Ina Road WRF Capacity and Effluent Quality Upgrade

30% Value Engineering Documentation

Pima County

Regional Wastewater Reclamation Department

CH2MHILL

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4. Primary Sludge Thickening

Value engineering refinement of the design influent wastewater characteristics reduced the loading on the primary treatment system, while refinement of the primary treatment performance increased the loading on the primary sludge thickening system. Overall, the net result is an increase in loading to the gravity thickeners of approximately 20 percent.

With the increased loadings, the redundancy level is reduced to where the WEF Manual of Practice 8 recommended a dry solids loading rate of 18-28 lb/day per square foot (ft^2) is exceeded at maximum month design flows with one thickener out of service, and at maximum week conditions with all four tanks operating. Operating as dissolved air floatation thickeners (DAFTs) increases the loading criteria slightly, however, so the overall loading under peak conditions is not expected to present operational problems. Shutdown of a tank for inspection and/or maintenance should be scheduled during non-peak periods.

No changes to the actual thickening facilities are included as part of the VE modifications, and are therefore unchanged from the 30% schematic design report.

Table 4-1 lists design criteria for the gravity thickening process. Overflow and solids loading rates are based on all units operating as gravity thickeners (GTs) and may vary if units are operated as DAFTs.

TABLE 4-1
Design Criteria –Gravity Thickening Process
Ina Road WRF Capacity and Effluent Quality Upgrade

		30% Schematic Design Report			30% VE		
		Average Annual	**Maximum Month**	**Maximum Week**	**Average Annual**	**Maximum Month**	**Maximum Week**
Gravity Thickeners – Primary Sludge							
Operation	hours per day days per week	24 7	24 7	24 7	24 7	24 7	24 7
Gravity Thickener Feed Sludge							
Total solids dry mass rate	pounds per day	86,000	103,000	120,000	104,000	126,000	147,000
Concentration	percent digested sludge	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Volumetric rate	gallons per day	1,030,000	1,240,000	1,447,000	1,251,000	1,505,000	1,756,000
Overflow rate, solids only	gallons per day per square foot	204	246	287	248	299	348
Solids loading rate							
3 Tanks	pounds per square foot per day	23	27	32	28	33	39
4 Tanks	pounds per square foot per day[a]	17	20	24	21	25	29
Thickened Primary Sludge to Digestion							
Total solids dry mass rate	pounds per day	72,000	85,000	100,000	94,000	113,000	132,000
Concentration	percent digested sludge	4.5%[b]			4.5%[b]		
Volumetric rate	gallons per day	191,000	228,000	266,000	250,000	301,000	351,000

[a] WEF Manual of Practice (MOP) 8 recommended loading range is 18-28 lb/sq-ft/day

[b] Thickening performance per ROMP Table 5-7, page 5-7. This is an expected average performance applicable for all operating conditions within normal loading range.

mgd = millions of gallons per day

WRC = Water Reclamation Campus

WRF = Ina Road Water Reclamation Facility

5. Waste-Activated Sludge Storage and Thickening

The 30% Schematic Design Report included two dedicated WAS storage tanks in the form of converted existing HPO secondary clarifiers. The other two existing HPO clarifiers were to be used for emergency digested sludge storage. The VE evaluation recognized the need for two WAS storage tanks, such that one can serve as a backup should the primary tank require maintenance. Because the digested sludge storage is intended as a backup or emergency function, the decision was made in workshop discussions with PCRWRD staff to arrange one of the two WAS storage tanks to also be able to operate as the emergency digested sludge storage tank. Therefore, the VE modifications are to convert only two of the four tanks (HPO clarifiers) for sludge storage, with one being dedicated for WAS and the second being able to switch between WAS storage and emergency digested sludge storage. Each tank will be configured with covers, air mixing, and odor control per the 30% Schematic Design Report.

The VE refinements of the design influent wastewater characteristics and primary treatment performance result in reduced design loads on secondary treatment and subsequent reduction in the WAS production estimates. For the 30% Schematic Design Report, the WRC contribution was based on the ROMP WAS production value. However, to maximize the VE impact, the WRC WAS production was estimated using a separate process model using the same influent characteristics as were used for the Ina Road WRF. This separate modeling resulted in a reduction in the WRC WAS contribution. In addition, the decision to thicken the WRC WAS component to 2 percent dry solids prior to pumping to the Ina Road WRF results in a reduction in the volume of WAS received from the WRC. Tables 5-1 and 5-2 present the revised WAS thickening process criteria, and Table 5-3 presents the associated equipment design criteria. Table 5-4 presents the WAS and digested sludge storage system design criteria.

