IEUA Wastewater Facilities Master Plan
TM 6 RP-4 Future Plans

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DATE:	October 29, 2014

Executive Summary

Regional Water Recycling Plant No. 4 (RP-4) began operation in 1997 and treats wastewater from the Cities of Rancho Cucamonga and Fontana, as well as unincorporated areas of San Bernardino County. RP-4 consists of liquid treatment facilities and sends solids to Regional Water Recycling Plant No. 1 (RP-1) for treatment.

The current and future flows and loads for RP-4 were estimated in *Technical Memorandum (TM) 4 Wastewater Flow and Loading Forecast*. An analysis of the influent wastewater characteristics at RP-4 was conducted to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and the 2060 ultimate buildout year. These projections and the effluent requirements detailed in the Santa Ana Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0021 were used to evaluate the existing capacities of the RP-4 liquid treatment facilities. The estimated capacities were then compared to the projected flow and loads to determine the RP-4 processes that require expansion within the 20-year planning period, and when those facilities would need to be online.

Due to the incorporation of septic flows into the Inland Empire Utilities Agency (IEUA) sewer system, RP-4 plant influent flows and loads are projected to increase substantially by 2035. Although the existing primary and secondary treatment processes at RP-4 have sufficient capacity to treat projected flows and loads through planning year 2035, the tertiary processes will need to be expanded. Additional filtration and disinfection units will be needed by 2035 to handle the increased flows and loads. The RP-4 Tertiary Expansion Project would expand the RP-4 tertiary treatment capacity beyond 14 mgd to match that of the primary and secondary treatment processes. The capital costs included in the 20-year CIP for this project are summarized in Table 6-1.

TABLE 6-1
RP-4 Expansion Projects Capital Cost Estimate Summary

Component Description	RP-4 Tertiary Expansion Project
Total Direct Cost[a]	$2,160,000
Total Estimated Construction Cost[b]	$3,622,000
Total Estimated Project Costs	$4,709,000

[a] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).
[b] Cost does not include escalation to midpoint of construction.
The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

1.0 Background and Objectives

IEUA contracted with CH2M HILL and Carollo Engineers (Consultant Team) to develop a Wastewater Facilities Master Plan (WFMP). The objective of the WFMP is to plan IEUA’s wastewater treatment and conveyance improvements and develop a Capital Improvement Program (CIP). The capital program will guide IEUA in the development of major improvements to treatment and conveyance facilities. There are five goals for this TM:

- Summarize information from TMs 1 through 4 as it pertains to RP-4.
- Evaluate the current capacities and limitations of the existing facilities.
- Determine treatment facilities required to treat projected flows and loads through planning year 2035.
- Estimate timing and preliminary capital costs for plant expansion projects required during the 20-year planning period.

2.0 RP-4 Overview

RP-4 has been in operation since 1997 and serves the Cities of Rancho Cucamonga and Fontana, as well as unincorporated areas of San Bernardino County. It acts as an upstream satellite facility to RP-1 by scalping flow from the Etiwanda sewer, which is tributary to RP-1. RP-4 includes preliminary, primary, secondary, and tertiary liquid treatment facilities. The liquid facilities are permitted to treat an annual average flow of 14 million gallons per day (mgd) and produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. Solids produced at RP-4 are returned to the collection system and conveyed to RP-1 for treatment. A schematic of the RP-4 facility is shown in Figure 6-1.

Preliminary treatment at RP-4 includes screening that consists of two mechanical bar screens, influent pumping, flow measurement by magnetic flowmeter, and grit removal by two vortex-type grit chambers. As flow enters RP-4, it passes through the screening process and is pumped to the headworks splitter box, where it is split between two vortex grit basins. Foul air from the preliminary and primary treatment facilities is sent to a biofilter for treatment and discharge. Primary treatment consists of two circular primary clarifiers. Ferric chloride and polymer are added upstream to improve settling performance and reduce odors in the solids handling facilities.

Secondary treatment includes three parallel, multistage Bardenpho activated sludge treatment systems and three circular clarifiers. Each system consists of an anoxic basin and an aeration basin. Each aeration basin is divided into two trains; each train is further subdivided into four zones: an extended anoxic zone, oxic zone, anoxic zone, and oxic zone. Aerobic zones are equipped with fine bubble diffused air strips that are supplied with air by three centrifugal blowers. Tertiary treatment consists of coagulation/flocculation, filtration, and disinfection. Secondary effluent is split between two tertiary trains. In the first train, coagulation/flocculation and filtration processes are achieved using US Filter's "Trident" process. Alum is added upstream of an upflow "contra-clarifier" followed by dual media filtration. Effluent is sent to two chlorine contact basins operated in series. In the second train, alum is added upstream of three flocculation basins operated in series and followed by cloth disc filtration. Effluent is directed to a chlorine contact basin. Disinfection is achieved using sodium hypochlorite, and recycled water is pumped to the distribution system for reuse. Excess recycled water from RP-4 is conveyed to RP-1 where it is combined with effluent from RP-1, dechlorinated, and discharged. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

3.0 Current and Future Flows and Loads

As presented in *TM 4 Wastewater Flow and Loading Forecast*, an analysis of the influent wastewater characteristics at RP-4 was conducted as part of this WFMP effort to establish current average and peak influent flows, concentrations, and loads at the plant and to develop flow and load projections for the 2035 planning year and 2060 ultimate buildout year. The data analysis is based on 2 consecutive years of recent data provided by IEUA for influent flow and key wastewater quality constituents including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia (NH3-N), and total Kjeldahl nitrogen (TKN).

Flow projections were developed by the Integrated Water Resources Plan (IRP) Consultant and are based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. As discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis*, the WFMP planning effort is based on IEUA's preferred Flow Diversion Alternative 2, which includes diverting flows from Whispering Lakes and Haven Pump Stations to RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035 form the basis of the master planning effort and treatment plant capacity evaluation presented herein. Projections are also presented for the 2060 ultimate buildout year; these projections are used for site planning considerations. Influent wastewater flows are projected to increase significantly at RP-4, largely due to the gradual incorporation of septic flows into the system between 2020 and 2060.

A summary of the current and projected average influent wastewater flows and loads for RP-4 are presented in Tables 6-2 and 6-3.

