CHAPTER 10. RECOMMENDED PLAN

The recommended plan presented in this chapter is based on the evaluation of alternatives and assessment of existing facilities. The recommended facilities are sized to serve the City's wastewater treatment needs through anticipated buildout conditions. An implementation schedule provides a recommended timeline for project phasing.

DESCRIPTION OF RECOMMENDED FACILITIES AND IMPROVEMENTS

The recommended approach includes both new facilities to increase capacity and enhance performance, and improvements to existing facilities to correct deficiencies and reduce operation and maintenance (O&M) demands. Design data for recommended facilities are presented in Table 10-1, while a preliminary site layout is provided as Figure 10-1.

Liquid Stream Treatment Facilities

Liquid stream treatment alternatives were presented and compared in Chapter 7. Prior to a detailed evaluation of process alternatives, potential wastewater management strategies were identified, screened, and evaluated. Two wastewater management strategies were recommended:

- *Dry Weather (DW) 1. Expand Existing Facilities.* This management strategy consists of continued use of the WRF's existing treatment facilities and expanding its capacity by constructing similar facilities.
- *Wet Weather (WW) 2. Collection System Improvements.* Under this management strategy, collection system rehabilitation will reduce I/I such that the peak hour flow at the WRF will be maintained at 32 mgd.

The recommendations presented in this section are consistent with these two management strategies. As discussed in Chapters 5 and 7, future changes in the regulatory framework and other criteria could trigger the City to revisit the selection of these management strategies. Should this occur, the recommendations presented in this section should be re-evaluated.

The sizing of many of the liquid stream treatment facilities is dictated by the peak flow rate treated at the WRF. Management strategy WW2. Collection System Improvements is based on the WRF's peak design flow remaining at 32 mgd. Because meeting the I/I reduction objective is crucial to permit compliance and the overall success of the recommended plan, the City should periodically evaluate the flow reduction effectiveness of its collection system rehabilitation program and make adjustments to rehabilitation methodologies or treatment facility sizing as needed.

A liquid stream process schematic diagram is provided as Figure 10-2.

Table 10-1. Buildout Design Data

Description	Value
DESIGN FLOWS	
Dry Weather, mgd	
Average Day Dry Weather Flow (ADWF)	6.1
Maximum Month Dry Weather Flow (MMDWF)	11
Maximum Day Dry Weather Flow (MDDWF)	20
Wet Weather, mgd	
Average Day Wet Weather Flow (AWWF)	10
Maximum Month Wet Weather Flow (MMWWF)	20
Maximum Day Wet Weather Flow (MDWWF)	31
Peak Hour Flow (PHF)	32
DESIGN LOADS	
Biochemical Oxygen Demand (BOD), lbs/day	
Average annual	11,500
Maximum month	15,500
Total Suspended Solids (TSS), lbs/day	
Average annual	14,400
Maximum month	21,300
Ammonia-N, lbs/day	
Average annual	930
Maximum month	1440
Phosphorus, lbs/day	
Average annual	340
Maximum month	510
EFFLUENT REQUIREMENTS	
May 1 – October 31, Monthly Average	Dependent on river flow
CBOD, lbs/day (mg/L)	230-470 (5-10)
TSS, lbs/day (mg/L)	230-470 (5-10)
Ammonia-N, lbs/day (mg/L)	23-230 (0.5-5)
Phosphorus, mg/L	
Max @ River Flow < 100 cfs	0.07
Dissolved Oxygen, daily average, minimum, mg/L	6.5
TDS, monthly average	Not to exceed 500 mg/L
E.coli Bacteria per 100 ml	126 monthly geometric mean and no single sample shall exceed 406
Excess Thermal Load, weekly average	160 Million kcals

Table 10-1. Buildout Design Data, cont'd…

Description	Value
November 1 – April 30, Monthly Average	Dependent on plant influent flow
CBOD lbs/day (mg/L)	1,200-3,000 (25)
TSS, lbs/day (mg/L)	1,400-3,600 (30)
E.coli per 100 mL	126 monthly geometric mean and no single sample shall exceed 406
TDS, monthly average	Not to exceed 500 mg/L
LIQUID UNIT PROCESSES	
Existing Screen (at Flow Diversion Structure)	
Type	Articulated rake mechanically cleaned
Number	1
Opening, inches	0.5
Motor HP	3
Existing Raw Sewage Pumps	
Type	Non-Clog Centrifugal, Adjustable Speed
Number	5
2 Pumps	
Capacity, gpm, each	1,500-5,500
TDH, ft, each	53-163
Motor HP	350
3 Pumps	
Capacity, gpm, each	4,000-8,750
TDH, ft, each	64-124
Motor HP	400
Existing Screens (at WRF)	
Type	Mechanical Self Cleaning
Number	2
Opening	6 mm
Motor HP	0.75
Existing Screenings Press	
Number	2
Max capacity, each, CF/hr	60
Motor HP	3
Grit Basin and Grit Handling System	
Type	Vortex
Diameter (ft)	16
Number existing	1
Number new	1
Capacity, each, mgd	20

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Grit Pump	
Number existing	1
Number new	1
Type	Recessed Impeller Centrifugal
Capacity, each, gpm	200
Motor, HP	5
Grit Washing	
Type	Cyclone/Classifier
Cyclones	
Number existing	1
Number new	1
Classifiers	
Number existing	1
Motor HP	1
Septage Receiving	
Number existing	1
Tank Volume, gal	5,000
Septage Pumps	
Number existing	2
Pump Type	1 - Grinder 1 - Recessed Impeller
Capacity, each, gpm	Grinder @ 175 Recessed Impeller @ 200
Motor HP	Grinder @ 7.5 Recessed Impeller @ 10
Aeration Basins (Orbal Oxidation Ditches)	
Number existing	2
Number new	1
Size, each, ft	165 x 137
Sidewater Depth, ft	11.8
Total Volume, Million Gal	4.6
Aeration Equipment	
Type	Surface Disc
Number per basin	8
Capacity per basin, lbs O_2/day	12,000
Total Connected Horsepower per basin	200
Hydraulic Retention Time at ADWF	18.1 hrs
Hydraulic Retention Time at AWWF	9.2 hrs

