MARCH 2014

FINAL DRAFT

Riverside Park Water Reclamation Facility

NLT Engineering Report/ Wastewater Facilities Plan Amendment No. 3

PREPARED FOR

City of Spokane

PREPARED BY

CH2MHILL

WBG030514153650SPK

Final Draft

Riverside Park Water Reclamation Facility

NLT Engineering Report/ Wastewater Facilities Plan Amendment No. 3

Prepared for

City of Spokane

3-6-2014

DAVID T. REYNOLDS
STATE OF WASHINGTON
17940
REGISTERED PROFESSIONAL ENGINEER

Prepared by

CH2MHILL®

March 2014

Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

7-DADMax	7-day average of the daily maximum temperatures
AACEI	American Association of the Advancement of Cost Engineering International
ADWF	average dry weather flow
AKART	All Known Available and Reasonable Technologies
BFP	belt filter press
BOD	biochemical oxygen demand
$CBOD_5$	5-day carbonaceous biochemical oxygen demand
CEPT	chemically enhanced primary treatment
cfu	colony-forming units
cfs	cubic feet per second
County Facility	Spokane County Regional Water Reclamation Facility
CSO	combined sewer overflow
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESD	egg-shaped digester
Facilities Plan	November 1999 *City of Spokane Wastewater Facilities Plan*
FPA2	*Riverside Park Water Reclamation Facility Wastewater Facilities Plan Amendment No. 2*
FPA3	NLT Engineering Report/Facilities Plan Amendment No. 3
FPPA	Farmland Protection Policy Act
G	mean velocity gradient, sec^{-1}
GBT	gravity belt thickener
gpm/ft^2	gallons per minute per square foot
gfd	gallons per square foot per day
gpcd	gallons per capita per day
I/I	infiltration/inflow
µg/L	micrograms per liter
m	meter
MBR	membrane bioreactor
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
mL	milliliter

N	nitrogen
NEPA	National Environmental Policy Act
NLT	Next Level of Treatment
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
O&M	operation and maintenance
PCBs	polychlorinated biphenyls
pg/L	picograms per liter
psig	pounds per square inch gauge
RCW	Revised Code of Washington
RPWRF	Riverside Park Water Reclamation Facility
SEPA	State Environmental Policy Act
SERP	State Environmental Review Process
SR	State Route
SRF	State Revolving Fund
SRT	solids retention time
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TRP	total reactive phosphorus
TSS	total suspended solids
UAA	use attainability analysis
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WLA	waste load allocation
WRIA	water resource inventory areas

Executive Summary

The City of Spokane is committing substantial resources to a series of projects that will improve the water quality in the Spokane River. These projects will reduce pollutant loading in the river by reducing overflows from combined sanitary and stormwater sewers, enhancing stormwater management, and improving treatment levels at the City's Riverside Park Water Reclamation Facility (RPWRF). The City is developing an environmentally and financially responsible Integrated Clean Water Plan using U.S. Environmental Protection Agency guidelines in order to achieve a cleaner river faster. Adding tertiary treatment at the RPWRF is an integral part of the plan and the City's investment in water quality improvements. This report evaluates the next level of treatment (NLT) for the RPWRF and provides a clear path to achieve regulatory compliance and improved water quality with a program that is also cost-effective for City of Spokane wastewater customers.

This NLT Engineering Report amends previous City wastewater facilities plans[1] and is also referred to as Facilities Plan Amendment No. 3 (FPA3). It is prepared pursuant to Washington State Department of Ecology (Ecology) direction to prepare a Next Level of Treatment Engineering Report. This requirement was a condition of the June 23, 2011, National Pollutant Discharge Elimination System (NPDES) permit for the RPWRF. This document meets Ecology requirements for both an engineering report and facilities plan as defined in Washington Administrative Code (WAC) 173-240. A facilities plan is a requirement for funding assistance through the State Revolving Fund (SRF) loan program that the City routinely uses. The current Facilities Plan is being amended since the scope of the amendment is within the scope of the current Facilities Plan and presents updated and more detailed information in support of the current Facilities Plan.

The NPDES permit requires that an approvable Engineering Report be prepared by the City and submitted to Ecology for review and approval no later than January 3, 2013**.** Ecology amended this date to January 7, 2014, to allow time for evaluation of additional reclaimed water alternatives. The NLT Engineering Report/FPA3 addresses the following:

- Wastewater treatment processes needed to reliably comply with the waste load allocations (WLAs) of the Spokane River and Lake Spokane dissolved oxygen total maximum daily load (TMDL) for the following:
  - 5-day carbonaceous biochemical oxygen demand (CBOD5)
  - Ammonia
  - Total phosphorus (TP)
- Site options and piping and process options for future addition of process elements to achieve the final equivalent effluent limitations and water reclamation requirements as described in Chapter 173-219 WAC "Reclaimed Water Use"

Chapter 1 introduces the NLT Engineering Report/FPA3. Chapter 2 summarizes the discharge standards that establish requirements for treatment. Chapter 3 presents background information relevant to FPA3 including:

- Existing environment in the RPWRF vicinity
- Demographics and land use including:
  - Current population

[1] The previous plans include the *City of Spokane Wastewater Facilities Plan* (Facilities Plan) (Bovay Northwest, 1999), the *Spokane Riverside Park Water Reclamation Facility Plan Amendment* [No. 1] (CH2M HILL, 2010), and the *Riverside Park Water Reclamation Facility Wastewater Facilities Plan Amendment No. 2* (FPA2) (CH2M HILL, 2012).

  - Current wastewater flows
  - Current waste loads

- Existing conveyance and treatment facilities owned and operated by the City of Spokane

Chapter 4 summarizes estimates of future population, wastewater flows, and waste loads. Chapter 5 describes the evaluation of alternatives for NLT. The All Known, Available and Reasonable Methods of Prevention, Control and Treatment (AKART) analysis of NLT alternatives is summarized. The recommended AKART alternative is presented, along with the update to FPA2. Chapter 6 describes the recommended alternative in greater detail. Included are a site layout, flow diagram, sizing/design parameters, design life, ability to expand, and operation and maintenance (O&M)/staffing needs. Chapter 7 is the financial analysis of the recommended alternative. Included are:

- Initial project cost estimates
- Estimated annual O&M costs
- User charges
- Financial capability
- Capital financing plan
- Implementation plan

Chapter 8 describes compliance with water quality management plans, SEPA and SERP compliance, and required permits for implementation of the recommended alternative.

ES.1 Discharge Standards

Spokane's RPWRF received a new NPDES permit in June 2011 with revised or extended interim effluent limits for 2011 to 2016 and final effluent limits starting March 1, 2018. Effluent requirements for the interim 2011 to 2016 period are similar to the effluent requirements in the previous NPDES permit. This facilities plan amendment, FPA3, describes improvements providing additional treatment capacity to meet the interim effluent requirements and are sufficient to meet the ammonia requirements beginning March 2018. The final limits that begin March 2018 implement more stringent effluent requirements needed to comply with the Spokane River TMDL. Additional treatment is needed to comply with biochemical oxygen demand (BOD), total suspended solids (TSS), and phosphorus requirements by March 1, 2018, and the NLT alternatives evaluation (see Chapter 5) and recommended alternative (see Chapter 6) address the additional treatment required.

The final effluent limits are defined for two main seasons each year, critical and non-critical, and one sub-season for ammonia during the critical season:

- The "critical season" from March 1 through October 31 includes the period of lowest flows for the Spokane River when the most stringent requirements are in effect to meet the Spokane River TMDL. Effluent requirements specify low mass limits of BOD and TSS, very low mass limits of ammonia, and extremely low mass limits of phosphorus. The "sub-season" for ammonia, June 1 to September 30, has much more stringent ammonia limits than during the rest of the "critical season."

- The "non-critical season" from November 1 through the end of February requires achievement of the secondary treatment technology limits.

Specific requirements for RPWRF beginning March 1, 2018, may be found in Table 2-1 in Chapter 2.

ES.2 Flows and Waste Loads

Table ES-1 shows a comparison of population equivalent and average annual flow, BOD, and TSS for the Facilities Plan, FPA2, and FPA3. The dates for comparison are 2015 for the Facilities Plan and 2030 for FPA2 and FPA3. Table ES-1 shows that design flows and waste loads are decreasing from the Facilities Plan. FPA2 used the same population growth rates as the Facilities Plan, but used actual flows and waste loads observed in 2007 and 2008 as the starting flows and waste loads. This NLT Engineering Report/FPA3 used new population forecasts and includes the impact of the addition of the Spokane County Regional Water Reclamation Facility (County Facility). The City Planning Department's current annual growth projections of 0.53 percent are much lower than the growth rates previously used in the Facilities Plan. Beginning in 2012, the County Facility removed about 6.5 million gallons per day (mgd) from the RPWRF influent. It will continue to divert flows from RPWRF until the County Facility capacity of 8.0 mgd is reached.

TABLE ES-1
Comparison of Design Flows and Waste Loads for RPWRF

Parameter	Facilities Plan	Facilities Plan Amendment No. 2	NLT Engineering Report/Facilities Plan Amendment No. 3
Year of Estimated Loading	2015	2030	2030
Population Equivalent	370,000	350,000	260,000
Average Annual Flow (mgd)	54.4	48	41.2
Average Annual BOD (lb/day)	85,100	79,800	57,600
Average Annual TSS (lb/day)	85,100	78,800	59,200

Note: Design population, flow, and waste loads were not modified in Facilities Plan Amendment No. 1.

Chapter 4 contains detailed descriptions of design flows and waste loads for 2012 to 2030. A few highlights are as follows:

- Because the City has a combined sewer system, flows vary greatly as a result of infiltration and inflow (I/I) from precipitation and local snowmelt.
- Planned combined sewer overflow (CSO) abatement projects will decrease peak flows and increase larger flow durations following major precipitation events.
- Additional significant I/I occurs during high Spokane River flows from mountain snowmelt, particularly in May and June.
- High Spokane River flow has a significant impact on NLT facilities because it significantly increases flow at RPWRF and has a long duration.
- Flows vary significantly from year to year and seasonally during the year as a result of I/I.
- Flows are expressed in probabilistic terms from the minimum in a 10-year period to once every 25 years.

ES.3 Alternatives

The following alternatives were evaluated to comply with the discharge requirements established to meet the dissolved oxygen TMDL for the Spokane River:

- Additional treatment and discharge to the Spokane River
- Agricultural land application
- Urban irrigation
- Stream flow augmentation/groundwater recharge
- Groundwater recharge

Additional treatment and discharge to the Spokane River was found to be the lowest-cost alternative and the only alternative that could be completed by the March 1, 2018, deadline required by Ecology. Agricultural land application, urban irrigation, streamflow augmentation, and groundwater recharge all required permitting that exceeded the performance time frames for compliance. The additional treatment and discharge alternative will produce Class A reclaimed water and allow for implementation of the other alternatives in the future, if desired to reduce or eliminate discharge to the Spokane River or to use reclaimed water for beneficial use. Additional evaluation of membrane filtration and of high-rate sedimentation followed by conventional filtration (called "conventional filtration" in this FPA3) was recommended.

Both conventional filtration and membrane filtration were evaluated at 100-mgd peak flow capacity to allow RPWRF to continue to discharge treated effluent to the Spokane River. Figure ES-1 is a schematic of the two alternatives. 100 mgd was chosen because it is the capacity of the existing primary and secondary treatment processes at RPWRF and is the maximum capacity of conventional filtration that will fit within the existing property lines at RPWRF. Conventional filtration was found to have a lower initial cost of $128 million compared to $143 million for membrane filtration, and lower life-cycle costs expressed as present worth of $140 million compared to $152 million for membrane filtration. All costs are expressed in October 2013 dollars and include sales tax and engineering, legal, and administration. As a result, at 100-mgd peak flow capacity, conventional filtration was found cost-effective compared to membrane filtration.

Membrane filtration produces a higher quality effluent than conventional filtration based on the pilot project conducted at RPWRF, and the City requested a comparison of an optimized membrane filtration option with the 100-mgd peak capacity conventional filtration option. The optimized membrane filtration option included the following:

- Increased primary and secondary treatment capacity to 125 mgd
- Sustained, firm capacity of 50-mgd membrane filtration

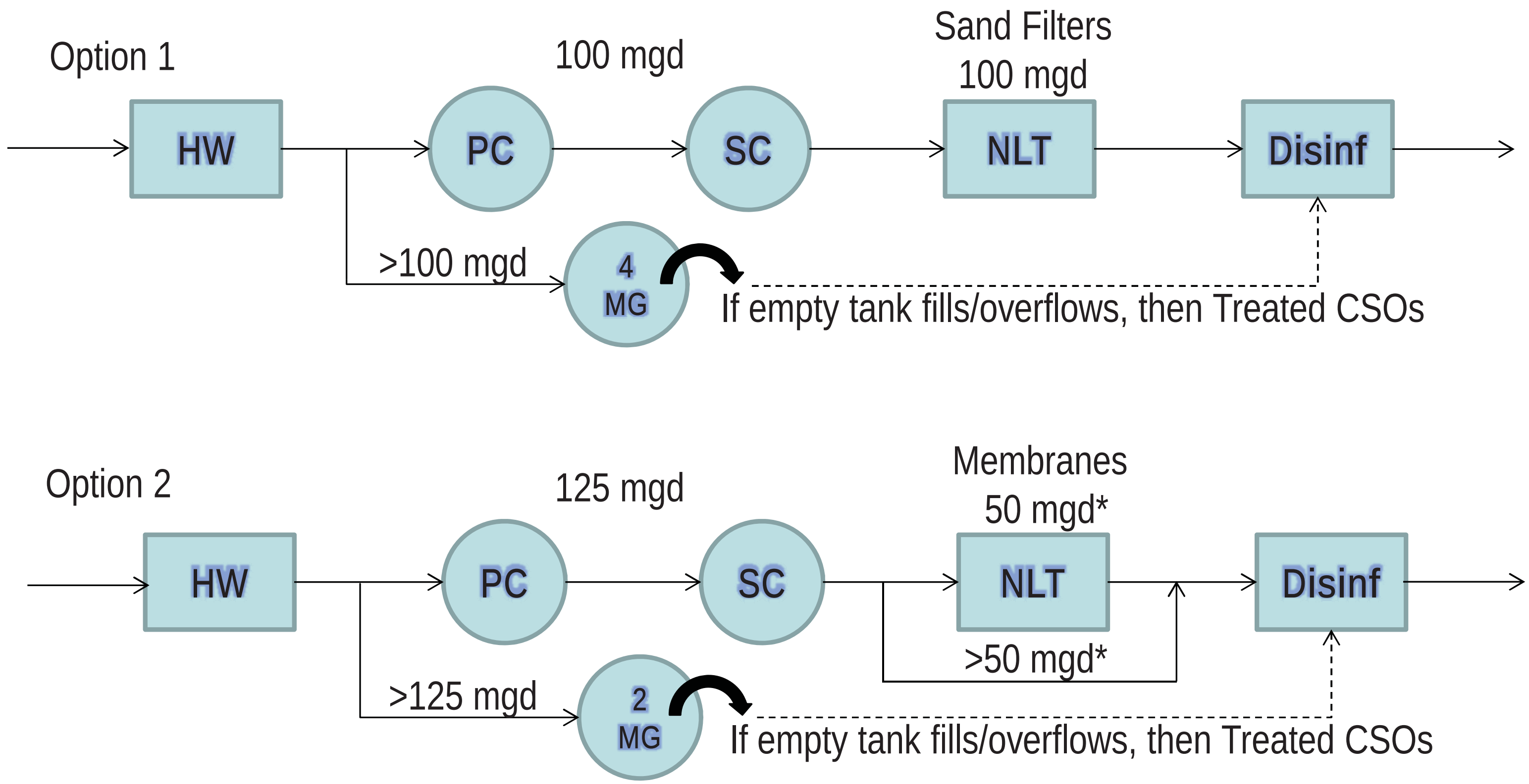
The optimized membrane filtration option was compared environmentally and economically to the 100-mgd peak capacity conventional filtration option. Both options meet the discharge standards of the future NPDES permit. Key differences between the two alternatives are as follows:

- The 50-mgd membrane filtration option provides lower treated CSO volumes in the critical season and nearly eliminates treated CSO in the non-critical season as a result of increasing primary and secondary treatment capacity to 125 mgd.
- The 100-mgd conventional filtration option would not discharge secondary effluent in the critical season because conventional filtration capacity is the same as the primary and secondary treatment capacity.

The conclusions are that the 50-mgd membrane filtration option has a greater positive impact on water quality. This option compared to the 100-mgd conventional filtration shows a net environmental benefit of:

- Less $CBOD_5$ discharge
- Less phosphorus discharge
- Equivalent PCB removal

$CBOD_5$ would be reduced to approximately 20 percent of the future discharge standard for both options. The membrane filtration option would discharge about 8 percent less $CBOD_5$ than the conventional filtration option, but the difference between options is small in comparison to the discharge standard. Figure ES-2 shows that the difference in total phosphorus discharged is nearly 20 percent on average, and the difference over a 10-year period is nearly 2 years' total discharge of phosphorus.



* 50 mgd is nominal net capacity with one train not treating flow while deconcentrating and one train out of service for maintenance. Actual capacity varies depending on the number of trains operating and flux rate.

FIGURE ES-1
Options Schematic

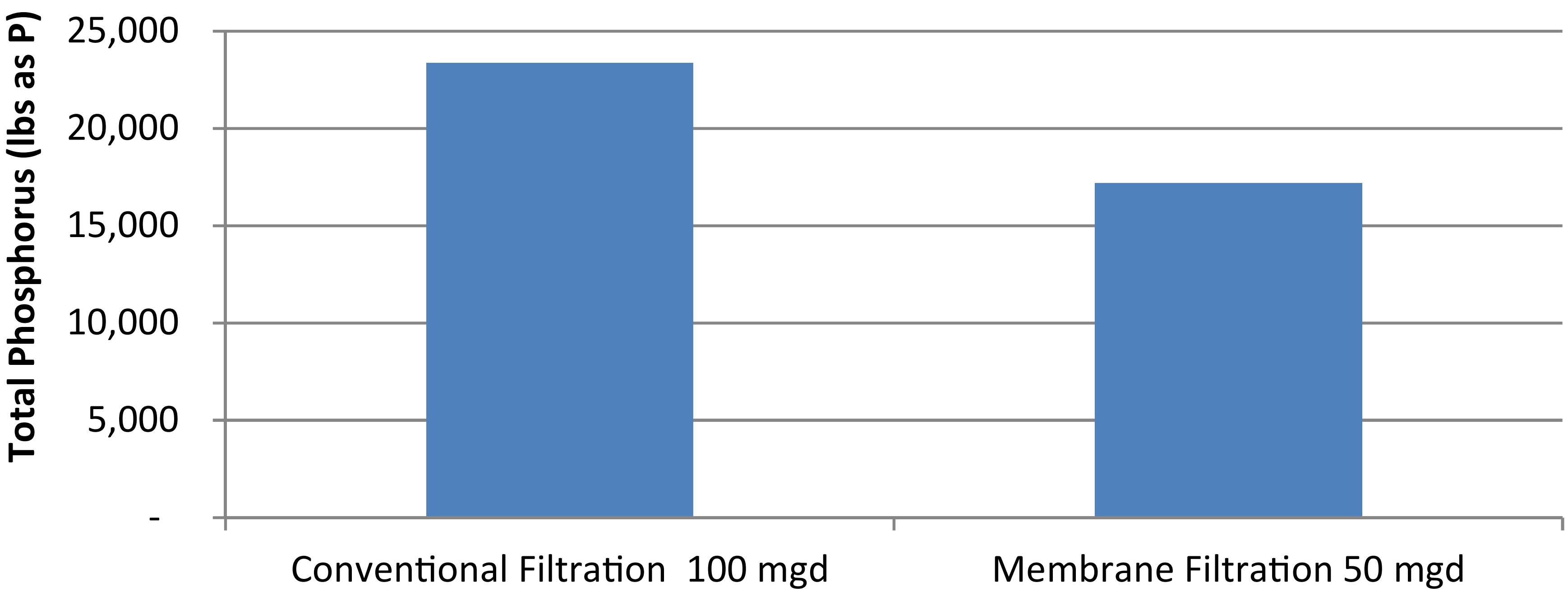


FIGURE ES-2
10 Year Total Critical Season
Total Phosphorus

CH2MHILL.

Figure ES-3 shows the total phosphorus that would be discharged for each option during the dry season (July 1 through September 30) based on simulations of year 2030 flows and based on the conditions observed for the years 2001 through 2011. The data show that total phosphorus discharged for the membrane filtration option would always be much lower than the conventional filtration option during the dry season when Spokane River flows are lowest. Figure ES-4 shows that in a year similar to 2011 when the maximum secondary effluent would be discharged in the critical season, nearly all of this discharge occurs in the March 1 to June 30 time period when Spokane River flows exceed 15,000 cfs. Therefore, 50 mgd of membrane filtration with 125 mgd of primary and secondary treatment provides net environmental benefits compared to 100 mgd of conventional filtration with 100 mgd of primary and secondary treatment.

The membrane filtration option is cost-effective compared to the conventional filtration option. Initial costs are $111 million for membrane filtration and $128 million for conventional filtration.[2] The life-cycle cost expressed as total present worth is $118 million for the membrane filtration option and $140 million for the conventional filtration option. The cost per pound of phosphorus removed is $384 for the membrane filtration option and $471 for the conventional filtration option.[3]

The 50-mgd membrane filtration option with 125 mgd primary and secondary treatment capacity is recommended as the most cost-effective option that meets discharge standards and provides net environmental benefit compared to the 100-mgd conventional filtration option. Less treated CSO will be discharged with the membrane filtration option. Ecology will need to approve discharge of minimal secondary effluent during the critical season.

Several additional improvements to RPWRF that were recommended in FPA2 were reevaluated in FPA3 to confirm that they would still be needed with reduced flows and waste loads. These improvements are as follows:

- Silo Digester No. 3
- Waste gas burner upgrade
- Stormwater, parking, and landscaping
- Primary Clarifier No. 5 (needed for 125-mgd primary treatment capacity)
- Chemically enhanced primary treatment (CEPT)/NLT chemical storage facility
- Solids recycle pump station
- CSO Clarifier No. 6 upgrades (rehabilitation of 40-year-old facility)

ES.4 Recommended Improvements

Table ES-2 summarizes the specific recommended improvements, the reasons the improvements are needed, and the estimated construction costs in October 2013 dollars. Construction costs do not include sales tax, engineering, legal, and administrative costs.

Figure 6-1 (see Chapter 6) shows the location of the recommended improvements. Space remains for construction of a sixth aeration basin, two additional silo digesters, and additional treatment or expansion of membrane filtration facilities. Due to slower growth than predicted in the 1999 Facilities Plan, the RPWRF site is expected to provide adequate capacity until well after the year 2030.

Figure 7-2 (see Chapter 7) is an implementation schedule for the recommended improvements. The schedule shows that all the recommended facilities will be completed by March 1, 2018.

[2] Costs are expressed in October 2013 dollars and include sales tax and engineering, legal, and administration.

[3] The cost per pound of phosphorus removed is calculated by dividing the total present worth by the pounds of phosphorus removed for the period 2018 through 2030. The cost per pound of phosphorus removed will vary depending on the assumptions used in the calculation.