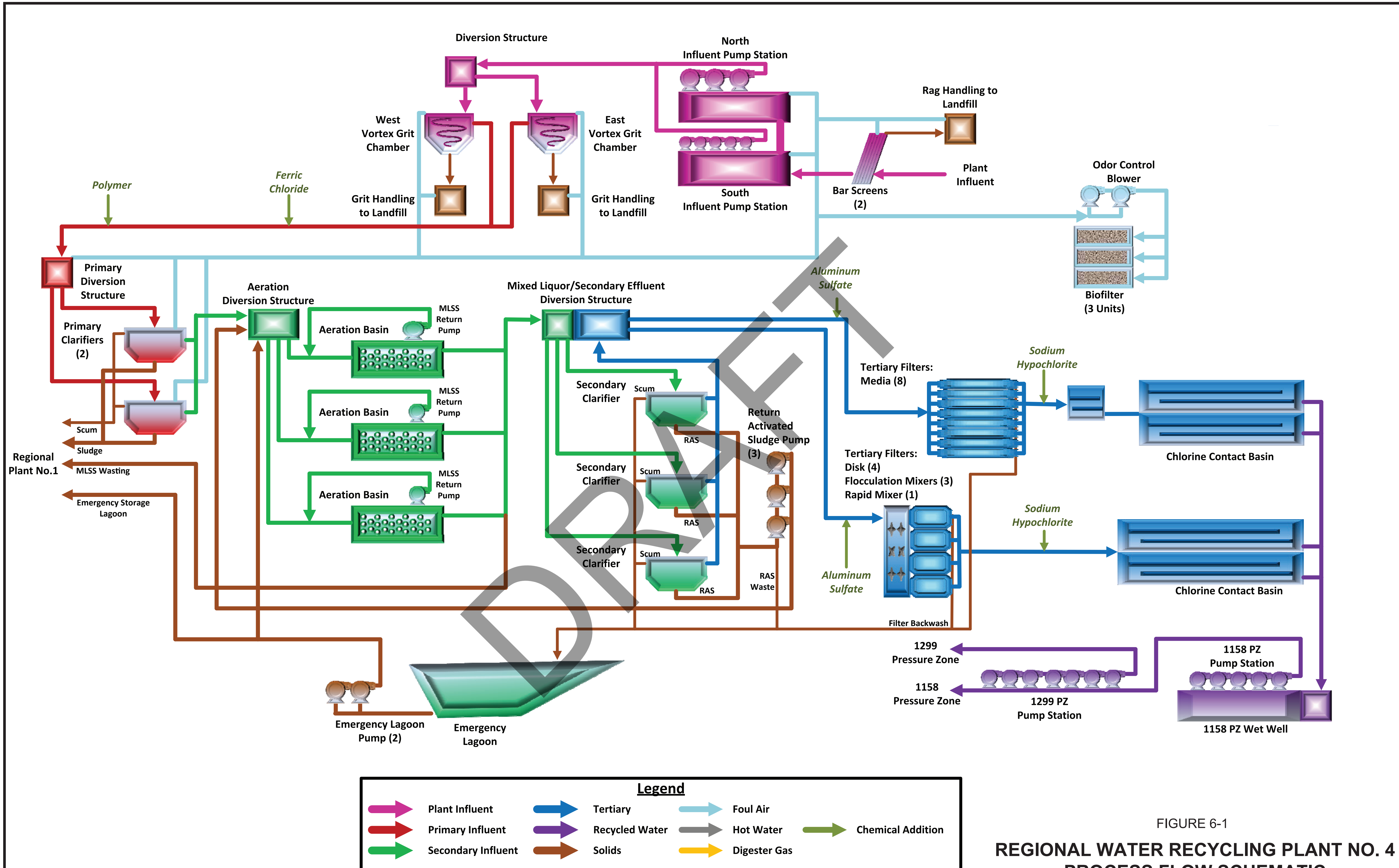

FIGURE 6-1

REGIONAL WATER RECYCLING PLANT NO. 4
PROCESS FLOW SCHEMATIC

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WASTEWATER FACILITIES MASTER PLAN

20-IEUA-10-14F6-1-9370A00.AI

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TABLE 6-2
RP-4 Current and Projected Average Influent Wastewater Flows

	Current	2035[a]	2060[a,b]
Average Influent Flow (mgd)	10.5	14.7	18.4

[a] Projections developed by IRP Consultant and IEUA based on November 2013 flow monitoring period. Reflects projected flows for IEUA preferred Flow Diversion Alternative 2 and includes septic flows tributary to RP-4.
[b] Site planning considerations are based on the projections established for the 2060 ultimate buildout planning year.

TABLE 6-3
RP-4 Current and Projected Average Influent Wastewater Characteristics

	Current Concentration (mg/L)	Current Load (lb/day)	2035 Load[a] (lb/day)	2060 Load[a] (lb/day)
BOD	352	30,543	43,207	54,082
TSS	318	27,630	38,948	48,752
NH3-N	41	3,550	5,010	6,271
TKN	59	5,015	7,186	8,994

[a] Load projections based on projected flows, concentrations, and load peaking factors presented in *TM 4 Wastewater Flow and Loading Forecast.*
mg/L – milligrams per liter
lb/day – pounds per day

4.0 Treatment Requirements

IEUA operates under an umbrella permit and must meet water quality requirements for discharge and recycled water.

4.1 Discharge Requirements

The tertiary effluent from RP-4 is discharged at Reach 1 of Cucamonga Creek (Discharge Point [DP] 002), regulated by RWQCB Order No. R8-2009-0021, which replaced Order No. 01-1 and Order No. 95-43, National Pollutant Discharge Elimination System (NPDES) No. CA 0105279. This permit is an umbrella permit governing all of IEUA's wastewater treatment plants (RP-1, RP-4, RP-5, and Carbon Canyon Water Recycling Facility [CCWRF]). It includes a stormwater discharge permit and the enforcement of an industrial pretreatment program. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water, due to the use of receiving waters for water contact recreation. A summary of the key effluent quality limits is provided in Table 6-4.

TABLE 6-4
Summary of Effluent Quality Limits[a]

Parameter	Weekly Average	Monthly Average	Annual Average	Daily Maximum	Notes
BOD	30 mg/L[b]	20 mg/L[b]	-	-	45 mg/L weekly average and 30 mg/L monthly average with 20:1 dilution.
TSS	30 mg/L/[b]	20 mg/[b]	-	-	
NH_4-N	-	4.5 mg/L	-	-	
Chlorine Residual	-	-	-	0.1	Instantaneous maximum ceiling 2 mg/L
TIN	-	-	8 mg/L	-	
TDS	-	-	550 mg/L	-	Shall not exceed 12-month running average TDS concentration in water supply by more than 250 mg/L
Turbidity	-	-	-	-	1. Daily average – 2 NTU 2. 5% maximum in 24 hr – 5 NTU 3. Instantaneous maximum – 10 NTU
Coliform	< 2.2 MPN	-	-	-	Maximum 23 MPN, once per month
pH	-	-	-	6.5 – 8.5	99% compliance
Free Cyanide	-	4.2 µg/L	-	8.5 µg/L	
Bis(2-ethylhexyl) Phthalate	-	5.9 µg/L	-	11.9 µg/L	
Selenium	-	4.1 µg/L	-	8.2 µg/L	

[a] RWQCB Order No. R8-2009-0021.
[b] Without 20:1 dilution and for recycled water.
NTU – nephelometric turbidity unit(s)
MPN – most probable number
µg/L – micrograms per liter

4.2 Recycled Water Requirements

As mentioned previously, effluent from RP-1 and RP-4 is used as recycled water for irrigation and groundwater recharge via spreading in seven Phase I recharge basin sites and six Phase II recharge basin sites. Specifically, recycled water from RP-1 is discharged to a use area overlying Chino North “Max Benefit” Groundwater Management Zone (DP 005). Recycled water quality requirements for groundwater recharge are governed under RWQCB Order No. R8-2007-0039. Table I, Table II, and Table III in the permit provide concentration limits for many constituents of concern, such as inorganic chemicals, volatile organic chemicals, radionuclides, metals, and disinfection byproducts. Recycled water quality for irrigation is regulated by Order No. R8-2009-0021 and must meet the discharge requirements described in Table 6-4.