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Solids Retention Time, days	11.5
Design MLSS, mg/L	3000
ADWF Capacity, mgd	6.3
PHF Capacity, mgd	32
Secondary clarifiers	
Type	Suction Arm
Number existing	2
Number new	1
Diameter, ft	120
Sidewater Depth, ft	15.7
Surface Area, each, SF	11,310
Design Overflow Rates, gpd/SF	
ADWF, 1 unit out of service	270
AWWF, all units	354
MDWWF, all units	914
Peak hourly flow, all units	943
Return Sludge Pumps	
Type	Screw Induced Flow Adjustable Speed
Number existing	4
Number new	2
Capacity, each, gpm	900-2,000
Motor HP	7.515
Waste Sludge Pumps	
Type	Screw Induced Flow Adjustable Speed
Number existing	2
Number new	1
Capacity, each, gpm	200-500
Motor, HP	7.5
Scum Pumps	
Type	Progressing Cavity, Constant Speed
Number existing	2
Number new	1
Capacity, gpm, each	50
Motor HP	3

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Tertiary Clarifiers	
Type	Solids Contact
Number existing	2
Diameter, ft	70
Side Water depth, ft	20
Reactor Detention Time, min	30
Upflow Rate at MMDWF, gpm/SF (gpd/SF)	0.6 (864)
Chemical Sludge Pumps	
Type	Screw Induced Flow Centrifugal
Number existing	2
Capacity, gpm	150
Motor HP	1.5
Existing Filters	
Type	Continuous Upflow
Number	6
Surface Area, each, sf	200
Basin Geometry	
Length, ft	14.21
Width, ft	17.61
Depth, ft	19.55
Air Requirements, scfm/filter module	2.5
Min Backwash Surface Loading Rate, gpm/SF	50
Peak Loading Rate, gpm/SF	4.0
Peak Capacity (all units in service), mgd	8.6
Peak Capacity (one unit out of service), mgd	7.2
New Filters	
Type	TBD
Peak capacity, mgd	4.2
Disinfection	
Type	UV
Channels	3
Channel Dimensions	
Length, ft	48.42
Width, ft	6.00
Depth, ft	4.75
Peak capacity, mgd	32
Post Aeration	
Blowers	

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Number existing	2
Capacity @ 4.5 psig, scfm	250
Motor HP	20
Diffusers	
Type	Membrane Tube
Number existing	90
Capacity, lbs O_2/hr	31.04
CHEMICAL SYSTEMS	
Alum	
Storage Tanks	
Number existing	1
Capacity, ea, gal	6,500
Feed Pumps	
Number existing	2
Type	Chemical Metering, Adjustable Speed
Capacity, gph	0.1-8
Sodium Hypochlorite	
Storage Tanks	
Number existing	1
Capacity, each, gal	6,500
Feed Pumps	
Number existing	2
Type	Chemical Metering, Adjustable Speed
Capacity, each, gph	0.1-8
Sodium Hydroxide	
Storage Tanks	
Number existing	1
Capacity, gal	6,500
Feed Pumps	
Type	Chemical Metering, Adjustable Speed
Number existing	2
Capacity, each, gph	0.1-8
Aluminum Chlorohydrate	
Storage Tanks	
Number existing	2
Capacity, gal	6,500

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Feed Pumps	
Type	Chemical Metering, Adjustable Speed
Number existing	2
Capacity, gph	0.1-8
Utilities	
W3 Pumps	
Type	Centrifugal, Adjustable Speed
Number existing	3
Capacity, each, gpm	2 @ 250-600 1 @ 50 - 300
Motor, HP	2 @ 75 1 @ 20
W3 Strainers	
Type	Automatic
Number existing	1
Capacity, each, gpm	2,000
Motor HP	1
Air Compressor	
Type	Rotary Screw, Desiccant
Number existing	2
Capacity, scfm @ 100 psig	1 @ 186 1@ 24 -100
Biosolids Compressor	
Number	2
Capacity, scfm @ 20 psi	500
Odorous Air Compressor	
Number	2
Capacity, scfm @ 20 psi	500
Odor Control	
Type	Biofilter with mist pre-ammonia removal
Number	2
Capacity, cfm	10,000
Size (W x D x H), feet	40 x 40 x 4
Plant Drain	
Sump Volume, gallons	26,000
Plant Drain Pumps	

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Type	Centrifugal Adjustable Speed
Number existing	2
Capacity, gpm, each	200-1,000
Motor HP	25
SOLIDS UNIT PROCESSES	
Waste Sludge Summary (maximum month)	
WAS TSS, lbs/day	18,610
% Volatile	63%
WAS VSS, lbs/day	11,720
WAS NVSS, lbs/day	6,890
Alum Sludge, lbs/day	3,090
TSS, lbs/day	21,700
Sludge Thickening	
Gravity Belt Thickener	
Number	2
Belt Width, meters	2
Capacity, each, gpm	200-500
Thickened Sludge Concentration, %	5-6
Thickened Sludge Transfer Pumps	
Type	Induced Flow Centrifugal, Constant Speed
Number	2
Capacity, gpm	900
Motor HP	20
Type	Progressing Cavity, Constant Speed
Number	1
Capacity, gpm	200
Motor HP	7.5
Digestion	
Digested Biosolids Transfer Pumps	
Type	Centrifugal
Number	1
Capacity, gpm	400
Motor HP	10
Type	Progressing Cavity
Number	1
Capacity, gpm	200
Motor HP	7.5

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Digesters (ATAD)	
Type	Autothermal Thermophilic Aerobic Digestion
Number (Existing)	3
Size	
Diameter, ft	35
Sludge Depth, ft	10
Volume, gal	67,628
Total Digestion Detention Time, days	8
Design Temperature, °C (°F)	60 (140)
Volatile Solids Loading, lb/KCF/day	230
Minimum Volatile Solids	54%
Equipment per tank:	
#1 Digester	4 – Spiral Aspirating Aerators 10 HP 2 – Turborator Aerators 10 HP 6 – Foam Controllers
#2 Digester	4 – Spiral Aspirating Aerators 10 HP 2 – Turborator Aerators10 HP 6 – Foam Controllers
#3 Digester	4-Spiral Aspirating Aerators 10 HP 8 – Foam Controllers
Solids Reduction	38%
ATAD Transfer Pumps	
Type	Centrifugal
Drive	Constant Speed
Number	2
Capacity, gpm each	900
Motor HP	15
Digested Biosolids Storage	
Existing Tank	Covered
Type	
Number	1
Size	
Diameter, ft	160
Height, ft	20
Volume, gal	2,800,000