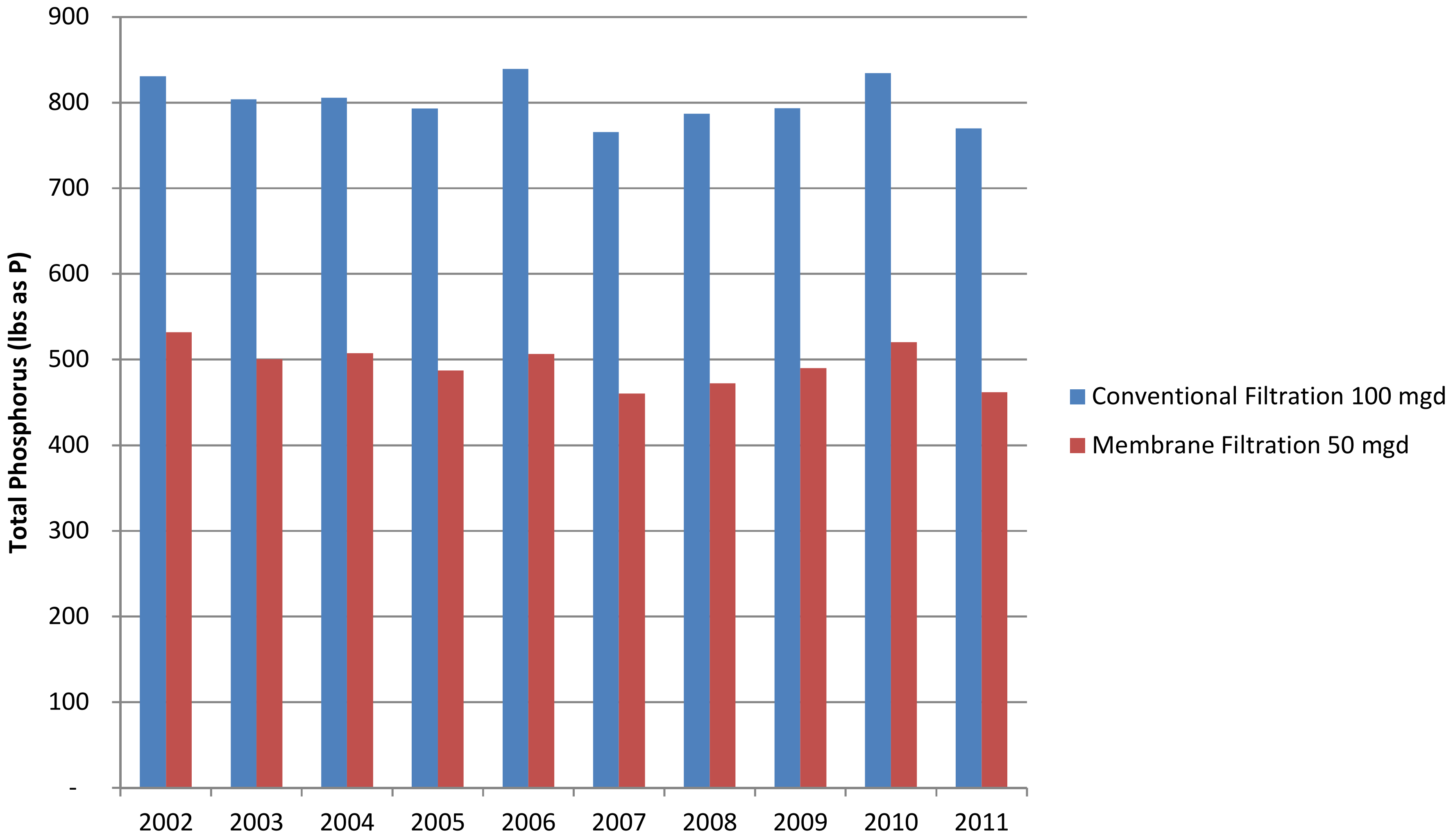


FIGURE ES-3
Dry Season RPWRF Total Phosphorus in Effluent

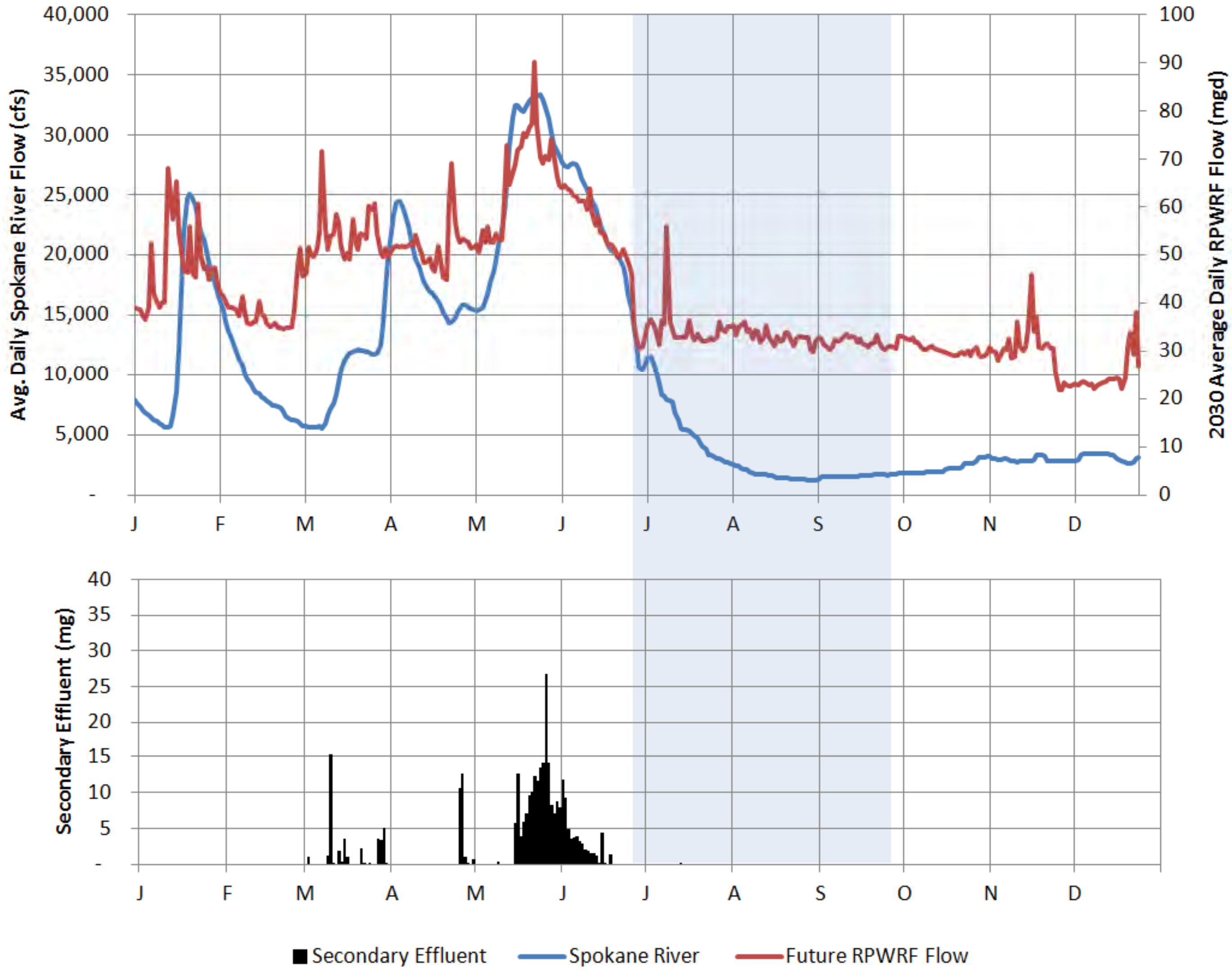


FIGURE ES-4
Simulation of Year 2011 Conditions

TABLE ES-2
Recommended Improvements

Improvement	Reason Needed	Estimated Construction Cost[a] October 2013 Dollars	Total Project Costs
Package C:			
Silo Digester No. 3	Meet regulatory requirements and replace capacity of digesters Nos. 1 and 2 lost because of structural inadequacies	$11,030,000	
Waste Gas Burner Upgrade	Replace high-pressure waste gas burner with low-pressure burner for increased capacity and reduction in energy use	$1,040,000	
Stormwater, Parking, and Landscaping	Eliminate drainage connection to Spokane River, replace impermeable paving with permeable paving at entrance to administration building, and improve access safety	$650,000	
Total Package C		**$12,720,000**	**$18,492,000[b]**
Package D:			
CEPT/NLT Chemical Storage Facility	Implement CEPT to increase available capacity of secondary treatment process and provide storage for NLT chemical coagulant for phosphorus removal, sodium hydroxide for effluent pH adjustment, and citric acid for membrane cleaning	$5,480,000	
Primary Clarifier No. 5	Increase primary treatment hydraulic capacity to 125 mgd to reduce treated CSO	$4,393,000	
Solids Recycle Pump Station	Increase available capacity of secondary treatment process	$1,709,000	
CSO Clarifier No. 6	Rehabilitate 40-year-old steel structure and pump	$2,000,000	
Total Package D		**$13,582,000**	**$20,337,000[c]**
NLT Membrane Filtration	Meet discharge standards related to Spokane River dissolved oxygen TMDL	$81,354,000	$125,475,000[d]
Total		**$107,656,000**	**$164,304,000[e]**

[a] Construction costs do not include sales tax, change orders, engineering, legal, and administration costs and escalation.
[b] Costs in August 2015 dollars assuming 3% per year inflation and include sales tax and allowances for change orders, engineering, legal, and administrative costs.
[c] Costs in August 2016 dollars assuming 3% per year inflation and include sales tax and allowances for change orders, engineering, legal, and administrative costs.
[d] Costs in August 2017 dollars assuming 3% per year inflation and include sales tax and allowances for change orders, engineering, legal, and administrative costs.
[e] Sum of total project costs for Packages C and D and NLT in 2015, 2016 And 2017 dollars respectively.

ES.5 Financial

The City funds RPWRF capital improvements predominantly with sewer rates paid by customers connected to the collection system. Any debt obligations incurred must also be repaid from rate revenue. In addition to the upgrades described in this Facilities Plan Amendment No. 3, the City faces significant costs for controlling CSOs and stormwater and installing recommended improvements at the RPWRF. Sewer rate increases of 15.00 percent, 16.85 percent, and 13.50 percent were enacted in 2009, 2010, and 2011, respectively, to enable the City to better meet these financial obligations. Future rate increases are planned to be limited to the rate of inflation to maintain greater affordability for the City's customers. The City is anticipating funding many improvements for CSO facilities, stormwater facilities, and RPWRF improvements using SRF loans, grants, and other state and federal funding to maximize improvements with less impact to user rates. The City is developing an Integrated Clean Water Plan and is evaluating all CSO, stormwater, and NLT improvements to provide the maximum overall water quality benefit; it will evaluate all three programs in terms of user charges, financial capability, and capital financial planning.

ES.6 Environmental Compliance

This Facilities Plan Amendment No. 3 amends the 1999 Facilities Plan, which was a nonproject, programmatic action. Ecology concurred on May 16, 2000, that "the State Environmental Policy Act (SEPA) process is complete" and that the Facilities Plan "is in compliance with the State Environmental Review Process (SERP)." This facilities plan amendment is fully within the scope of the 1999 Facilities Plan.

Additional project-specific SEPA/SERP process and permits will be required for the recommended improvements in addition to this Facilities Plan Amendment No. 3.

SECTION 1
Introduction

This chapter describes the location of the Riverside Park Water Reclamation Facility (RPWRF) and areas evaluated for receiving reclaimed water from RPWRF, identifies the problem to be solved, and describes the organization of this Next Level of Treatment (NLT) Engineering Report. Figure 1-1 shows the location of RPWRF. RPWRF provides wastewater treatment for the City of Spokane and a portion of Spokane County. Treated wastewater from RPWRF is currently discharged to the Spokane River at the RPWRF site. Figure 1-1 shows areas around RPWRF that were evaluated for receiving reclaimed water from RPWRF to reduce or eliminate the amount of treated wastewater discharged to the Spokane River.

The address of RPWRF is:

> 4401 N. Aubrey L. White Parkway
> Spokane, Washington 99205

The owner's representative for this project is Lars Hendron, Principal Engineer for City of Spokane. His telephone number is (509) 625-7929.

Figure 1-2 shows the wastewater service area for RPWRF. Spokane County recently constructed a new water reclamation facility that diverts wastewater from the area east of Spokane known as Spokane Valley. The new County facility is called Spokane County Regional Water Reclamation Facility (County Facility) and has an average capacity of 8 million gallons per day (mgd). The County has two pump stations on the North and South Valley Interceptors that can pump wastewater to the County Facility. An area of unincorporated Spokane County also discharges wastewater into City of Spokane Interceptor No. 1 in north Spokane. This discharge is separate from the main valley interceptor and cannot be diverted to the County Facility.

This NLT Engineering Report is also referred to as Facilities Plan Amendment No. 3 (FPA3). It amends the *City of Spokane Wastewater Facilities Plan* (Facilities Plan) (Bovay Northwest, 1999), the *Spokane Riverside Park Water Reclamation Facility Plan Amendment* [No. 1] (CH2M HILL, 2010), and the *Riverside Park Water Reclamation Facility Wastewater Facilities Plan Amendment No. 2* (FPA2) (CH2M HILL, 2012). It was prepared to comply with Washington State Department of Ecology (Ecology) requirements that the City prepare a NLT Engineering Report as stated in the June 23, 2011, National Pollutant Discharge Elimination System (NPDES) permit for RPWRF. This document meets the requirements for both an Engineering Report and Facilities Plan as defined in Washington Administrative Code (WAC) 173-240. A Facilities Plan is needed to comply with Ecology requirements for funding assistance through the State Revolving Fund (SRF) loan program that the City wishes to use to fund the improvements at RPWRF. The original Facilities Plan is being amended since the scope of the amendment is within the scope of the original Facilities Plan and presents updated and more detailed information in support of the original Facilities Plan.

1.1 Problem Identification

The NPDES permit for RPWRF requires that two copies of an approvable Engineering Report be prepared by the City in accordance with WAC 173-240 and submitted to Ecology for review and approval no later than January 3, 2013**.** Ecology amended this date to January 7, 2014, to allow time for evaluation of additional reclaimed water alternatives. The Engineering Report must address the following:

- Wastewater treatment processes needed to reliably comply with the 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), ammonia, and total phosphorus (TP) waste load allocations (WLAs) of the Spokane River and Lake Spokane dissolved oxygen total maximum daily load (TMDL)
- Site options and piping and process options for future addition of process elements to achieve the final equivalent effluent limitations and water reclamation requirements as described in Chapter 173-219 WAC "Reclaimed Water Use"

The Engineering Report is to address the following topics based on rule requirements, pollutant equivalency consideration, and potential for offset creation and management including trading, etc.:

1. Population projections by year for the next 20 years
2. Loading projections, flow, TP, $CBOD_5$, ammonia, and total nitrogen (TN)
3. Wastewater treatment processes needed to reliable comply with the $CBOD_5$, NH_3 and TP WLAs of the Spokane River and Lake Spokane dissolved oxygen (DO) TMDL, including loadings potentially bypassed in a "blending event" and requiring an offset or pollutant equivalency consideration
4. Projection of loading removed for TP, $CBOD_5$, ammonia, and TN
5. Projection of offset(s) and other actions needed for compliance with the DO TMDL that reduce TP, $CBOD_5$, and ammonia loadings to the final effluent and the river
6. Options considered to generate offset(s)
7. Recommended offset option and/or other actions (such as water reclamation and offset generating options if projected to be needed)
8. Timeline of offsets and other DO compliance actions to be needed and implementation schedule to achieve DO TMDL compliance
9. Site options and process options for future addition of process elements and offset generating activities to achieve the final equivalent effluent limitations and water reclamation requirements as described in Chapter 173-219 WAC "Reclaimed Water Use"
10. Establishment of a ratio of TP to total reactive phosphorus (TRP), and a ratio of TRP to bio-available phosphorus
11. Findings from the University of Washington/Water Environment Research Foundation bioavailability lab study
12. Subsequent monitoring and modeling of bioavailable phosphorus impacts in Lake Spokane
13. The pounds of phosphorus that are not bio-available, not reactive, and not a nutrient source that contribute to the total phosphorus waste load allocation
14. Recommended adjustment potentially made to the effluent limitations needed for compliance with the DO TMDL because of non bio-available phosphorus in the effluent
15. The plan update, in combination with the pollutant reduction from technology, providing reasonable assurance of meeting the permittee's waste load allocations in 10 years
16. Updated analysis of CSO control options and no feasible alternative option for expansion of the treatment facilities to avoid "blending" of fully treated effluent and partially treated effluent during CSO events

FPA3 includes requirements 1, 2, 3, 4, 9, and 15. Requirements 5, 6, 7, and 8 are not included because offsets are not required for RPWRF to comply with the WLAs. Requirements 10, 11, 12, 13, and 14 are not included because the studies of TRP and bio-available phosphorus were not required for RPWRF to comply with the WLAs and thus were not completed. Requirement 16 will be addressed, but Ecology has requested that the "no feasible alternative" analysis be included with the next NPDES permit application.

1.2 FPA3 Format

Chapter 2 summarizes the requirements for treatment resulting from the effluent limits established by the June 2011 NPDES permit in part S1.B "Effluent Limitations for Compliance with Spokane River DO TMDL" beginning March 1, 2018.

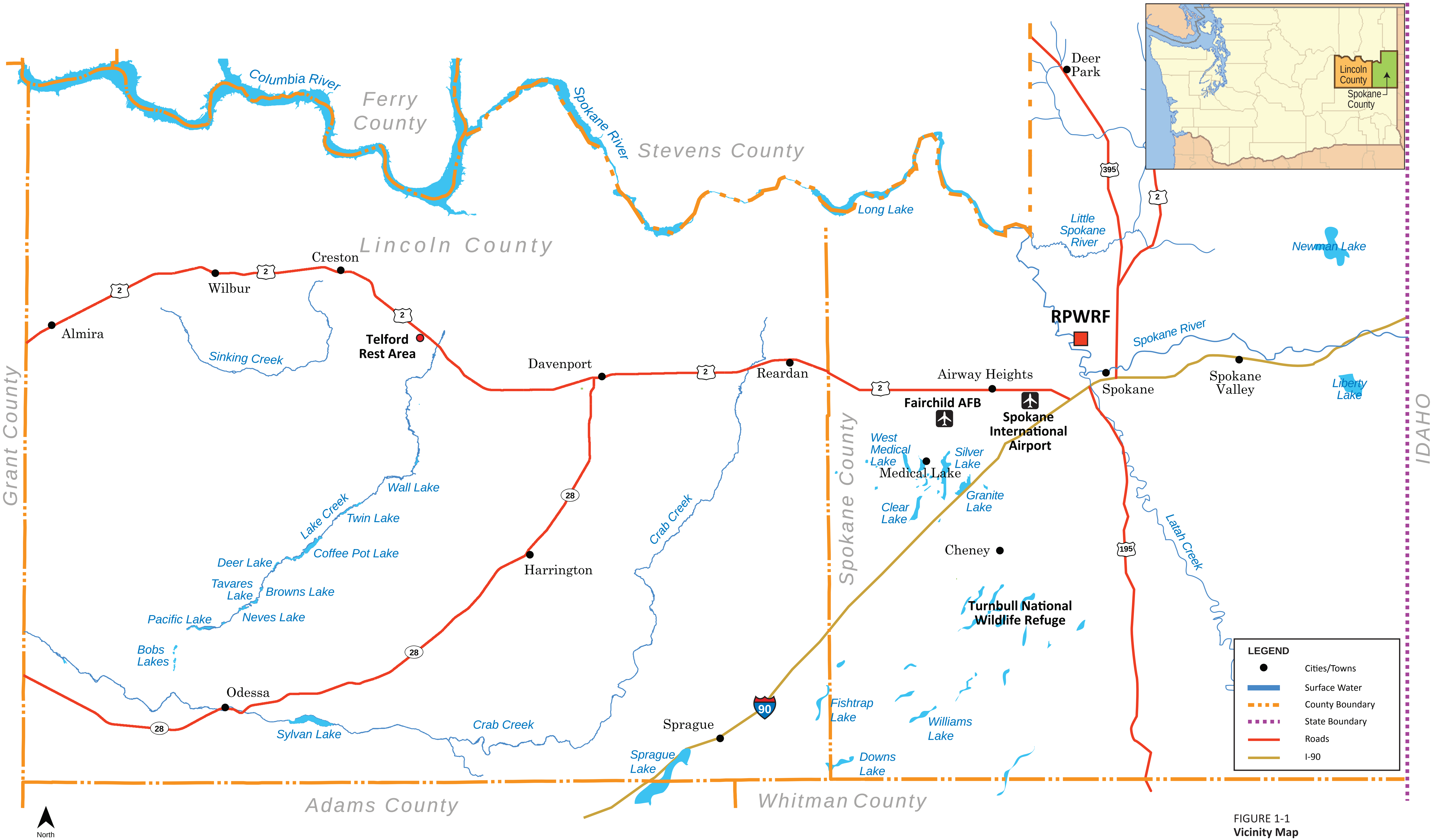


FIGURE 1-1
Vicinity Map

CH2MHILL

WBG012313172655SPK Fig1-1_VicinityMap_V2.ai 12.24.13 jr

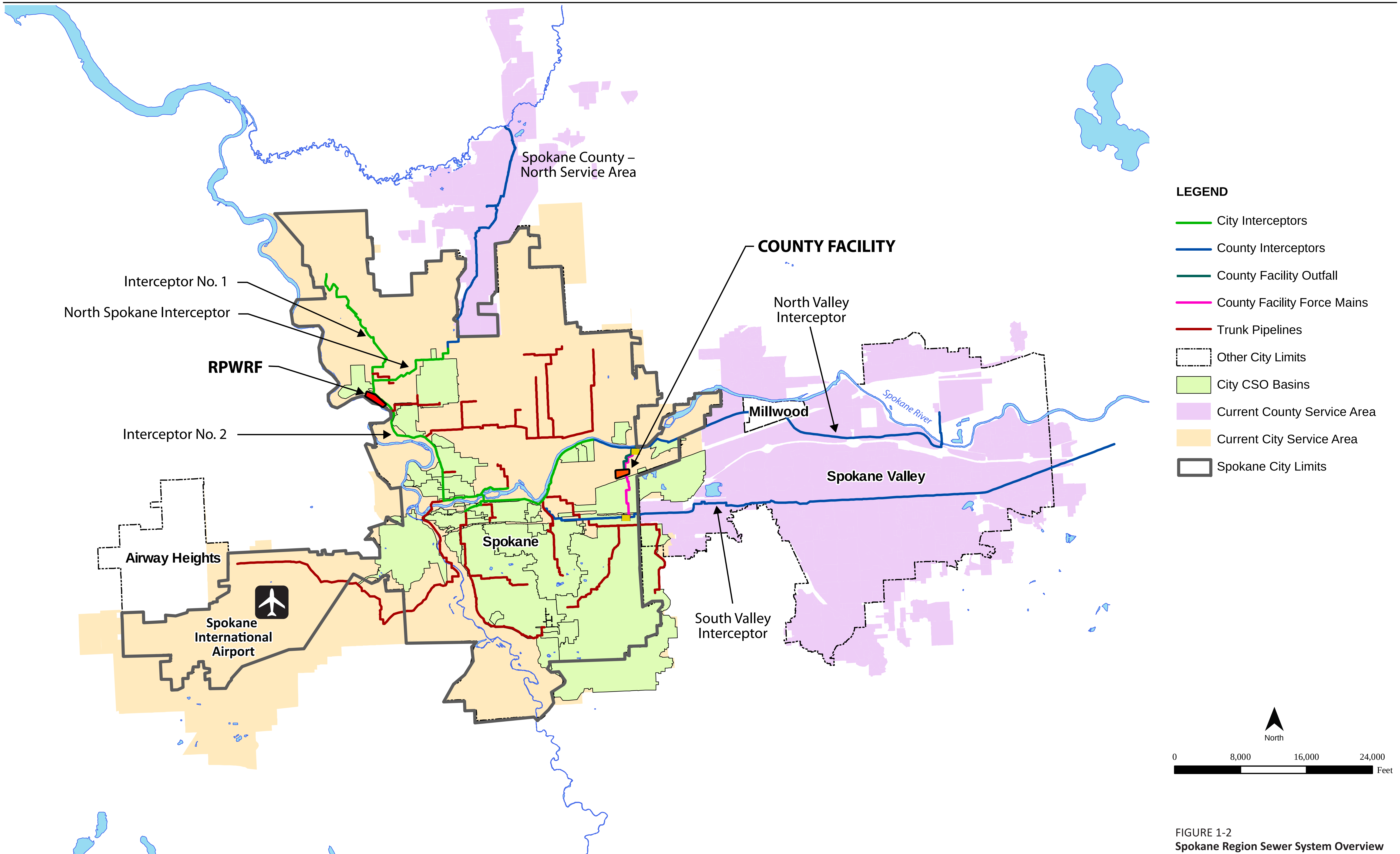


FIGURE 1-2
Spokane Region Sewer System Overview

CH2MHILL.

WBG012313172655SPK Fig1-2_SewerMap_V3-4.ai 01.27.14 ez

Chapter 3 presents background information relevant to FPA3. The existing environment is described including surface waters, groundwater, air, geographical and geological features, floodplains, shorelines, wetlands, endangered or threatened species and habitats, public health, prime or unique farmland, archeological and historical sites, and any federally recognized wild and scenic rivers. Demographics and land use will also be reviewed, including current population, current flows and waste loads, and existing conveyance and treatment facilities owned and operated by the City of Spokane.

Chapter 4 summarizes estimates of future population, wastewater flows, and waste loads. The ability to incorporate recreation and open space alternatives is discussed.

Chapter 5 describes the evaluation of alternatives for NLT. The All Known Available and Reasonable Methods of Prevention, Control and Treatment (AKART) analysis of NLT alternatives is summarized, concluding with a recommendation of one alternative for implementation. Updates to FPA2 are presented.

Chapter 6 describes the recommended alternative. A site layout, flow diagram, sizing/design parameters, design life, ability to expand, and operation and maintenance (O&M)/staffing needs are included.

Chapter 7 presents a financial analysis of the recommended alternative. Initial project cost estimates, estimated annual O&M costs, user charges, financial capability, capital financing plan, and implementation plan are discussed.

Chapter 8 describes compliance with the water quality management plan, SEPA and SERP compliance, and required permits for implementation of the recommended alternative.

SECTION 2

Description of Discharge Standards

The City of Spokane received an NPDES permit for the RPWRF in June 2011. Discharge standards are commonly referred to as “limits” because the NPDES permit establishes the maximum quantity or concentration that can be discharged without the discharge exceeding the permit. The permit establishes interim effluent limits that are effective from July 1, 2011, to June 30, 2016, as well as future limits intended to reflect effluent limits needed to satisfy the Spokane River and Lake Spokane dissolved oxygen TMDL waste load allocations and Managed Implementation Plan (Ecology, 2006). NLT is required to provide the level of treatment to meet the future discharge standards that are listed in the NPDES permit in Section S1.B “Effluent Limitations for Compliance with Spokane River DO TMDL” beginning March 1, 2018, that are shown in Table 2-1. Ecology has communicated to the City that performance-based limits for polychlorinated biphenyls (PCBs) will be added in a future NPDES permit after PCB data are obtained from RPWRF effluent with NLT operating. Ecology has also indicated that effluent pH limits will change from the values shown in Table 2-1 as a result of the designation of the Spokane River for salmonid spawning, rearing, and migration. Ecology further indicates that metals limits in Table 2-1 will be recalculated for future NPDES permits and are likely to change.

TABLE 2-1
NPDES Effluent Limits for RPWRF Beginning March 1, 2018

March-October		
Parameter	**Seasonal Average**	
$CBOD_5$	1,778 lb/day	
Total phosphorus (as P)	17.8 lb/day	
Ammonia (as N)	March 1 to May 31 351 lb/day June 1 to September 30 89 lb/day October 1 to 31 351 lb/day	
Parameter	**Average Monthly**	**Average Weekly**
TSS	30 mg/L, 10,759 lb/day	45 mg/L, 16,138 lb/day
Fecal coliform bacteria	200 CFU/100 mL	400 CFU/100 mL
pH	Daily minimum ≥6 and daily maximum ≤9	
Parameter	**Average Monthly**	**Maximum Daily**
Total ammonia (as N) June 1 to September 30	--	7.5 mg/L
Total residual chlorine	8.5 µg/L, 4.3 lb/day	22.2 µg/L, 24.0 lb/day
Cadmium	0.076 µg/L	0.233 µg/L
Lead	0.772 µg/L	1.34 µg/L
Zinc	53.8 µg/L	72.6 µg/L
November-February		
Parameter	**Average Monthly**	**Average Weekly**
$CBOD_5$	25 mg/L, 8,966 lb/day	40 mg/L, 14,345 lb/day
TSS	30 mg/L, 10,759 lb/day	45 mg/L, 16,138 lb/day

TABLE 2-1
NPDES Effluent Limits for RPWRF Beginning March 1, 2018

Fecal coliform bacteria	200 CFU/100 mL	400 CFU/100 mL
pH	Daily minimum ≥6 and daily maximum ≤9	
Parameter	**Average Monthly**	**Maximum Daily**
Total residual chlorine	8.5 µg/L, 4.3 lb/day	22.2 µg/L, 24.0 lb/day
Cadmium	0.076 µg/L	0.233 µg/L
Lead	0.772 µg/L	1.34 µg/L
Zinc	53.8 µg/L	72.6 µg/L

Notes:
Fecal coliform bacteria are calculated as the geometric mean.
There are no ammonia limits when Spokane River 7-day average flow exceeds 5,000 cubic feet per second.
Chemical phosphorus removal must be initiated by April 15 and terminate no earlier than October 15.
Cadmium, lead, and zinc are total recoverable values.
TSS = total suspended solids
mg/L = milligrams per liter
µg/L = micrograms per liter
cfu = colony-forming units
mL = milliliter

Source: Section S1.B of June 23, 2011, NPDES permit for RPWRF.