The reduction in solids results in the elimination of two gravity belt thickeners (GBTs) and the associated feed pumps, polymer feed pumps, and thickened sludge transfer pumps. The criteria for the thickened solids concentration was also modified from 5.0 percent dry solids to 5.5 percent dry solids to match the recommended design value for WAS thickening established in the pilot testing. This results in a further reduction of thickened WAS (TWAS) volume to the digesters.

Digested Sludge Storage and Transfer

As noted above, one of the WAS storage tanks will be fitted to alternatively operate as a digested sludge storage tank, receiving sludge from the digesters. Two transfer pumps will be located in the converted sludge pump station to transfer digested sludge to the Centrifuge Building. As with the 30% Schematic Design Report, the tank will be covered and fitted with coarse bubble aeration for mixing, and odor controlled.

TABLE 5-1
GBT WAS Thickening Process – Ina Road WRF and WRC Waste-Activated Sludge Contributions
Ina Road WRF Capacity and Effluent Quality Upgrade

		30% Schematic Design Report			30% VE		
Design Criterion	**Unit**	**Average Annual**	**Maximum Month**	**Maximum Week**	**Average Annual**	**Maximum Month**	**Maximum Week**
Gravity Belt Thickener Waste-Activated Sludge							
Operation	hours per day days per week	24 7	24 7	24 7	24 7	24 7	24 7
Gravity Belt Thickener Feed Sludge (Ina Road WRF Contribution)							
Total solids dry mass rate	pounds per day	63,000	72,000	84,000	52,000	64,000	75,000
Concentration	% dry solids	0.5%	0.6%	0.6%	0.7%	0.8%	0.8%
Volumetric rate	gallons per day	1,450,000	1,410,000	1,645,000	919,000	924,000	1,078,000
Gravity Belt Thickener Feed Sludge (WRC Contribution)[a]							
Total solids dry mass rate	pounds per day	101,000	121,000	141,000	57,000	69,000	80,000
Concentration	% dry solids	0.7%	0.7%	0.7%	2.0%	2.0%	2.0%
Volumetric rate	gallons per day	1,720,000	2,070,000	2,410,000	340,000	411,000	479,000

[a] Note that WRC contribution exceeds Ina Road WRC contribution due to the absence of primary clarification at the WRC

mgd = million gallons per day

WRC = Wastewater Reclamation Campus

WRF = Ina Road Wastewater Reclamation Facility

TABLE 5-2
Design Criteria – GBT Waste-Activated Sludge Thickening Process
Ina Road WRF Capacity and Effluent Quality Upgrade

		30% Schematic Design Report			30% VE		
Design Criterion	**Unit**	**Average Annual**	**Maximum Month**	**Maximum Week**	**Average Annual**	**Maximum Month**	**Maximum Week**
GBTs – Waste-Activated Sludge							
Operation	hours per day days per week	24 7	24 7	24 7	24 7	24 7	24 7
GBT Feed Sludge (Total)							
Total solids dry mass rate	pounds per day	164,000	193,000	225,000	109,000	133,000	155,000
Concentration	% dry solids	0.6%	0.7%	0.7%	1.0%	1.2%	1.2%
Volumetric rate	gallons per day	3,170,000	3,480,000	4,055,000	1,259,000	1,335,000	1,557,000
GBT Thickening Operations							
Number of units installed		5 (4 duty, 1 standby, space provided for 1 future)			3 (2 duty, 1 standby)		
Effective belt width	meters	2.8			2.8		
Processing capacity (each)	gallons per minute	770[a]			770[a]		
Processing capacity (firm)	gallons per minute	3,080[a]			1,540[a]		
Number of gravity belt thickeners in operation		3	3	4	2	2	2
Required feed rate to each gravity belt thickeners	gallons per minute	734	734	604	447	476	555
Capture efficiency	%	95%[a]			95%		
Concentration	% dry solids	5.0%[b]			5.5%[c]		

[a] Processing capacity of 275 gallons per minute per meter, per GBT vendor pilot testing results.

[b] Per discussion at Interim Biosolids Progress Meeting, 7/10/2008.