Table 10-1. Buildout Design Data, cont'd…

Description	Value
Design Solids Conc, %	6
Detention Time, days	100
Air Mix, No. of Diffusers	40
Supernating siphon, capacity gpm	20
Odor Scrubber System	1
New Tank	Covered

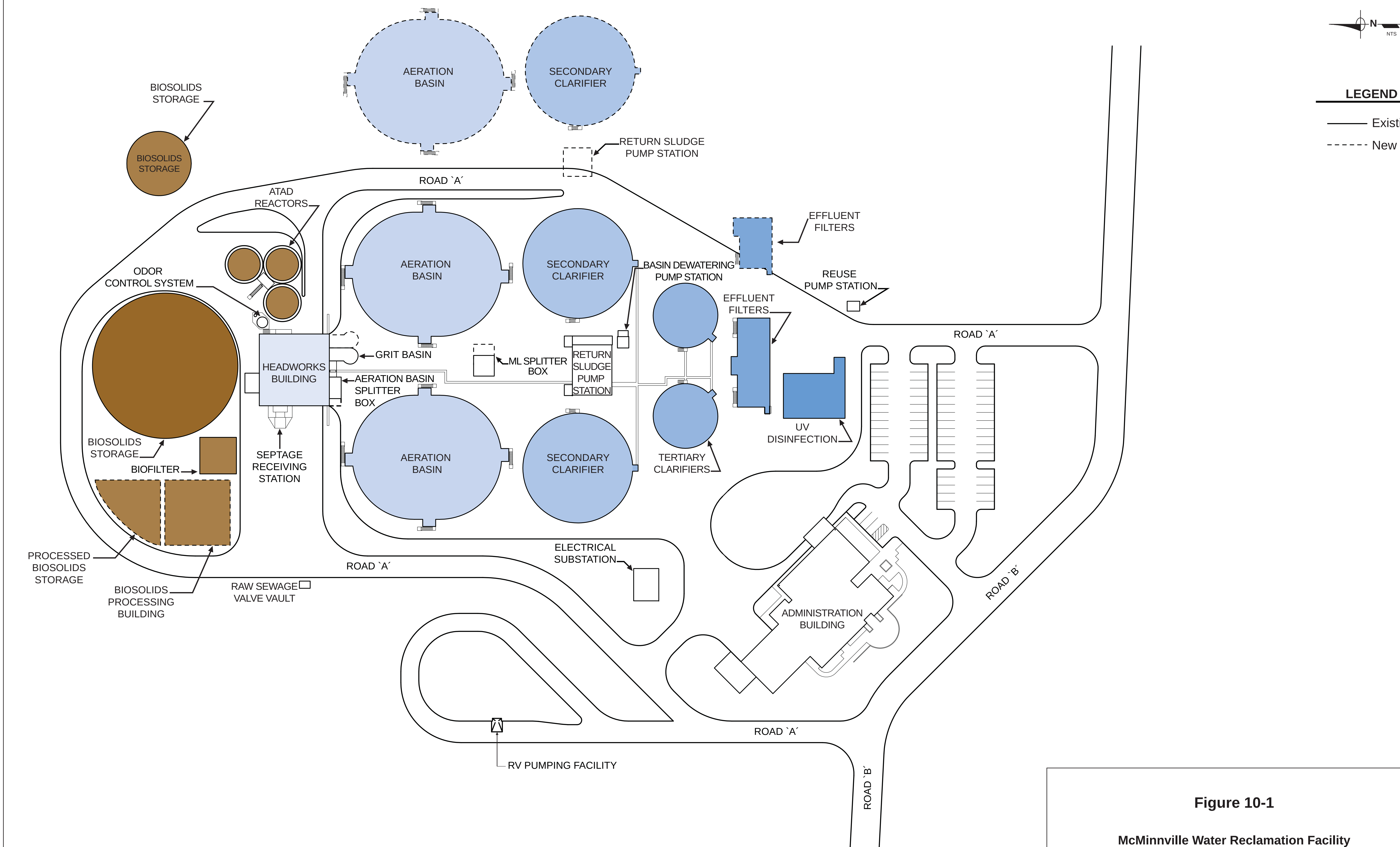

Figure 10-1

McMinnville Water Reclamation Facility

RECOMMENDED SITE PLAN AND PLANT LAYOUT

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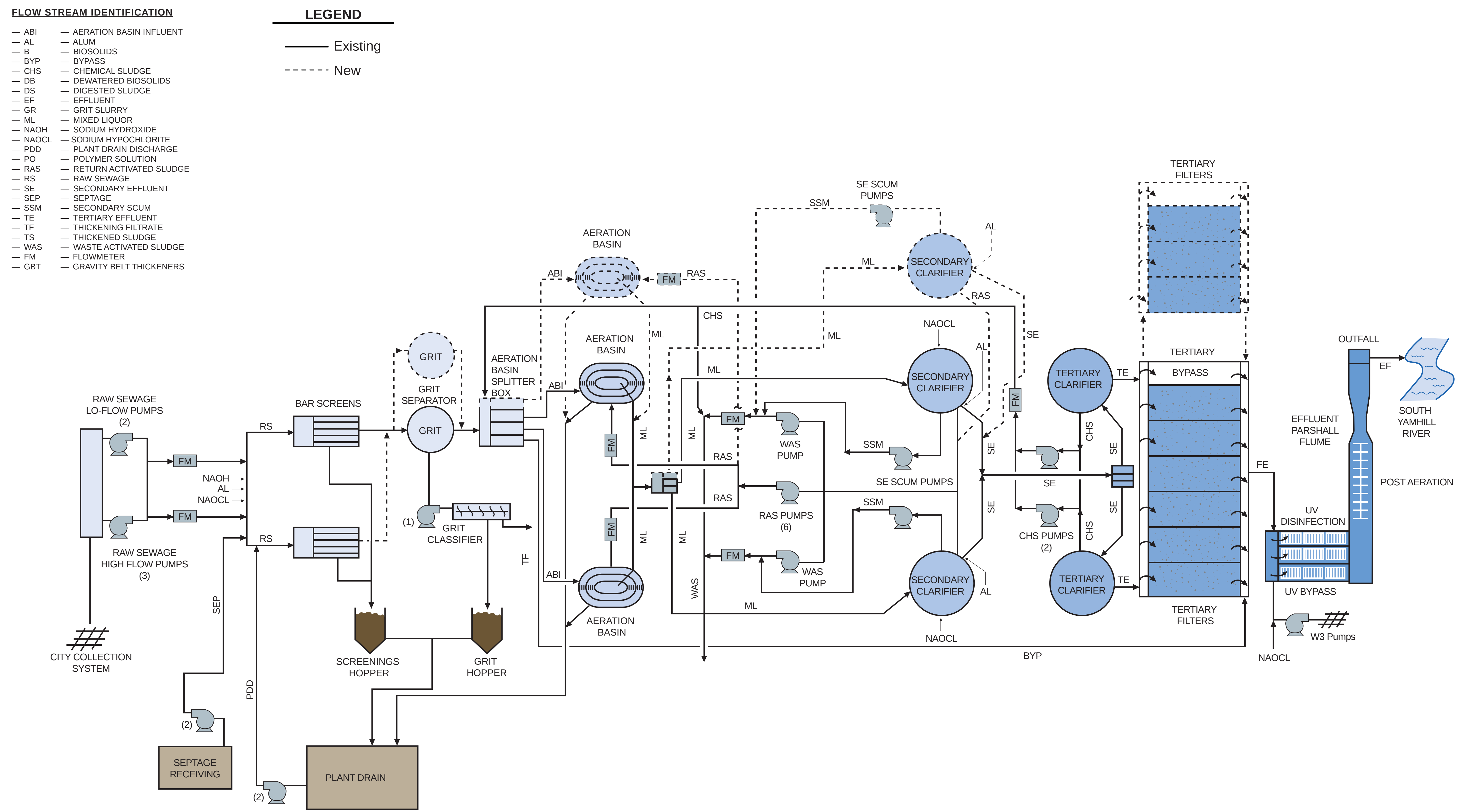