5.0 Existing Plant Capacity and Limitations

Existing facilities and the current plant performance were used as the basis for RP-4 process model development. A whole plant model was developed using PRO2D and calibrated based on plant influent data and plant operations data for the period between October 15, 2011, and October 15, 2013. This period was selected as the basis after a review of the influent and plant data to reflect a 2-year-long complete data set. Existing plant operation and the findings of the capacity evaluation through the use of process modeling are presented below for the liquid treatment facilities at RP-4.

5.1 Existing Plant Operation

A summary of RP-4 plant operations is provided in Table 6-5 for the liquid treatment and solids handling facilities. Unit process performance values were averaged over the evaluation period, with operating ranges noted. These values were used in development and calibration of the process models. Detailed data summaries for the evaluation period are provided in Appendix 6-A.

TABLE 6-5
RP-4 Average Plant Operations Summary

Parameter	Value
Primary Treatment	
TSS Removal Rate (%)	69
TOC Removal Rate (%)	38
Primary Sludge (gpd)	174,000
Secondary Treatment	
MLSS (mg/L)	4,600
MLVSS (%)	81
RAS SS (mg/L)	7,430
Solids Inventory (klb)	350 – 385
Basins DO (mg/L)	0.8 – 1.5
WAS (mgd)	0.050 – 0.194
SVI (ml/g)	193
SRT (Basins Only) (day)	46 – 190[a]
Residual Alkalinity (mg as $CaCO_3$/L)	135

[a] Wide range of SRT values experienced due to solids wasting practices.
gpd – gallons per day
MLSS – mixed liquor suspended solids
MLVSS – mixed liquor volatile suspended solids
RAS – return activated sludge
SS – suspended solids
klb – kilopounds
DO – dissolved oxygen
WAS – waste activated sludge
mL/g – milliliters per gram
SVI – sludge volume index
SRT – solids retention time
$CaCO_3$/L – calcium carbonate per liter

A performance summary for the major treatment processes is presented in Table 6-6. These values, which represent the average over the evaluation period, were used in the subsequent plant process modeling and the capacity evaluations for the major treatment units. Detailed data summaries for the evaluation period are provided in Appendix 6-A.

TABLE 6-6
RP-4 Average Plant Performance Summary

Parameter	Primary Effluent	Secondary Effluent
TOC (mg/L)	120	4.2
BOD (mg/L)	217	1.2
TSS (mg/L)	91	3.5
NH3-N (mg/L)	30	0.2
NO3-N (mg/L)	N/A	4.2
NO2-N (mg/L)	N/A	0.1
TIN (mg/L)	N/A	4.5
Alkalinity (mg as $CaCO_3$/L)	N/A	135

NO3-N – nitrate as nitrogen
NO2-N – nitrite as nitrogen
TIN – total inorganic nitrogen

The values in Table 6-6 are for the current operation, which includes secondary treatment with internal mixed liquor recycling, configured in an anoxic-oxic-anoxic-oxic biological nutrient removal (BNR) configuration with step feed capability, consisting of pre-anoxic tanks followed by plug flow reactors.

5.2 Existing Plant Capacity

5.2.1 Process Modeling

The capacity of the existing system was evaluated through process modeling using CH2M HILL's whole plant simulator, PRO2D. PRO2D is a process simulation model that takes into account the mass balances through an entire facility for particulate and soluble components and, similar to other commercially available process models, is based on the International Water Association (IWA) ASM2D biological process kinetics. The base model was constructed to reflect the actual facility setup, including flow splits and backwash. The process model facility setup flow diagram is presented in Figure 6-2. The model was constructed with the operations and performance criteria reflective of the evaluation period, and then calibrated to reflect the actual performance, solids yields, and water quality data.

As shown in Figure 6-2, the model was constructed to represent the actual plant operation for all the major process units. The model also allows establishing sizing and design considerations for each major unit process tankage and equipment. Similar to the actual operations, the plant model was built with the filter backwash and solids thickening recycles being returned to the main plant for further treatment, with the dewatering recycles being diverted offsite. The liquid and solids mass balances calculated for the current conditions allow calibration of the model against the actual field data. The calibrated model is then used to evaluate current capacity as well as establish expansion needs and process bottlenecks.

The process model was constructed and calibrated using the current influent and operating data available for the facility. The purpose of the model calibration step is to establish a baseline condition that closely resembles current operations and provides a means to reliably predict operations and system limitations under different scenarios or alternatives. Key model calibration results are presented in Table 6-7. As the listed values show, the model was calibrated such that the simulation results are within a value range that is 5 percent or smaller as compared to the actual data. This level of accuracy will allow reliable capacity estimations to be made for the various capacity scenarios and future operation needs.