SECTION 3

Background Information

This chapter presents background information for FPA3. Section 3.1 describes the existing environment, providing general information helpful for understanding the analysis of alternatives. The second section reviews demographics and land use, including current population, current wastewater flows and waste loads, and existing conveyance and treatment facilities owned and operated by the City of Spokane.

3.1 Existing Environment

A preliminary environmental evaluation was conducted of the study area (Figure 3-1) that generally encompasses the following NLT alternative locations discussed in Chapter 5:

- The RPWRF site for additional treatment and discharge to the Spokane River alternative, and for a groundwater recharge alternative location
- Agricultural land application sites north of the RPWRF (Deer Park area), west of the RPWRF (the West Plains area), and south of the RPWRF (Latah Creek area) (CH2M HILL, 2013a)
- The City of Spokane for urban reuse (irrigation) alternative
- Lake Creek/Crab Creek drainage in Lincoln County for the stream flow augmentation/groundwater recharge alternative (CH2M HILL, 2013b)
- West Plains area for the groundwater recharge alternative

The following evaluation describes background conditions, potential environmental issues related to the potential alternatives, and likelihood of further study.

3.1.1 Surface Waters

Several surface water bodies are in proximity to the alternative project sites/activities described in Chapter 5. The largest water body is the Spokane River, which presently serves as the receiving water for the RPWRF, a number of municipal and industrial wastewater point discharges, non-point agricultural runoff, non-point storm runoff, combined sewer overflow, and urban runoff from both Idaho and Washington. Major point sources of river pollutants upstream of the city limits include the Coeur d'Alene, Post Falls, Hayden Lake, and Liberty Lake wastewater treatment plant discharges, County Facility discharges, and two major industries (Kaiser and Inland Paper). Non-point sources include stormwater urban runoff that is regulated under the Phase 2 Stormwater General Permit for the City of Spokane. Non-point sources that are beyond the City's control include agricultural runoff and onsite septic and drain field systems, which add to the river's pollutant load. Latah Creek and the Little Spokane River also have an impact on the Spokane River's total pollutant load, primarily from agricultural runoff. Other known Spokane River pollutants from runoff to the Spokane River are heavy metals and PCBs.

Water quality standards in the State of Washington protect surface waters by numeric and narrative criteria, designated uses, and an anti-degradation policy. Numeric and narrative criteria are assigned to a water body based on use designations. Washington State law allows for the development of site-specific criteria protective of existing and designated uses, and for the removal of non-existing and unattainable designated uses via the use attainability analysis (UAA) process. A UAA was prepared for the Spokane River and Long Lake Reservoir in 2004 (CH2M HILL, 2004), but it was not adopted. Therefore, standard numeric and narrative criteria assigned to water bodies are currently in practice, based on use designations described in WAC 173-201A, Table 602.

These activities would occur within five Washington water resource inventory areas (WRIAs): WRIA 43 (Upper Crab Creek), WRIA 54 (Lower Spokane), WRIA 55 (Little Spokane), WRIA 56 (Hangman), and WRIA 57 (Middle Spokane). WRIAs for alternative project locations, and WRIA water bodies and their use designations are summarized in Table 3-1.

Activities and alternatives described in this plan occur in the watersheds of Little Spokane River, Latah (Hangman) Creek, Spokane River, and Crab Creek. Use designations are given for three reaches of the Spokane River: Spokane River mouth to Long Lake Dam, Long Lake Dam to Nine Mile Bridge, and Nine Mile Bridge to Washington-Idaho border. Uses are also designated for Crab Creek and its tributaries, which include Lake Creek in Lincoln County. Numeric and narrative criteria for these water bodies are summarized in Table 3-2. Complete descriptions of criteria are complex and can be found in WAC 173-201A.

3.1.2 Groundwater

FPA3 alternatives that include direct discharge to the Spokane River, groundwater discharge at the RPWRF location, and urban irrigation that occurs within Spokane city limits would take place over the Spokane Valley-Rathdrum Prairie Aquifer. These activities would have to be in compliance with all relevant laws, codes, and rules relating to protection of this sole-source aquifer. Land application alternatives occur in the Little Spokane River basin (Deer Park area), Latah (Hangman) Creek basin, and/or the West Plains area and would not affect this aquifer. The stream flow augmentation/groundwater recharge alternative in the West Plains and/or Lincoln County is also outside of the Spokane Valley-Rathdrum Prairie Aquifer area. Therefore, these activities would take place over different aquifers (described below), but they are still subject to State groundwater quality regulatory requirements.

3.1.2.1 Aquifers

Flowing from Lake Pend Oreille and under downtown Spokane to discharge into the Little Spokane and Spokane Rivers, the Spokane Valley-Rathdrum Prairie Aquifer (Figure 3-2) underlies about 370 square miles and serves over 500,000 people in the Spokane and Coeur d'Alene areas in Washington and Idaho. The Spokane Valley-Rathdrum Prairie aquifer is unusual in that it has one of the fastest flow rates in the United States, flowing as much as 60 feet per day in some areas. Because of the highly permeable flood deposits through which the aquifer flows, and the thin topsoil deposits in many areas overlying the aquifer, mobile pollution released at ground surface or in the subsurface over the aquifer can quickly reach groundwater (www.spokaneaquifer.org). It was designated as a "sole-source aquifer" by the U.S. Environmental Protection Agency (EPA) in 1978, meaning the region has no other affordable sources of water and that the aquifer needs special protection. All proposed projects that receive federal funds are subject to EPA review to ensure that they do not endanger this water source. All groundwaters of the State of Washington are protected by State technology-based treatment requirements and water quality standards. State water quality standards for groundwaters include enforcement limits, criteria, and an anti-degradation policy.

The Spokane Valley-Rathdrum Prairie Aquifer has a history of local protection and management. Spokane County completed the Spokane Valley Water Quality Management Plan in 1979. Implementation of this plan resulted in expansion of sewer service to many properties previously using onsite treatment with discharge over the aquifer. In conjunction with the Water Quality Management Plan, an Aquifer Sensitive Area Overlay Zone was developed to help implement policies included in Spokane County's Comprehensive Plan (Spokane County, 2012). Sewer system planning, stormwater runoff, and chemical handling and storage areas were then managed or regulated to protect the aquifer. Many of these policies were incorporated into City of Spokane codes. Water quality monitoring was extended in the aquifer beginning in 1980 (Miller, 2002). In 1985, Spokane County authorized the Aquifer Protection Area, and again re-authorized in 2004. This authorized the collection of fees for the withdrawal of water and use of onsite treatment systems. This revenue is used to offset costs associated with connecting to approved sewer systems, as well as for construction of sanitary sewage collection, disposal, and treatment, and stormwater drainage.

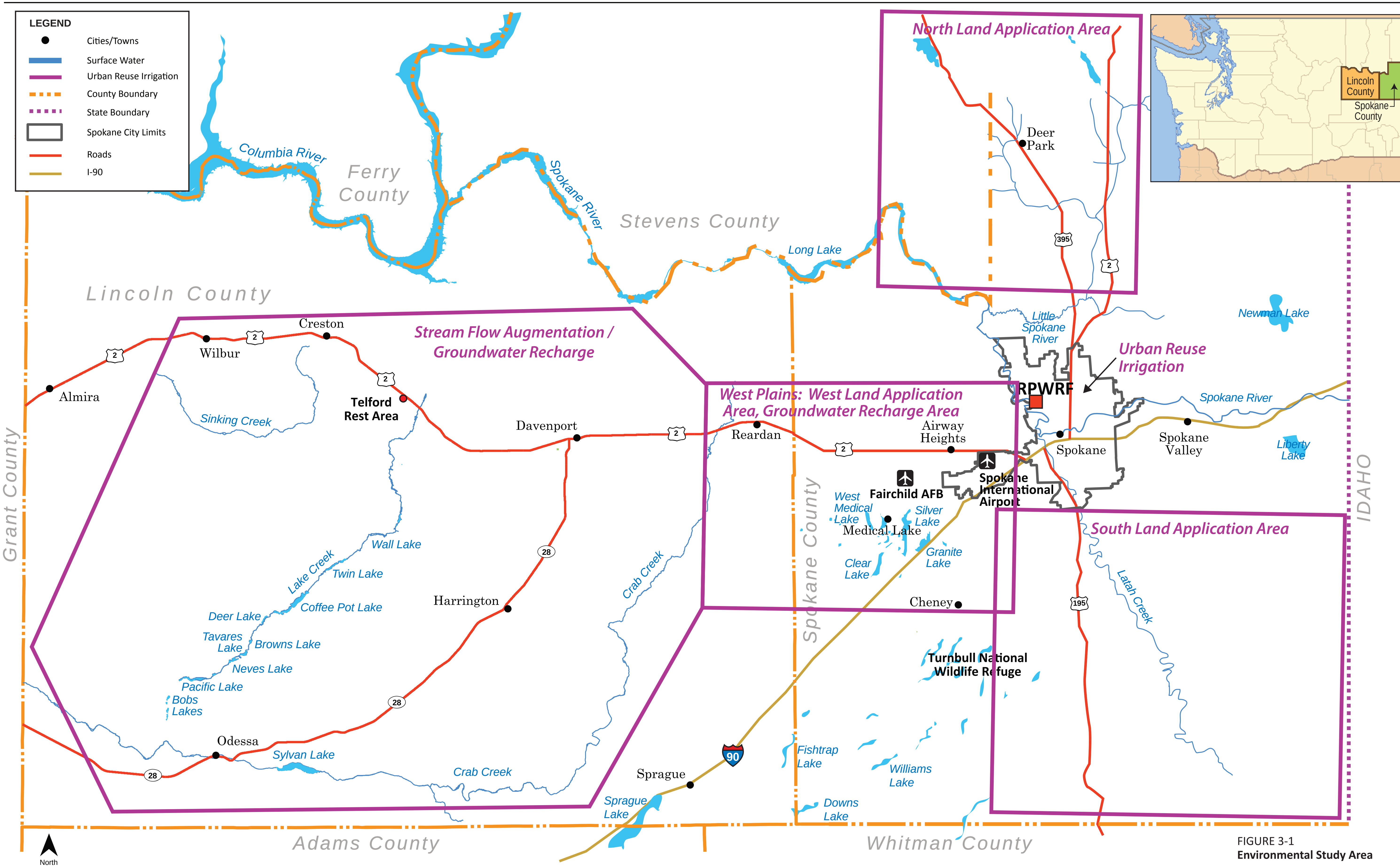


FIGURE 3-1
Environmental Study Area

CH2MHILL.

TABLE 3-1
WRIA Water Body Use Designations

Water Body/Alternative Project Locations	Use Designations
WRIA 43 (Upper Crab-Wilson) – Stream Flow Augmentation Alternative in Lincoln County	
Crab Creek and tributaries including Lake Creek	Rearing/Migration Only, Secondary Contact Recreation, Industrial Water, Agricultural Water, Stock Water, Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics
WRIA 54 (Lower Spokane) – RPWRF Alternatives and West Land Application Sites Alternative	
Spokane River from mouth to Long Lake Dam	Spawning/Rearing, Primary Contact Recreation, Domestic Water, Industrial Water, Agricultural Water, Stock Water, Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics [a]
Spokane River from Long Lake Dam to Nine Mile Bridge	Core Summer Habitat, Extraordinary Primary Contact Recreation, Domestic Water, Industrial Water, Agricultural Water, Stock Water, Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics
Spokane River from Nine Mile Bridge to Idaho border	Spawning/Rearing, Primary Contact Recreation, Domestic Water, Industrial Water, Agricultural Water, Stock Water, Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics [a]
WRIA 55 (Little Spokane) – Land Application Sites in North Area Alternative	
Little Spokane River	None[a]
WRIA 56 (Hangman) – Urban Irrigation and South Land Application Sites Alternative	
Latah/Hangman Creek	None
WRIA 57 (Middle Spokane) – Urban Irrigation Alternative	
Spokane River from Nine Mile Bridge (river mile 58.0) to the Idaho border (river mile 96.5)	Spawning/Rearing, Primary Contact Recreation, Domestic Water, Industrial Water, Agricultural Water, Stock Water, Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics

Note: Use designations for fresh water bodies are from WAC 173-201A, Table 602.
[a] As part of the State of Washington Scenic River program, additional protections are applied to publicly owned lands along the Little Spokane River.

In January 2000 the City of Spokane and the Spokane Aquifer Joint Board published a wellhead protection plan, which was subsequently updated in 2007 (CH2M HILL, 2000). This plan delineates special wellhead protection areas for each water utility. Potential contaminant sources were identified, notified, and reported to regulatory agencies. Individual purveyor and cooperative contingency plans were prepared in the event of a groundwater threatening accident or changes in monitored groundwater quality were to occur.

The Deer Park area proposed for the land application alternative overlies two separate primary groundwater aquifers. The upper aquifer is characterized by water flowing freely through unconsolidated glaciofluvial/glaciolacustrine sediments. Well depth for this aquifer in the Deer Park vicinity may vary from at the surface to 160 feet below ground surface, and is subject to seasonal variations. This upper aquifer is more susceptible to contamination due to the relatively unrestricted transmitting ability of the sandy gravelly soils. This is the most productive unit, with highly productive wells occurring north of the city of Deer Park and within Deer Park city limits. Groundwater generally flows from northwest to southeast in the shallow, unconsolidated aquifer. Historically, some Deer Park area private and public water wells in the upper aquifer have experienced nitrate contamination over 10 mg/L, due in large part to agricultural practices in areas where the glacial deposits are unsaturated (Sweet-Edwards/EMCON, 1991). The lower aquifer is a more confined basalt aquifer, somewhat protected by overhead rock layers. Well depth for basalt aquifer wells can vary from 80 to 350 feet below ground surface, with 175 feet being a typical depth.

TABLE 3-2
Spokane River Numeric and Narrative Criteria Summary

	Aquatic Life Criteria					Recreational Criteria	General Criteria	
Water Body	**Temperature, Highest 7-DADMax**	**Dissolved Oxygen, Lowest 1-Day Minimum**	**Turbidity**	**Total Dissolved Gas**	**pH**	**Bacteria**	**Toxic, Radioactive or Deleterious Materials**	**Aesthetics**
Spokane River from mouth to Long Lake Dam	17.5°C	8.0 mg/L	≤ 5 NTU over background 50 NTU or less; ≤ 10% increase over background greater than 50 NTU	≤ 110% of saturation	6.5 - 8.5, < ± 0.5 effect	100 cfu / 100mL	Concentrations below those that adversely affect water uses, cause acute or chronic toxicity to most sensitive biota, or adversely affect public health	Not impaired by materials or their effects offending senses of sight, smell, touch, or taste
Spokane River from Long Lake Dam to Nine Mile Bridge	16°C	9.5 mg/L			6.5 - 8.5, < ± 0.2 effect	50 cfu / 100mL		
Spokane River from Nine Mile Bridge to Idaho Border	17.5°C	8.0 mg/L			6.5 - 8.5, < ± 0.5 effect	100 cfu / 100mL		
Crab Creek and tributaries	17.5°C	6.5 mg/L	≤ 10 NTU over background 50 NTU or less; ≤ 20% increase over background greater than 50 NTU		6.5 - 8.5, < ± 0.5 effect	200 cfu / 100mL		

Note: Criteria for fresh water bodies are from WAC 173-201A.
7-DADMax = 7-day average of the daily maximum temperatures
NTU = nephelometric turbidity units

Basalt and granite rock layers beneath the shallow aquifer restrict movement of groundwater from the upper aquifer to the lower basalt aquifer. Flow is generally from the northwest to the southeast in the lower aquifer, although potentiometric depressions and mounds create local variations in flow direction. Groundwater in the lower aquifer is generally under artesian pressure. Yields at individual wells drawing from this lower aquifer range from negligible to adequate for individual domestic and stock needs (Buchanan, 1986).

Primary known aquifers in the West Plains area include the Wanapum Basalt Aquifer, the Grande Ronde Basalt Aquifer, and paleochannel aquifers (Figure 3-3). Over the majority of the West Plains area, an unconsolidated unit of 0 to 380 feet thickness is encountered. This is underlain by the Wanapum Basalt Unit, except in the major area ravines, to a thickness of 5 to 250 feet. The Upper Latah Interbed Unit (0 to 115 feet thick) separates the Wanapum Basalt Unit from the lower Grande Ronde Basalt Unit (0 to 500 feet thick). The Lower Latah Interbed Unit (0 to 240 feet thick) separates the Grande Ronde Basalt Unit from the basement bedrock. Water wells in the West Plains are typically completed in either the Wanapum Basalt Aquifer or the Grande Ronde Basalt Aquifer. Collectively, these lava flows and interbedded sediments are known as the Columbia River Basalt Group. Groundwater level declines, ranging from 15 to 120 feet, have been documented in the West Plains Columbia River Basalt Group aquifers over the last decade (Spokane County Water Resources et al., 2011). The West Plains paleochannels are former erosional features that have been filled with permeable deposits from historical floods that may intersect highly permeable subsurface water-bearing zones in basalt. These paleochannel aquifers discharge through the subsurface either directly to the Spokane River or indirectly to the Spokane River via Deep Creek (CH2M HILL, 2013b).

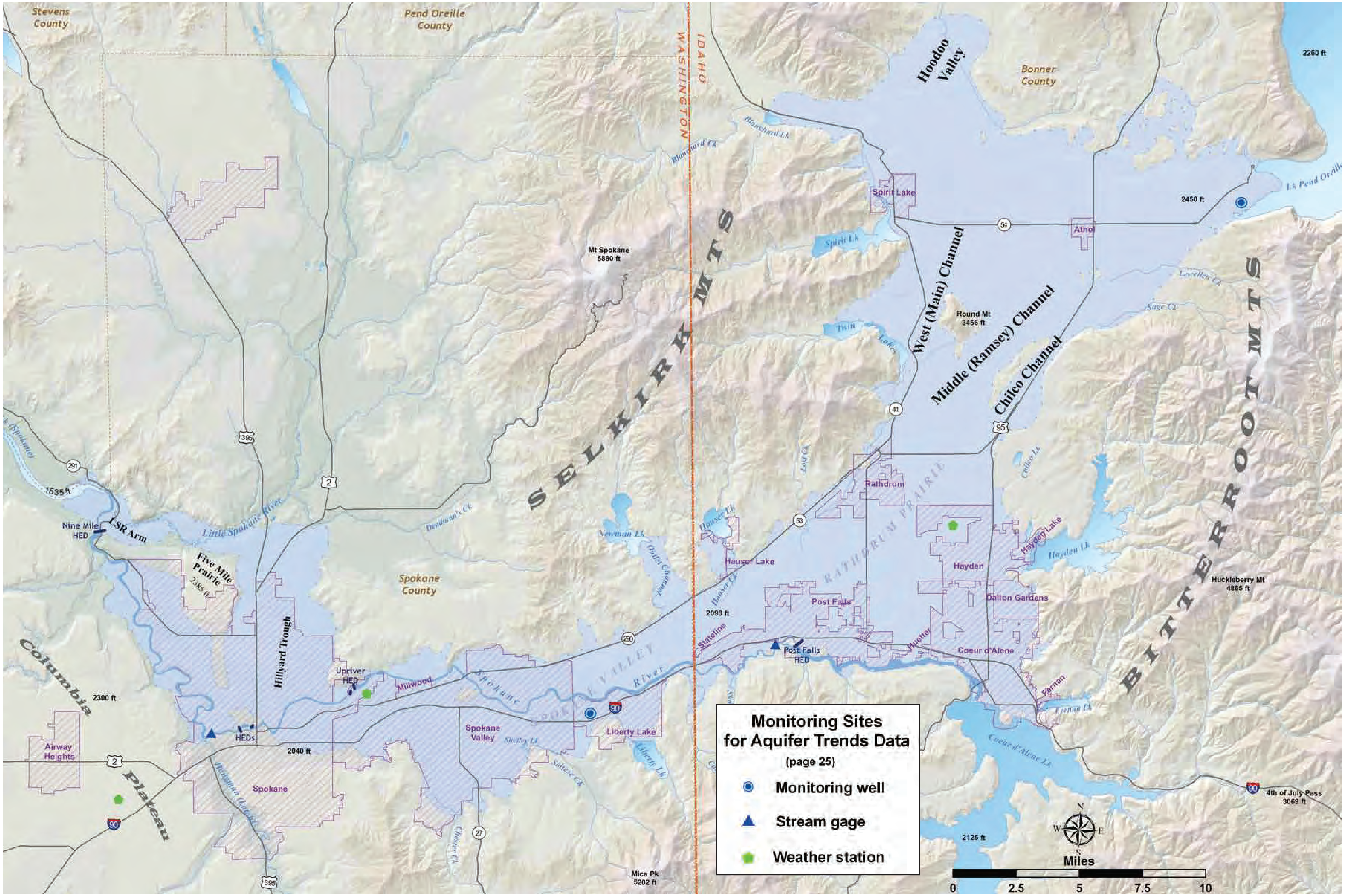


FIGURE 3-2
Spokane Valley-Rathdrum Prairie Aquifer

CH2MHILL

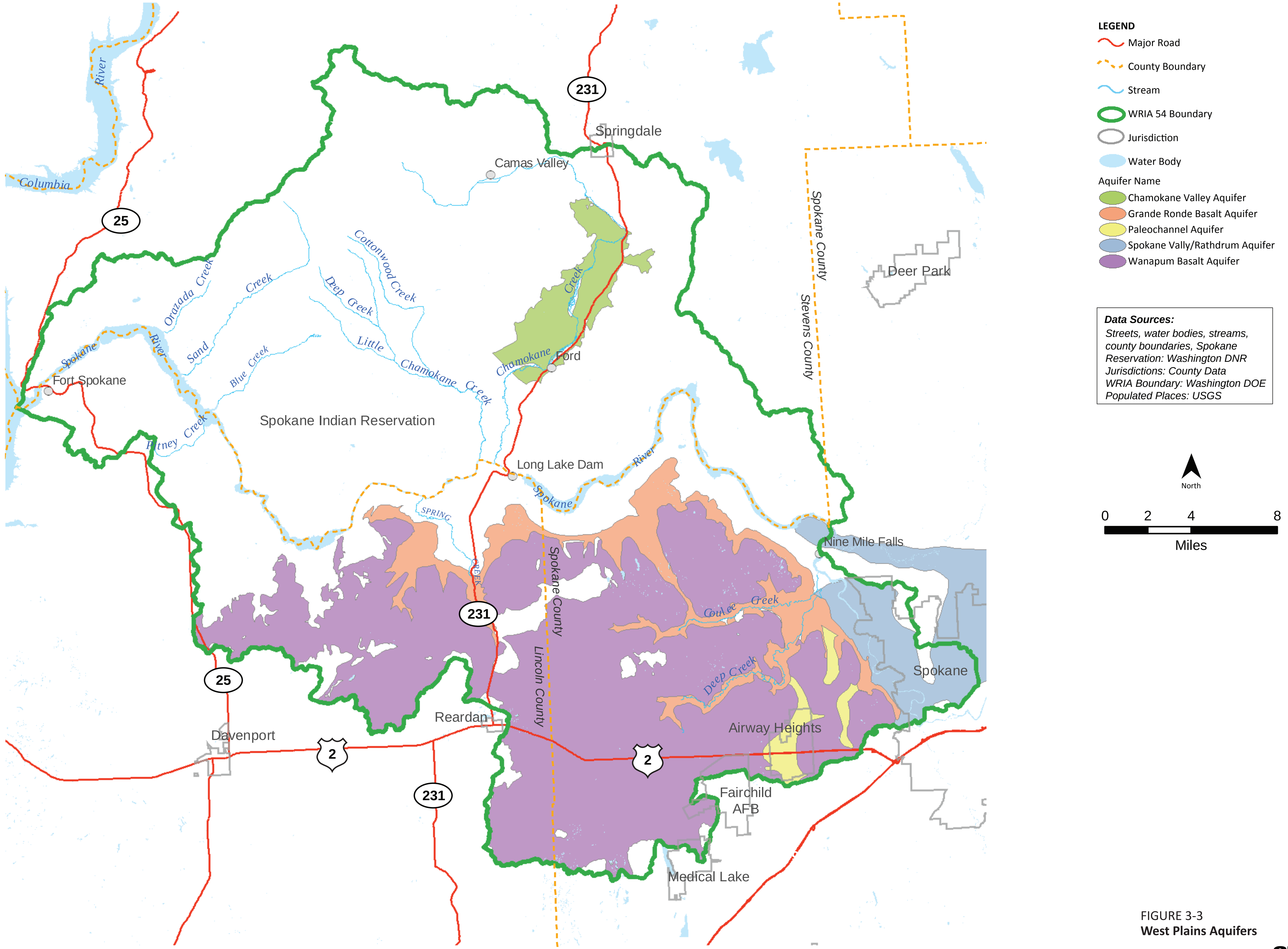


FIGURE 3-3
West Plains Aquifers

CH2MHILL

A hydrogeologic study of Latah (Hangman) Creek basin aquifers suggests that the groundwater resource in this area is limited. Water-bearing zones occur primarily in basalt formations, although unconfined water-bearing zones occur locally within glaciofluvial and flood deposits or basalt. Aquifers are limited in their lateral extents, typically extending less than one mile laterally, although some basalt aquifers extend 10 miles or more. Area groundwater generally flows both toward Spokane River and locally toward Latah (Hangman) Creek. Continuity between surface water and groundwater is significant. Latah Creek and its tributaries are gaining reaches (gaining flow from groundwater) for most of their length. The lower reach of Latah Creek is a losing reach (losing flow into the groundwater) during very low flow conditions (Northwest Land and Water, 2011).