Figure 10-2

McMinnville Water Reclamation Facility

LIQUID STREAM PROCESS FLOW SCHEMATIC

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Pre-Screening Facility. No modifications to the pre-screening facility are recommended at this time. The facility has a peak flow capacity of 32 mgd, which matches the buildout peak hour flow (PHF). Equipment replacement will be required as the screen and washer/compactor reach the end of their useful lives.

Raw Sewage Pump Station. Since the buildout PHF is less than the current firm pumping capacity of the Raw Sewage Pump Station (RSPS), no capacity expansion will be required. Recommended improvements focus on correcting the condition issues associated with the station and identified in Chapter 3. These include:

- <u>Vibration Study and Corrective Measures.</u> A technical investigation and study should be undertaken to determine the causes of the excessive pump vibrations and to identify a means of reducing them to acceptable levels.
- <u>Pump and Screen Programming Changes.</u> The SCADA programming of the pumps and the influent mechanical screen should be reviewed to identify ways of reducing the surging conditions that are created as a result of intermittent screen raking operations and the small available volume that exists between the screen and the pumps. Programming changes could also be made to more evenly distribute the operation of the pumps. Finally, all SCADA information collected at the RSPS should be relayed on to the WRF so that operations personnel know the status of the station's components even when not present at the facility. Similarly, the ability to acknowledge alarms originating at RSPS and to make changes in the operation of the pump station remotely from the WRF should be added.
- <u>Suction Valve Maintainability Improvements.</u> The knife gate valves on the suction side of the raw sewage pumps require periodic maintenance. In order to perform this maintenance, WRF personnel must enter the wet well and plug the pump's suction piping. Alternatives for the use of a different valve type are limited by the very short pipe length between the wall spool and the suction elbow to each pump. The recommendation is based on providing better access to the wet well for the purpose of plugging the pump suction line. These improvements would consist of: (1) provide a more operator-friendly access opening to the wet well; (2) erect a mezzanine platform in the wet well to allow maintenance staff to get to the dividing wall of the wet and dry wells for the purpose of installing a plug in the opening; and (3) install a positive ventilation system for the wet well to enhance personnel safety when placing and removing the plugs.
- <u>Drain Pump Replacement.</u> The motors for the existing dry well sump pumps are mounted just above floor level and are not rated for submersible service. Consequently, these pumps would fail in the event of a significant line break or leak. Replacement of the existing dry well drainage pumps with submersible pumps would result in the elimination of the concern that the pump motors could become submerged in the event of a major leakage in the dry well.
- <u>Structural Repairs.</u> Minor structural damage that has resulted from the equipment vibration and piping movement should be repaired in the course of addressing the vibration and pipe support issues.

Headworks. Three alternatives were identified in Chapter 7 for improving the influent screening operation at the WRF. The recommended screening system option is *Alternative 3. Automatic Screen Lifting System.* This alternative avoids costly structural modifications that would be required by constructing a third screen channel. Because all influent flow is screened upstream of the RSPS, short-term interruptions in screen functionality at the headworks should not create significant O&M issues.

A second vortex grit tank will be provided adjacent to the existing tank. This will provide the needed hydraulic capacity to accommodate PHF conditions when both units are on line. A single unit would be able to handle all flow conditions that would be encountered in dry weather, thereby providing seasonal redundancy.

In addition to the construction of a second vortex grit tank, the existing tank should be modified to mitigate current hydraulic deficiencies that are adversely affecting its performance. This could consist of raising the floor level of the vortex section so that water depths during the operation of the unit are consistent with the manufacturer's design. Minor modifications to the in-tank equipment would also be needed to accomplish this.

Secondary Treatment. Recommended secondary treatment facilities include a third Orbal oxidation ditch, third secondary clarifier, and return activated sludge (RAS) pump station expansion. The third Orbal would be identical to the existing units, with the exception that features to allow operation in contact/stabilization mode would be included. The existing Orbals would be retrofitted with these same features after the third unit is operational.

A third secondary clarifier is included as part of the recommended plan; however, the City should re-evaluate the need for the clarifier as buildout conditions are approached. With continued blending during peak flow conditions and continued production of solids with excellent settling properties, it may be possible to postpone construction of the third clarifier indefinitely. Conversely, should regulatory requirements change such that blended treatment is disallowed, construction of the third secondary clarifier would be needed upon implementation of the rule change.

Major secondary process equipment that will require replacement as its useful life is reached includes:

- Aerators
- Secondary clarifier sludge collection mechanisms and drive units
- RAS pumps
- Waste activated sludge (WAS) pumps

A condition assessment performed on the Orbals identified two deficiencies that should be corrected:

- Install variable frequency drives (VFDs) on the remaining constant speed aerators to reduce energy use and improve process control.
- Repair cracks in concrete.