[c] Per GBT vendor pilot testing results

GBT = gravity belt thickener

mgd = million gallons per day

TABLE 5-3
Design Criteria – WAS Thickening, Waste-Activated Sludge GBT Facility Equipment
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Gravity Belt Thickeners		
Number of units	5 (4 duty, 1 standby)[a]	3 (2 duty, 1 standby)
Effective belt width	2.8 meters	2.8 meters
Drive	Adjustable speed (variable frequency drive); 5 hp	Adjustable speed (variable frequency drive); 5 hp
Volumetric loading capacity	275 gpm per meter (confirmed by pilot testing and guaranteed by vendor)	275 gpm per meter (confirmed by pilot testing and guaranteed by vendor)
Thickened sludge solids concentration	5 percent, dry mass basis	5.5 percent, dry mass basis
Capture efficiency	95%[b]	95%[b]
Polymer dose	11 pounds per dry ton	11 pounds per dry ton
Filtrate Tank		
Type	Rectangular, concrete	Rectangular, concrete
Number of units	1	1
Capacity	20,000 gallons, active volume	To be determined
Configuration	Below grade, horizontal	Below grade, horizontal
Filtrate Pumps		
Type	Submersible	Submersible
Number of units	3 (2 duty, 1 standby)	3 (2 duty, 1 standby) [to be evaluated further]
Capacity and head	1,520 gpm, head to be determined	Capacity and head to be determined
Drive	Adjustable speed (variable frequency drive); horsepower to be determined	Adjustable speed (variable frequency drive); horsepower to be determined

TABLE 5-3
Design Criteria – WAS Thickening, Waste-Activated Sludge GBT Facility Equipment
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Polymer System		
Type	**Dry – makedown to 0.25% solution**	**Dry – makedown to 0.25% solution**
Capacity	To be determined	To be determined
Mix Tanks	2 (750 gallons, each)	2 (750 gallons, each)
Feed Tanks	2 (1,000 gallons, each)	2 (1,000 gallons, each)
Mixers	2 (propeller type)	2 (propeller type)
Polymer Feed Pumps		
Type	Progressing cavity	
Number of units	5 (4 duty, 1 standby)[a]	3 (2 duty, 1 standby)
Capacity and head	15 gpm, head to be determined	Capacity and head to be determined
Drive	Adjustable speed (variable frequency drive); horsepower to be determined	Adjustable speed (variable frequency drive); horsepower to be determined
Ferric Chloride System		
Feed Tank	2 (8,000 gallons each)	2 (8,000 gallons each)
Feed Pumps	2 (capacity to be determined)	2 (capacity to be determined)
Thickened Sludge Transfer Pumps		
Type	Open-throat, progressing cavity	Open-throat, progressing cavity
Number of units	5 (4 duty, 1 standby)[a]	3 (2 duty, 1 standby)
Capacity and pressure	120 gpm at 180 ft TDH (5% sludge)	Capacity and pressure to be determined
	95 gpm at 280 ft TDH (6% sludge)	
Drive	Adjustable speed (variable frequency drive); 20 hp	Adjustable speed (variable frequency drive); hp to be determined
Configuration	Horizontal, inline speed reducer	Horizontal, inline speed reducer

TABLE 5-3
Design Criteria – WAS Thickening, Waste-Activated Sludge GBT Facility Equipment
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Belt Wash Water Pumps		
Type	End-suction centrifugal	End-suction centrifugal
Number of units	3 (2 duty, 1 standby)[a]	3 (2 duty, 1 standby) [to be evaluated further]
Capacity and head	220 gpm at 200 ft TDH	Capacity and head to be determined
Drive	Variable speed; 20 hp	Variable speed; hp to be determined
Configuration	Horizontal, inline	Horizontal, inline

[a] The facility will be designed with space to add one future gravity belt thickener and associated equipment.

[b] Pilot test vendor guarantee is 92%, actual value to be coordinated for specifications.

