

City of Riverside

**WASTEWATER COLLECTION AND TREATMENT
FACILITIES INTEGRATED MASTER PLAN**

**VOLUME 8: SOLIDS TREATMENT AND HANDLING
CHAPTER 3: DESIGN CRITERIA**

FINAL
February 2008



**WASTEWATER COLLECTION AND TREATMENT
FACILITIES INTEGRATED MASTER PLAN**

**VOLUME 8: SOLIDS TREATMENT AND HANDLING
CHAPTER 3: DESIGN CRITERIA**

TABLE OF CONTENTS

	<u>Page No.</u>
3.1 PURPOSE	3-1
3.2 EXISTING SOLIDS HANDLING FACILITIES	3-1
3.3 SOLID HANDLING ALTERNATIVES	3-1
3.4 SOLIDS PROJECTION	3-2
3.5 DESIGN CRITERIA	3-2
3.5.1 Co-Thickening	3-2

LIST OF TABLES

Table 3.1 Solids Projections	3-2
Table 3.2 Design Criteria for Primary Sludge Thickening	3-2
Table 3.3 Design Criteria for WAS Thickening	3-3
Table 3.4 Digestion Design Criteria	3-4
Table 3.5 Dewatering Design Criteria	3-5

3.1 PURPOSE

The purpose of this chapter is to summarize the design criteria for the solids handling facilities for the City of Riverside (City) Regional Water Quality Control Plant (RWQCP). This chapter serves as a basis for the solids handling alternative evaluations.

3.2 EXISTING SOLIDS HANDLING FACILITIES

The RWQCP is a tertiary wastewater treatment plant that currently treats approximately 33 mgd. Existing solids handling processes include: primary sludge thickening within primary sedimentation basins, Dissolved Air Flotation Thickening (DAFT) of Waste Activated Sludge (WAS), mesophilic anaerobic digestion, and belt-filter presses and centrifuges for dewatering.

3.3 SOLID HANDLING ALTERNATIVES

The following is a list of solids handling alternatives to be evaluated for this master plan. This list was approved by the City at the July 2006 kick-off meeting:

1. Primary Thickening:
 - a. Gravity Thickeners.
 - b. Gravity Belts.
 - c. Rotary Drum Thickeners.
 - d. Co-Thickening.
2. WAS Thickening:
 - a. Centrifuges.
 - b. Rotary Drum Thickeners.
 - c. Gravity Belts.
 - d. Co-Thickening.
3. Digestion:
 - a. Mesophilic Anaerobic.
 - b. Acid-Phase Anaerobic.
4. Dewatering:
 - a. Belt Presses (existing).
 - b. Centrifuges (selected previously for expansion).

The City has stated during the kick-off meeting that they do not want to continue the use of in-tank thickening for primary sludge, as the City wants to improve the primary solids content to lower the digester feed flow rate. In addition, the City would like to explore other alternatives besides DAFTs for the WAS thickening option.

3.4 SOLIDS PROJECTION

Solids projections were made for an average daily flow of 52 mgd. Table 3.1 summarizes the solids projections, which are based on current future levels of treatment.

Table 3.1 Solids Projections Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside		
Parameter	Primary Sludge	WAS
Solids, lbs/day	103,000	118,000
Feed Solids Concentration, %	1.5	0.6
Flow, mgd	0.82	2.36
VSS, %	81	85

3.5 DESIGN CRITERIA

3.5.1 Co-Thickening

The following information was used to develop the process design and unit sizing for the rest of the unit processes considered for the RWQCP expansion. Table 3.2 lists the primary sludge thickening design criteria, Table 3.3 lists the WAS thickening design criteria, and Table 3.4 lists the digestion design criteria.

Table 3.2 Design Criteria for Primary Sludge Thickening Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Parameter	Values
Gravity Thickeners	
Mass Loading Rate, lbs/sf/day	20 to 40
Hydraulic Loading Rate, gpd/sf	380 to 760
Solids Retention Time, days	1 to 2
Side Water Depth, feet	15
Dilution Water Use	1:1
Gravity Belts	
Hydraulic Loading Rate, gpm/meter of belt width	150
Feed Solids Concentration, %	1 to 2

Table 3.2 Design Criteria for Primary Sludge Thickening Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Parameter	Values
Thickened Solids Concentration, %	5 to 7
Solids Capture Efficiency, %	90 to 98
Polymer Dose, active lbs/ton of dry solids	10 to 12
Minimum Flocculation Time, seconds	30
Rotary Drum	
Maximum Hydraulic Loading Rate, gpm	300
Feed Solids Concentration, %	1 to 2
Thickened Solids Concentration, %	5 to 7
Solids Capture Efficiency, %	93 to 98
Polymer Dose, active lbs/ton of dry solids	6 to 8

Table 3.3 Design Criteria for WAS Thickening Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Parameter	Values
Centrifuge	
Feed Rate, gpm	Up to 900
Dewatered Cake Solids Concentration, %	6 to 10
Solids Capture Efficiency, %	85 to 90
Operating Speed	2,000 to 3,000 rpm
Polymer Dose, active lbs/ton of dry solids	6 to 8
Gravity Belts	
Hydraulic Loading Rate, gpm/meter of belt width	150
Feed Solids Concentration, %	0.6 to 1.5
Thickened Solids Concentration, %	5 to 7
Solids Capture Efficiency, %	90 to 98
Polymer Dose, active lbs/ton of dry solids	10 to 12
Minimum Flocculation Time, seconds	30
Rotary Drum	
Maximum Hydraulic Loading Rate, gpm	300
Feed Solids Concentration, %	0.6 to 1.5

Table 3.3 Design Criteria for WAS Thickening Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Parameter	Values
Thickened Solids Concentration, %	4 to 8
Solids Capture Efficiency, %	90 to 95
Polymer Dose, active lbs/ton of dry solids	8 to 10

Table 3.4 Digestion Design Criteria Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Parameter	Value
Anaerobic Digestion	
<u>Volatile Solids Loading (lbs/ft³/day)</u>	
All Units In Service	0.12
Largest Unit Out of Service	0.15
<u>Detention Time (days)</u>	
All Units In Service	20
Largest Unit Out of Service	15
Acid-Phase Anaerobic Digestion	
<u>Acid Phase</u>	
Volatile Solids Loading (lbs/ft ³ /day)	
Largest Unit Out of Service	1 to 3
Detention Time (days)	
All Units In Service	2
<u>Methane-Phase</u>	
Volatile Solids Loading Rate	
Acid Phase In Service	N/A
Acid Phase Out of Service	0.15
Detention Time (days)	
All Units In Service	15
One Unit Out of Service	12
Acid Phase Out of Service	15

The design criteria for the solids dewatering facilities are listed in Table 3.5. These criteria were taken from the previous Biosolids Master Plan.

Table 3.5 Dewatering Design Criteria Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside			
Parameter	Belt Press⁽¹⁾	High-Speed Centrifuge⁽²⁾	
		Existing Unit	Future Unit
Feed Rate, gpm			
Average	100	175	200
Peak	160	250	300
Cake Solids Content, %	16	25	25
Solids Capture, %	95	96	96
Estimated Polymer Dose (lb active/dry ton)	12	20	20
Typical Power Load per Machine, kW	20	90	110
Notes:			
(1) Information given by the City Staff.			
(2) Information taken from 2003 Biosolids Master Plan.			