Tertiary Treatment. The recommended tertiary facilities expansion consists of constructing additional filters that would operate in series with the existing tertiary clarifiers, and in parallel with the existing continuous backwash sand filters. An additional chemical feed point would be added and the new filters would be sized such that direct filtration of secondary effluent with alum floc would be possible in the event a tertiary clarifier is out of service. The City may want to consider conducting a pilot study as part of a preliminary design process to aid in the selection of a filtration technology.

Large tertiary process equipment and materials that will require eventual replacement includes:

- Tertiary clarifier sludge collection mechanisms and drive units
- Chemical sludge pumps
- Air scour compressors
- Filter media

Condition improvements for the tertiary facilities include:

- Automation of the tertiary bypass gate
- Addition of a filter head box drain
- Media replacement
- General improvements in automation, including remote control and monitoring

UV Disinfection System. The existing UV disinfection system has sufficient capacity to disinfect the projected peak hour flow when all three channels are in service. The firm capacity of the facility (with one channel out of service) is sufficient to accommodate dry weather disinfection needs. Consequently, the existing facility was determined to be adequate for the projected buildout conditions.

The existing disinfection equipment will require replacement as it reaches the end of its useful life. Therefore, budgeting for the replacement of this equipment is recommended. As UV disinfection technology is continuing to evolve, the replacement equipment should include the latest enhancements, such as an in-channel lamp cleaning systems, in order to maximize performance, efficiency, and reliability.

Outfall. No modifications to the existing outfall and diffuser are required. The capacity and performance are adequate to accommodate long-term needs.

Solids Management Facilities

Solids management alternatives were presented and evaluated in Chapter 8. Potential solids management strategies were identified, screened, and evaluated. The following solids management strategy was recommended:

SM2 ATAD Treatment and Dewatering and Stabilization. This management strategy consists of continued use of the ATAD process up to the capacity of the existing process and constructing a parallel process that incl1udes dewatering, sludge stabilization and storage for treatment of additional sludge volume.

The recommendations presented in this section are consistent with this management strategy.

A solids management process schematic diagram is provided as Figure 10-3.

Sludge Thickening. The existing gravity belt thickeners (GBTs) have been operated successfully at loading rates of 200 gpm/meter of belt width. This is at the low end of typical GBT loading rates. At this processing rate, a single GBT could process the projected buildout average WAS and chemical sludge production in just under eight hours per day. The projected buildout maximum month sludge volume could be processed by a single machine in just under twelve hours per day. Since two units are generally available, processing could still be achieved in one shift per day operation most of the time. Therefore, the existing GBTs have sufficient capacity to handle the projected buildout solids quantities.

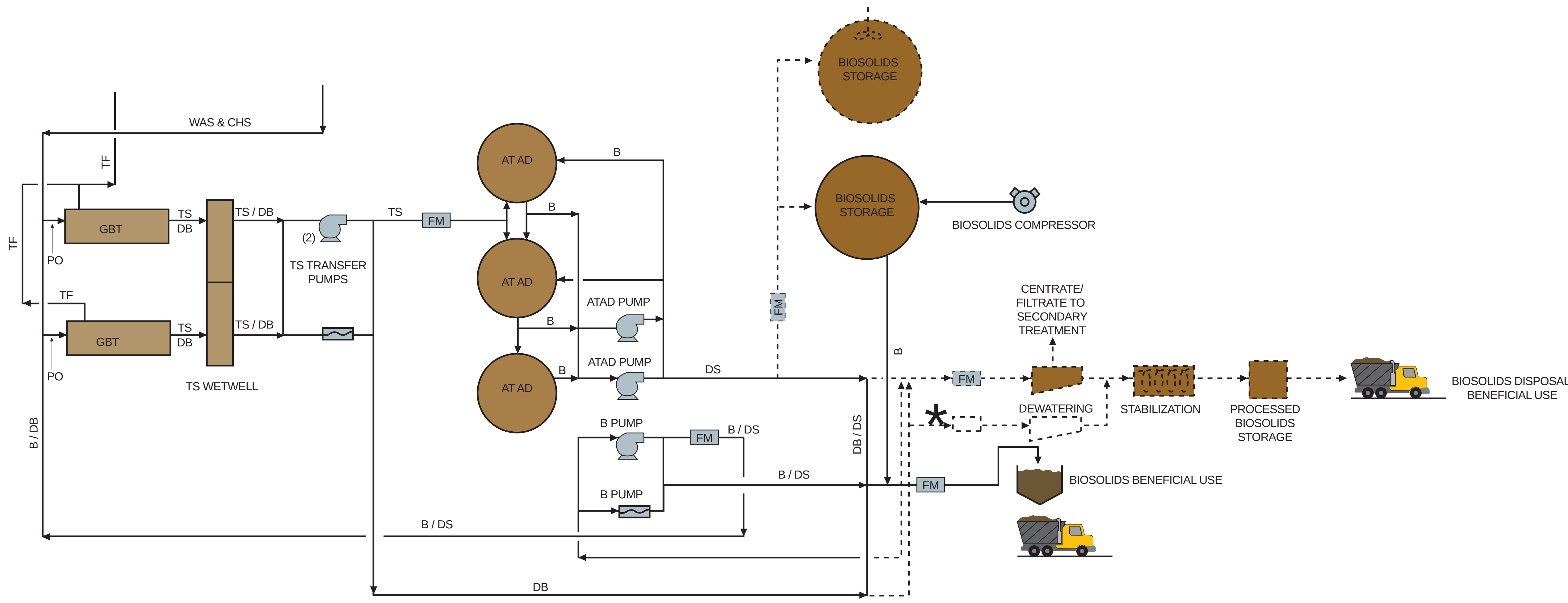
Two GBTs were provided in the original design to provide direct thickening of WAS/alum sludge or recuperative thickening for digested sludge. However, recuperative thickening has not been practiced to date nor does WRF staff plan to initiate this practice. The polymer feed system, the thickened sludge storage tank and the thickened sludge transfer pumps have adequate capacity for buildout conditions. Therefore, no expansion to this facility will be required.