TABLE 5-4
Design Criteria – WAS Thickening, Existing Secondary Clarifier Facility Equipment
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
WAS Storage Tanks (also Digested Sludge Storage Tank)		
Type	Cylindrical, concrete – converted secondary clarifiers	Cylindrical, concrete – converted secondary clarifiers
Number of units	2	1 duty, 1 standby (also used for emergency digested sludge storage)
Capacity	1,190,000 gallons each (2,380,000 gallons total)	1,190,000 gallons each (2,380,000 gallons total)
Configuration	At grade, vertical	At grade, vertical
Gravity Belt Thickener Feed Pumps		
Type	Centrifugal, non-clog	Centrifugal, non-clog
Number of units	3 (2 duty, 1 standby)	3 (2 duty, 1 standby) [to be evaluated further]
Capacity and head	1,925 gpm at 80 feet TDH	Capacity and head to be determined
Drive	Adjustable speed (variable frequency drive); 60 hp	Adjustable speed (variable frequency drive); hp to be determined
Configuration	Vertical	Vertical
WAS Storage Tank Aeration Blowers		
Type	Positive displacement , rotary lobe	Positive displacement , rotary lobe
Number of units	2	2
Capacity and head	1,600 SCFM @ 9 psig	1,600 SCFM @ 9 psig
Drive	100 hp	100 hp
Digested Sludge Transfer Pumps		
Type	Screw centrifugal	Screw centrifugal
Number of units	2 (1 duty, 1 standby)	2 (1 duty, 1 standby)
Capacity and head	220 gpm at 200 ft TDH	Capacity and head to be determined
Drive	Variable speed; 20 hp	Variable speed; hp to be determined

6. Digestion

The VE modifications that affect anaerobic digestion include the following:

- Overall reduction of plant loads from the change in design influent wastewater characteristics (inclusive of WRC solids reduction)
- Revise the primary treatment performance
- Increase thickened WAS concentration design criteria from 5.0 percent dry solids to 5.5 percent dry solids
- Revise redundancy criteria for design from N-1 digesters at maximum month loadings to N-1 digesters at average annual loading

The latter two of these criteria principally result in the elimination of two digesters and the associated ancillary equipment in the digester control building from the Upgrade Project. The revised VE design will include one new 1.8 million gallon digester of the same design as the digester for the Interim Biosolids (IBS) Project, for a total of two new digesters altogether. The digester control building will remain the same as per the IBS Project, but will not be fitted with the equipment and piping for deleted digesters No. 7 and 8.

Tables 6-1 and 6-2 display the revised design criteria for the digesters and the ancillary equipment.

TABLE 6-1
Design Criteria – Digesters
Ina Road WRF Capacity and Effluent Quality Upgrade

		Interim Biosolids Project		Upgrade Project (30% Schematic Design Report)		Upgrade Project 30% VE	
		Average	**Maximum Month**	**Average**	**Maximum Month**	**Average**	**Maximum Month**
Digester Feed							
Total solids mass load	pounds per day	119,000	138,000	238,000	281,000	207,000	251,000
Volatile solids mass load	pounds per day	91,000	105,000	188,000	222,000	143,000	173,000
Volumetric rate	gallons per day	312,000	358,000	593,000	700,000	480,000	580,000
% dry solids		4.60%	4.60%	4.80%	4.80%	5.2%	5.2%
Digesters							
Number of units							
Existing		4		5		5	
New		1		3		1	
Total installed		5		8		6	
Active volume, each (millions of gallons)		4 @1.33 and 1 @ 1.80		4 @ 1.33 and 4 @ 1.80		4 @ 1.33 and 2 @ 1.80	
Solids Residence Time							
With all units in service (days)		22.8	19.9	21.0	17.8	18.8	15.6
With 1 unit out of service (days)		17.0	15.0	18.0	15.3	15.0	12.4
With 2 units out of service (days)		11.3	10.0	15.0	12.7	11.1	9.2
Volatile Solids Loading (lbs VS/day/1000cf)							
With all units in service		102	118	112	133	118	144
With 1 unit out of service		128	147	131	155	149	181
With 2 units out of service		193	222	158	186	201	244

TABLE 6-2
Upgrade Digester Equipment Design Criteria
Ina Road WRF Capacity and Effluent Quality Upgrade

	Interim BiosolidsProject	**Upgrade Project (30% Schematic Design Report)**	**Upgrade Project 30% VE**
Digester Mixer			
Number of units	1	3	1
Type	Linear motion	Linear motion	Linear motion
Size	10 hp	10 hp	10 hp
Sludge Recirculation/Heating Pumps			
Number of units	2	4	1
Type	Screw induced centrifugal	Screw induced centrifugal	Screw induced centrifugal
Capacity	400 gpm	400 gpm	400 gpm
Sludge Heating Water Pumps			
Number of units	2	2	0
Type	Centrifugal	Centrifugal	Centrifugal
Capacity	330 gpm	330 gpm	330 gpm
Heat Exchanger			
Number of units	1	3	1
Type	Tube-in-tube	Tube-in-tube	Tube-in-tube
Capacity	2,300,000 BTU/hr	2,300,000 BTU/hr	2,300,000 BTU/hr
Digested Sludge Pump			
Number of units	2	2	0
Type	Screw induced centrifugal	Screw induced centrifugal	Screw induced centrifugal
Capacity	500 gpm	500 gpm	500 gpm

