact basin is based on the proper hydraulic detention time to achieve acceptable disinfection. Traditionally, a minimum hydraulic retention time of 30 minutes is used for designing and evaluating chlorine contact basins. At a 30-minute detention time, the PWWF capacity for the chlorine contact basin is 13.5 mgd.

Outfall

The existing outfall system is designed to operate under surcharged conditions during peak flow events. Since the manholes on the outfall pipeline are either sealed structures with watertight manholes or are sandbagged when necessary, the chlorine contact tank overflow weir provides the hydraulic constraint on the capacity of the outfall. Based on a 100-year flood elevation of 336 feet for the South Santiam River at the discharge location, the capacity of the outfall system is 21 mgd.

Return Activated Sludge Pumping

As with the influent pump stations, the capacity of a sludge pumping station is based on the largest pump being out of service. With three of the four sludge pumps operating, the station is capable of pumping approximately 4.4 mgd. This estimate is based on the reported rated capacity of each pump as opposed to analysis of the system curve and individual pump curves.

WAS Thickening

The WWTP has one gravity belt thickener with a rated capacity of 400 gpm of WAS. GBT capacity is a function of the amount of time it is operated. It was assumed that the GBT would run 95 percent of the time during peak WAS production. Using the rated capacity and an average WAS concentration of 10,000 mg/L, the processing capacity for the GBT was calculated at 45,000 lbs/day. The 1999 average WAS production was 2,200 lbs/day, while the peak month was 3,400 lbs/day.

Aerobic Digestion

The capacity of the aerobic digestion facilities was evaluated based on solids retention time criteria. In order to provide adequate pathogen and vector attraction reduction, it was assumed that the digesters would need to provide a solids retention time of 60 days. Based on the volume of each digester and an average thickened solids concentration of 55,000 mg/L, the capacity of the digesters is approximately 6,000 pounds per day of thickened waste activated sludge. This is equivalent to an influent BOD loading rate of approximately 6,000 ppd. The plant also has the ability to provide additional pathogen and vector attraction reduction through lime stabilization.

Digester Aeration Equipment

The capacity of the digester aeration equipment is based on their estimated oxygen transfer rate and the oxygen requirements for reduction of volatile Suspended Solids (VSS). Also, since the capacity should be based on the firm capacity of the aeration equipment, the calculation assumes that only 2 of the three surface aerators are in operation. Based on an oxygen transfer rate of 2.5 pounds of oxygen per horsepower per hour and oxygen requirements of 2 pounds of oxygen per pound of VSS, the aeration equipment capacity is 1,500 pounds per day of VSS.

Biosolids Drying

When land application is not possible, sludge can be pumped to the drying beds. The capacity evaluation for the drying beds was based on the following criteria:

- 37,200 square feet of drying beds;
- One application per year 9 inches deep;
- Sludge from the digester is approximately 3 percent solids.

Using the above parameters, the design loading rate to the drying beds is 26 dry tons per year.

WWTP PERFORMANCE

A review of recent plant influent and effluent quality data is useful for characterizing the current performance of the wastewater treatment system. As shown in Table 4-3, the WWTP produced high quality effluent in 2003. The City has a waiver on the maximum daily load limits on days when the average plant flow exceeds 6.0 mgd.

Table 4-3. 2003 Plant Performance Summary

	Influent Flow, mgd		Effluent Concentration, mg/L			
Month	Average	Maximum Day	Average CBOD	Max Day CBOD	Average TSS	Maximum Day TSS
January	7.0	13.1	3.7	4.7	7.5	13.2
February	6.0	13.0	5.1	15.3	14.9	72.0
March	5.7	7.7	3.8	4.7	5.2	7.4
April	6.2	8.5	4.4	7.0	5.2	9.3
May	3.1	4.6	4.1	6.3	3.4	7.2
June	1.9	2.3	6.1	7.5	3.3	4.8
July	1.4	1.6	7.5	8.6	3.4	5.2
August	1.3	1.6	5.8	7.1	4.1	4.8
September	1.3	1.6	6.5	9.5	5.0	7.0
October	1.4	1.9	7.1	9.7	5.4	8.2
November	2.5	7.6	7.6	16.2	6.6	13.6
December	1.8	2.3	5.1	11.1	8.3	25.0
Average	3.3	5.5	5.6	9.0	6.0	14.8
Maximum	7.0	13.1	7.6	16.2	14.9	72.0

[a]CBOD is the five-day carbonaceous biochemical oxygen demand.