TABLE 6-7
RP-4 Average Plant Performance Summary

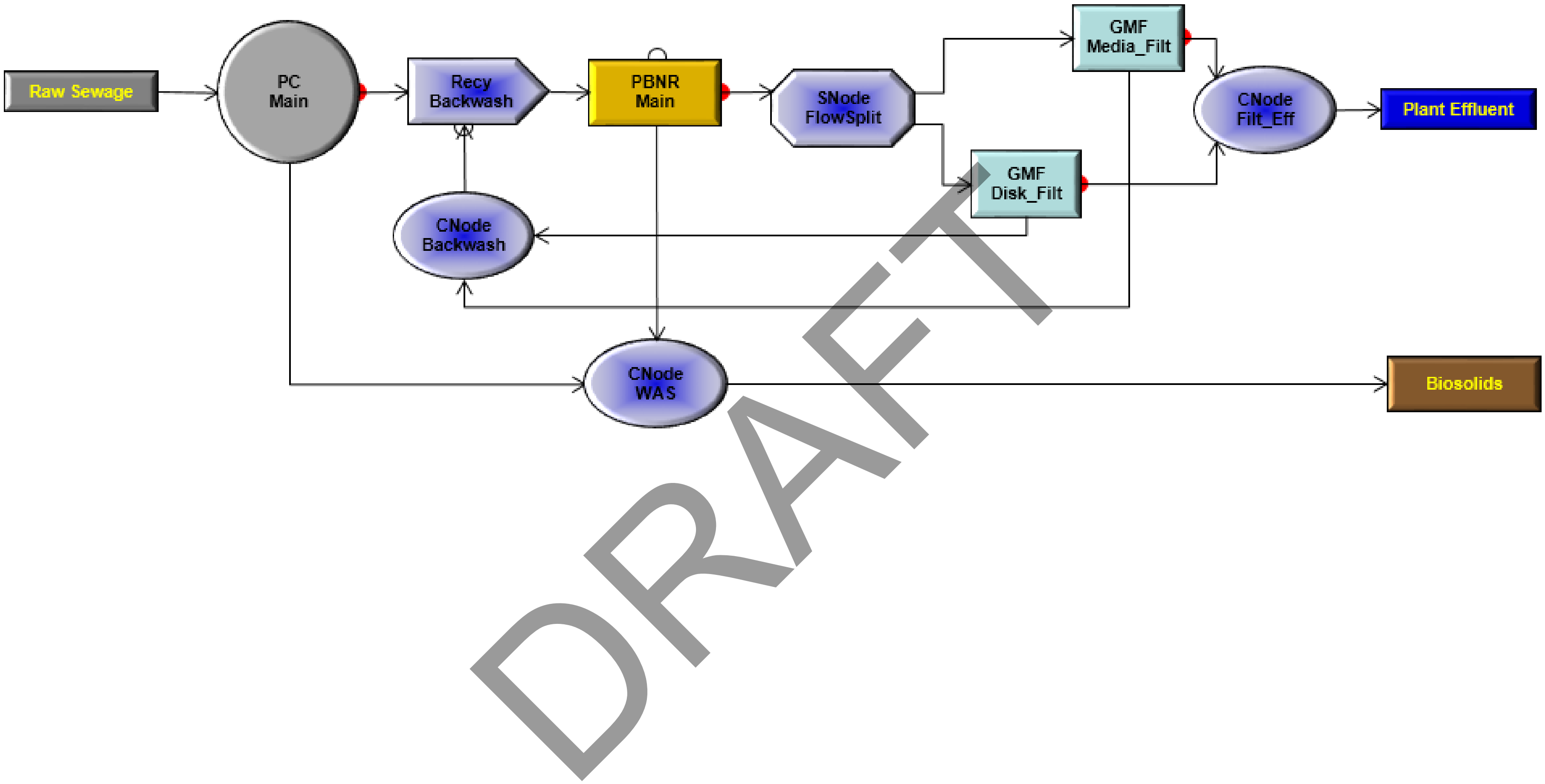
Parameter	Actual Data Average Values	Model Results
Effluent BOD (mg/L)	1.2	0.1
Effluent TSS (mg/L)	<5	<5
Effluent TIN (mg/L)	4.5	4.3
Effluent Alkalinity (mg as $CaCO_3$/L)	135	140
MLSS Inventory (lb)	367,500	364,300
Sludge Volatile Solids Content (%)	81	80
Total Waste Solids (Dry Solids lb/day)	30,500	31,400

Subsequent process modeling using the calibrated model as the base model was conducted to evaluate the following scenarios:

- Current Plant Capacity
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Liquid treatment capacity to meet 5-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Solids generation rates under average and maximum month flow and load conditions
- Future capacity implications for the planning year 2035
- Future facility footprint implications for the planning years 2035 and 2060

Findings of the current plant capacity evaluation are presented next in this section. Future capacity needs are presented in Section 6.0.

FIGURE 6-2
RP-4 Process Model Facility Setup



5.2.2 Liquid Treatment Capacity

An evaluation of the liquid treatment capacity was conducted using the whole plant process model under both the average and maximum month conditions. The capacity evaluation was conducted based on achieving a plant effluent TIN concentration of 5 mg/L and 8 mg/L. As established at the onset of the project, the facility reliability and redundancy considerations are based on the IEUA's overall wastewater treatment system, with RP-5 being the end-of-the-line facility receiving all flow diversions if needed from other Regional Water Recycling Plants. Since redundancy is provided by taking the largest unit out of service for each process at RP-5, the RP-4 plant capacity is based on all RP-4 units in service.

The facility has two primary clarifiers in service. The average hydraulic loading rates with two units in service are around 800 gallons per day per square foot (gpd/ft^2). If one unit needs to be taken out of service, especially under peak flow conditions, the primary clarifiers will be hydraulically loaded at 1,600 gpd/ft^2 or greater. Considering that flow diversion to RP-5 is available for times if a primary clarifier needs to be taken out of service, chemically enhanced primary treatment (CEPT) could be implemented under these conditions to avoid overloading the downstream secondary treatment system. The facility already has a ferric chloride system in place and injecting 16 mg/L ferric on average.

Process modeling showed that the liquid treatment capacity can be limited by the secondary treatment system. SVI values are reportedly greater than 190 mL/g, which indicates sludge settleability could be impaired at times. One limitation of the secondary treatment system was found to be the secondary clarification solids loading resulting from the current operations and the influent wastewater solids loading rates. Maintaining the SVI values at or below 150 mL/g is important for this reason also.

Waste solids (primary sludge and WAS) generated at RP-4 are diverted to RP-1 via the sewer system. For this reason, there are no solids handling recycles processed at this facility. RP-4 waste solids will continue to be diverted offsite. The solids are not continuously discharged, but maintained in the system; wasting is achieved intermittently.

Primary and secondary treatment capacity is presented in Table 6-8.

TABLE 6-8
RP-4 Existing Primary/Secondary Process Capacity

	All Units in Service	One Unit Out of Service[a]
Plant Effluent TIN $\leq$ 8 mg/L	16 mgd	14 mgd
Plant Effluent TIN $\leq$ 5 mg/L	14 mgd	12 mgd

[a] One secondary clarifier out of service.

The capacity of the RP-4 tertiary processes also were evaluated; the methodologies employed are consistent with those presented in the Title 22 Engineering Report (DDB Engineering, Inc. [DDB], 2009). The filters were designed based on a California Department of Public Health (CDPH) maximum filter loading rate of 5 gallons per minute per square foot (gpm/ft^2) for dual-media filters and 6 gpm/ ft^2 for cloth filters, with one dual-media filter cell in backwash and one cloth filter out of service. In order not to exceed the maximum approved filter loading rates, the maximum flow the filtration system can handle is 32.5 mgd. Applying a peak hourly wet weather peaking factor of 2.3, based on current plant data, the resulting average filtration capacity is 14.1 mgd.

As described in Section 2.0, the disinfection system consists of the original Chlorine Contact Basins No. 1A and 1B and the expanded Chlorine Contact Basin No. 2. Basins 1A and 1B were designed based on Title 22 requirements with a minimum concentration and time (CT) value of 450 milligrams per minute per liter (mg-min/L) and a minimum modal contact time of 90 minutes during the peak hourly dry weather flow. Tracer testing conducted by IEUA at RP-4 in 2005 showed that Basins 1A and 1B can handle a peak flow of 14.3 mgd while maintaining a modal contact time of 90 minutes (DDB, 2009). Applying a peak hourly dry weather peaking factor of 2.0, the resulting average disinfection capacity of Basins 1A and 1B is 7.2 mgd.

Basin 2 was designed based on an annual average capacity of 7 mgd and estimated peak dry weather capacity of 14 mgd while providing 90 minutes modal contact time (DDB, 2009). The Title 22 Engineering Report indicated the actual modal contact time and capacity of Basin 2 needs to be confirmed by tracer testing. Thus, the overall average disinfection capacity of Basins 1A, 1B, and 2 is approximately 14.2 mgd. The results of the tertiary treatment capacity evaluation are summarized in Table 6-9.