TABLE 6-2
Upgrade Digester Equipment Design Criteria
Ina Road WRF Capacity and Effluent Quality Upgrade

	Interim BiosolidsProject	**Upgrade Project (30% Schematic Design Report)**	**Upgrade Project 30% VE**
Digester Gas Compressor			
Number of units	2	3	1
Type	Liquid ring	Liquid ring	Liquid ring
Capacity	2 @ 170 cfm	3 @ 170 cfm	1 @ 170 cfm

7. Digested Sludge Thickening and Dewatering and Centrate Equalization

Digested Sludge Thickening/Dewatering

The following VE modifications resulted in a slight increase in the digested sludge mass production for the 30% VE design compared to the 30% schematic design:

- Overall reduction of plant loads from the change in design influent wastewater characteristics
- Revision of the primary treatment performance increased the primary sludge production and a subsequent decrease in the proportion of volatile solids feed rate to digestion
- Increased thickened WAS concentration design criteria from 5.0 percent dry solids to 5.5 percent dry solids reduced sludge volume and increased digested sludge solids concentration.

Two additional changes incorporated into the 30% VE design that resulted in the elimination of the South Centrifuge Building, with the exception of the truck loadout bay portion, were:

- The centrifuge loading rate was increased based on the bench-scale testing of Ina Road WRF digested biosolids conducted by three centrifuge vendors
- Centrifuge operating hours were increased from 16 hours/day to 24 hours/day

Replacement of the three existing centrifuges and their associated feed and dewatered sludge transfer pumps in the existing Centrifuge Building remains the same as in the 30% Schematic Design Report. The truck loadout bay portion of the South Centrifuge Building will be retained to provide an odor-controlled facility for the required dewatered cake handling.

Table 7-1 provides a comparison between digested sludge thickening and dewatering design criteria for the 30% schematic design and the 30% VE design. Table 7-2 compares equipment to be installed in the Centrifuge Facility to meet the process criteria for the 30% Schematic Design Report and the 30% VE Design summarized in Table 7-1.

TABLE 7-1
Digested Sludge Thickening and Dewatering System Design Criteria Comparison
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report		**30% VE**	
	Average Annual Operation (2030)	**Maximum Month Operation (2030)**	**Average Annual Operation (2030)**	**Maximum Month Operation (2030)**
Digested Sludge Feed				
Solids Concentration (%)	2.4	2.4	3.0	3.0
Dry Mass Rate (lbs/day)	120,000	141,000	119,000	145,000
Volumetric Rate (gal/day)	595,000	703,000	479,000	580,000
Dewatered Sludge (Thickening Operation)				
Solids Concentration (%)	8	8	8	8
Solids Capture Efficiency (%)	90	90	90	90
Dry Mass Rate (lbs/day)	109,000	129,000	108,000	132,000
Volumetric Rate (gal/day)	164,000	193,000	162,000	198,000
Centrate Production (gal/day)[a]	529,000	624,000	413,000	499,000
Dewatered Sludge Cake				
Solids Concentration (%)	22	22	22	22
Solids Capture Efficiency (%)	90	90	90	90
Dry Mass Rate (lbs/day)	109,000	129,000	108,000	132,000
Volumetric Rate (cy/day)	327	386	324	397
Centrate Production (gal/day)[a]	626,000	739,000	509,000	617,000
Operating Schedule				
Hours/Day	16[b]	16[b]	24	24
Days/Week	7	7	7	7
Dewatered Sludge Cake Loadout				
Containers per Day[c]	13	15	12	15
Number of Standby Centrifuges[d]	2	1	1	1

[a] Centrate flow rates include 0.2% polymer solution flow rate.

[b] Hours of operation includes 1 hour for startup and 1 hour for shutdown, so that actual centrifuge operation will be 2 hours less per day than what is shown.

[c] Loadouts per day based on maximum hauling weight of 20 tons, which is more conservative than a volumetric basis.