Crab Creek and its tributaries and Lake Creek were evaluated for potential surface water discharge sites that might also recharge the depleted aquifer within the Odessa Subarea. This aquifer is the water supply source for municipal use (Town of Odessa), residential potable supplies, and agricultural irrigation. This aquifer is part of a large, slow-moving, precipitation-fed system that covers much of east central Washington. The Lake Creek system lies in a basalt formation, with thin rocky soils overlying the basalt bedrock. Basalt aquifer recharge is typically extremely slow because the bedrock has very low to essentially no infiltration capacity (U.S. Department of Energy, 1988). However, along the approximately 40-mile length of Lake Creek, there may be areas where an underlying basalt substrate is dominated by a rubbly and/or brecciated interflow zone. In such cases, the infiltration capacity of soils could be favorable for basalt aquifer recharge (Lincoln County Conservation District et al., 2011). Infiltration areas to these basalt interflow zones are possible at faults, folds, or where sediment-filled coulees or paleochannels bisect basalt interflow zones.

3.1.2.2 Water Rights

Water rights need to be part of surface and groundwater evaluations because proposed alternatives could potentially affect existing water right holders. Withdrawing water from the Spokane River for agricultural land application, urban irrigation, and stream flow augmentation/groundwater recharge at the West Plains or in Lincoln County would reduce Spokane River flows temporarily or permanently, or modify them. Modifications could include transferring surface water to a different drainage basin, which would affect groundwater tables and flows that may raise water table elevations or cause new seepage areas to the Spokane River. Any alternative that changes quantity or location of existing Spokane River discharge needs to be evaluated for water resource issues (benefits and disadvantages).

3.1.3 Geology and Geography

The FPA3 alternatives are located within a large geographical area that includes the city of Spokane, Spokane Valley, Spokane River tributaries (Little Spokane and Latah Creek), the West Plains, and the Crab Creek/tributaries drainage in Lincoln County. RPWRF is located at the bottom of a canyon adjacent to the Spokane River at elevation 1,650 feet. The City of Spokane elevation varies from 1,850 feet downtown to over 2,500 feet on surrounding hills. Areas in the West Plains are approximately elevation 2,350 feet. Land application areas vary from 1,900 to 2,500 feet to the north and higher elevations to the west and south. The variations in elevation mean that large amounts of electrical energy are required to pump water from RPWRF to areas where reclaimed water can be beneficially used.

3.1.3.1 RPWRF Site; Land Application Sites at Deer Park, West Plains, and Latah Creek; and Groundwater Recharge at West Plains and Urban Irrigation Sites

Spokane is located across the terminal end of the broad Spokane Valley, running generally east-west in Washington State. Flowing from Coeur d'Alene Lake to the Columbia River, the Spokane River is the only river flowing above the Spokane Valley-Rathdrum Prairie Aquifer and across the Spokane Valley. Major tributaries to the Spokane River include the Little Spokane River, draining a large basin to the north, and Latah (Hangman) Creek, originating in Idaho and draining a large basin to the south. The city of Spokane Valley lies to the east of Spokane. To the northeast lie the Selkirk Mountains, dominated by Mount Spokane. Liberty Lake and Saltese Flats (formerly Saltese Lake, before being drained) are to the east, and feed into the aquifer from the south, draining from Mica Peak, Gable Peak, and associated hills. South of Spokane, the terrain gains in elevation in the South Hill and Moran Prairie neighborhoods, and to a greater extent in the Dishman Hills area. The area to the west of Spokane is dominated by the West Plains plateau, on which is located the Spokane International Airport, Fairchild Air Force Base, the city of Airway Heights, and the scabland and lake area around the city of Medical Lake. This plateau is incised by several paleochannels draining to the Spokane River and Deep Creek. The Spokane River continues to flow to the northwest, away from the city of Spokane, through a series of lakes and dams until discharging to the Columbia River.

The Spokane Valley and surrounding areas are underlain by the rock formation referred to as the "basement." Plutonic rocks characterize the west slope of Mount Spokane through the Mead and Dartford areas. The Latah formation of weakly lithified sedimentary rocks was deposited in shallow lake conditions, and overlies the basement rocks. Columbia River basalts extend throughout the Spokane area. These originated from fissures south of Spokane and Cheney. The basalts often lie atop the Latah Formation, but occur as invasive flows into the Latah in some areas. The Spokane Valley and Spokane Valley-Rathdrum Prairie Aquifer were formed by repeated flood releases from former glacial Lake Missoula, resulting in the current topography and fast-moving shallow aquifer extending from Lake Pend Oreille to the Little Spokane River.

3.1.3.2 Stream Flow Augmentation/Groundwater Recharge Site in Lincoln County

The Crab Creek watershed encompasses most of Lincoln County. The land surface generally consists of flood-scoured basalt bedrock (known as channeled scablands) or of rolling hills that are areas of wind-deposited silt and fine sand (loess). Elevation in the area ranges from approximately 2,600 feet above mean sea level at the drainage dividing Lake Roosevelt from Crab Creek watershed to approximately 1,400 feet above mean sea level at the base of the Crab Creek drainage. Land uses in the scablands are primarily stock grazing, small localized irrigated farming, habitat management, and recreational activities. Land uses in the hilly areas are dryland agriculture, grazing, and habitat conservation uses. Towns and communities represent less than 1 percent of Lincoln County's land area. The most densely populated areas in the county are small towns located mostly on State Route (SR) 2, SR 28, and SR 23.

A series of coulees runs north to south and southwest into the Crab Creek drainage, formed by Pleistocene cataclysmic flood waters. Streams and lakes found in this drainage typically do not fill these scoured canyons, with the notable exception of Lake Creek, in which a number of lakes are found or were found historically. Lincoln County is located at the northern edge of the Columbia River Basalt zone, where it pinches out against the metamorphic and crystalline igneous rocks of the Okanogan Highlands.

3.1.4 Air

The Spokane Valley and surrounding areas are within the Spokane particulate matter maintenance area established by the Department of Ecology. Additionally, a Spokane County carbon monoxide maintenance area with somewhat different borders has also been established by Ecology. Furthermore, alternatives proposed outside of Spokane Valley and the city of Spokane are located in attainment areas without maintenance restrictions, but may have burning restrictions to control air emissions. Activities and alternatives described in this Facility Plan Amendment are not expected to appreciably affect air quality in or outside of these areas.

3.1.5 Climate

The Spokane area is characterized by hot, dry weather in the summer and cool, snowy, and moist weather in the winter. The warmest months are July and August, which average 21.0°C in Spokane. The city average for the coolest month, December, is -2.6°C. The Spokane area lies within the rain shadow of the Cascade Mountains and receives an annual precipitation of 16.5 inches. Average seasonal snowfall is 44 inches at the Spokane International Airport, but much more snow falls in surrounding hills and mountains, with Mount Spokane receiving up to 150 to 200 inches annually. Precipitation decreases west of Spokane with about 14.5 inches annually near Reardan, which is the headwaters of Crab Creek. Intense rain events are relatively rare. The heaviest 1-day rainfall during the period of record was 1.65 inches in Spokane in 1905.

Thunderstorms occur at an average frequency of about 10 days per year, mostly occurring between May and August.

3.1.6 Floodplains

Executive Order 11988 requires all SRF wastewater construction projects to determine if the project is located in or will affect a floodplain. Floodplain permits are administered by the City of Spokane. Some shoreline areas of the RPWRF are located within a 100-year and 500-year Spokane River floodplain. Proposed projects at the RPWRF will need to be constructed in compliance with floodplain development requirements.

The land application and irrigation alternatives are not anticipated to be sited in a 100-year floodplain, but they could be located within the identified general areas that are within a 100-year floodplain (adjacent to tributaries of the Little Spokane River or to Latah [Hangman] Creek). Similarly, the West Plains paleochannel groundwater recharge alternative would not be constructed in a 100-year floodplain. The Lake Creek stream flow augmentation/groundwater recharge alternative may have impacts to the Lake Creek floodplain and to lake floodplains that are part of Lake Creek's drainage. Analysis of all alternatives would be necessary when potential project sites are known in order to assess whether they have the potential to affect a 100-year floodplain downstream of the discharge point.

3.1.7 Shorelines

SRF projects in Washington State are required to conform to the Coastal Zone Management Act. However, the project is not within a designated Coastal Zone Management Area, and will not affect any barrier islands. Therefore, Coastal Zone Management Certification is not required.

The Shorelines Management Act of 1971 (Revised Code of Washington [RCW] 90.58.020) established local jurisdictions to prepare and implement Shoreline Management Plans including a permit program. Shoreline uses related to the alternatives evaluated under the FPA3 are as follows:

- **RPWRF Site:** The RPWRF upgrades would occur in proximity to the Spokane River. All projects must comply with shoreline permitting by the City that includes a Shoreline Substantial Development Conditional Use Permit, variance to shoreline 50-foot setback and 15-foot buffer, and a Zoning Special Permit Amendment. These permits provide conditions for all future projects at the RPWRF site.
- **Land Application at Deer Park, West Plains:** Shorelines permitting is not anticipated at potential land application sites at Deer Park or West Plains. Application sites would need to be located outside of the shorelines buffer area of Medical Lake, Silver Lake, and other West Plains lakes.
- **Urban Irrigation:** Shoreline permitting is not anticipated at potential urban irrigation sites within Spokane city limits unless these publicly owned lands are located within a shorelines buffer area.
- **Stream flow augmentation and groundwater recharge:** Stream flow augmentation in Lincoln County may require shoreline permitting because discharge into Lake Creek or Crab Creek would ultimately reach Lincoln County lakes that may be under the Lincoln County Shorelines Management Plan. Groundwater recharge projects at the West Plains or RPWRF site are not anticipated to require a shorelines permit.

3.1.8 Wetlands

Executive Order 11990, Protection of Wetlands, establishes that activities supported by the federal government must, to the extent possible, avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Wetlands provide key ecological services and are important habitat for fish, migratory birds, and other wildlife. Wetlands analysis should be conducted when developing specific siting locations for the land application or irrigation water reuse alternatives, in order to protect this resource and to be compliant with Executive Order 11990. Because there is a high potential for encountering wetlands along the pipeline delivery route to the headwaters of Lake Creek and impacting existing wetlands on Lake Creek and nearby lakes, wetland surveys should be completed in the development of the stream flow augmentation/groundwater recharge water reuse alternative to ensure compliance.

The Turnbull National Wildlife Refuge is located six miles south of Cheney, Washington, in Spokane County. This refuge was established in 1937 by Executive Order, and encompasses approximately 18,217 acres. The ecosystem within Turnbull National Wildlife Refuge is unique within the National Wildlife Refuge System. There are over 130 marshes, wetlands, and lakes within the refuge, providing aesthetic beauty as well as high quality breeding habitat for waterfowl populations that have experienced major decline across North America due to loss and degradation of habitat (U.S. Fish and Wildlife Service, 2013). The refuge is managed by the U.S. Department of Interior, Fish and Wildlife Service to provide quality breeding and migratory habitat for waterfowl. Because of the critical habitat resource of Turnbull National Wildlife Refuge and its protected status, this area is not included for consideration for acceptance of reclaimed water from the RPWRF.

A known wetland site exists at the RPWRF site, which is a band of wetland vegetation along the Spokane River and to the east of the RPWRF. Project-specific construction plans and specifications would be required to determine any impact to these wetlands and applicable mitigation measures to assure wetland protection.

3.1.9 Endangered Species/Habitats and Priority Species

The Endangered Species Act of 1973 (16 U.S.C. 1531-1544) provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. Section 7 of the Endangered Species Act requires federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

The Washington State Department of Fish and Wildlife (WDFW) shares in the responsibility of protecting habitats and species in Washington State.

3.1.9.1 RPWRF Site

There are three federally listed plant species in Spokane County (water howellia [*Howellia aquatilis*], Spalding's silene [*Silene spaldingii*], and Ute ladies'-tresses [*Spiranthes diluvialis*]). However, there is no habitat on the RPWRF to support any of these plant species. State-listed priority habitats in the RPWRF area include a band of wetland vegetation along the river and to the east of the RPWRF, riparian habitat along the river, instream habitat, and white-tailed deer winter range habitat.

There are no threatened or endangered animal species on or near the RPWRF site. State protected animal species in the Spokane River corridor or in proximity of the RPWRF include:

- Bald eagle (*Haliaeetus leucocephalus*): Designated as a Washington State Sensitive Species by WDFW and known to occur in the Spokane River corridor.
- State Candidate species habitat observed around the RPWRF: Vaux's swift (*Chaetura vauxi*), Lewis's woodpecker (*Melanerpes lewis*), white-headed woodpecker (*Picoides albolarvatus*), and spotted frog (*Rana pretiosa*).
- State Monitor species observed around the RPWRF: great blue heron (*Ardea Herodias*) and osprey (*Pandion haliaetus*). Herons use the Spokane River corridor and osprey nest occasionally on RPWRF property.
- State Priority species observed around the RPWRF: white-tailed deer (*Odocoileus virginianus*), Rocky Mountain mule deer (*Odocoileous hemionus),* and rainbow trout (*Oncorhynchus mykiss*). It should be noted that the white-tailed deer near the project are not part of the federally endangered Columbian white-tailed deer distinct population segment found in parts of eastern Washington. There are no known residents of this distinct population segment in Spokane County.

3.1.9.2 RPWRF Offsite

Project sites located away from the RPWRF (i.e., in the city of Spokane, Deer Park, West Plains, Latah Creek, Lincoln County) that would be used for infiltration, surface water augmentation, or land application would require additional study regarding protected plants and animals at those specific proposed sites.

3.1.10 Public Health

The Spokane Valley-Rathdrum Prairie aquifer is the primary drinking water source for over 500,000 users, and all discharges via land application, groundwater recharge, irrigation, and surface water discharge over the aquifer must be evaluated for protection of this resource. The aquifer is protected by the anti-degradation policy for groundwaters of the State of Washington. Because of its sole source status, all federally funded projects that could impact the aquifer are subject to review by EPA.

The Spokane River has received runoff that has heavy metals and PCBs. Certain riverbank areas have undergone cleanup under the supervision of the Department of Ecology. The Washington Department of Health is working in coordination with Ecology in developing and managing the Water Reclamation and Reuse Program, conducting proposal reviews for public health issues. Note that effluent from the RPWRF will be treated to meet NPDES permit requirements. These permit requirements will protect the Spokane Valley-Rathdrum Prairie aquifer and Spokane River water quality, and provide water quality protection for RPWRF project sites located elsewhere (i.e., Deer Park, West Plains, Latah Creek, Lincoln County).

3.1.11 Prime or Unique Farmland

The Farmland Protection Policy Act (FPPA) (7 USC 4201) provides special requirements to projects that irreversibly convert farmland to nonagricultural use that are completed by a federal agency or with assistance from a federal agency. Assistance can include acquiring or disposing of land, providing financing or loans, managing property, or providing technical assistance. The FPPA defines farmland as “prime farmland” (best combination of characteristics for producing crops), “unique farmland” (other than prime farmland, used for producing specific high-value crops), or “farmland” (other than prime or unique farmland, of statewide or local importance for agricultural production). Some actions and alternatives described in this plan would enhance farmland productivity (land application, irrigation). Additionally, some alternatives may potentially convert farmland to nonagricultural use in the construction of water conveyance and storage. There are no farmlands as defined by the FPPA at the site of the RPWRF.

3.1.12 Archaeological and Historical Sites

Under the authority of the Historic Preservation Act, the federal government maintains a National Register of Historic Places (NRHP) for preservation of historic properties and resources. Additionally, the Washington State Department of Archaeology and Historic Preservation maintains a historic property inventory list. A preliminary search of State records using the Washington Information System for Architectural and Archeological Records Data (WISAARD) was completed for the Deer Park land application areas, West Plains land application/groundwater recharge areas, and the Lincoln County stream flow augmentation/groundwater recharge areas. Eight properties registered in the NRHP were found in the vicinity of the Deer Park land application areas, and approximately 517 properties were found on the State historic property inventory list. For the West Plains areas, 534 National Register properties and 512 records in the State historic property inventory list were found. Similarly, one NRHP property and one State historic property inventory list record was found within 3 miles of the headwaters of Lake Creek (the entire pipeline delivery route and creek discharge drainage area was not investigated). Further desk-top and field investigations would be conducted when the exact location and extent of these proposed projects are identified. Upgrades to the RPWRF plant would all occur on mostly constructed and highly developed RPWRF property. A prior WISAARD database search showed an uncompleted historic property inventory report (No. 3402) (CH2M HILL, 2013b). There are no places or objects listed on or proposed for national, state, or local preservation registers.

3.1.13 Federally Recognized Wild and Scenic Rivers

No federally recognized wild and scenic rivers are in the vicinity of any activities or alternatives presented in this plan. None of the surface water bodies or aquifers in the vicinity of any alternatives discharge directly or indirectly into any federally recognized wild and scenic river.

Although not federally designated as a wild and scenic river, the Little Spokane River is designated as part of the Washington State Scenic River System from the upstream boundary of the state park boat put-in site near Rutter Parkway to its confluence with the Spokane River. This designation creates protective action requirements for publicly owned lands along the bank of the protected reach of the Little Spokane River.

3.1.14 Recreation and Open Space Alternatives

Parks and recreational lands and their public uses are protected under Section 4(f) of the U.S. Department of Transportation Act of 1966. Recreational uses related to the alternatives evaluated under the FPA3 are as follows:

- **RPWRF site:** The RPWRF is located adjacent to Riverside State Park. It has not impacted the use of that state park or any other recreational uses on or near the Spokane River. Additional Section 4(f) evaluation would not be anticipated for any proposed projects at the RPWRF site.
- **Land application at Deer Park or West Plains:** Land application of Class A reclaimed water on agricultural land located in the Deer Park or West Plains areas is not expected to impact recreational use because the existing use of these lands is agricultural.
- **Urban irrigation:** Class A reclaimed water would be used to irrigate publicly owned lands within the Spokane city limits. The use of City parklands and golf courses would need additional evaluation under Section 4(f) for any urban irrigation project proposed on Section 4(f) properties.
- **Stream flow augmentation and groundwater recharge:** Stream flow augmentation and groundwater recharge options could occur in Lincoln County, and groundwater recharge could occur in the West Plains and at the RPWRF site. Stream flow augmentation in Lincoln County could potentially impact recreational use of Crab Creek and its tributaries, and the chain of lakes in the Lake Creek drainage. The discharge of Class A reclaimed water to these surface waters would need additional evaluation under Section 4(f). The groundwater recharge in the West Plains and at the RPWRF site may impact recreational use if recharge entered the Spokane River where a variety of recreational activities occur. These impacts are expected to be minimal because existing effluent is permitted to discharge into the Spokane River, and these proposed projects would also need to meet discharge permit requirements.

3.2 Demographics and Land Use

The City of Spokane estimated that the 2012 population of the RPWRF service area was 236,944 people. Current zoning for the city is described in the City of Spokane Comprehensive Plan (City of Spokane, 2012). This plan establishes the framework for all City planning activities and documents. There are two main things that the Comprehensive Plan is required to do. The state Growth Management Act (GMA) includes provisions to ensure that the City follows the Comprehensive Plan directives. First, the City must regulate land use and development consistent with the plan (Figure 3-4); the zoning code, subdivision code, environmental ordinances, and building code must follow the plan’s intent. Second, the City must make capital budget decisions and capital project investments in conformance with the plan. Sewer service connections to property outside the designated urban growth area are approved only if the connection is to existing infrastructure with surplus capacity and has health district and Department of Health approval or a vested development agreement. Otherwise, the growth must occur within the urban growth area. Most of the land within the service area is developed, limiting new future flow to RPWRF.

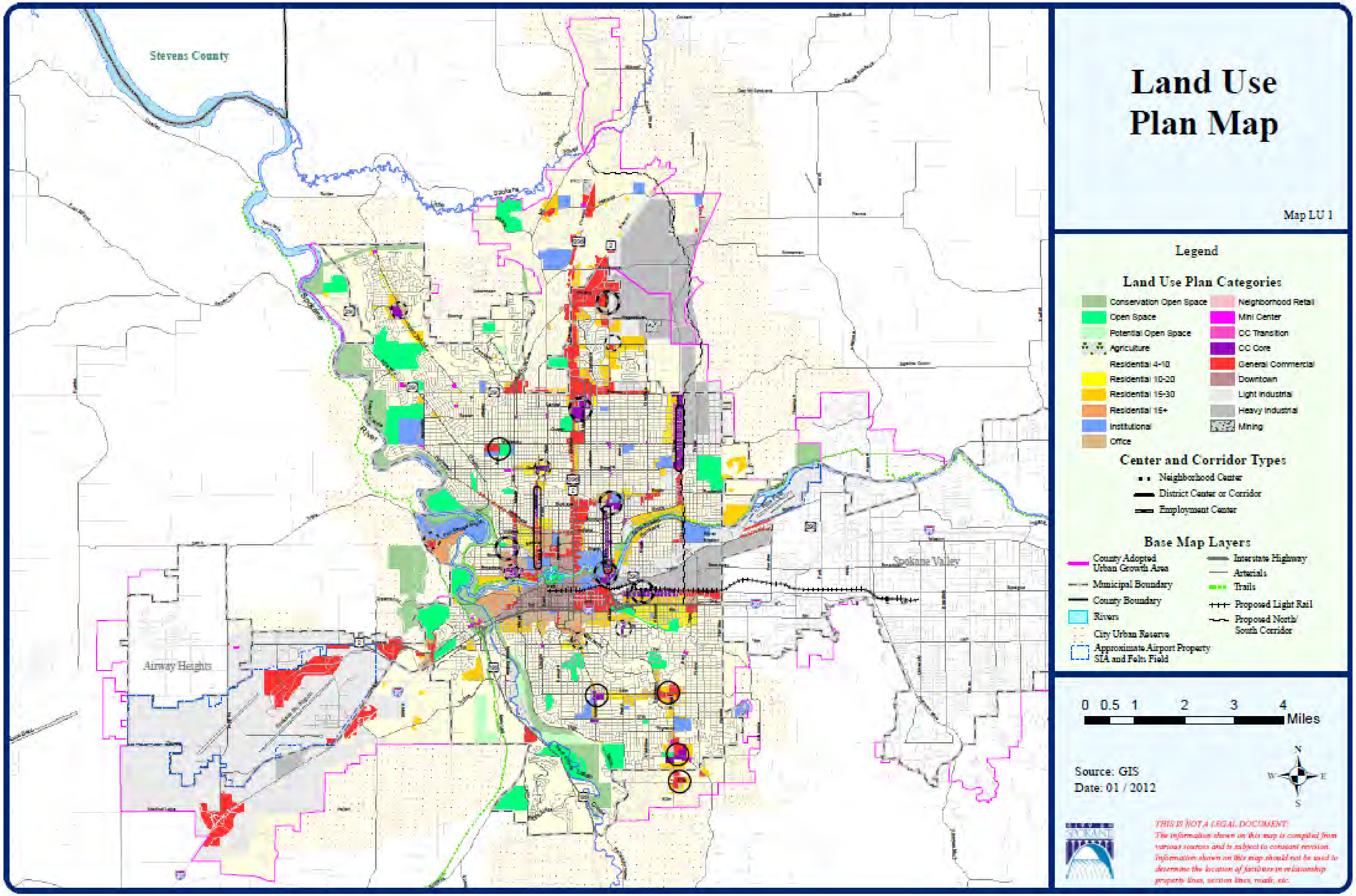


FIGURE 3-4
Land Use Plan Map
Source: City of Spokane's Comprehensive Plan (2012)

Figure 1-2 in Chapter 1 shows the wastewater service areas of RPWRF and the main trunk and interceptors conveying wastewater to RPWRF. Any interceptors or trunk lines extended outside the urban growth area must be for the overall operational benefit and efficiency of the City of Spokane's sewer utility system. Such extensions are to be for conveyance purposes only. This restricts the overall growth capacity and plant expansion needs as outlined in the City's Comprehensive Plan. These provisions limit future growth outside the designated service area and urban growth boundaries.

The growth alternatives presented in the Comprehensive Plan are based on projected growth for Spokane County for the next 20 years as decided by elected officials from all jurisdictions in the county. Growth to the east of the city of Spokane is limited by the city of Spokane Valley. Over the years, the city has typically grown at a rate of less than .5 percent per year. During the years between 1990 and 1995, the city's population growth was more rapid, increasing to 188,800, an expansion of more than 1 percent per year. The population has remained relatively stable with slow growth over Spokane's history (City of Spokane, 2012; Chapter 3).

The County Facility currently intercepts wastewater flows up to the 8-mgd average capacity of the treatment facilities. There are approximately 4,000 septic tanks in Spokane County that will be connected to sewers before 2015, and 3,200 of these are located in the area east of Spokane. Additional flows from east of Spokane are expected to discharge to RPWRF once flows exceed the 8-mgd average capacity of the County Facility. Spokane County wastewater would be conveyed to Interceptor No. 2 by the existing North and South Spokane Valley interceptors.

The area north of the city is currently served by Spokane County and future flows from this area are based on growth estimates for Spokane County. There are 800 septic tanks that are expected to be connected to sewers in north Spokane before 2015. Wastewater from north Spokane is conveyed to the RPWRF by the North Spokane Interceptor and City sewers into Interceptor No. 1.

Spokane County has an agreement with the City of Spokane allowing the County to discharge a combined total of 10 mgd average flow from north Spokane and the Valley to RPWRF. In the future this capacity is assumed to be split between average flows in excess of 8 mgd from Spokane Valley and flows from north Spokane.

The West Plains area has been recently annexed into the City of Spokane and contains significant undeveloped land. This area is zoned for light industrial, a small pocket of heavy industrial, and general commercial development along the freeway and SR 2. There are small sections of residential zoned land adjacent to the western edge of the previous city limit boundary. The City has provided wastewater treatment to Airway Heights and Fairchild Air Force Base through previous extensions. The City of Airway Heights has constructed its own wastewater treatment and reclamation facilities that became operational in the summer of 2012, reducing this flow to zero. The City of Airway Heights has retained reserved capacity of 680,000 gallons per day at RPWRF and will maintain reserved capacity at least until the new treatment and reclamation facilities are proven and accepted by Ecology. It is anticipated that capacity is available to Airway Heights until the year 2020 without impact on the design capacity of RPWRF. If the City of Airway Heights requires the ability to reserve capacity after the year 2020, RPWRF may need to be expanded earlier than the year 2030 for BOD and TSS, but the flow capacity of RPWRF is adequate until at least the year 2030. There are other factors influencing the design capacity of RPWRF that are much more significant than the reserve capacity for the City of Airway Heights.

The area south of Spokane is primarily residential in nature but is expanding its multi-family development around business centers of neighborhood retail, business commercial, centers, and corridor development per the City's comprehensive plan. Stormwater management is an issue in this area along with subsurface water. The recent development of Hazel's Creek and plans for stormwater management projects around the KXLY radio towers will open up future development of the Southside areas.