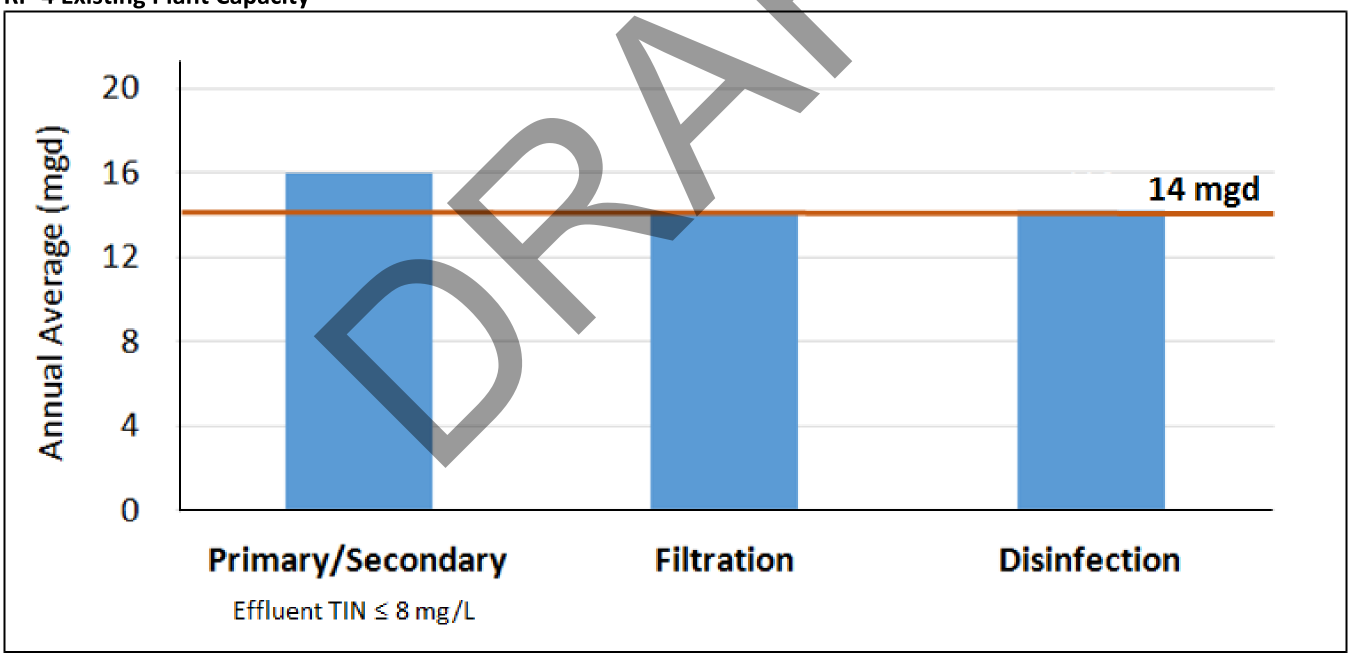
TABLE 6-9
RP-4 Existing Tertiary Process Capacity

	All Units in Service	Two Filters Out of Service[a]
Average Filtration Capacity	17.5 mgd	14.1 mgd
Average Disinfection Capacity	14.2 mgd	N/A

[a] One dual-media filter cell in backwash and one cloth filter out of service.

The overall plant capacity is determined by its most limiting process capacity. For RP-4, the tertiary processes are limited to approximately 14 mgd. Therefore, the RP-4 plant capacity is approximately 14 mgd under the assumptions presented in this section including the system reliability and redundancy being provided at RP-5. The primary and secondary process capacity will be 14 mgd if one unit of service is considered to meet 8-mg/L effluent TIN. A summary of the individual process capacities in comparison to the overall plant capacity is depicted in Figure 6-3.

FIGURE 6-3
RP-4 Existing Plant Capacity



6.0 Plant Expansion Needs

The flow projections for the planning years 2035 and 2060 were established as described under Section 3.0 of this TM. Accordingly, 2035 flow projections will be the basis of facility expansion and the CIP planning effort, while the facilities needed for the 2060 flow conditions will constitute the basis of site planning. The corresponding planning flows are listed in Table 6-2.

6.1 Facility Expansion Requirements

For the 2035 capacity expansion requirements that will constitute the basis of the CIP planning, facility sizing was determined using the whole plant PRO2D process model developed and calibrated for the current operation and wastewater quality, and for future average and maximum month flow and load conditions. Accordingly, the capacity requirement at RP-4 is in the tertiary treatment facilities for the 2035 flow projections, considering the facility could meet 5-mg/L or 8-mg/L effluent TIN with all primary and secondary process units in service. The expansion requirements are summarized in Table 6-10.

TABLE 6-10
RP-4 Facility Expansion Requirements for Planning Year 2035

Parameter	Size of New Units	Comments
Primary Clarifiers	-	No new units are needed.
Secondary Treatment	-	No new units are needed.
Tertiary Filters	1 Cloth Filter	Same size as existing cloth filters, with 12 discs per filter.
Disinfection	1 Train	Same size as existing Chlorine Contact Tank No. 2 train, with 3 passes or channels per train.

6.2 Ultimate Facilities Site Plan

For ultimate site planning purposes, the facilities for the ultimate capacity increase were established and are presented in Figure 6-4. Facility sizing was determined using the whole plant PRO2D process model developed and calibrated for the current operation and wastewater quality, and for future average and maximum month flow and load conditions. Accordingly, the ultimate capacity needs include secondary treatment capacity expansion as well as tertiary treatment expansion, with RP-5 serving to provide reliability and redundancy for the system.

IEUA has decided to base the capacity expansion and footprint requirements on the membrane bioreactor (MBR) technology for RP-4. The benefits of the MBR technology for long term IEUA planning include small footprint requirements, elimination of secondary clarifiers as well as tertiary filters for recycled water production, superior water quality, and ability to produce thicker waste sludge compared to conventional technologies. Modular design capability of the MBR technology also allows stepwise expansion of the treatment facility to meet both load capacity and different effluent TIN requirements. Furthermore, the superior-quality effluent can be directly fed to a reverse osmosis (RO) system if IEUA needs to produce higher-quality effluent or reduce final effluent TDS. Therefore, a 4.5-mgd average capacity MBR train was included in site planning. This eliminates the need to implement filter expansion beyond planning year 2035.

No other site planning considerations were identified by the project team.