ATAD Digestion. ATAD digestion up to the capacity of the existing three ATAD tanks would continue under the recommended plan. Major ATAD equipment that will need to be replaced as it reaches the end of its useful life includes:

- Aspirating aerators
- Foam cutters
- ATAD transfer pumps
- Biosolids pumps

Recommended improvements focus on correcting the condition issues associated with the process and identified in Chapter 3. These include:

- Periodic coating. Periodic coating is required for protection from corrosion. Minor corrosion was noted in the recent condition assessment.
- Mixing and aeration improvements. The recent installation of vertical aspirating aerators (Turborators) have improved the performance of the process significantly. Installation of Turborators on all three tanks is recommended. The ability to adjust the orifice of the aerator would improve its operation if and when that feature is offered.
- Installation of foam detectors. Foam detectors would reduce the run time and extend the life of the foam cutters.
- Construct runoff containment. A berm and gravity drainage system would provide containment of runoff in the area surrounding the ATADs.



FLOW STREAM IDENTIFICATION

— ABI	— AERATION BASIN INFLUENT
— AL	— ALUM
— B	— BIOSOLIDS
— BYP	— BYPASS
— CHS	— CHEMICAL SLUDGE
— DB	— DEWATERED BIOSOLIDS
— DS	— DIGESTED SLUDGE
— EF	— EFFLUENT
— GR	— GRIT SLURRY
— ML	— MIXED LIQUOR
— NAOH	— SODIUM HYDROXIDE
— NAOCL	— SODIUM HYPOCHLORITE
— PDD	— PLANT DRAIN DISCHARGE
— PO	— POLYMER SOLUTION
— RAS	— RETURN ACTIVATED SLUDGE
— RS	— RAW SEWAGE
— SE	— SECONDARY EFFLUENT
— SEP	— SEPTAGE
— SSM	— SECONDARY SCUM
— TE	— TERTIARY EFFLUENT
— TF	— THICKENING FILTRATE
— TS	— THICKENED SLUDGE
— WAS	— WASTE ACTIVATED SLUDGE
— FM	— FLOWMETER
— GBT	— GRAVITY BELT THICKENERS

LEGEND

——— Existing

- - - - New

* Raw TS dewatered separately from ATAD or stored sludge for landfilling

Figure 10-3

McMinnville Water Reclamation Facility

BIOSOLIDS HANDLING
PROCESS FLOW SCHEMATIC

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Liquid Biosolids and Dewatered/Stabilized Biosolids Storage. The existing design capacity of 210 days of total biosolids storage (with no decanting) will be maintained. At the current solids loading, 190 days storage is provided. Over the last several years, approximately 2.7 million gallons per year have been decanted out of the sludge storage tank and recycled through secondary treatment. The tank is decanted to increase the solids concentration. However, the volume that can be decanted at any given time depends on plant flow and secondary process performance, and is therefore uncertain. The following improvements are recommended for the existing storage tank as result of the condition assessment performed on the tank:

- Meter decant flow. Decant is returned to the secondary process. The quantity of flow that can be decanted depends on plant flow and available secondary process capacity. The ability to meter decant flow would enhance operations.
- Repair cracks. Minor cracks in the tank exterior should be repaired.

Construction of a new 1 MG liquid biosolids storage tank is recommended in the near term to provide sufficient storage capacity. The balance of the required storage capacity should be provided for dewatered/stabilized biosolids as the new biosolids process is constructed. The dewatered/stabilized biosolids storage facility would consist of an open sided building with a concrete slab and metal roof. The size of the storage area will differ depending on the selected biosolids process.

Biosolids Storage Tank Mixing. Energy will be required for mixing the contents of new biosolids storage tank(s). The fact that the liquid level in the storage tank varies must be taken into account when considering mixing technology. Therefore, aerated mixing is recommended for the new storage tank.

Sludge Dewatering. The recommended solids alternative includes a process that would operate in parallel with the ATADs. The parallel process would include dewatering prior to sludge stabilization. The dewatering facility should be sized to accommodate average day thickened sludge production with seven-days-per-week, single-shift operation. Increased loadings would be accommodated by increasing operation time. Flexibility should be built in the process so that digested and stored biosolids could also be dewatered. Therefore, the City should choose a dewatering technology that will perform satisfactorily with an ATAD sludge, which is notably challenging to dewater. The City may wish to perform pilot testing as part of a preliminary design process to select an appropriate dewatering technology.

Dewatered Sludge Stabilization. Sludge stabilization would follow dewatering in the recommended plan. Available processes include thermal drying, lime stabilization and composting. Each of the approaches offers advantages in capital cost, operational cost or quality of final product. A detailed evaluation should be performed as part of a preliminary design process to determine the preferred stabilization process.

Odor Control

Odor control is currently provided for the head space in the Headworks Building, the Biosolids Storage Tank and the ATAD tanks. Odorous air is treated in a biofilter. The design capacity of the biofilter is approximately 10,000 SCFM. Based on the volume of air currently treated, the biofilter would need to be expanded (or new odor control constructed) to provide odor control for a building to house dewatering and biosolids processing equipment and for the headspace in the new biosolids storage tank.

Effluent Reuse Facilities

While effluent reuse is not a core element of the recommended plan, the City should nevertheless continue to monitor regulatory changes that could trigger the need for a reuse program. For example, more stringent thermal limits could prompt the City to plan and implement reuse projects.

In addition, the City should continue to identify opportunities for collaboration in the development of reuse projects. Projects in which costs can be shared between the City and other public or private entities have the potential to provide multiple benefits in a cost-efficient manner. Potential partners include Cascade Steel and McMinnville Water and Light.

To prepare for a potential future reuse program, the City could pursue the development of a demonstration project. Such projects can be effective in clarifying O&M demands, improving cost estimates for larger scale projects, and facilitating public education and support.

Other Facilities

Support facilities are crucial to the successful operation of a wastewater treatment plant. Support facility recommendations are presented in this section.

Plant Water System and Outside Piping. While the plant water system has adequate capacity at this time, its capacity should be re-evaluated each time another large demand is added to the system. In addition, WRF personnel have discovered that corrosion of the buried plant water distribution and process piping may be occurring. Consequently, a corrosion study of existing piping should be conducted to identify if protective measures are needed to protect the piping from premature deterioration.