Facility phasing serves to integrate the concurrency requirements of the GMA with the environmental assessment requirements of SEPA. This, in turn, provides a high level of predictability for both developers and the community regarding what type of development is permitted and what infrastructure is provided to support that development (City of Spokane, 2012; CFU 2, Phasing of Service).

3.3 Existing Conveyance and Treatment Facilities

RPWRF provides most of the wastewater treatment for the Spokane area and the conveyance system drains by gravity to this location. Beginning in the fall of 2011, the County Facility began operation, reducing the flow to RPWRF by about 6.5 mgd. The County Facility operates similar to a “scalping” facility removing flow from the North and South Valley interceptors by a pump station located on each interceptor and pumping wastewater to the County Facility. The County Facility discharges treated effluent to the Spokane River at a location near the facility and hauls treated solids to the Barr Tech Composting Facility located in Lincoln County. The County Facility has an average capacity of 8 mgd and it is assumed that wastewater will be pumped from the Valley interceptors up to this capacity. Flows in excess of an average of 8 mgd will discharge to Interceptor No. 2 and flow by gravity to RPWRF until the capacity of the County Facility is expanded. It is anticipated that the next expansion of the County Facility will occur after 2030.

Interceptor No. 2 conveys most of the wastewater to RPWRF serving areas east, south, and west of RPWRF. Part of the service area draining to Interceptor No. 2 is combined sewer and stormwater. There are 20 CSO outfalls. Most of these CSOs are along the Spokane River upstream of RPWRF to Upriver Dam. One CSO is associated with Interceptor No. 1 downstream of RPWRF. The City is planning CSO improvements concurrent with planning for NLT improvements. A separate CSO plan describes the CSO improvements proposed. City staff intend to design CSO improvements that will limit future peak flows through Interceptor No. 2 to a maximum of 120 mgd during the design event when the CSO improvements are completed.

Interceptor No. 1 conveys much less flow than Interceptor No. 2 and receives the flow from the north Spokane service area in Spokane County. Spokane County is planning for significant growth and septic tank elimination in this area generating wastewater flows predicted to be less than 3 mgd in the year 2030. Since the total flow from the county to RPWRF is limited to 10 mgd and the north Spokane area is not planned to have a treatment facility, the maximum flow from Spokane Valley must be limited as this north area’s wastewater flow increases so the total does not exceed 10 mgd. Future total flows in the year 2030 from Spokane County, including both Spokane Valley interceptors and north Spokane, are predicted to be much less than 10 mgd. Spokane County wastewater planning states the County intends to expand the County Facility to keep total wastewater flow to RPWRF to a maximum of 10 mgd. North Spokane wastewater flows with septic tank elimination and estimated growth are predicted to be less than 3 mgd in the year 2030. Eventually, if Spokane County continues to treat all flows from Spokane Valley, up to 10 mgd could be received at RPWRF from North Spokane. This would require a population increase of over 70,000 people, and based on current growth projections, this population occurs much later than maximum growth management population estimates for this area.

The County Facility is a complete treatment plant designed to meet the DO TMDL for phosphorus. It includes complete solids-handling facilities. Wastewater flows and waste loads treated by the County Facility are assumed to be removed from RPWRF up to 8 mgd average flow.

RPWRF provides preliminary, primary, secondary, and phosphorus treatment and disinfection for flows to 100 mgd and preliminary and primary treatment and disinfection for flows between 100 and 150 mgd. The treatment plant screens material greater than ¼ inch diameter to 150 mgd using perforated plate screens and washing and compaction for screenings. Grit removal is provided by aerated grit chambers. Four 125-foot-diameter primary clarifiers have capacity for 100 mgd. Full-scale chemically enhanced primary treatment (CEPT) has been tested since May 2011, where alum is added downstream of the screens at the Parshall flumes and polymer is added at the flow distribution box of the primary clarifiers. Flows to the primary clarifiers are controlled by a butterfly valve based on flow measurements by a Venturi flow meter.

The butterfly valve limits the flow to the primary clarifiers to a maximum of 100 mgd. Flows in excess of 100 mgd flow over a fixed weir and are piped to secondary Clarifier No. 5 and CSO Clarifier No. 6. These two clarifiers are referred to as the “CSO clarifiers” and will be discussed later.

Secondary treatment including high efficiency ammonia removal is provided by activated sludge with a high enough solids retention time for nitrification (biological ammonia oxidation). Five aeration basins are in place, and space is available to add a sixth 4-million-gallon (MG) aeration basin in the future. Four aeration basins are 3 MG each and are entirely aerobic. The fifth aeration basin is 4 MG. It has a 1-MG anoxic zone divided equally into three parts and three 1-MG aerobic zones in series following the anoxic zone, separated by baffles. The anoxic zones each have platform-mounted mixers to keep the mixed liquor solids in suspension. Pumps return mixed liquor from the final aerobic zone to the anoxic zone to provide nitrate for denitrification in the anoxic zone. All aeration basins are 25 feet deep and aerated by ethylene propylene diene monomer membrane fine-bubble diffusers. Air for the diffused air system is supplied by four 13,000-standard-cubic-feet-per-minute Turblex high-efficiency blowers. Mixed liquor from the aeration basins is distributed to four 160-foot-diameter secondary clarifiers with a capacity of 100 mgd (this is the net capacity excluding the return activated sludge [RAS] flow). There are six 12-mgd RAS pumps providing a maximum RAS pumping capacity of 48 mgd; two of the six are backup pumps. Clarifier No. 5 can be used as a secondary clarifier if four secondary clarifiers are needed and one of the other four secondary clarifiers is out of service.

Phosphorus treatment has historically been provided by adding alum to the mixed liquor before it enters the secondary clarifiers. CEPT and secondary treatment has provided phosphorus removal most of the time since CEPT has been used. Additional alum has been added to the secondary clarifiers late in the summer when phosphorus levels approach current NPDES permitted limits.

Flows to RPWRF in excess of 100 mgd are diverted to the CSO clarifiers. The volume of each clarifier is about 2 MG before it discharges to disinfection. If the total volume diverted to the CSO clarifiers is less than 4 MG, all the diverted flow is stored and later pumped back to the headworks for full treatment. If the flow diverted to the CSO clarifiers exceeds the available storage volume, the excess flows by gravity to disinfection. This is called a “bypass” by Ecology and EPA and must be reported. The “bypass” wastewater received primary treatment or CEPT if alum is being added downstream of the screens. The primary or CEPT effluent is mixed with secondary effluent and disinfected by chlorine and dechlorinated before discharge to the Spokane River.

Disinfection is provided by sodium hypochlorite and retention in chlorine contact basins Sodium bisulfite is added at the end of the chlorine contact basins to react with the residual chlorine and form a non-toxic compound before discharge to the Spokane River. Effluent is discharged to the Spokane River using a steep channel.

RPWRF has solids-handling facilities to prepare dewatered biosolids that are land applied on dryland crops in farming areas within 40 miles of the city of Spokane. Four 3-meter-wide gravity belt thickeners co-thicken primary and waste activated solids prior to anaerobic digestion. Two 2.8-MG egg-shaped anaerobic digesters provide stabilization and pathogen reduction to produce Class B biosolids. Two existing conventional digesters would require extensive modifications before they could be used again and are not available as anaerobic digesters. Biosolids are dewatered to 17 percent solids by eight 2-meter belt filter presses. Dewatered Class B biosolids are hauled by trucks to privately owned land where they are applied using manure spreaders. Figure 3-5 shows the areas where biosolids have been applied over the past 20 years. Specific sites vary over time, and Figure 3-5 shows the general areas and not specific sites. Specific sites are documented in the City biosolids management program on file with Ecology.

The areas used for biosolids application are a small percentage of the agricultural land surrounding Spokane. Locations where biosolids have been applied include an area south of Deer Park and north of Spokane, areas in the vicinity of Fairchild Air Force Base, areas near and north of Highway 2 in eastern Spokane County, and areas near Reardan in eastern Lincoln County. As development occurs, it is likely that biosolids land application sites will become located further from the City of Spokane. Biosolids are incorporated into the soil at the end of the day by the private farmers. Dryland winter wheat is the primary crop grown. Biosolids are applied at the agronomic rate to provide nitrogen fertilizer for the crop.

3.4 Current Flows and Waste Loads

3.4.1 Current Flows

Table 3-3 summarizes flow to RPWRF from 2001 to August 2012. As discussed in the previous section, the County Facility began operation in the fall of 2011 and in 2012 it reduced flows to RPWRF by approximately 6.5 mgd; therefore, this 2012 period cannot be used in the data analysis. Table 3-3 categorizes the flows into three time periods. “Annual” values are for the entire 12 months of the year shown. “Critical” and “non-critical” seasons refer to the two time periods in the future NPDES permit with different effluent requirements. Critical season is from March 1 through October 31 when $CBOD_5$, ammonia, and phosphorus discharge standards are more stringent to meet the DO TMDL.

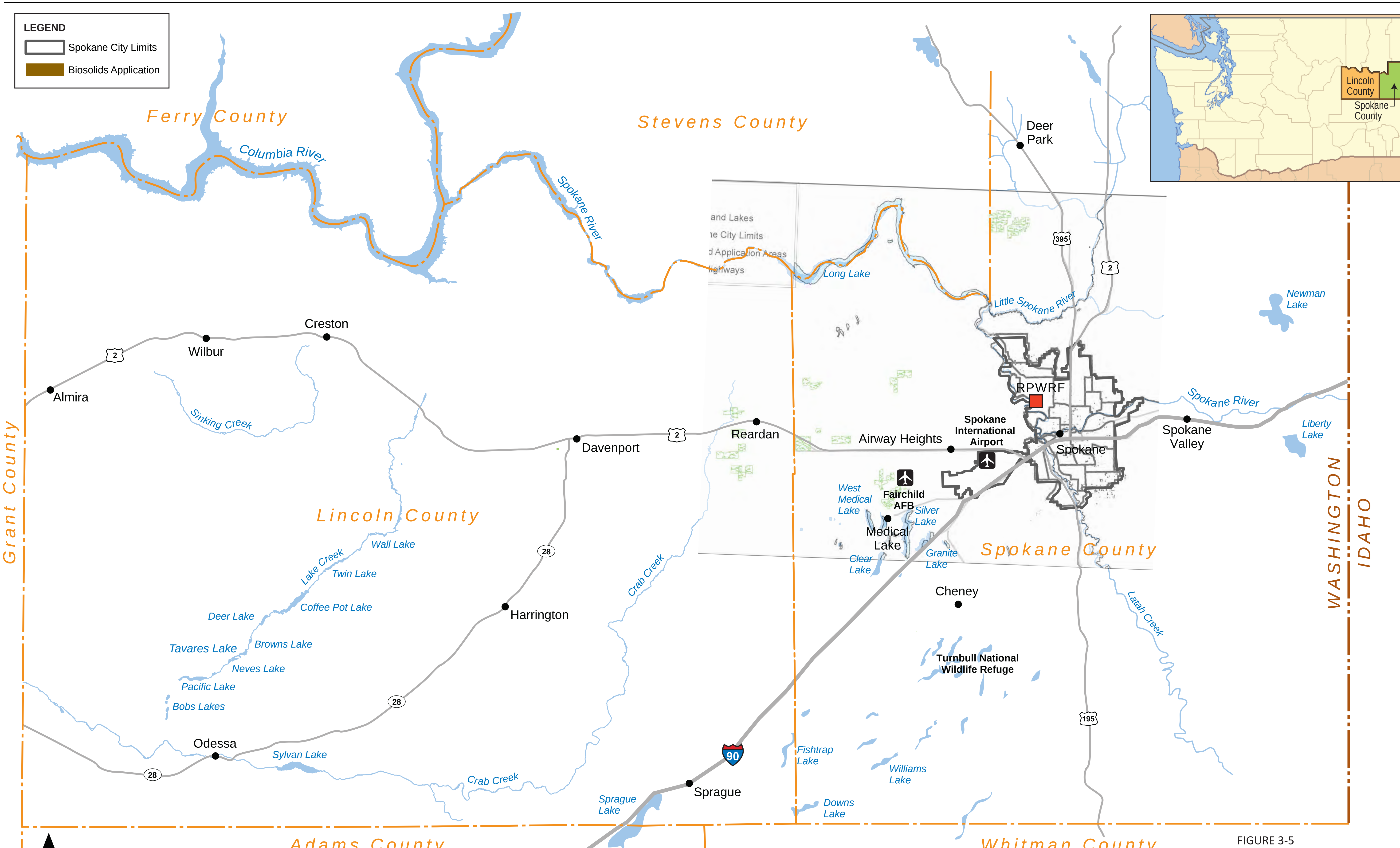


FIGURE 3-5
Biosolids Land Application Areas

CH2MHILL.

WBG012313172655SPK Biosolids_App_v2.ai 02.28.14 gr

TABLE 3-3
RPWRF Influent Flows (mgd)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 (through July)	Maximum 2001 - 2011		Minimum 2001 - 2011		Average 2001 - 2011
Annual													Year	Flow	Year	Flow	Flow
Average Flow	37.7	39.4	37.6	37.3	36.4	41.4	37.2	39.5	39.0	38.1	40.8	37.3	2006	41.4	2005	36.4	38.6
Maximum Day	67.4	61.4	61.3	71.5	79.1	82.4	80.6	67.8	86.0	66.8	80.9	68.8	2009	86.0	2003	61.3	73.2
Maximum 7-Day	50.5	57.3	50.4	47.9	48.7	63.8	45.4	65.0	59.4	57.0	70.6	61.7	2011	70.6	2007	45.4	56.0
Maximum 30-Day	43.6	50.6	43.8	41.6	39.8	53.6	42.6	59.9	47.3	45.3	62.2	50.3	2011	62.2	2005	39.8	48.2
Critical Season (March 1 through October 31)																	
Average Flow	37.3	40.0	36.9	37.2	36.3	39.8	37.0	41.0	39.0	37.2	42.5	39.5	2011	42.5	2005	36.3	38.6
Maximum Day	52.5	59.4	58.4	71.5	60.6	70.8	49.1	67.8	63.4	61.6	80.9	68.8	2011	80.9	2007	49.1	63.3
Maximum 7-Day	43.0	57.3	41.7	47.9	43.7	55.6	43.5	65.0	53.7	44.1	70.6	61.7	2011	70.6	2003	41.7	51.5
Maximum 30-Day	40.3	50.6	40.2	40.9	39.8	46.1	42.6	59.9	47.3	41.3	62.2	50.3	2011	62.2	2005	39.8	46.5
Non-critical Season (January 1 through February and November 1 through December 31)																	
Average Flow	38.6	38.0	39.0	37.4	36.5	44.4	37.8	36.4	38.8	39.9	37.3	31.6	2006	44.4	2008	36.4	38.6
Maximum Day	67.4	61.4	61.3	56.1	79.1	82.4	80.6	52.8	86.0	66.8	70.4	50.1	2009	86.0	2008	52.8	69.5
Maximum 7-Day	50.5	43.6	50.4	45.8	48.7	63.8	45.4	44.1	59.4	57.0	60.2	38.7	2006	63.8	2002	43.6	51.7
Maximum 30-Day	43.6	42.4	43.8	41.6	39.1	53.6	42.6	40.0	43.3	45.3	50.3	34.2	2006	53.6	2005	39.1	44.1
Maximum Peak Hourly Flow																	
Date(s)	28-Apr-01	1-Apr-02, 22-Aug-02	30-May-03	21-May-04	22-Dec-05	13-Jun-06	21-May-07	11-Jun-08	23-Feb-09	4-Jun-10	26-May-11	3-May-12	2001	141.5	2011	80.9	123.3
Max. Peak Hourly Flow	141.5	126.0	132.0	133.0	124.9	137.3	123.3	131.7	129.5	114.2	80.9	68.8					
Annual Volume of CSO Bypass to CSO Clarifiers and Discharge of Primary and Disinfected Effluent to Spokane River (MG/year)																	
CSO Diverted to CSO Clarifiers	NA	2.62	NA	13.39	33.89	29.66	11.47	27.00	18.71	64.30	24.00	17.10	2010	64.3	2002	2.62	25.00
Treated CSO (Primary and Disinfected Effluent to Spokane River)	2.10	0.32	2.57	0.31	2.89	1.05	0.00	0.00	4.10	0.00	0.00	0.00	2009	4.1	2007, 2008, 2010, and 2011	0	1.21

NA = data show CSO bypass is less than primary and disinfected effluent to Spokane River, which is not possible.

Non-critical season is from November 1 through the end of February when there are no ammonia or phosphorus discharge requirements and BOD and TSS are secondary effluent requirements unchanged from the current NPDES permit. Review of Table 3-3 shows tremendous variation in flows from year to year and between average, maximum 30-day, maximum 7-day, and maximum day flows. Table 3-3 also shows the maximum peak hourly flow for each year, CSO diversion to the CSO clarifiers, and the volume of primary and disinfected effluent (treated CSO) discharged each year. The maximum peak hourly flow in this period was 141.5 mgd in 2001. The annual volume of wastewater diverted to the CSO clarifiers varied from 2.6 to 64 MG, but only 0 to 4 MG was actually discharged to the Spokane River. The difference was pumped back to the headworks and received complete treatment.

Figure 3-6 shows the ADWF to RPWRF has remained essentially constant for the period 1994 through 2011. ADWF is calculated as the average of the flow from July 1 to October 1. ADWF represents a period when infiltration/inflow (I/I) is minimal. The observation that the ADWF is constant during this period implies that the variation in flow observed from 2001 through 2011 is the result of I/I. There are two main causes of I/I: precipitation and snowmelt, and high river flows. Precipitation and snowmelt affect flows to RPWRF through the combined sewers to RPWRF and this is known as inflow. Inflow tends to cause large increases in flow to RPWRF and be of short duration. Some of this inflow currently discharges from CSOs and does not reach RPWRF. Implementation of CSO improvements will change the flow rate and volume of inflow at RPWRF. The second main cause of I/I is related to Spokane River flows greater than 22,000 cubic feet per second (cfs). There is a linear relationship between RPWRF influent flow and Spokane River flow above 22,000 cfs. The increase in flow due to the river is less than caused by inflow, but the duration is much longer. The remaining specific locations of I/I related to Spokane River flow are not known. The City has made significant improvements to the collection system since the 1997 flood that has reduced I/I associated with Spokane River flow, but Table 3-4 shows that this is still significant. 2006 is the year with the highest amount of inflow caused by precipitation. 2008 and 2011 are two years with high Spokane River flows. Inflow from precipitation and snowmelt primarily affects the maximum day flows. Spokane River I/I affects the maximum 7- and 30-day flows.

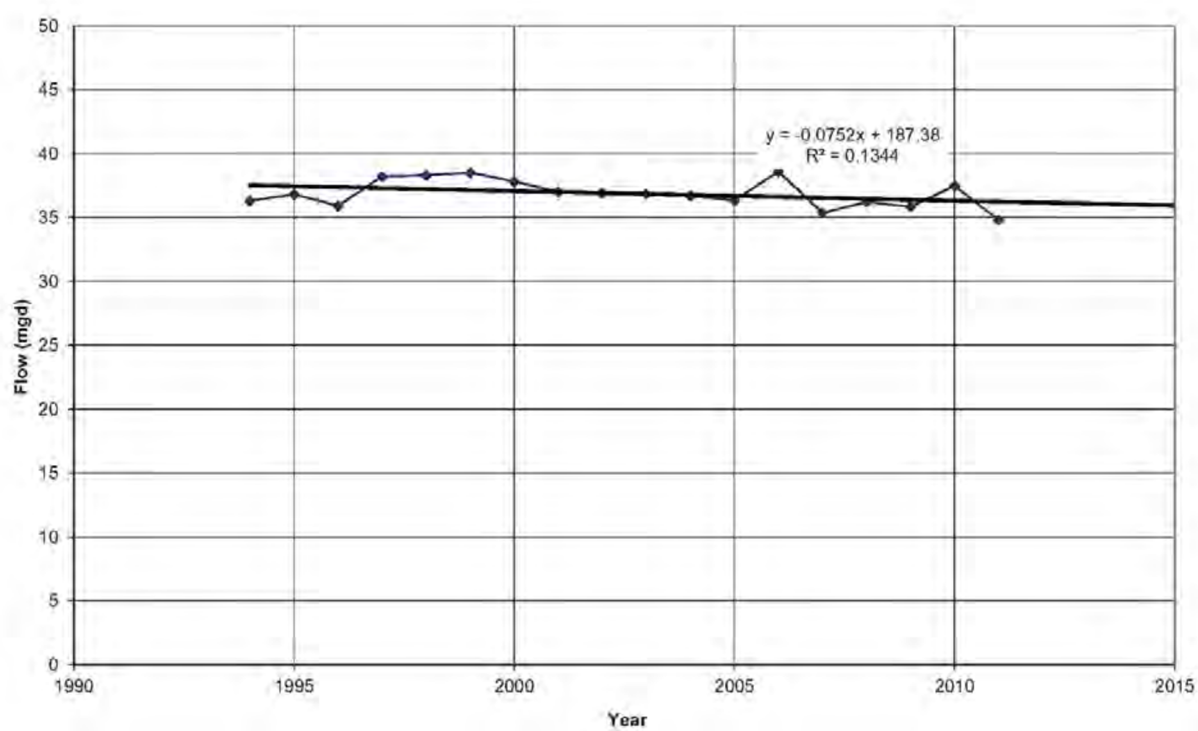


FIGURE 3-6
RPWRF Average Dry Weather Flow

TABLE 3-4
Summary of 2012 Estimated Flows Based on Existing Flows (mgd)

	Before County Facility			After County Facility		
Condition	**Typical**	**Minimum**	**Maximum**	**Typical**	**Minimum**	**Maximum**
Annual Average	38.6	36.4	43.1	32,1	29.9	36.6
Critical Season (March 1 through **October 31)**						
Average	38.6	36.3	42.5	32.1	29.8	36.0
Maximum 30-day	44	39.8	68	37.5	33.3	61.5
Maximum 7-day	49	41.7	77	42.5	35.2	70.5
Maximum 1-day	62	49.1	86	55.5	42.6	79.5
Non-critical Season (November 1 through **end of February)**						
Average	38.6	36.4	44.4	32.1	29.9	37.9
Maximum 30-day	43	39.1	57	36.5	32.6	50.5
Maximum 7-day	50	43.6	71	43.5	37.1	64. 5
Maximum 1-day	69	52.8	96	62.5	46.3	89.5

Note: Includes flow diverted to County Facility.

The variations in flows to RPWRF for the period 2001 through 2011 were evaluated to determine the frequency of occurrence. Figure 3-7 shows the results of this evaluation. Flows were put into three categories for development of design flows. “Minimum” flows are defined as the minimum flows observed in the 2001 through 2011 time period. “Typical” flows are defined as having a 2-year return interval, i.e., they occur every 2 years on average. “Maximum” flows are defined as having a 25-year return interval, which is approximately once in the design life of the facilities. Table 3-4 summarizes the estimated 2012 flows. Two sets of 2012 flows are shown. The flows listed under “Before County Facility” show the flows based on analysis of flows for the period 2001 through 2011 to RPWRF. Figure 3-6 showed that the average dry weather flow is essentially constant for the 2001 through 2011 period, so the variation is due to I/I, and these flows can be reasonably assumed for the initial year (i.e., 2012) of this plan. Flows listed under “After County Facility” show estimated RPWRF flows after subtracting 6.5 mgd based on the average County flows from Spokane Valley for 2010 and 2011. The variation in flows shown in Table 3-4 is due to I/I, and the effect of removal of Spokane Valley flows is assumed to be constant. Errors due to the assumption that City and County flows do not vary are small compared to the variation in I/I.

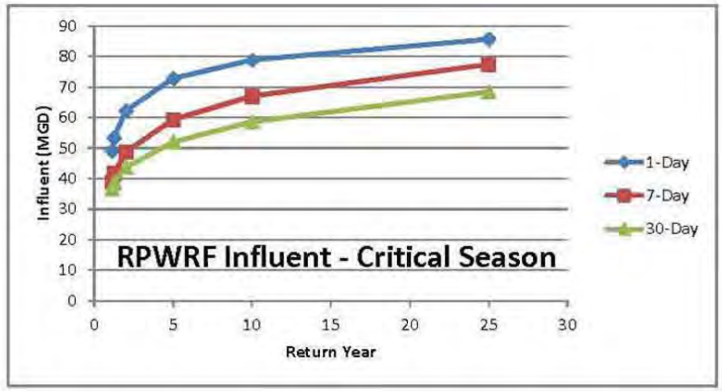
3.4.2 Current Waste Loads

Table 3-5 summarizes RPWRF influent waste loads for 2009 through 2012. Table 3-5 shows the influent waste loads are relatively constant from 2009 through 2011, but dropped significantly in 2012 when the County Facility removed an average of 6.5 mgd. Influent waste loads from the County Facility for 2012 were added to the RPWRF 2012 waste loads and the sum was found to be within 6 percent of the 2011 RPWRF waste loads. The 2012 RPWRF waste loads were used as the starting point for calculating future influent RPWRF waste loads since they already include the effect of removing the County Facility and the waste loads are reasonably constant.