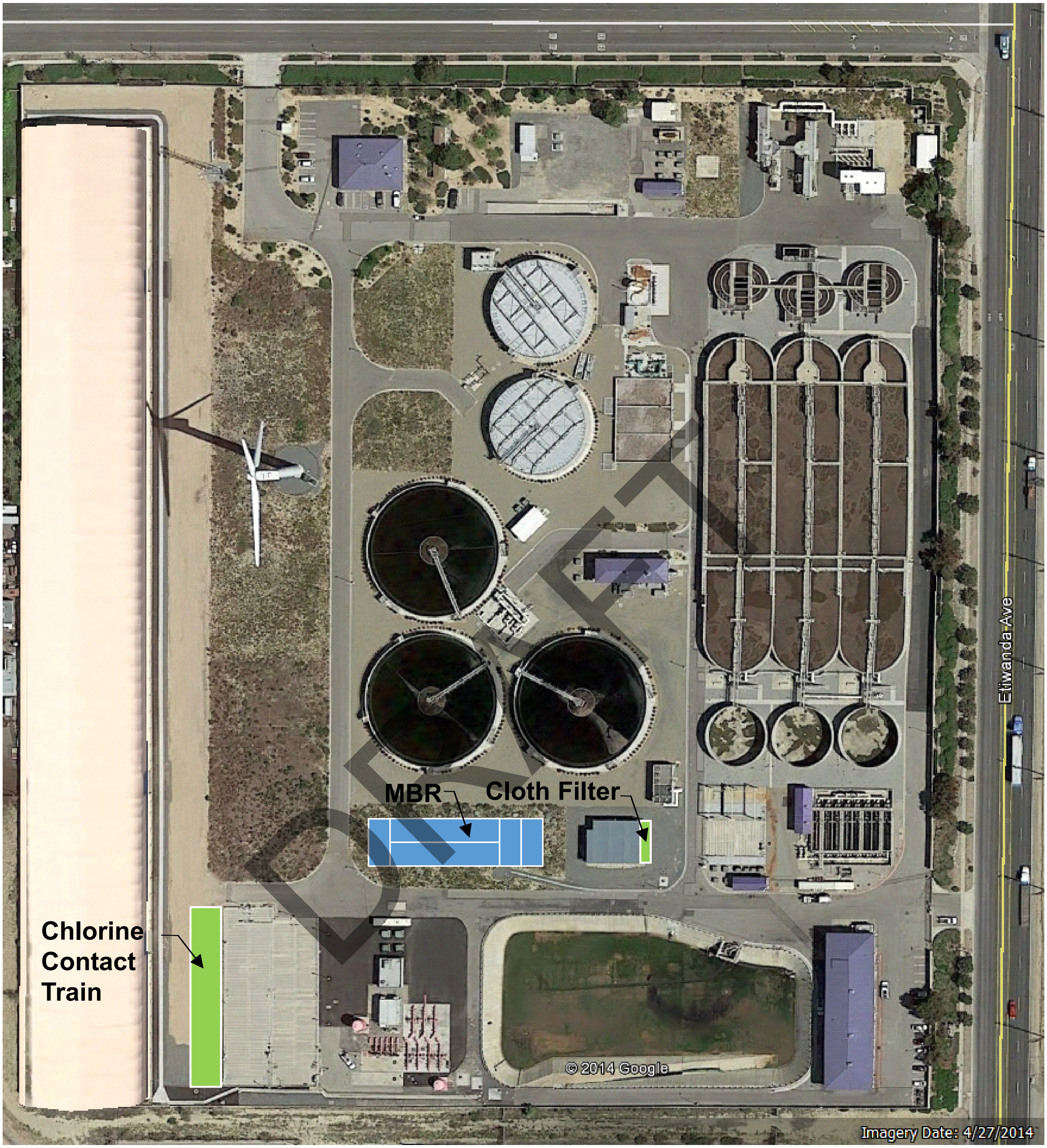


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Figure 6-4
RP-4 Ultimate Facilities Site Plan

Inland Empire Utilities Agency
Wastewater Facilities Master Plan

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7.0 20-Year CIP Plant Expansion Projects and Capital Cost

One plant expansion project was identified during the 20-year CIP, the RP-4 Tertiary Expansion Project. Capital costs were estimated for the project and placed into the 20-year CIP. The planning-level capital costs for each process identified were developed based on cost curves established from previous projects and known direct costs for similar-size projects. Additionally, several assumptions were made to estimate the total construction cost and total project costs for the expansion project. The assumptions included the following:

- The WFMP assumed a 20-year planning period.
- 10 percent of facilities subtotal for civil/site work.
- 0 to 5 percent of facilities subtotal for demolition depending on existing site conditions.
- 20 percent of facilities subtotal for electrical and instrumentation.
- 10 percent of total direct cost for contractor general conditions.
- 15 percent of total direct cost for contractor overhead and profit.
- 8 percent sales tax was applied to 50 percent of the total direct cost.
- 30 percent for construction contingency.
- 30 percent for engineering, construction management, environmental, and legal costs was applied to the total construction cost to estimate the total project cost.

The total construction cost and total project cost for the expansion project are summarized in Table 6-11.

8.0 Conclusion

The following conclusions can be made from the evaluation of RP-4:

- RP-4 influent flows and loads are projected to increase substantially due to incorporation of septic flows tributary to RP-4.
- Primary and secondary treatment processes have sufficient capacity to treat projected liquid flows through the 20-year planning period.
- Additional filtration and disinfection capacity will be needed by 2035.

9.0 References

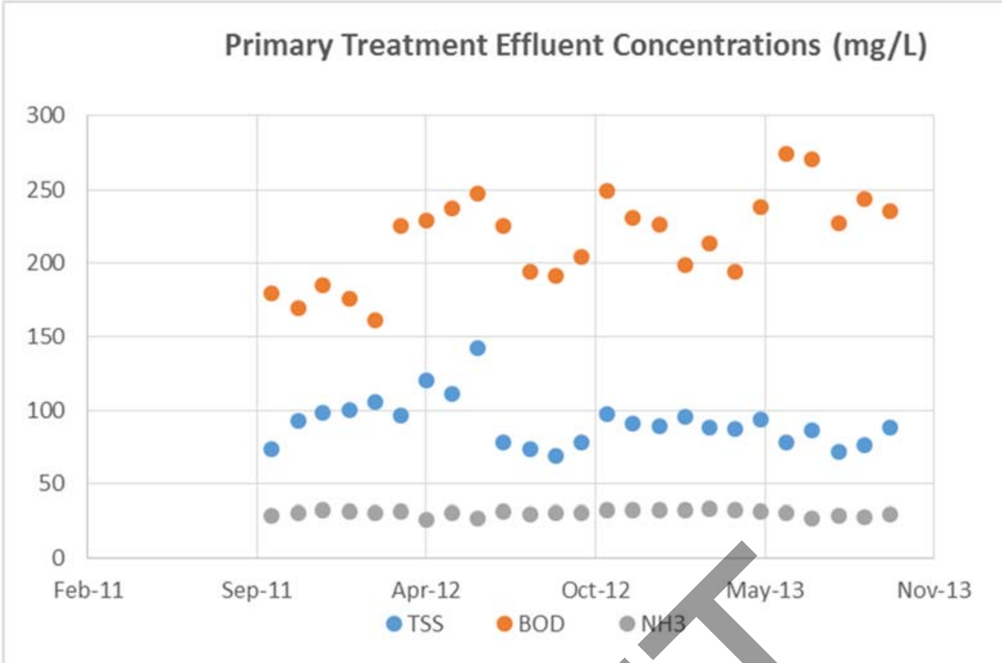
DDB Engineering, Inc. (DDB). 2009. *Inland Empire Utilities Agency Regional Plant No. 4 Title 22 Engineering Report.* September.