Electrical Distribution, Control, and Instrumentation Systems. Several deficiencies in the WRF's electrical distribution, control and instrumentation systems were cited in Chapter 3. The recommendations for correcting these deficiencies include:

- Improve the automatic transfer scheme, multifunction metering system, and operating environment at the RSPS.
- Verification that the pushbutton stations in the second floor of the Headworks Building are suitable for this classified environment.
- Repair the ductwork in the Headworks Building HVAC/Mechanical Room so that leakage from the foul air retrieval system does not result in deterioration of nearby electrical equipment.

- Replace of the inoperable starter cubicle circuit breakers in the Headworks Building MCC room.
- Provide power conditioning filters on sensitive process monitoring instrumentation.
- Evaluate the need for local alarm panels and modify or eliminate to reduce staff time required for alarm responses.

Administration, Laboratory, and Maintenance Facilities. The administration building, including the laboratory and maintenance areas, is at its design capacity. The expansion of the WRF to accommodate increased flows and loads will trigger the need for additional staff. With the addition of personnel, an expansion of the administration, laboratory, and maintenance areas will we required.

In addition to the need for more space, WRF staff identified the following areas of improvement of the plant's administration, laboratory, and maintenance facilities:

- Improve exhaust ventilation in laboratory
- Separate shop and storage spaces
- Modify HVAC system in parts storage area to better protect stored items

ESTIMATED COSTS

The capital costs for the facilities recommended for buildout conditions are summarized in Table 10-2. The capital costs are construction costs with the following mark up factors:

- Contingency – 30%
- Engineering Legal and Administration – 25%

Table 10-2. Capital Costs for the WRF Recommended Plan

Item	Capital Cost, 2008$, $1000
Liquid STream	
Screen modifications	150
Grit system expansion	2,000
Orbal No. 3	7,000
Orbal Nos. 1 and 2 Contact Stabilization modifications	366
Clarifier No. 3 and RAS pumping expansion	6,600
Filtration system expansion	2,200
Solids Management	
1 MG storage tank and mixer	4,300
Dewatering (based on centrifuge dewatering, 1 unit)	5,700
Stabilization (based on thermal drying, 1 unit)	9,400
Stabilized Biosolids Storage	700
Odor Control	250
Total	38,700

In addition to recommended plan capital costs, the cost of major equipment replacement should be budgeted. Table 10-3 summarizes major equipment at the WRF with installation date, expected useful life and resulting expected replacement date. It should be noted that the useful equipment lives shown in the table are based on industry standards. Actual equipment life will vary. A proactive maintenance program like that at the WRF can extend useful life significantly.

Table 10-3. Master Plan Equipment Replacement List

Equipment Description	In Service	Estimated Life	Estimated Replacement Date
Sewer Cleaning Truck	1993	15	2008
CCTV Van	1998	15	2013
Dump Truck (5 CY)	2008	20	2028
Service Truck w/ Crane	2006	20	2026
Forklift	1996	30	2026
ATAD reactor no.1 Aerators + Foam Controllers	1996	20	2016
ATAD reactor no.2 Aerators + Foam Controllers	1996	20	2016
ATAD reactor no.3 Aerators + Foam Controllers	1996	20	2016
Gravity belt thickener #1	1996	30	2026
Gravity belt thickener #2	1996	30	2026
100 kw Onan portable generator (NE PS)	2000	20	2020
125 KW Olympian Generator (3 Mile #1 PS)	2003	20	2023
IDI climber screen	2001	30	2031
Schreiber washer compacting unit	2001	20	2021
Grit separator (pista-grit)	1996	20	2016
Grit classifier	1996	20	2016
Aeration basin 1 aerator 1 assembly	1996	20	2016
Aeration basin 2 aerator 1 assembly	1996	20	2016
Aeration basin 1 aerator 2 assembly	1996	20	2016
Aeration basin 2 aerator 2 assembly	1996	20	2016
Aeration basin 1 aerator 3 assembly	1996	20	2016
Aeration basin 2 aerator 3 assembly	1996	20	2016
Aeration basin 1 aerator 4 assembly	1996	20	2016
Aeration basin 2 aerator 4 assembly	1996	20	2016
Secondary clarifier 1 drive	1996	30	2026
Secondary clarifier 2 drive	1996	30	2026
W3 strainer	1996	20	2016
Air compressor no.2	1996	30	2026
Pump station: Cozine pump no.1	1996	20	2016
Pump station: Cozine pump no.3	1996	20	2016

Table 10-3. Master Plan Equipment Replacement List, cont'd…

Equipment Description	In Service	Estimated Life	Estimated Replacement Date
Pump station: Cozine pump no.4	1996	20	2016
Pump station: Cozine pump no.6	1996	20	2016
Raw sewage pump no.1	1996	20	2016
Raw sewage pump no.2	1996	20	2016
Raw sewage pump no.3	1996	20	2016
Raw sewage pump no.4	1996	20	2016
Raw sewage pump no.5	1996	20	2016
Pump station: Oregon street	1989	30	2019
Pump station: Three mile lane no.1	2004	40	2044
Pump station: Three mile lane no.3	1973	40	2013
Pump station: cozine	1996	40	2036
Pump station: Morgan lane	1997	30	2027
Pump station: Cozine woods	1998	30	2028
Pump station: West side	1990	30	2020
Pump station :Riverside	1981	30	2011
Pump station :North east	1993	30	2023
Pump station: Crestbrook	1994	30	2024
Pump station: Autumn ridge	2005	30	2035
Pump station: Kathleen manor	1996	30	2026
Pump station: Raw sewage	1996	40	2036
Screenings no.1 (Screen & Press)	1996	20	2016
Screenings no.2 (Screen & Press)	1996	20	2016
UV channel 1 system equipment	1996	20	2016
UV channel 2 system equipment	1996	20	2016
UV channel 3 system equipment	2000	20	2020

STAFFING

Current WRF staffing levels conditions are summarized in Table 10-4. The expansion of the existing liquid stream treatment processes and the addition of solids management processes will add to O&M demands at the WRF. In terms of operations, the following factors will impact future staffing levels:

- Additional secondary process flexibility
- Expansion of the filtration process using a potentially different technology
- Addition of a parallel solids processing system
- Increased flows, loads, and subsequent solids quantities
- Potential increased monitoring requirements and associated sampling and laboratory work

Staffing for the conveyance system is addressed in the *Conveyance System Master Plan.*

IMPLEMENTATION PLAN

The implementation plan provided as Table 10-5 has been coordinated with the *Conveyance System Master Plan*. The timing of improvements is typically based on one or more of the following generalized factors:

- Need for additional capacity
- Need for performance improvements
- Available financial resources

For projects of significant size, a 3-year duration was estimated. This window provides adequate time for preliminary design, design, bidding, and construction, but does not include a schedule allowance for funding acquisition.