Return Intervals
RPWRF Flows 2001 through 2011

Critical Season: March-October

Return Interval (years)	RPWRF Influent (mgd) 1-day	7-day	30-day
1.11	49	39	37
1.25	53	42	39
2	62	49	44
5	73	59	52
10	79	67	59
25	86	77	68



Non-Critical Season: Jan-Feb+Nov-Dec

Return Interval (years)	RPWRF Influent (mgd) 1-day	7-day	30-day
1.11	52	41	37
1.25	57	44	39
2	69	50	43
5	81	59	49
10	88	64	52
25	96	71	57

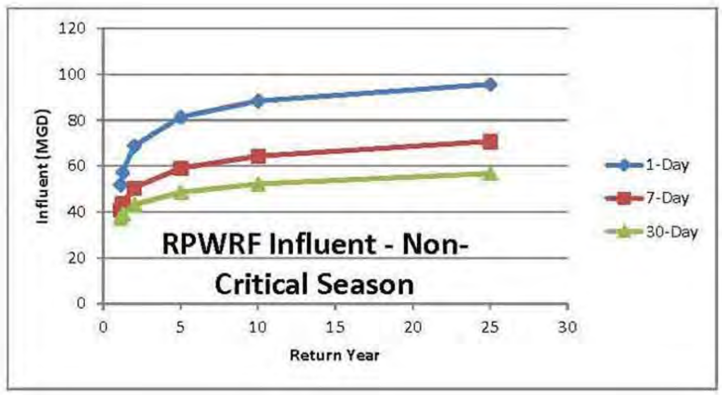


FIGURE 3-7
RPWRF Influent Flows by Return Interval

TABLE 3-5
RPWRF Influent Wasteloads (lb/day)

Parameter	2009	2010	2011	2012
BOD	57,800	59,100	57,100	42,500
TSS	54,800	57,200	58,400	49,200
TKN	9,800	10.500	10,100	8,000
TP	1,500	1,400	1,300	1,100

SECTION 4

Future Conditions

This chapter presents the future population projections, wastewater flows, and waste loads used for evaluation of NLT alternatives, design of the recommended NLT alternative, and updating of the recommended alternatives from FPA2. Population estimates are made for the period 2012 through the year 2030. The first year of operation of NLT facilities is 2018, and 20 years of operation would go to the year 2038. The evaluation is made through the year 2030 for the following reasons:

- Population forecasts beyond 2030 do not exist and would be unreliable.
- The City intends to construct facilities for the immediate need in 2018 and then expand using a "just in time" approach to minimize rate impacts to current rate payers, maintaining steady inflation-based rate increases over the long term. "Just in time" construction differs from the approach used to construct RPWRF. RPWRF was constructed initially to provide treatment capacity for the next 20 years. "Just in time" phasing includes plans for the ability to expand capacity to meet needs for the next 20 years, but initially constructs capacity to meet immediate needs plus sufficient capacity to plan and construct the next phase of capacity before it is needed. "Just in time" phasing preserves capital and bonding capability that minimizes current rate-payers having to pay for improvements to provide capacity for future growth that benefits future rate-payers.
- RPWRF and NLT facilities will be planned to allow construction to the maximum that will fit on the available RPWRF site.
- Flow variation caused by infiltration/inflow (I/I) is much greater than the flow increases from growth, and I/I reduction may actually reduce flows in the future, but the effectiveness of I/I reduction is not currently known.
- Spokane County may expand the County Facility after 2030, reducing flows and waste loads to RPWRF.

4.1 Population Forecasts

RPWRF's service population includes the city of Spokane, parts of Spokane County, and Fairchild Air Force Base. This section summarizes the population forecasts for the city and Spokane County. Fairchild Air Force Base is a small contributor and its population is assumed to remain unchanged for the foreseeable future.

The City of Spokane Planning Department developed a population forecast for the RPWRF service area. The population forecast was originally for the Water Department, but the planners felt that the water service area was very similar to the wastewater service area. Low and high population forecasts were made. The low forecast assumed 0.52 percent per year population growth, and the high forecast assumed 1.0 percent per year growth. These rates are both lower than the growth rates projected by the State of Washington Office of Financial Management Growth Management Act and the 1999 Facilities Plan. The City of Spokane believes that the 0.52 percent per year population growth rate should be used for FPA3 based on actual growth in the city over the last 10 years. Table 4-1 shows the actual city population in 2011 and estimates for 2012, 2018, 2024, and 2030, and the net increase from the 2011 population.

Spokane County users discharge wastewater to RPWRF through Interceptor No. 1 for areas north of the city and through Interceptor No. 2 for areas east of the city. Areas east of the city discharge into the North and South Valley interceptors that eventually flow to Interceptor No. 2. Historically, all flow from Spokane Valley went to the RPWRF, but two pump stations that began operation in late 2011, one on each Valley interceptor, can pump up to an average of 8 mgd to the County Facility. It is assumed that the pump stations remove all wastewater flow up to an average of 8 mgd and discharge to the County Facility, reducing flow and waste load to RPWRF by an equal amount. Population increases in Spokane County served by the Valley interceptors would not result in an increase in wastewater flow or waste load to RPWRF until the average flow in both interceptors exceeds 8 mgd because it is pumped to the County Facility.

TABLE 4-1
City of Spokane Population Forecast

Year	Population	Change from 2011
2011	235,719	--
2012	236,944	1,225
2018	244,430	8,711
2024	252,430	16,434
2030	260,120	24,401

Spokane County flows from north of Spokane flow into Interceptor No. 1 and are not affected by diversion to the County Facility. Additionally, there is population served by 4,000 septic tanks that will be converted to sewer service by 2015. Additional wastewater flow and waste load will result from connection of this population to the City's wastewater system. It is assumed that 3,200 of these septic tanks are located in the Spokane Valley service area and 800 are located in the north Spokane service area. Total Spokane County wastewater flow to RPWRF is limited to an average of 10 mgd. Spokane County may expand the capacity of the County Facility in the future, remove future wastewater flows and waste loads from the Valley interceptors, and reduce future flows and waste loads going to the RPWRF.

Changes in Spokane County wastewater flows to RPWRF are based on percentage changes in the wastewater flow from Spokane County rather than population. The City has detailed historical records of flows from each discharge location for Spokane County. Spokane County has assumed that existing wastewater flows will increase 1.83 percent per year.

4.2 Future Wastewater Flows

This section summarizes the projection of future wastewater flows. Additional flows will result from growth in the City of Spokane, growth in Spokane County, and the Spokane County septic tank elimination program as discussed in the previous section. Additional flows will also occur following implementation of the combined sewer overflow (CSO) reduction program as discussed in Section 4.2.3. However, ongoing water conservation efforts will reduce wastewater flows as described in Section 4.2.4. I/I reduction may also reduce flows, but no predictions are made in FPA3 because insufficient information exists at this time to estimate the effectiveness of I/I reduction projects.

4.2.1 City of Spokane

The increase in City of Spokane wastewater was estimated using the increase in wastewater service population from Table 4-1 times a per capita flow developed from RPWRF records. The per capita flow is 125 gallons per capita per day (gpcd) based on the average dry weather flows in 2010 through 2012 and a city of Spokane population of 209,100 (note that the population presented earlier includes the entire service area including Spokane County). This can be allocated to 80 gpcd for domestic wastewater, 20 gpcd for commercial/industrial wastewater, and 25 gpcd for I/I. Increases from 2011 average dry weather wastewater flows are estimated to be 1.1, 2.1, and 3.1 mgd in 2018, 2024, and 2030, respectively.

4.2.2 Spokane County

Future wastewater flows from Spokane County were estimated using an increase of 1.83 percent for current wastewater flows plus the increase for the septic tank elimination program minus an average of 8 mgd for Spokane Valley Interceptor flows removed and pumped to the County Facility. North Spokane average dry weather flows are estimated to increase from 1.70 mgd in 2011 to 2.09 mgd in 2018 and 2.56 mgd in 2030. This includes 0.17 mgd for elimination of 800 existing septic tanks.

Spokane Valley wastewater flows are more complicated to calculate because of the diversion of up to an average of 8.0 mgd to the County Facility while the remaining flow goes to the RPWRF. Regardless of which treatment facility they go to, average dry weather flows to the Spokane Valley Interceptors are estimated to increase from 6.50 mgd in 2011 to 8.04 mgd in 2018 and 9.84 mgd in 2030. This includes 0.66 mgd for elimination of 3,200 existing septic tanks. Spokane Valley flow to RPWRF is reduced by 8.0 mgd in 2018 and 2030 by the County Facility and results in a net average dry weather wastewater flow to RPWRF of 0.04 and 1.84 mgd.

The total average dry weather wastewater flow to RPWRF from Spokane County is estimated to be 4.40 mgd in 2030. A peaking factor of 1.12 was estimated for Spokane County flows, and application of this peaking factor results in an estimated maximum month flow discharged to RPWRF of 4.93 mgd in 2030. Since this is less than the 10 mgd that the County can discharge to RPWRF, it is anticipated that the County will not expand the County Facility until after 2030.

4.2.3 CSO

The City of Spokane has been implementing CSO reduction improvements required by the NPDES permit currently scheduled to be completed by the end of 2017. The original CSO improvement plan involved capturing CSO and storing it in large structures for release to the sewer system after a large storm event passed. The CSO plan is being modified and is not complete at this time. For development of flows from implementation of the CSO program, it was assumed that all CSO currently discharged to the Spokane River will be captured and transported to RPWRF for treatment. It is likely that this is a conservative assumption since the volume of CSOs may be reduced by alternative CSO control techniques and the CSO control program will allow an average of one CSO per CSO outfall per year using a 20-year rolling average. It is not possible to estimate the reduction of CSO volume at this time because the CSO plan is still in development, and use of a conservative assumption is appropriate for the evaluation of NLT. The impact of this assumption on design flows is expected to be small and to not affect the NLT evaluation or design criteria of the recommended NLT alternative.

Additional flow needs to be added to the values shown in Table 3-4 to account for flows added as a result of CSO reduction improvements. Future typical CSO was estimated as the average of CSO observed in the period 2001 through 2011 and added to the “typical” flows shown in Table 3-4 in Chapter 3. Future minimum CSO was estimated as the minimum of CSO observed in the period 2001 through 2011 and added to the “minimum” flows in Table 3-4.

Maximum CSO was observed in 2006 because this was the year of maximum precipitation in the 2001-2012 time period. A 20 percent factor of safety was added to these flows to account for flow measurement accuracy and potential for a year with greater precipitation. Existing CSO flows were estimated from the CSO monitoring data for individual CSO locations. The 2006 CSO volumes plus the 20 percent factor of safety were added to the “maximum” flows in Table 3-4. Maximum 7- and 30-day CSO flows were added directly to the values in Table 3-4. Maximum 1-day flows were added to the maximum 7-day values in Table 3-4 because the stored CSO is not released until the storm has passed, and it is assumed that the peak flow will have passed before the stored CSO is released.

4.2.4 Water Conservation

Water conservation has been implemented through adoption of plumbing codes requiring more water-efficient faucets, toilets, and showers and U.S. Environmental Protection Agency energy standards for washing machines and dishwashers. There have been no specific studies on the effect of water conservation in the Spokane area. *North America Residential Water Usage Trends Since 1992* (Water Research Foundation, 2010) found that water conservation reduces water use approximately 0.44 percent per year, primarily due to low-flow toilets, restricted-flow showers, and high-efficiency clothes washers. LOTT, a wastewater utility in the Olympia, Washington, area, has an aggressive water conservation program that has reduced wastewater discharged to their facilities by 1 mgd over a 15-year period, which is about 0.67 percent reduction per year. It is recommended that 0.44 percent per year be used for the development of design flows to RPWRF because it is clear from the trend in average dry weather flow (ADWF) that there is some reduction in flow occurring and there are no specific studies for Spokane that would justify another assumption. Water conservation will result from replacement of fixtures and appliances over time with more water-efficient fixtures and appliances. Use of the higher water conservation reduction rate observed in the LOTT service area is not justified because the City of Spokane has no plans for a more aggressive water conservation program. Water conservation, based on this assumption, will reduce design flow to RPWRF by 3.5, 6.2, and 8.8 percent in 2018, 2024, and 2030, respectively. The percentage will be applied to all estimated domestic and commercial/industrial water use, which is 100 gpcd of the total 125 gpcd.

4.2.5 Future Wastewater Flows

Table 4-2 summarizes the future wastewater flows to RPWRF based on the previously discussed factors. It shows annual average, critical season, and non-critical season design flows for 2012, 2018, 2024, and 2030. Design flows for 2012 are based on the flows from Table 3-4 “After County Facility” to reflect the operation of the County Facility. It is assumed that future flows from Spokane Valley will be diverted to the County Facility up to its capacity of 8 mgd. Flows are expressed in probabilistic terms to better describe the variation in flows that occurs from year to year. “Minimum” refers to the minimum flows that were observed in the period 2001 through 2011. “Typical” flows are based on flows with a return interval of 2 years. “Maximum” flows are based on flows with a return interval of 25 years.

4.3 Future Waste Loads

Future waste loads were estimated by adding the estimate for increased waste load from the city and county to the 2012 waste load observed at RPWRF (Table 3-5 in Chapter 3). Increased waste loads for the City were estimated using per capita waste loads. Increased waste loads for Spokane County were estimated using the estimate of increased wastewater flow and concentrations of parameters observed at the County Facility (flow times concentration yields pounds per day).

Per capita waste loads for the city of Spokane were developed for BOD, TSS, TKN, and TP based on RPWRF influent flow data for 2012 and 2012 service population of 236,944. The following per capita loads were developed:

- BOD 0.2 lb/capita/day
- TSS 0.2 lb/capital/day
- TKN 0.035 lb/capita/day
- TP 0.0045 lb/capita/day

These were multiplied by the population increases in Table 4-1 to calculate the increased waste load for the city of Spokane.

Flow increases described in the previous section were multiplied by the following concentrations observed in the County Facility daily monitoring reports for 2012 to calculate the increased waste load for Spokane County:

- BOD 210 mg/L
- TSS 242 mg/L
- TKN 42 mg/L
- TP 5.1 mg/L

TABLE 4-2
Summary of RPWRF Design Flows

	Recommended Year 2012 Design Flows (mgd)			2018 Design Flow (mgd)			2024 Design Flow (mgd)			2030 Design Flow (mgd)		
	Typical	Minimum	Maximum	Typical	Minimum	Maximum	Typical	Minimum	Maximum	Typical	Minimum	Maximum
Annual Average	32.1	29.9	36.6	34.3	31.9	39.0	35.3	33.0	40.1	36.5	34.1	41.2
Critical Season (March 1 through October 31)												
Average	32.1	29.8	36.0	34.2	31.8	38.2	35.3	32.9	39.3	36.4	34.0	40.4
Maximum 30-day	37.5	33.3	61.5	40.6	35.5	65.6	41.9	36.8	66.8	43.1	38.0	68.1
Maximum 7-day	42.5	35.2	70.5	47.8	37.5	79.3	49.1	38.7	80.5	50.3	40.0	81.7
Maximum 1-day	55.5	42.6	79.5	66.9	45.2	92.1	68.2	46.4	93.3	69.4	47.6	94.6
Non-critical Season (November 1 through end of February)												
Average	32.1	29.9	37.9	34.3	32.0	40.5	35.4	33.1	41.6	37.1	34.7	43.2
Maximum 30-day	36.5	32.6	50.5	39.3	34.9	53.9	40.5	36.1	55.2	41.8	37.3	56.4
Maximum 7-day	43.5	37.1	64.5	47.6	39.5	70.6	48.8	40.7	71.8	50.1	42.0	73.1
Maximum 1-day	62.5	46.3	89.5	72.3	49.0	91.8	73.5	50.2	93.0	74.8	51.4	94.2

Peaking factors from the 1999 Facilities Plan were compared to the observed peaking factors at RPWRF for the 2009-2011 time period and found to be reasonable. The average waste loads were multiplied by the Facilities Plan peaking factors to estimate maximum 1-, 7-, and 30-day waste loads for each parameter.

Table 4-3 summarizes the design waste loads for RPWRF for 2012, 2018, 2024 and 2030. Waste loads are shown for average, 30-day maximum, 7-day maximum, and 1-day maximum time periods. Waste loads are not estimated separately for critical and non-critical seasons because maximum waste loads are not different for the two time periods.

TABLE 4-3
RPWRF Waste Loads

	2012	2018	2024	2030
BOD (lb/day)				
Annual average	48,275	50,456	53,953	57,637
Maximum 30-day	57,930	60,547	64,743	69,164
Maximum 7-day	72,412	75,684	80,929	86,455
Maximum 1-day	96,550	100,912	107,905	115,273
Peak hour	125,515	131,186	140,277	149,855
TSS (lb/day)				
Annual average	49,152	51,430	55,222	59,223
Maximum 30-day	58,983	61,716	66,267	71,067
Maximum 7-day	73,729	77,146	82,833	88,834
Maximum 1-day	98,305	102,861	110,444	118,445
Peak hour	127,796	133,719	143,578	153,979
TKN as N (lb/day)				
Annual average	7,958	8,356	9,018	9,717
Maximum 30-day	9,550	10,028	10,822	11,660
Maximum 7-day	11,937	12,535	13,527	14,575
Maximum 1-day	15,916	16,713	18,037	19,433
Peak hour	20,691	21,727	23,448	25,263
Ammonia as N (lb/day)				
Annual average	4,616	4,847	5,231	5,636
Maximum 30-day	5,540	5,817	6,278	6,764
Maximum 7-day	6,925	7,271	7,847	8,455
Maximum 1-day	9,233	9,695	10,463	11,273
Peak hour	12,003	12,603	13,601	14,655
Total Phosphorus as P (lb/day)				
Annual average	1,068	1,118	1,200	1,287
Maximum 30-day	1,281	1,342	1,440	1,544
Maximum 7-day	1,602	1,677	1,800	1,930
Maximum 1-day	2,136	2,236	2,400	2,574
Peak hour	2,777	2,907	3,121	3,346

SECTION 5

Alternatives

This chapter evaluates alternatives for NLT and reviews the recommendations made in FPA2 for the reduced flow and waste loads presented in Chapter 4, addition of NLT facilities, and revisions to the implementation schedule for improvements to RPWRF. The evaluation of NLT satisfies AKART (All Known Available and Reasonable Methods of Prevention, Control and Treatment) requirements. Initially, five NLT alternatives were screened to one alternative that meets the Spokane TMDL and NPDES compliance schedule, while maintaining the possibility to implement the other alternatives in the future. The screened alternative was then separated into the two most promising options. These two options were evaluated in detail, and one NLT option is recommended for implementation. FPA2 recommended several additional improvements to RPWRF in the same time period as implementation of NLT. These improvements were reviewed to determine when they will be needed with the lower flows and waste loads estimated in FPA3 compared to FPA2. NLT chemical doses are now refined with the evaluation of the NLT pilot data and are lower, resulting in lower solids production. Finally, the City has reevaluated all the wastewater improvements to reduce the impact on sewer rates and may defer some of the improvements recommended in FPA2.

5.1 NLT Alternatives

The City of Spokane identified the following five alternatives, each with many options, as potential ways to comply with the March 1, 2018, deadline in the current NPDES permit for RPWRF that requires CBOD, phosphorus, and ammonia discharges to the Spokane River to be reduced in response to the dissolved oxygen TMDL developed for the river:

- Additional treatment and discharge to the Spokane River
- Agricultural land application
- Urban irrigation
- Stream flow augmentation/groundwater recharge
- Groundwater recharge

All alternatives except additional treatment and discharge to the Spokane River comply with the NPDES permit by diverting treated effluent to land reuse for the critical season or the entire year. The NPDES permit requires reduced CBOD, phosphorus, and ammonia discharges during the critical season defined as March 1 through October 31.

The four alternatives above that do not discharge to the Spokane River, particularly in the critical season, may require treatment in addition to the activated sludge secondary treatment provided by existing facilities at the RPWRF. Class D reclaimed water is likely produced by the existing activated sludge and disinfection processes. Several alternatives require Class A reclaimed water, which would necessitate an additional filtration step at RPWRF. Groundwater recharge requires reduction of total nitrogen to less than or equal to 10 mg/L (as nitrogen [N]), and that would require modification of the activated sludge process at RPWRF. Interest was expressed in evaluating wetlands as a non-mechanical approach to reducing nitrogen and phosphorus instead of adding treatment facilities at RPWRF. These treatment options, while not stand-alone alternatives, are discussed separately and costs are added to the five main alternatives as required to create complete alternatives.

The following sections provide brief descriptions of each alternative with options.

5.1.1 Additional Treatment and Discharge to the Spokane River

Four options were identified for additional treatment and discharge to the Spokane River alternative:

- Modification of the existing activated sludge process to membrane bioreactors (MBRs)
- Tertiary membranes following chemical addition, rapid mixing, and flocculation

- Tertiary membranes following chemical clarification
- Conventional filters following chemical clarification

All four additional treatment options include addition of alum or ferric chloride followed by a filtration step by either membranes or conventional filters to meet the phosphorus effluent requirements. CBOD removal is also accomplished by the filtration process. Ammonia removal occurs in the existing activated sludge process or by the MBR process because ammonia is soluble and not removed by filtration.

The first option evaluated was modification of the existing activated sludge process to the MBR process. Chemically enhanced primary treatment (CEPT) would provide the initial phosphorus removal step and reduce the biochemical oxygen demand (BOD) and total suspended solids (TSS) loading to the MBR process, minimizing the bioreactor volume. Primary effluent would be screened to remove debris before the MBR process. A conventional MBR process would be used with the addition of alum to enhance phosphorus removal. The MBR process would be constructed in three phases to allow the activated sludge process to remain operational during construction. Design criteria for the MBR option are shown in Table 5-1.

TABLE 5-1
Design Criteria for MBR Option

Parameter	Design Criteria
Primary effluent screening:	
Type	Center feed band
Capacity	125 mgd
Perforated plate opening size	2 mm
Bioreactors:	
Number	4
Volume	7.0 mg
Type	Multi-zone anoxic followed by multi-zone aerobic
Mixed liquor suspended solids	6,600 mg/L
Solids retention time	18 days (14.7 days aerobic)
Alum dose	34 mg/L
Membranes:	
Membrane design flux (gfd):	
Maximum month	13.1
Peak	17.9
Membrane cassettes per train	20

mm = millimeters
gfd = gallons per square foot per day

The existing aeration basins and space reserved for Aeration Basin No. 5 would be used for the MBR process. Existing Aeration Basin No. 6 would be modified to provide two bioreactors. Two additional identical bioreactors would be constructed in the space reserved for future Aeration Basin No. 5. Membrane facilities would be constructed in existing Aeration Basins No. 2-4. A total of 18 membrane trains would be installed, providing capacity for a peak flow of 100 mgd. Aeration Basin No. 1 and one secondary clarifier would be used to provide an additional 25 mgd capacity in the non-critical season. The remaining secondary clarifiers would be used for flow equalization.

The next three options were evaluated for 100-mgd peak capacity following the existing activated sludge process. A 100-mgd peak capacity was selected because that is the current capacity of the existing activated sludge process and results in minimal treated CSO discharge. The NLT pilot plant identified membranes with and without high-rate sedimentation and conventional filters with high-rate sedimentation as treatment options that would meet future NPDES permit requirements and fit on the RPWRF site. Conventional sedimentation tanks with lamella settlers are too large to fit on the RPWRF site. The high-rate sedimentation processes tested in the pilot test were found to lose sand (Actiflo) and magnetite (CoMag) that caused plugging and excessive wear of pumps, and they were eliminated from consideration. Densadeg, not piloted, was evaluated as a representative recirculating-chemical-solids high-rate sedimentation process that would fit on the RPWRF site. Sedimentation is not required before membranes, but is needed for conventional filtration to avoid solids overloading of the filters. Table 5-2 summarizes criteria for the three options.

5.1.2 Additional Treatment to Existing RPWRF Facilities

Additional treatment that is required for land application, urban irrigation, stream flow augmentation, and groundwater recharge alternatives is discussed in this section. Additional treatment is not considered its own alternative. Costs for additional treatment will be added to each alternative as described below.

5.1.2.1 Class A Reclaimed Water at RPWRF

Class A reclaimed water is required for urban irrigation and is assumed to be required for agricultural land application through an irrigation district, for stream flow augmentation, and for groundwater recharge by percolation. Chemical coagulation and filtration are needed to meet requirements for Class A reclaimed water. A variety of filtration technologies is available for meeting Class A reclaimed water requirements. Conventional filtration was used as a representative technology for this evaluation. The design criteria are the same as shown in Table 5-2 for conventional filtration except Densadeg high-rate chemical clarification is not required because the alum dose is much lower. The lower alum dose sufficiently reduces the solids loading to the filters to avoid overloading, thus, eliminating the need for sedimentation ahead of the filters.

5.1.2.2 Nitrogen Removal at RPWRF

Additional anoxic volume and addition of methanol is required to reduce total nitrogen to less than 10 mg/L for stream flow augmentation and groundwater recharge alternatives. Aeration Basin No. 6 has an anoxic zone, but Aeration Basins No. 1-4 do not. Anoxic zones would need to be added to Aeration Basins No. 1-4. Additionally, supplemental carbon is likely to be needed to ensure the effluent total nitrogen is less than 10 mg/L. Methanol is typically used for supplemental carbon. It is possible that an additional anoxic zone at the effluent end of the aeration basins would also be needed, but was not assumed for this analysis.

5.1.2.3 Class A or D Reclaimed Water and Nitrogen Removal by Wetlands Treatment

A number of wetlands treatment options were evaluated for treatment of RPWRF effluent for the entire year. It was determined that the wetlands would need to produce an effluent of less than 0.040 mg/L total phosphorus and, if anoxic zones in existing aeration basins were not added as noted above, 10 mg/L total nitrogen to provide adequate quality for the stream flow augmentation and groundwater recharge alternatives. Agricultural land application can use either Class D reclaimed water, which does not require wetlands treatment, or Class A reclaimed water, which cannot be produced by wetlands treatment. Wetlands treatment was evaluated for Class A and D reclaimed water options. The area evaluated for potential wetlands treatment was the West Plains in the vicinity of Spokane International Airport, where the wetlands would support groundwater recharge. Wetlands treatment may also have application in Lincoln County prior to stream flow augmentation, but the costs would be much higher because the scablands in that area are likely to require much more grading and rock excavation. Wetlands designed to receive Class D reclaimed water were found to require more than 4,200 acres and were eliminated from consideration because it was judged that it may be impossible to obtain this much area in the West Plains within a reasonable distance. Wetlands designed to receive Class A reclaimed water were found to require 2,500 acres of wetlands. The difference in acreage required is a result of the difference in influent phosphorus concentration to the wetlands.

TABLE 5-2
Criteria for Evaluation of Additional Treatment after Existing Activated Sludge Process before Discharge of Effluent to Spokane River

Criteria	Membranes	Sedimentation and Membranes	Sedimentation and Conventional Filtration
Screening:			
Number of units	2	NA	NA
Capacity, each (mgd)	75	NA	NA
Type	Drum	NA	NA
Perforation diameter (mm)	1	NA	NA
Rapid mixing:			
Number of units	5	NA	NA
Capacity each (mgd)	25	NA	NA
G (sec^{-1})	1,000	NA	NA
Flocculation:			
Number of trains	5	NA	NA
Flocculators per train	6	NA	NA
Type	Vertical paddle mixers	NA	NA
G (sec^{-1})	80	NA	NA
Detention time at 50 mgd (min)	20	NA	NA
Densadeg sedimentation:			
Number of trains	NA	4	6
Capacity per train (mgd)	NA	16.17	16.17
Effluent TSS at rated capacity (mg/L)	NA	5	5
Overflow rate at rated capacity (gpm/ft^2)	NA	7.8	7.8
Membranes:			
Trains	16	16	NA
Cassettes per train	14	14	NA
Design flux (gfd):			
Maximum month	16.1	16.1	NA
Maximum (at 100 mgd)	19.0	19.0	NA
Conventional filters:			
Number of filters	NA	NA	16
Filtration rate (gpm/ft^2—active filters only)	NA	NA	4.0 – 5.0

G = mean velocity gradient, sec^{-1}
gpm/ft^2 = gallons per minute per square foot
gfd = gallons per square foot per day

The area of wetlands is based on the area to treat maximum month flows in the months of December, January, and February when the wastewater temperature is low and flows can be high. Wetland area is greatly reduced if maximum flows are reduced and the wetland is only required to operate in the warmer months of the year.