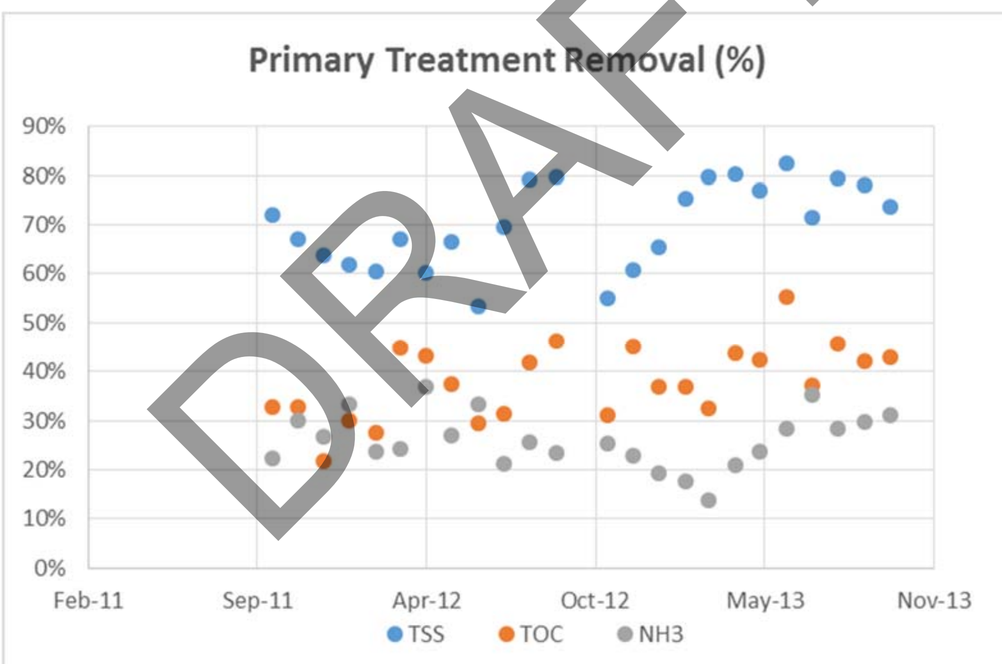
TABLE 6-11
RP-4 Expansion Projects Capital Cost Estimate

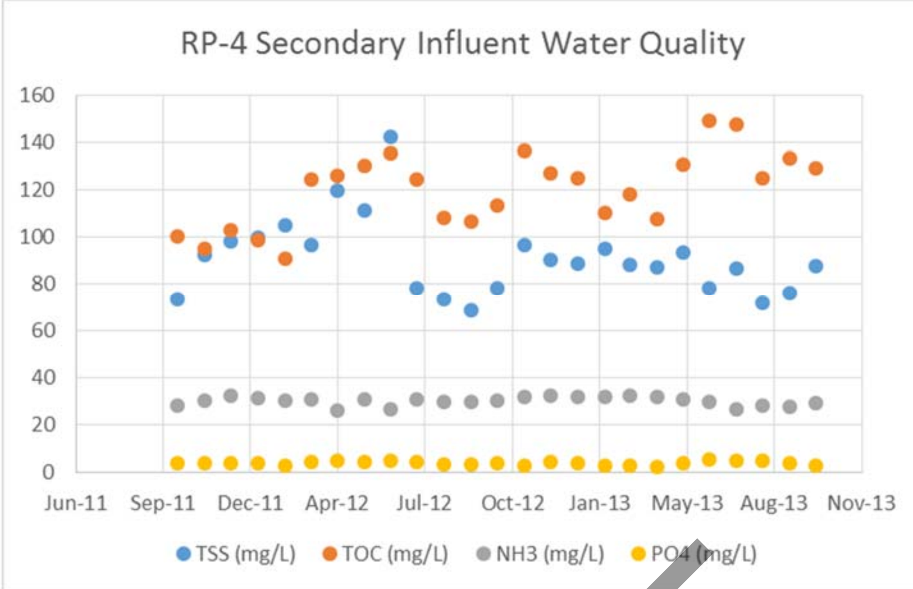
Component Description		RP-4 Tertiary Expansion Project
Filtration		$700,000
Chlorine Contact Basin		$900,000
	Facilities Subtotal	**$1,600,000**
Civil/Site Work (10%)		$160,000
Demolition (5%)		$80,000
Electrical and Instrumentation (20%)		$320,000
	Total Direct Cost[a]	**$2,160,000**
General Conditions (10%)		$216,000
General Contractor Overhead and Profit (15%)		$324,000
Sales Tax (8%)[b]		$86,000
	Subtotal	**$2,786,000**
Construction Contingency (30%)		$836,000
	Total Estimated Construction Cost[c]	**$3,622,000**
Engineering, Construction Management, Environmental, and Legal Costs (30%)		$1,087,000
	Total Estimated Project Costs	**$4,709,000**

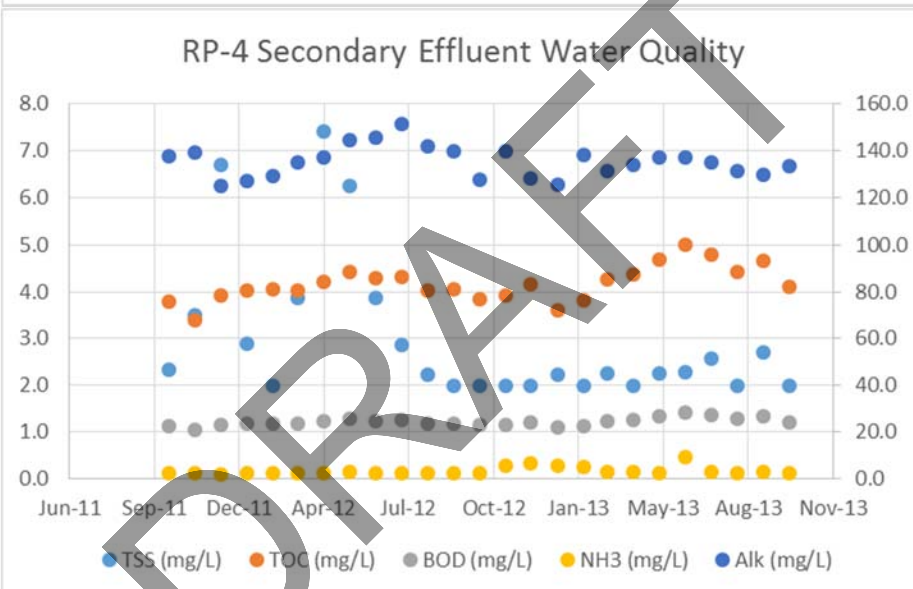
[a] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).
[b] Calculated assuming 50% of direct costs are taxable.
[c] Cost does not include escalation to midpoint of construction.
The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