For some projects, the City has significant flexibility in implementation timing. For example, while the deficiencies in the screening and grit removal systems are well understood and problematic, WRF personnel have modified operational practices to minimize their impacts. Consequently, the City has flexibility to adjust the timing of this project to conform to the combined demands of operations, maintenance, and budget. Other projects have relatively well defined drivers:

- *Third orbal.* Construction of the third Orbal will be driven by increased loading from residential, commercial, and industrial growth. As the capacity of the existing Orbals is reached and exceeded, compliance with effluent ammonia limits will become increasingly difficult.

Table 10-4. Recommended Staffing Levels for the Wastewater Reclamation Facility

Classification	Current staffing level (FTE[a])
Wastewater Division Manager	1
Operations Superintendent	1
Office Specialist II	1
Senior Environmental Tech (pretreatment)	1
Environmental Tech II	1
Senior Operator	1
Operator II	3
Senior Mechanic	-
Mechanic	2
Instrument tech	-
Senior Lab Tech	1
Lab Tech	1
Total	13

(a) FTE = Full time equivalent

- *Third secondary clarifier*. The performance of the secondary clarifiers is affected by the performance of the Orbals and flow rates. Higher sustained flow rates will increase the demands on the existing clarifiers. If regulatory changes eliminate blending as a treatment option, the third secondary clarifier will have to be constructed earlier than planned.
- *Filtration system expansion.* As dry weather flows increase in response to City growth, the existing filtration system will approach its capacity. In addition, if a tertiary clarifier is taken out of service for maintenance, the solids loading to the filters will increase, further stressing the system. Additional filter capacity will be needed to accommodate increased flows and provide redundancy.
- *Biosolids storage.* The existing storage capacity is adequate only with decanting back to the secondary process. If high plant flows or process capacity limit the volume of decanting during the wet season, additional storage is needed to meet current biosolids storage needs.
- *Biosolids processing.* The ATADs are at their rated capacity based on detention time design criteria. New aerators have improved the performance of the process allowing their capacity to be extended. However, increased solids production as a result of increasing loads will continue to stress the process.

Table 10-5. Implementation Plan

Item	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	19-20	20-21	21-22	22-23	Totals
	Fiscal Year															
ADWF Flow, mgd	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.1	
Annual Average BOD Load, ppd	6,100	6,486	6,871	7,257	7,643	8,029	8,414	8,800	9,186	9,571	9,957	10,343	10,729	11,114	11,500	
Collection System																
Michelbook Basin Pipelines		$634,000														$634,000
10th Street Pipeline	$75,000															$75,000
Existing Rehabilitation	$1,000,000	$2,000,000	$2,500,000	$2,500,000												$8,000,000
Buildout Rehabilitation					$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$790,000	$8,690,000
WRF - Liquids																
Headworks - Screen modifications							$30,000	$60,000	$60,000							$150,000
Headworks - Grit system expansion							$400,000	$800,000	$800,000							$2,000,000
Secondary Treatment - Orbal No. 3				$1,400,000	$2,800,000	$2,800,000										$7,000,000
Secondary Treatment - Orbal Nos. 1 and 2 CS Mods							$366,000									$366,000
Secondary Treatment - Clarifier No. 3 + RAS pumping expansion												$1,320,000	$2,640,000	$2,640,000		$6,600,000
Tertiary Treatment - Filtration system expansion			$400,000	$900,000	$900,000											$2,200,000
Administration Building										$1,250,000	$1,250,000					$2,500,000
WRF - Solids																
New 1 MG Storage Tank and Mixer		$900,000	$1,700,000	$1,700,000												$4,300,000
Dewatering Process (Equipment and Building)						$1,100,000	$2,300,000	$2,300,000								$5,700,000
Dryer													$1,800,000	$3,800,000	$3,800,000	$9,400,000
Dry Biosolids Storage						$100,000	$300,000	$300,000								$700,000
Odor Control						$50,000	$100,000	$100,000								$250,000
Investigation and Consultant Services																
Flow monitoring																$0
Model updates																$0
Totals	$1,075,000	$3,534,000	$4,600,000	$6,500,000	$4,490,000	$4,840,000	$4,286,000	$4,350,000	$1,650,000	$2,040,000	$2,040,000	$2,110,000	$5,230,000	$7,230,000	$4,590,000	$58,565,000

A number of uncertainties exist which could substantially affect the City's approach to long-term wastewater and solids management. Therefore, as important regulatory, loading, and flow uncertainties become resolved over time, the City should revisit the potential management strategies presented in Chapters 7 and 8 to see if significant plan modifications are warranted.

Examples of conditions that could trigger plan modifications include:

- Stringent thermal limits. A more stringent temperature standard for the South Yamhill River could limit effluent discharge volumes. Effluent reuse and cooling are potential responses.
- Toxics and metals compliance issues. Toxics and metals are receiving increased regulatory scrutiny, which could ultimately lead to more restrictive effluent limits. Treatment performance enhancements and effluent reuse are potential responses.
- Persistent bio-accumulative and toxic pollutants (PBTs). While currently unregulated, increasing scientific understanding and public awareness of PBTs could eventually lead to the establishment of effluent limits. With the exception of reverse osmosis (RO), few treatment processes are known to be effective at removing a wide range of PBTs. Effluent reuse is a potential response to the imposition of stringent PBT effluent limits.
- Higher than anticipated peak flows. If the collection system rehabilitation is unable to reduce peak flows to 32 mgd, additional wet weather treatment capacity may have to be constructed.
- Reduced available acreage for liquid land application or acceptability of the liquid product. If local land application acreage is reduced or eliminated, a biosolids process that could produce a product with more flexibility with respect to end use or disposal would need to be constructed.

Budgeting for capital replacement projects should be scheduled in addition to the recommended plan capital costs. Figure 10-4 shows the relative number of projects scheduled according to dates listed in Table 10-3 through the planning period. As previously stated, the replacement schedule is based on industry standards. Actual equipment life will vary and can be more closely estimated by WRF O&M staff throughout the planning period.

Figure 10-4. Estimated Capital Equipment Replacement Plan