[d] Hours of operation based on expected throughput during dewatering mode

Centrifuge Facility

TABLE 7-2
Centrifuge Facility Design Criteria
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Centrifuges		
Number of Units	Five, with space for one additional unit	Three (replacement of existing units)
Type	High solids, horizontal solid bowl	High solids, horizontal solid bowl
Capacity		
Solids Loading Limit (dry lbs/hr)	3,000	3,500
Volumetric Feed Limit (gpm)	300	350 [to be further evaluated]
Main Drive	250 hp, adjustable frequency drive	250 hp, adjustable frequency drive
Back Drive	50 hp, adjustable frequency drive	50 hp, adjustable frequency drive
Lube Oil Pump	2 hp, constant speed	2 hp, constant speed
Centrifuge Feed Pumps		
Number of Units	Seven, with space for one additional unit	Four (replacement of existing units)
Type	Flanged progressing cavity	Flanged progressing cavity
Capacity	100 – 300 gpm	350 gpm [to be further evaluated]
Drive	Adjustable frequency drive	Adjustable frequency drive
Power	20 hp	horsepower to be determined
Centrifuge Cake Pumps		
Number of Units	Five, with space for one additional unit	Three (replacement of existing units)
Type	Open throat progressing cavity with bridge breaker	Open throat progressing cavity with bridge breaker
Capacity	25 – 100 gpm	capacity to be determined
Drive	Adjustable frequency drive	Adjustable frequency drive
Power	50 hp	horsepower to be determined
Centrifuge Cake Loadout		
Number of Silos	Three	Three
Type	13’ diameter with actuated gates	13’ diameter with actuated gates [to be further evaluated]
Capacity	3,400 cf	3,400 cf [to be further evaluated]
Discharge Gate Type	Hydraulically actuated diamond gate	Hydraulically actuated diamond gate
Power	TBD	TBD

TABLE 7-2
Centrifuge Facility Design Criteria
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Centrifuge Centrate Pumps		
Number of Units	Four, one duty and one standby at each Centrifuge Building	Two, one duty and one standby (replacement of existing units)
Type		
Centrate Sump 1	Self-priming, non-clog, centrifugal	Self-priming, non-clog, centrifugal
Centrate Sump 2	Submersible, non-clog centrifugal	NA
Capacity	1,400 gpm at 38 ft total dynamic head, water	capacity and head to be determined
Drive	Adjustable frequency drive	Adjustable frequency drive
Power	20 hp	horsepower to be determined
Polymer System for the South Centrifuge Building[a]		
Type	Dry – makedown to 0.25% solution	NA
Capacity	To be determined	NA
Mix Tanks	2 (750 gallons, each)	NA
Feed Tanks	2 (1,000 gallons, each)	NA
Mixers	2 (propeller type)	NA
Polymer Feed Pumps		
Type	Progressing cavity	NA
Number of units	3 (2 duty, 1 standby)	NA
Capacity and head	15 gpm, head to be determined	NA
Drive	Adjustable speed (variable frequency drive); horsepower to be determined	NA
Ferric Chloride System		
Feed Tank	2 (8,000 gallons)	2 (8,000 gallons)
Feed Pumps	2 (capacity to be determined)	2 (capacity to be determined)

[a] The existing centrifuge system in the North Centrifuge Building has adequate capacity for the centrifuges located there. As a result, the existing polymer makedown and feed systems will not be replaced.

Centrate Storage and Equalization

Table 7-3 provides a comparison between recycle equalization basin design criteria for the 30% Schematic Design Report and 30% VE design. For the recycle equalization basin, a converted secondary clarifier will be used in the 30% VE design instead of the converted HPO basins as was proposed for the 30%schematic design. Two recycle pumps will be located in the converted sludge pump station to transfer recycle flows to the Intermediate Pump Station.

TABLE 7-3
Design Criteria – Recycle Equalization Basin
Ina Road WRF Capacity and Effluent Quality Upgrade

	30% Schematic Design Report	30% VE
Recycle Equalization Basin		
Type	Rectangular, concrete – existing	Cylindrical, concrete – converted secondary clarifiers
Number of units	2 (normally hydraulically connected, but may be isolated)	1
Capacity	0.91 million gallons (total)	1.19 million gallons
Configuration	Below grade, converted HPO bioreactors	Below grade, converted secondary clarifiers
Recycle Pumps		
Type	Centrifugal	Screw-Induced Centrifugal
Number of units	3 (2 duty, 1 standby)	2 (1 duty, 1 standby)
Capacity and head	1,000 gpm @ 30 ft of head	capacity and head to be determined
Drive	10 hp Adjustable speed (variable frequency drive	Adjustable speed (variable frequency drive); horsepower to be determined