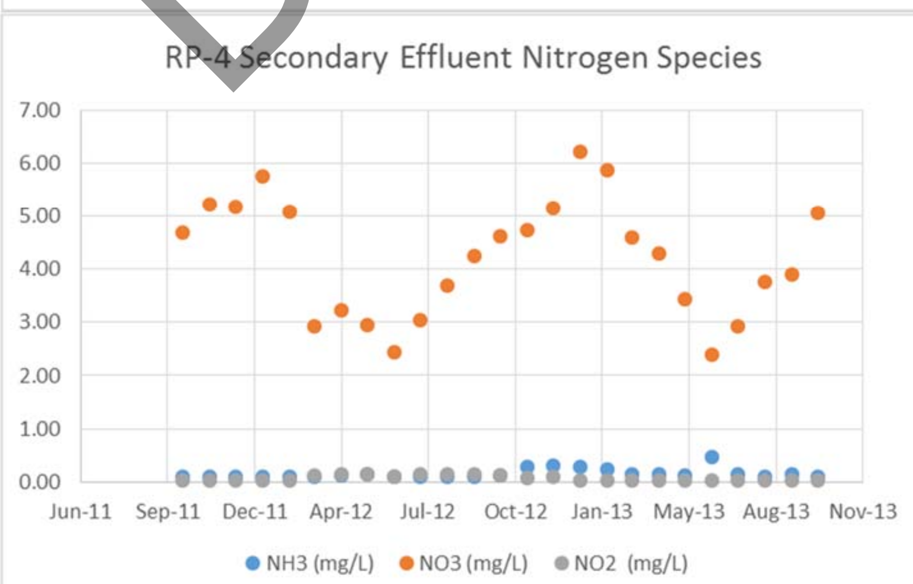
Appendix 6-A
RP-4 Plant Operations Summary (2011-2013)

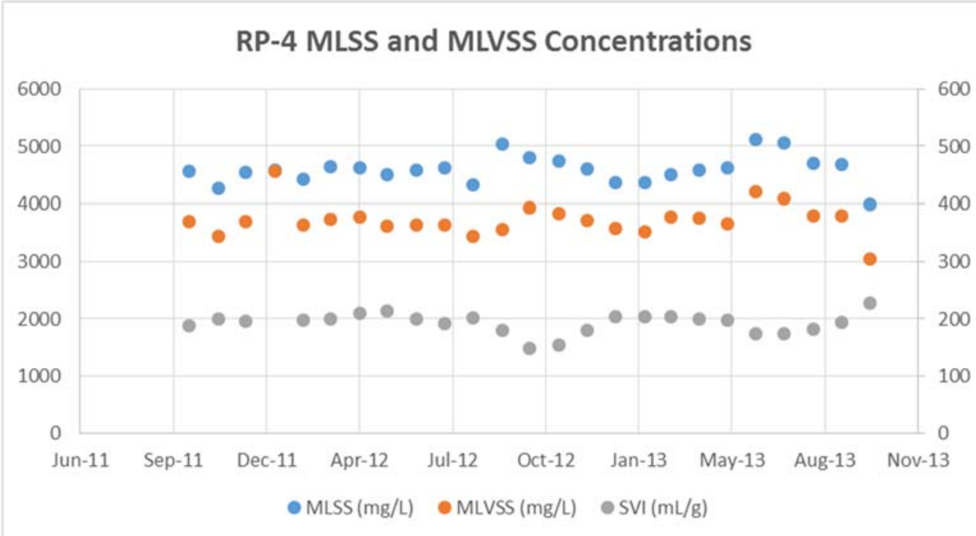

Primary Treatment Effluent Concentrations (mg/L)
300
250
200
150
100
50
0
Feb-11
Sep-11
Apr-12
Oct-12
May-13
Nov-13
TSS
BOD
NH3

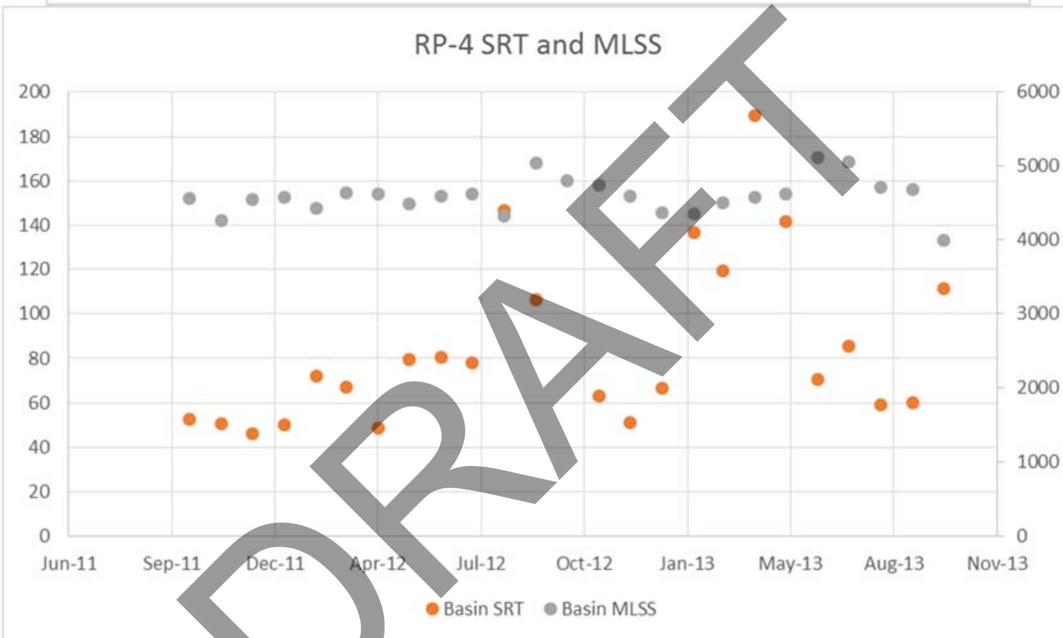

Primary Treatment Removal (%)
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Feb-11
Sep-11
Apr-12
Oct-12
May-13
Nov-13
TSS
TOC
NH3


RP-4 Secondary Influent Water Quality
160
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
PO4 (mg/L)


RP-4 Secondary Effluent Water Quality
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
BOD (mg/L)
NH3 (mg/L)
Alk (mg/L)


RP-4 Secondary Effluent Nitrogen Species
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
NH3 (mg/L)
NO3 (mg/L)
NO2 (mg/L)


RP-4 MLSS and MLVSS Concentrations
6000
5000
4000
3000
2000
1000
0
600
500
400
300
200
100
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
MLSS (mg/L)
MLVSS (mg/L)
SVI (mL/g)


RP-4 SRT and MLSS
200
180
160
140
120
100
80
60
40
20
0
6000
5000
4000
3000
2000
1000
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
Basin SRT
Basin MLSS