5.1.3 Agricultural Land Application

A number of agricultural land application options were investigated. Representative areas north and west of Spokane were evaluated in detail. Areas south of Spokane were briefly evaluated, but were found to have no advantages compared to areas north and west of Spokane. Specific sites are not identified and the area used for estimating costs does not represent selection of an area for implementation. Identification of representative areas was for the sole purpose of developing cost estimates so that land application options can be compared with other options. The area north of Spokane was found to require shorter conveyance distance and pumping head with corresponding lower capital and annual operation and maintenance (O&M) costs. Costs presented in this TM are for the area located north of Spokane.

Options were evaluated for critical-season and entire-year diversion of RPWRF effluent from the Spokane River. No RPWRF effluent is assumed discharged to the Spokane River from March 1 through October 31 for critical-season options. No RPWRF effluent is assumed discharged to the Spokane River for the entire-year options, eliminating the need for an NPDES permit for the RPWRF. Irrigation of crops occurs primarily from May until October, and water in excess of irrigation needs is available from March 1 to June, from mid-September through October 31, and during periods of high flow. Water in excess of irrigation needs must be stored in reservoirs. Peak hydraulic capacity for conveyance systems is 100 mgd for the critical-season options and 150 mgd for the entire-year options.

Options were evaluated for two classes of reclaimed water, Class A and Class D. Class D would likely be produced by the existing RPWRF with potentially minor improvements to the chlorine disinfection facilities and operating procedures. Class D reclaimed water cannot be used to grow most human food crops and is highly regulated. Class A reclaimed water would require addition of filtration facilities. Class A reclaimed water is more highly treated and can be used to grow crops with no restrictions, and it has fewer regulatory requirements than Class D reclaimed water. Class A reclaimed water was assumed for evaluation of an irrigation district based on the January 2007 *Spokane Area Irrigation District Feasibility Study Draft Final Report* to eliminate crop restrictions and minimize monitoring requirements. Class D reclaimed water was assumed for the other options, which would restrict the types of crops that could be grown and would require monitoring of each irrigated area.

Three different land ownership and water management concepts were evaluated. The first concept is City-owned and -operated conveyance and storage facilities providing water to privately owned farms. The private farmers would be responsible for all farm activities including crop selection, planting, irrigation, maintenance, and harvesting. Individual farmers would need to purchase and install their own on-farm piping and irrigation systems. The land would be privately owned and the risks associated with farming would be borne by the private farmers. The City would need to enter into contracts with private farmers to accept a minimum quantity of water each year to assure adequate land for use of the available water. Farmers would be restricted to growing nonfood crops. The City would receive compensation for the value of the irrigation water.

The second concept is City ownership of conveyance, storage, and irrigation facilities and farmland. The City would lease the farmland to private farmers who would perform all farming activities. The private farmers would be responsible for all farm activities including crop selection, planting, irrigation, maintenance, and harvesting. The risks associated with farming would be borne by the private farmers. The City would enter into contracts with private farmers to accept a minimum quantity of water each year to assure adequate land for use of the available water. Farmers would be restricted to growing nonfood crops. The City would receive compensation for leasing the farmland.

The third concept would be formation of an irrigation district to manage storage reservoirs and irrigation water distribution facilities. The City would own and operate the conveyance facilities needed to convey Class A reclaimed water to the irrigation district. Class A reclaimed water is assumed necessary for the irrigation district concept because of regulatory restrictions on crops grown with Class D reclaimed water and regulatory requirements for irrigation with Class D reclaimed water. Private farmers would retain ownership of farms and all farming activities and risks would remain the private farmer's responsibility. Farmers would be required to take a minimum amount of water to ensure adequate land is available to use the available water. The City would contract with the irrigation district and receive compensation for the value of the irrigation water.

Table 5-3 summarizes facility requirements for critical season and year-round diversion of RPWRF from the Spokane River. Facility requirements are essentially the same for either class of reclaimed water or land ownership and management concept. Land requirements are slightly different for Class A and D reclaimed water due to different crop assumptions, but the differences are not significant at this level of analysis.

TABLE 5-3
Summary of Agricultural Land Application Facilities for North Area

Parameter	Critical Season Diversion From Spokane River	Year Round Diversion From Spokane River
Peak flow (mgd)	100	150
Area irrigated (acres)	13,632	20,658
RPWRF pump station:		
Maximum head (ft)	440	455
Horsepower	9,070	14,100
Low service pump station:		
Maximum head (ft)	388	338
Horsepower	6,200	6,000
High service pump station:		
Maximum head (ft)	388	338
Horsepower	6,200	6,000
Reservoir pump stations:		
Number	2	6
Horsepower	2,200	1,890
Conveyance pipeline:		
Diameter (in.)	68 and 56	78 and 66
Length (ft)	63,000 and 122,000	63,000 and 122,000
Storage reservoirs (4,300 acre-feet)	3	7

5.1.4 Urban Irrigation

Irrigation with Class A reclaimed water was evaluated for publicly owned land within the city limits. All publically owned land not covered with a building or pavement was identified using the City's GIS. This analysis identified approximately 9,000 acres of land, and comparison of this number with the land requirements for agricultural land application shows that insufficient publicly owned land exists within the city to use all of the effluent from RPWRF. The cost of urban irrigation was estimated for potentially irrigated areas within the city limits with a goal for minimizing cost rather than maximizing the use of reclaimed water. A four-phase distribution and storage tank concept was evaluated that would provide Class A reclaimed water to 2,738 acres and 5 mgd to Spokane International Airport for industrial use. Implementation of all four phases could potentially use 13,657 acre-feet (average of 18.2 mgd over 245 days) of Class A reclaimed water, which is about 45 percent of the maximum year critical season average flow. This estimate of the amount of Class A reclaimed water that can be irrigated within the city limits is likely optimistic because the potential urban area assumed to be irrigated includes unirrigated areas such as the Northside landfill, forested areas, conservation areas, and Felts Field that are unlikely to be irrigated in the future. Costs for this analysis allow comparison with costs for other alternatives to develop cost-efficient composite alternatives. Included in this alternative are six pump stations, storage tanks, and distribution pipelines to convey Class A reclaimed water throughout the city.

5.1.5 Stream Flow Augmentation/Groundwater Recharge

Options to use Class A reclaimed water for the stream flow augmentation/groundwater recharge alternative were developed to help solve some of the Spokane region's water resource problems. Three stream flow augmentation/groundwater recharge options were evaluated:

- Crab Creek
- Sinking Creek
- Lake Creek

Crab Creek, Sinking Creek, and Lake Creek in Lincoln County were considered for stream flow augmentation to provide water to help resolve water resource problems in this area. Crab Creek was eliminated from further consideration because of inadequate stream channels and lakes to receive the total flow from RPWRF, which would result in flooding. Sinking Creek was eliminated for the same reasons; it is also 10 miles further from RPWRF than Lake Creek. Discharge of Class A reclaimed water near the headwaters of Lake Creek was selected for analysis of the first option of the stream flow augmentation/groundwater recharge alternative. Lake Creek interconnects with a series of lakes (including Wall, Twin Lakes, Coffee Pot, Deer, Browns, Tavares, Neves, Pacific, and Bobs), and the creek discharge would flow into this lake system and either infiltrate into the groundwater that underlies the Odessa Subarea or would eventually discharge into Crab Creek near Odessa. From Crab Creek, the surface waters would flow to Moses Lake and into the Potholes, finally discharging into the Columbia River downstream from Wanapum Dam.

5.1.6 Groundwater Recharge

Two groundwater recharge options were evaluated for Class A reclaimed water:

1. Groundwater recharge by percolation on the West Plains
2. Direct injection at the RPWRF site using the abandoned Baxter well

Groundwater recharge by percolation into the Polo Grounds and Airway Heights paleochannels was considered for groundwater recharge of the West Plains. Paleochannels were evaluated because the basalt that underlies most of the West Plains is relatively impermeable and not suitable for recharge by percolation. Costs for analysis of this option assume use of the Polo Grounds Paleochannel because the size is believed to be larger and it is closer to the RPWRF.

Groundwater recharge at the RPWRF site by direct injection was also evaluated. Originally, use of the abandoned Baxter water well was considered, but it was estimated that 10 or 11 wells would be required and the area required would be larger than the RPWRF site. This option was eliminated from further consideration because it is likely that the minimum level of treatment would be the same as direct discharge to the Spokane River and could require reverse osmosis, which would be much more expensive than membranes. It is recommended that reverse osmosis be considered in the future if membranes are selected, and that direct injection groundwater recharge be evaluated further upstream where it could reduce the amount of water indirectly withdrawn from the Spokane River by potable water supply wells.

5.2 Evaluation of Alternatives

The following section describes the evaluation of alternatives and their options that was performed to identify the recommended alternative and its two most promising options for detailed analysis. First, the alternatives are compared using initial capital costs. Annual operation and maintenance costs were estimated for land application, streamflow augmentation, and groundwater recharge alternatives, which would be greater than for the alternative providing additional treatment and discharge to the Spokane River due to the cost of pumping from RPWRF to those sites. Life-cycle costs using net present worth were not calculated because capital costs were sufficient to screen alternatives. Second, the alternatives were evaluated using non-monetary criteria.

5.2.1 Economic Analysis

Table 5-4 summarizes the comparison of capital costs for the alternatives. The estimates were prepared in accordance with the guidelines of AACE International, the Association for the Advancement of Cost Engineering (AACE). According to the definitions of AACE International, the Class 5 Estimate is defined as the following:

Class 5 Estimate. This estimate is prepared based on limited information, where little more than proposed plant type, its location, and the capacity are known, where preliminary engineering is from 0% to 2% complete. Strategic planning purposes include, but are not limited to, market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, and long-range capital planning. Examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. Typically, little time is expended in the development of this estimate. The expected accuracy ranges for this class of estimate are –20% to –50% for the low range side and +30% to +100% on the high range side.

All costs are expressed in October 2013 dollars and include Washington State sales tax and allowances for engineering, permitting, legal and administration.

Table 5-4 shows a number of things. First, treatment and discharge to the Spokane River by membranes, sedimentation followed by membranes, and sedimentation followed by conventional filtration are much less expensive than MBR, agricultural land application for critical season and entire year, urban irrigation, stream flow augmentation to Lake Creek, and groundwater recharge by surface percolation to the Polo Grounds Paleochannel. The next lowest cost options of MBR and groundwater recharge by surface percolation to the Polo Grounds Paleochannel are at least twice as expensive as any additional treatment of RPWRF effluent and discharge to the Spokane River option. Second, supplemental wetlands treatment is more expensive than supplemental treatment at RPWRF to remove phosphorus and nitrogen. Third, diversion of effluent from the Spokane River for the entire year may cost over $1 billion. As will be pointed out in the non-monetary analysis, groundwater recharge by surface percolation to the Polo Grounds Paleochannel will result in flow of recharged water back to the Spokane River eventually because of limited storage and use capability in the paleochannel.

TABLE 5-4
Cost Summary for NLT Alternatives (October 2013 dollars)

Alternatives with Options			Capital Cost
Additional Treatment and Discharge to Spokane River		MBR	$319,000,000
		Membranes	$143,000,000
		Sedimentation followed by Membranes	$138,000,000
		Sedimentation followed by Conventional Filtration	$129,000,000
Agricultural Land Application to Eliminate Discharge of Effluent to Spokane River during the Critical Season	Class A Reclaimed Water	Irrigation District	$796,000,000
	Class D Reclaimed Water	City Owned	$755,000,000
		Private Farms	$695,000,000
Agricultural Land Application to Eliminate Discharge of Effluent to Spokane River for Entire Year	Class A Reclaimed Water	Irrigation District	$1,143,000,000
	Class D Reclaimed Water	City Owned	$1,091,000,000
		Private Farms	$1,000,000,000
Urban Irrigation of Class A Reclaimed Water[a]			$497,000,000
Stream Flow Augmentation of Class A Reclaimed Water to Lake Creek[b,c]			$1,069,000,000
Groundwater Recharge of Class A Reclaimed Water by Surface Percolation to Polo Grounds Paleochannel[b,d]			$320,000,000
Supplemental Treatment			**Capital Cost**
Class A Reclaimed Water at RPWRF – supplement for agricultural land application, urban reuse, stream flow augmentation, and groundwater recharge alternatives	100 mgd peak capacity		$101,000,000
	150 mgd peak capacity		$143,000,000
Nitrogen removal at RPWRF – if not performed by wetlands, supplement for stream flow augmentation and groundwater recharge alternatives			$9,000,000
Class A Reclaimed Water and Nitrogen Removal to 10 mg/L TN (as N) by Wetlands Treatment – supplement for agricultural land application, stream flow augmentation, and groundwater recharge alternatives	Without clay liner		$284,000,000
	With clay liner		$464,000,000

Notes: Class A reclaimed water alternatives include the cost of treatment to Class A reclaimed water.

Streamflow augmentation and groundwater recharge alternatives include the cost of treatment to Class A reclaimed water and nitrogen removal by Wetlands Treatment.
[a] Capacity is less than effluent from RPWRF and must be combined with another alternative to eliminate discharge to Spokane River during critical season.
[b] Eliminates discharge of effluent to Spokane River for entire year.
[c] Assumes Class A reclaimed water is suitable and no additional treatment costs are included.
[d] Assumes Class A reclaimed water with nitrogen removal is suitable and no additional treatment costs are included.

5.2.2 Nonmonetary Analysis

Table 5-5 summarizes significant findings of the non-monetary analysis of alternatives. The following categories were used to evaluate the alternative:

- Implementation by March 1, 2018?
- Need for additional studies/permits?
- Land acquisition needed?
- Water rights issues?
- Public acceptance
- Environmental issues
- Removes effluent from Spokane River?
- Beneficial use of effluent?

Ecology has established March 1, 2018 as the date that NLT must be operational. Only the treatment and discharge to the Spokane River alternative can be implemented by this date. All the other alternatives will require significantly longer to complete additional studies, acquire necessary land, resolve water rights issues, gain public acceptance and address environmental issues.

All alternatives will require additional studies and permits. Treatment and discharge to the Spokane River will require completion of SEPA and Shoreline Management and construction permits, but all construction of permanent facilities adjacent to the Spokane River will occur within the property boundaries of RPWRF. Since the TMDL and NPDES permit are complete, it has the least additional requirements of all alternatives. Agricultural land application will require more detailed studies to identify specific sites and pipeline routes to confirm cost estimates and then environmental impact analysis of alternatives. Urban irrigation will require detailed studies of potentially irrigated land and opportunities for use of Class A reclaimed water followed by studies to confirm landowner interest and development of systems to distribute reclaimed water. Stream flow augmentation to Lake Creek will require studies to determine water quality requirements, stream hydraulic studies, groundwater studies, lake water quality studies, and then environmental impact analysis. Groundwater recharge by surface percolation to Polo Grounds Paleochannel will require studies to determine the size of the paleochannel and capacity for storing water, groundwater quality, determination of the fate of applied water, and surface water and environmental impact analysis.

Land acquisition requires substantial time to accomplish and becomes more difficult for larger areas of land. Treatment and discharge to the Spokane River requires no additional land outside the property boundaries of RPWRF. Agricultural land application requires purchase of large acreages for the City owned option and development of agreements for acceptance of reclaimed water on large acreages for the other options. The irrigation district option requires formation of an irrigation district. Land must be acquired for pump stations and storage reservoirs. Easements will be needed for construction and maintenance of pipelines. Urban irrigation will require acquisition of land for storage reservoirs and pump stations, and identification of sufficient interested users to justify investing in pump stations, pipelines, and reservoirs to distribute reclaimed water. Stream flow augmentation to Lake Creek will require land acquisition for pump stations and storage reservoirs, and potentially land for supplemental treatment. Easements will be needed for construction and maintenance of pipelines. Groundwater recharge by surface percolation will require purchase of land for the percolation basins and potentially for supplemental treatment. Easements will be needed for construction and maintenance of pipelines.

Water rights are potentially affected by any diversion of effluent from the Spokane River, and resolution of water rights issues is complex and time-consuming. Only the treatment and discharge to Spokane River alternative does not have water rights issues because all effluent is discharged to the Spokane River. All the other alternatives divert all or a portion of the effluent to beneficial use and reduce the flow in the Spokane River.

TABLE 5-5
Non-Monetary Analysis of NLT Alternatives

Alternatives with options			Implementation by March 1, 2018?	Need for Additional Studies?	Land Acquisition Needed?	Water Rights Issues?	Public Acceptance	Environmental Issues	Remove Effluent from Spokane River?	Beneficial Use of Effluent?
Treatment and Discharge to Spokane River (TMDL)	MBR		Yes	Minor	No	No	Existing approach	Spokane River and Lake Spokane water quality	No	No
	Membranes		Yes	Minor	No	No	Existing approach	Spokane River and Lake Spokane water quality	No	No
	Sedimentation followed by Membranes		Yes	Minor	No	No	Existing approach	Spokane River and Lake Spokane water quality	No	No
	Sedimentation followed by Conventional Filtration		Yes	Minor	No	No	Existing approach	Spokane River and Lake Spokane water quality	No	No
Land Application to Eliminate Discharge of Effluent to Spokane River <u>during the Critical Season</u>	Class A Reclaimed Water	Irrigation District	No	Major	Yes	Yes	New approach	Groundwater quality	Yes, critical season	Yes, critical season
	Class D Reclaimed Water	City Owned	No	Major	Major	Yes	New approach	Groundwater quality and public health	Yes, critical season	Yes, critical season
		Private Farms	No	Major	Yes	Yes	New approach	Groundwater quality and public health	Yes, critical season	Yes, critical season
Land Application to Eliminate Discharge of Effluent to Spokane River <u>for Entire Year</u>	Class A Reclaimed Water	Irrigation District	No	Major	Yes	Yes	New approach	Groundwater quality	Yes	Yes
	Class D Reclaimed Water	City Owned	No	Major	Major	Yes	New approach	Groundwater quality and public health	Yes	Yes
		Private Farms	No	Major	Yes	Yes	New approach	Groundwater quality and public health	Yes	Yes
Urban Irrigation of Class A Reclaimed Water			No	Major	Yes	Yes	New approach	Groundwater quality and public health	Yes, partial critical season	Yes
Stream Flow Augmentation of Class A Reclaimed Water to Lake Creek			No	Major	Yes	Yes	New approach	Surface and groundwater quality and public health	Yes	Yes
Groundwater Recharge of Class A Reclaimed Water by Surface Percolation to Polo Grounds Paleochannel			No	Major	Yes	Yes	New approach	Surface and groundwater quality and public health	Yes, limited volume of groundwater used	Yes

Public acceptance of any alternative is a complex issue because of the large number of issues typically involved and the diversity of public opinion. Treatment and discharge to the Spokane River is the existing practice, and because of the history it may be the least controversial to the majority of citizens. All the other alternatives would be a new approach affecting a different population than currently affected by continued discharge to the Spokane River. While public acceptance of a new approach may be eventually obtained, it is likely to require additional time and thus preclude implementation by March 1, 2018.

Each alternative has a set of environmental issues that will be more or less significant depending on the individual. Treatment and discharge to the Spokane River affects water quality in the Spokane River and Lake Spokane. Agricultural land application has the potential to affect groundwater quality. Class D reclaimed water may be perceived as a public health risk by neighbors of land application sites because of the lower level of treatment. Urban irrigation may be perceived as a groundwater quality and public health risk because of potential effects on the underlying sole source aquifer and in the urban area. Stream flow augmentation to Lake Creek will affect surface water quality in streams and lakes and groundwater quality, and may be perceived as a public health risk. Groundwater recharge by surface percolation to the Polo Grounds Paleochannel will affect groundwater quality, surface water quality if it fills the aquifer and flows into the Spokane River, and public health for those using the paleochannel as a source of drinking water.

Removal of effluent from the Spokane River may improve water quality and could eliminate the need for an NPDES permit if all effluent is removed. Continued treatment and discharge to the Spokane River result in no removal of effluent from the Spokane River. All the other alternatives remove some or all of the effluent from the Spokane River. Agricultural land application to eliminate discharge of effluent to Spokane River during the critical season removes all effluent from the Spokane River during the critical season. Urban irrigation is predicted to use a maximum of 45 percent of the critical season effluent. Groundwater recharge by surface percolation to the Polo Grounds Paleochannel may remove the least amount of water from the Spokane River because actual removal depends on use of the groundwater. If not used, groundwater levels will increase and create springs that will flow back to the Spokane River. The remaining alternatives eliminate all discharge to the Spokane River. Removing significant effluent from the Spokane River will involve the Department of Fish and Wildlife, Indian tribes, and recreational river users in the conversation about the future of RPWRF's effluent.

Beneficial use of effluent to the extent that it replaces existing uses is viewed as a positive goal because pollutants are removed from the Spokane River and groundwater consumption is reduced, leading to higher flows in the Spokane River or other affected streams. Treatment and discharge to the Spokane River maintain minimum stream flows and support use of Spokane River water. This alternative also uses the effluent at RPWRF. All the other alternatives result in varying degrees of beneficial use of the effluent.

5.2.3 Screening Analysis

5.2.3.1 Screening to One Alternative

Treatment and discharge to the Spokane River is the recommended alternative for NLT because it is the lowest-cost alternative and is the only alternative that can be implemented by March 1, 2018.

The alternative with the next lowest cost is groundwater recharge by surface percolation to the Polo Grounds Paleochannel. This alternative requires supplemental treatment to Class A reclaimed water and nitrogen removal and does not include the costs of land acquisition and construction of surface percolation facilities. When the additional cost of pumping is included, the annual O&M costs are higher than treatment and discharge to the Spokane River. There are many unknowns that need to be answered before this recharge alternative could be implemented, and it is not possible for this alternative to be implemented by March 1, 2018. This recharge alternative, along with agricultural land application, urban irrigation, and streamflow augmentation, are eliminated from further consideration at this time for cost and schedule reasons.

5.2.3.2 Screening to Two Final Options

Conversion of the existing activated sludge process to MBRs is eliminated because of higher cost, more difficult construction, and lower effluent quality than the other three treatment and discharge to Spokane River options. The capital cost is twice the other three options and the annual O&M cost is comparable. The electricity cost of MBR is much higher because of the recirculation pumping, and chemical costs are about the same. There will be a slight savings in operations labor, but the difference in annual O&M cost will not be sufficient to offset the much higher capital cost. Conversion of the existing activated sludge process to MBR requires a very complicated construction schedule to keep adequate treatment capacity because the activated sludge process must remain operational at all times during construction. This construction is much more difficult and the risk is much higher compared to construction of an add-on facility at an undeveloped portion of the RPWRF site for the other three options. Finally, effluent quality measured as total phosphorus will not be as low (good) as the other three options for discharge to river.

Sedimentation followed by membranes is eliminated because it is a more complicated process, has higher risk, requires more site area, and is essentially equal in cost to the membrane option. This option would have Densadeg high-rate sedimentation prior to membranes. The primary benefit is the reduction of solids loading to the membranes, but the process requires sedimentation and operation of the high-rate clarification process. Sedimentation is sensitive to hydraulic loading and maintenance of a good settling suspension. RPWRF is subject to high flows for extended periods of time, making this process vulnerable. Costs assumed that loading rates would be allowed to exceed the maximum flow rate for achievement of low solids concentrations. Adding additional Densadeg units to maintain a lower effluent solids concentration would increase the costs, making this option equal to or higher than the cost of the membrane option. Operation of the Densadeg process is more complex and sensitive to chemical feed rates than the rapid mixing and flocculation processes ahead of membranes in the membrane option. Densadeg has been successfully used at other locations in comparable service, but it was not pilot-tested at RPWRF, and this increases the risk of this option compared to the membrane option.

The recommended options for detailed analysis are the membranes and the sedimentation followed by conventional filtration. Membranes will be referred to as the “membrane filtration” option. Sedimentation followed by conventional filtration will be referred to as the “conventional filtration” option, but it should be noted that this option includes high-rate sedimentation and the filtration technology is based on conventional filtration. These are the two lowest-cost options, and both can be implemented by March 1, 2018. Both options produce effluent that meets the requirements of Class A reclaimed water in addition to reducing CBOD and total phosphorus to NPDES limits to allow discharge to the Spokane River. This allows potential future implementation of other alternatives in this report to reduce or eliminate discharge of effluent to the Spokane River and to beneficially reuse the effluent. Membrane effluent will be a high enough quality to allow future addition of reverse osmosis to allow direct injection into groundwater.

5.3 Evaluation of Two Final Options

The two final options for the treatment and discharge to the Spokane River alternative, membrane filtration and conventional filtration, are first evaluated at peak flow capacity of 100 mgd. The peak flow capacity of the existing primary and secondary treatment facilities at RPWRF is currently 100 mgd. The maximum peak flow capacity of the conventional filtration option that will fit on the available RPWRF site is 100 mgd. Second, the optimum size of the membrane filtration option will be evaluated and compared to the 100-mgd conventional filtration option.

5.3.1 Evaluation of Two Final Options at 100 mgd Peak Flow Capacity

The evaluation is done in two parts. First, a quantitative economic evaluation is completed for each option. Then a nonmonetary analysis is completed to compare options qualitatively.

5.3.1.1 Economic Evaluation

The economic evaluation includes development of initial capital cost, annual O&M costs, and replacement costs, and these are used to develop a cash flow and life-cycle net present worth costs for each option.

Initial Capital Cost. Initial capital costs were estimated for each option sized for a peak flow capacity of 100 mgd in October 2013 dollars. Construction cost estimates were developed for each option using the design criteria presented earlier in Table 5-2. All construction cost estimates are classified as Class 5 estimates prepared in accordance with the guidelines of AACE International, the Association for the Advancement of Cost Engineering (AACE). According to the definitions of AACE International, the Class 5 Estimate is defined as the following:

Class 5 Estimate. This estimate is prepared based on limited information, where little more than proposed plant type, its location, and the capacity are known, where preliminary engineering is from 0% to 2% complete. Strategic planning purposes include but are not limited to, market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, and long-range capital planning. Examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. Typically, little time is expended in the development of this estimate. The expected accuracy ranges for these estimates are–50% for the low range side and +100% on the high range side.

Construction cost estimates include the following markups:

Contractor general conditions	7.0%
Contractor overhead	8.0%
Contractor profit	10.0%
Bonds and insurance	2.16%

Costs were adjusted to October 2013 dollars using the Engineering News Record construction cost index of 9689.

Estimates were prepared for individual facilities and a 25 percent contingency is added. Washington State sales tax of 8.7 percent is also included. An allowance of 19 percent is added for engineering, legal, and construction to obtain a total initial capital cost.

Initial capital cost estimates are $128.5 million for conventional filtration and $143.0 million for membrane filtration in October 2013 dollars , a difference of $14.5 million.

Annual O&M Costs. Annual O&M costs were estimated for each option for the years 2018 through 2030. Annual O&M costs were estimated for labor, electricity, chemicals, preventative maintenance and repair materials, and solids handling. Labor hours were estimated for operations, laboratory, maintenance mechanics, HVAC maintenance, and electrical and instrumentation and control, and multiplied by the average labor rate for each. Raw labor costs were increased 40 percent to account for benefits.

Electricity requirements were estimated by estimating the kilowatt-hours (kWh) required for 245 days of operation of the process during the critical season based on the estimated horsepower and percentage of time equipment would operate. Lighting and HVAC electricity requirements were based on 365 days per year of operation. Electricity costs were calculated based on the kWh per year times $0.06 per kWh.

Chemical costs were estimated for alum, sodium hydroxide, sodium hypochlorite, citric acid, and polymer. Both options use alum for phosphorus removal. Alum doses for each option were based on performance during the NLT pilot study. Conventional filtration was assumed to require 57.5 mg/L alum, the average of the high dose for 0.3 mg/L secondary effluent total phosphorus concentration and low dose for 0.6 mg/L secondary effluent total phosphorus concentration. Membranes were assumed to require 15 mg/L alum based on the same approach. Sodium hydroxide is needed to maintain the pH in the wastewater. Alum is an acid and higher alum dose requires more sodium hydroxide addition. The sodium hydroxide dose used for the evaluation was 27 mg/L for conventional filtration and 5.5 mg/L for membrane filtration. Sodium hypochlorite and citric acid are not used for conventional filtration, but are required for cleaning the membranes. Membranes require two types of cleaning. The first is called maintenance cleaning and is more frequent. Chemical solutions are pumped through the membranes in a maintenance clean. Maintenance clean chemical requirements are assumed to be 6.1 gallons per week per train for citric acid and 3.2 gallons per week of sodium hypochlorite. Recovery clean is much less frequent and requires soaking the membranes in a tank of chemical solution. Recovery clean chemical requirements were assumed to be 170 gallons per month for citric acid and 410 gallons per month for sodium hypochlorite. The following chemical costs per gallon were used:

- Alum 49% solution $1.29
- Sodium hydroxide 25% solution $1.00
- Citric acid 50% solution $5.38
- Sodium hypochlorite 10% solution $1.35

Polymer is needed for sedimentation of solids in the Densadeg high-rate clarification process.

Preventive maintenance and repair materials were estimated as percentages of equipment costs. Preventive maintenance costs were estimated as 1.5 percent of the equipment costs for every year from 2018 through 2030. Repair materials were estimated as 5 percent of the equipment cost at the end of the useful life of the equipment, but were adjusted by a factor that varies from 0.05 for new equipment and increases to 1.0 for equipment at the end of its useful life. This reflects the typical experience that new equipment requires little or no repair and that repair costs increase as equipment ages.

Solids-handling costs are estimated for the additional solids generated by NLT. Additional solids are generated by removal of additional TSS from the secondary treatment process and chemical solids generated by precipitation of alum and phosphorus. Annual O&M costs increase because of additional polymer for thickening and dewatering, and truck hauling and land application resulting from additional solids from NLT. Gravity belt thickener polymer costs are estimated to be $12 per dry ton of additional solids. Belt filter press polymer costs are estimated to be $30 per dry ton of additional solids. Biosolids truck hauling and land application are estimated to cost $100 per dry ton of additional solids. Membranes are estimated to produce 5,953 lb/day of additional solids, and conventional filtration is estimated to produce 9,410 lb/day of additional solids, both estimated in the year 2030. Conventional filtration produces more solids because more alum is needed for phosphorus removal.

Annual O&M costs are estimated to be $2.5 and $3.0 million per year for conventional filtration and $1.4 and $1.8 million per year for membrane filtration in year 2018 and year 2030, respectively, expressed in October 2013 dollars. Labor costs are assumed to be constant for the entire period. All other costs except preventative maintenance and repair materials are assumed to increase linearly between 2018 and 2030 as the equipment ages. Membranes (excluding membrane replacement costs discussed in next section) have lower annual O&M costs by about $1.2 million per year than conventional filtration. This is largely because of much lower chemical costs for alum and sodium hydroxide. Labor and preventative maintenance and repair materials costs are higher for membranes. Electricity and solids-handling costs are slightly lower for membranes.

Replacement Costs. Equipment is assumed to be replaced when it reaches the end of its useful life. Most mechanical and electrical equipment can be assumed to have a 20-year useful life if properly maintained. This analysis assumes the NLT facilities' first year of operation is 2018 and the last year of the analysis is 2030, so all equipment except the membranes do not need to be replaced in this economic analysis. Membranes are currently guaranteed for 10 years by the supplier and they are expected to need to be replaced in 2028. Membrane replacement costs in October 2013 dollars are $14.1 million with 8.7 percent sales tax included.

Cash Flow/Life-Cycle Net Present Worth. A cash flow projection was developed for the years 2013 through 2030 and used to calculate life-cycle costs using net present worth. The initial capital costs were used to develop cash flows for years 2014 through 2018. It was assumed that major equipment would be prepurchased in year 2015. Construction was assumed to occur in years 2016 and 2017 with equal expenditures in each year. The first year of operation was assumed to be 2018, and annual O&M costs begin in that year and continue to 2030. Membranes are assumed to be replaced in year 2028.

Life-cycle costs expressed as net present worth are calculated to be $140 million for conventional filtration and $152 million for membrane filtration. Costs for each year are inflated assuming an inflation rate of 3 percent per year. Present worth costs for each year are calculated using a discount rate of 6.5 percent and a single payment present worth factor times the inflated cost for each year. Life-cycle costs are the sum of the present worth costs for each year for the period 2013 through 2030. The present worth is calculated to the end of year 2013. Conventional filtration is about 8 percent less total present worth than membrane filtration for a peak flow capacity of 100 mgd.

5.3.1.2 Non-Monetary Analysis

Membranes produce a better quality effluent, the variation in effluent quality is less, and they are easier to operate than conventional filtration. Membranes provide a barrier to loss of solids that is an advantage compared to conventional filters. Membranes require less site area than conventional filters. Membranes are more complex and have a shorter operational history than conventional filtration.

Conventional filters have been used for many decades and are well proven and less complex than membranes. They require more space and produce a lower quality effluent with much more variability. They are sensitive to loss of solids and as a result are more difficult to operate.

Pilot testing of conventional and membrane filtration found that both technologies are capable of meeting NPDES permit requirements for total phosphorus. The effluent from conventional filtration is estimated to average 0.030 mg/L total phosphorus compared to 0.018 mg/L for membrane filtration. The future NPDES requirement to comply with the TMDL for total phosphorus is 17.8 pounds per day and was based on 0.042 mg/L total phosphorus concentration. The final TMDL is 17.8 pounds per day and does not include a concentration. Since conventional filtration produces an effluent less than 0.042 mg/L, conventional filtration is sufficient to comply with the future NPDES permit. Since flows to RPWRF vary and are less than previously estimated, the purpose of this comparison is to demonstrate that both alternatives, including conventional filtration, are capable of meeting future NPDES permit requirements.

Pilot testing of conventional filtration found that effluent quality expressed as total phosphorus was not as good as membrane filtration effluent, variability of effluent quality was greater, and the process was more difficult to control due to sensitivity to alum feed. As stated above, the effluent from conventional filtration is estimated to average 0.030 mg/L total phosphorus compared to 0.018 mg/L for membrane filtration. Effluent total phosphorus was found to be dependent on TSS removal and the conventional filtration option was more difficult to operate to maintain low TSS than membrane filtration with fixed pore size. The defined pore size of membranes referred to as a “barrier” is an advantage of membranes. Membranes were less sensitive to alum dose and produced a more consistent effluent quality.

Densadeg high-rate clarifiers would provide sedimentation for conventional filtration option but were not pilot tested at the RPWRF, and this increases the risk of the conventional filtration option. Conventional sedimentation tanks require a large area and will not fit on the RPWRF site. The two high-rate clarifier technologies pilot tested (Actiflo and CoMag) inherently lost their ballast sand and magnetite, respectively, associated with damage to equipment in other areas of the RPWRF. Densadeg, although not pilot tested at RPWRF, has been successfully used in other facilities for the same application. The risk is its performance at high flow rates because it does not use a ballast particle. An advantage is that it doesn't use abrasive ballast particles, which can cause damage in other parts of the RPWRF.

Conventional filtration requires more site area than membranes, and a 100-mgd peak flow capacity facility consumes the remainder of the RPWRF site and requires a major retaining wall below A.L. White Parkway to provide adequate area. Additional area would be needed to expand the sedimentation followed by conventional filtration facility to greater than 100-mgd peak flow capacity or to add future treatment facilities. Membranes require less site area and could be expanded within the site area or additional treatment could be provided on the RPWRF site.

Membranes are more complicated than conventional filtration and are likely to require more maintenance. Membrane facilities are highly automated and have operational requirements similar to conventional filtration, but the automated systems are complex and will require additional maintenance.

Conventional filters are more proven than membranes because the technology is much older. Membranes are maturing as a technology, but have a much shorter history than conventional filters.

5.3.1.3 Conclusions

Although conventional filtration has what appears to be lower initial capital cost and life-cycle cost expressed as net present worth compared to membrane filtration, when both are sized for 100-mgd peak flow it does not produce effluent of as high quality as membrane filtration. Conventional filtration requires more site area than membrane filtration, but a 100-mgd peak flow facility will fit on the RPWRF site with the use of extensive retaining walls. No additional site area within the property line would exist to expand the conventional filtration option or to add more treatment in the future if it was required. The Densadeg high-rate clarifier process was not pilot-tested at RPWRF, but has been successful at other locations. A major retaining wall would be required for conventional filtration, increasing risks to the stability of A.L. White Parkway and the main interceptor sewer to RPWRF that is located under the road.

Conventional filtration is a cost-effective option at 100-mgd peak flow capacity and would be recommended if 100-mgd peak flow capacity is required. Because of advantages observed in the pilot study, the City requested evaluation of lower-capacity membrane options to see if a lower-cost membrane option could meet the NPDES permit requirements and provide net environmental benefit compared to 100-mgd of conventional filtration. A lower-cost membrane option would leave room for future expansion if needed and produce a better quality filtration effluent.

5.3.2 Evaluation of Two Final Options: 100-mgd Conventional Filtration and 50-mgd Membrane Filtration

An analysis was performed to determine if a lower-capacity membrane could be constructed with lower initial capital and life-cycle costs that would meet the NPDES permit discharge standards and provide net environmental benefits compared to the 100-mgd peak flow conventional filtration option. This section describes the comparison of a 50-mgd average capacity membrane filtration option with the 100-mgd peak flow capacity conventional filtration option. First, a detailed definition of the two options is presented. Second, the effluent assumptions used in the net environmental benefit analysis are presented. The evaluation of net environmental benefit is dependent on the volumes of different qualities of effluent that result from the high flow variation experienced at RPWRF during precipitation events, heavy snow melt, and excessive river infiltration. The analysis is based on the ADWF estimated for the year 2030 and estimates for I/I that could occur based on observed flows at RPWRF for the period 2002 through 2011, and estimated changes in flows from implementation of the CSO improvement program. As will be shown in this section, there is tremendous possible variation and the actual flow in 2030 will depend on the precipitation, snow melt, and Spokane River flows that actually occur in 2030. Use of the observed flows for the period 2002 through 2011 allows evaluation of a reasonable range of conditions that could occur and determination that the RPWRF NLT facilities will comply with the NPDES permit in 2030 with this range of conditions, which documents the adequacy of the design of NLT facilities. When a specific year (for example 2008) is cited, this means that if the conditions that existed in the year 2008 occur in the year 2030, then the various effluent volumes and quality are predicted to occur in 2030. A range of values is presented because the actual conditions that will occur in the year 2030 cannot be known.

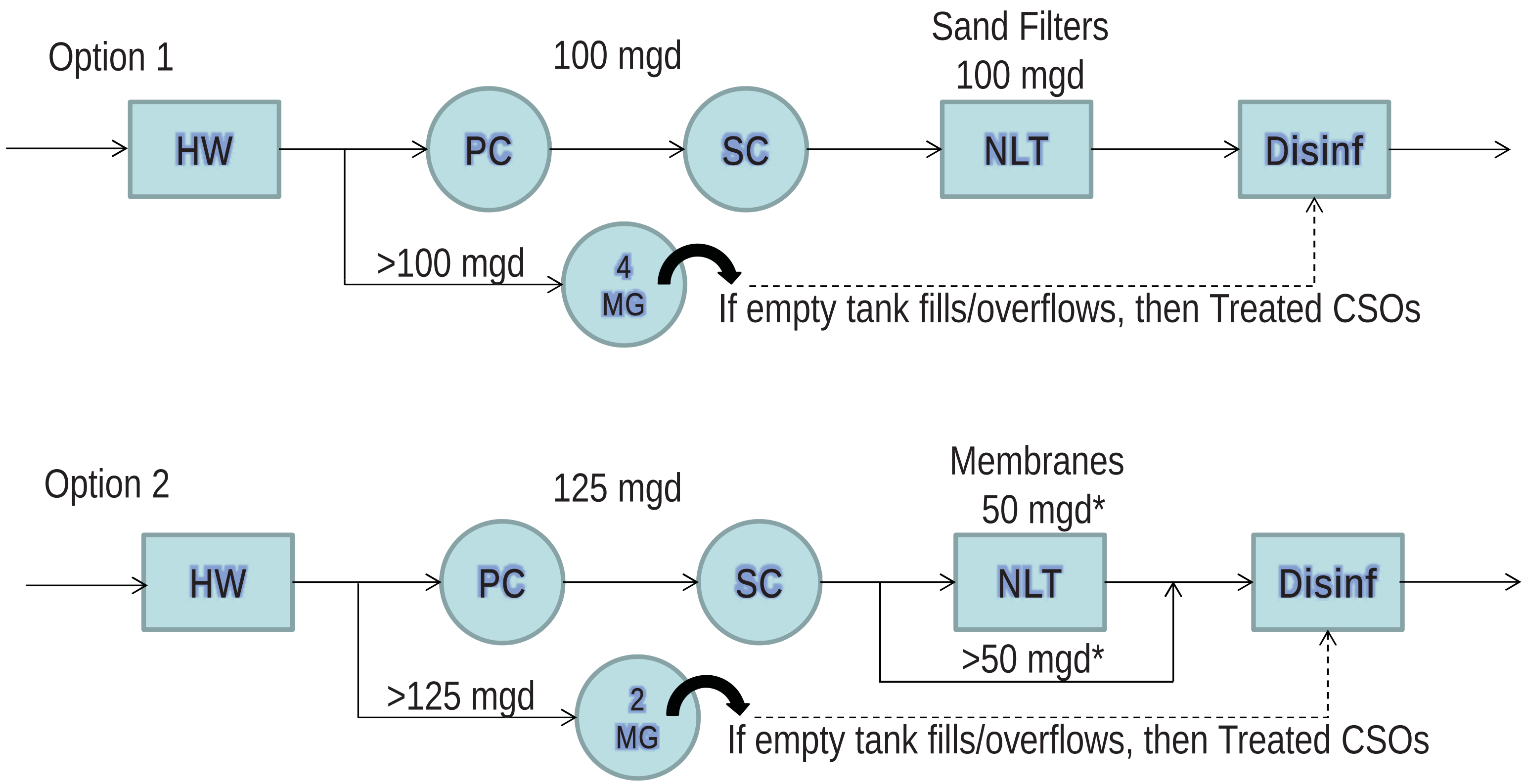
5.3.2.1 Definition of Options

Figure 5-1 shows process schematics for the two options. Option 1 shows the schematic for 100-mgd peak flow capacity of conventional filtration. The existing primary and secondary treatment processes would remain at the existing peak flow capacity of 100 mgd and as a result, all primary and secondary treated flow would receive NLT treatment. There is not sufficient site area at RPWRF to construct more than 100 mgd peak flow capacity of conventional filtration. Flows to RPWRF can be as high as 150 mgd for short periods of time. Flows in excess of 100 mgd are diverted to two 160-foot-diameter clarifiers with a combined volume of 4 million gallons (MG). These two clarifiers are called the “CSO clarifiers.” If the volume diverted is less than 4 MG, the collected wastewater is pumped back to the headworks and receives full treatment. For volumes greater than 4 MG, the excess wastewater is provided sedimentation treatment followed by disinfection before it is discharged to the Spokane River. Alum is added at the headworks and polymer is added downstream of the headworks when CEPT is being operated and the level of treatment in the CSO clarifiers is CEPT. CEPT will be operated in the critical season as the first step of phosphorus removal beginning March 2018. CEPT is not required in the non-critical season for phosphorus removal. CEPT will be required in the future for RPWRF capacity to treat BOD and TSS, and is not likely to be needed until many years after 2018. If CEPT is not being operated, the level of treatment is primary. Addition of alum improves CBOD, TSS, and phosphorus removal compared to primary treatment. Flows that are diverted around primary, secondary, and NLT treatment trains, but receive primary treatment and disinfection prior to discharge to the Spokane River, are called “treated CSO.”

Option 2 shows the schematic for 50-mgd average capacity of membranes. The 50-mgd description is a nominal capacity used to describe the option and the actual capacity is discussed later in this section. 50 mgd refers to the approximate average firm and net capacity. Firm capacity is the capacity with one membrane train not processing flow while deconcentrating solids and one membrane train out of service for maintenance. Net capacity is the capacity minus the flow resulting from recirculating solids. A fifth primary clarifier would be constructed and the fifth secondary clarifier (a converted CSO clarifier) would be used for secondary treatment, increasing the primary and secondary treatment capacity to 125 mgd.

Flows in excess of 125 mgd are diverted to one 160-foot-diameter clarifier with a volume of 2 MG. This clarifier is called the CSO clarifier. If the volume diverted is less than 2 MG, the collected wastewater is pumped back to the headworks and receives full treatment. For volumes greater than 2 MG, the wastewater is provided sedimentation treatment followed by disinfection before it is discharged to the Spokane River. Primary or CEPT treatment will be provided as discussed above for Option 1. The 50-mgd membrane capacity is less than the 125-mgd primary and secondary treatment capacity, and secondary effluent flows greater than the membrane capacity will be diverted around the membrane process to disinfection. Figure 5-2 defines the three different effluent quality streams for the membrane filtration option. “Treated CSO” is wastewater diverted ahead of the primary clarifiers in excess of 2 MG total volume. In the critical season, treated CSO receives CEPT and disinfection. In the non-critical season, treated CSO receives primary treatment and disinfection. “NLT effluent” is wastewater that receives primary, secondary, and NLT treatment before disinfection. “Secondary effluent” is primary and secondary treated wastewater that is diverted around NLT before disinfection. The blended effluent is calculated as the sum of the effluent from these three different treatment processes and compared to Option 1. The volume of each of these three effluent streams is calculated to estimate the blended effluent quality.

Primary Clarifier No. 5 and secondary Clarifier No. 5 will normally be offline and empty to allow use for in-line equalization to maximize the capacity of installed membranes for the membrane filtration option. These clarifiers are only needed for flows greater than 100 mgd, which are rare. These two clarifiers provide 0.9 and 2.0 mg of storage, respectively, and this volume can reduce the flow to membranes, minimizing the volume of secondary effluent that must be diverted around the membranes.



* 50 mgd is nominal net capacity with one train not treating flow while deconcentrating and one train out of service for maintenance. Actual capacity varies depending on the number of trains operating and flux rate.

FIGURE 5-1
Options Schematic

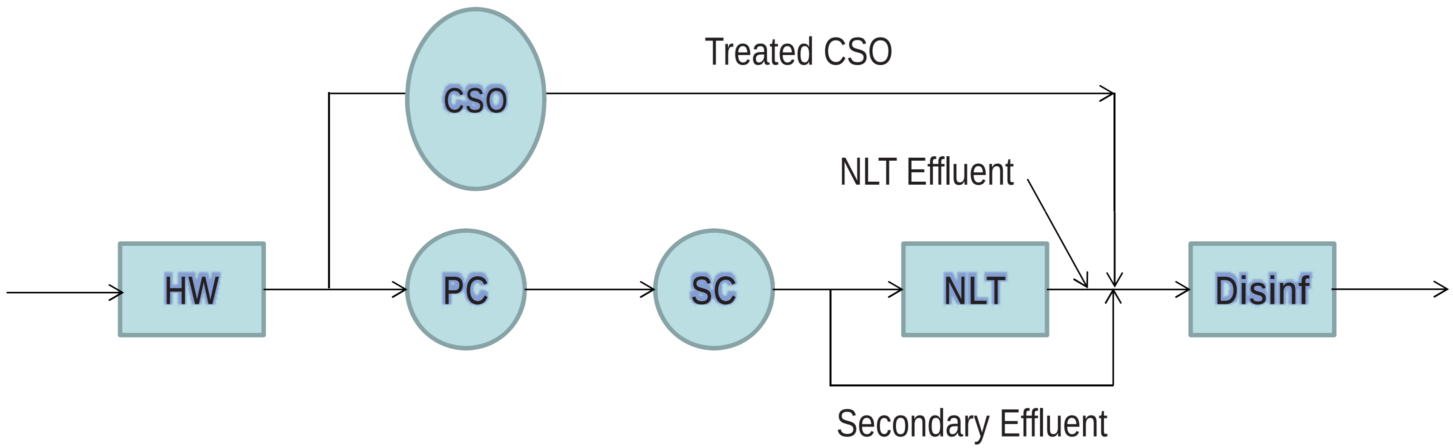


FIGURE 5-2
Definitions of Flows

The design criteria for 100-mgd peak flow conventional filtration is the same presented earlier in Table 5-2.

Design criteria for the 50-mgd membrane filtration option are shown in Table 5-6. The number of rapid mixing and flocculation trains is reduced to four, providing a peak flow capacity greater than the peak 12-hour capacity. Spare rapid mix and flocculation equipment will be purchased to allow rapid replacement rather than construct spare process trains. The number of membrane trains is reduced to 10, which provides 54.1-mgd firm sustained capacity and 81.1-mgd firm peak capacity less the recycle flow. Firm capacity is defined as the capacity with one train out of service for maintenance. It is assumed that all membrane trains can be operated during May and June to treat sustained high flow conditions. During May and June, the membranes may operate at 16.0 gfd 24 hours per day continuously for 60 days during high flow years. In the dry season, it is assumed that membrane flux can be increased to 24 gfd for up to 12 hours to respond to thunderstorms. One train is also assumed not processing flow while deconcentrating, i.e., removing accumulated solids from the membrane basin. The net capacity is the capacity after 10 percent is subtracted to account for the recycle flow from the membrane deconcentrating process.

The membrane filtration option will retain the ability to expand to 5 rapid-mix and flocculation trains and 16 membrane trains. This allows expansion of capacity to 86 mgd of firm, net sustained capacity and 125 mgd of firm, net peak capacity using the criteria listed in Table 5-6.

TABLE 5-6
Criteria for 50-mgd Membrane Option

Screening:	
Number of units	2
Capacity, each (mgd)	75
Type	Drum
Perforation diameter (mm)	1
Rapid mixing:	
Number of units	4
Capacity each (mgd)	25
G (sec^{-1})	1,000
Flocculation:	
Number of trains	4
Flocculators per train	6
Type	Vertical paddle mixers
G (sec-1)	80
Detention time at 50 mgd (min)	20
Membranes:	
Trains	10 installed
Cassettes per train	15
Membrane area (ft2/cassette)	28,160
Design flux (gfd):	
60-day, 24 hours/day sustained	16.0
Peak 12 hour intermittent	24.0 (July 1 through September 30 only)

TABLE 5-6
Criteria for 50-mgd Membrane Option

Membrane trains not processing flow:	
May/June	1 for deconcentrating
March to May and July to November	1 for maintenance and 1 for deconcentrating
Allowance for recycle from membranes	10 percent of incoming flow to membranes

5.3.2.2 Effluent Assumptions

Table 5-7 shows the effluent assumptions for treated CSO, secondary effluent, and NLT effluent for sedimentation followed by conventional filtration and membrane filtration.

Treated CSO. Treated CSO will result from flows to the primary clarifier exceeding 100 mgd with a volume greater than 4 MG for the filtration option and exceeding 125 mgd with a volume greater than 2 MG for the membrane filtration option. Effluent quality will vary depending on whether CEPT is being practiced or not. In the critical season (March 1 through October 31), CEPT will be used as the first step of phosphorus removal. Alum is added downstream of the Parshall flumes ahead of the overflow weir to the CSO clarifiers so treated CSO will receive CEPT when it is being operated. CEPT might not be used in the non-critical season (November 1 through the end of February) in the initial years of operation because phosphorus removal is not required in the non-critical season and CEPT is not needed to reduce the loading to the aeration basins to delay construction of Aeration Basin No. 5. If CEPT isn't operating, treated CSO will receive primary treatment.

Treated CSO effluent concentration predictions are based on 90th percentile CEPT and primary effluent values for RPWRF. There is very little actual treated CSO at RPWRF and no actual effluent data for treated CSO, so the CEPT and primary effluent data are the best data available. The overflow rates for the CSO clarifiers are much lower than the primary clarifiers, so the effluent quality should be comparable. Primary treatment data are for the year 2010, the most recent year when primary treatment was the operational practice at RPWRF. CEPT has been tested on all the primary clarifiers since May 2011, and CEPT effluent for 2012 and 2013 was used to calculate 90th percentiles. Since treated CSO occurs infrequently, the maximum day values are used for estimating effluent quality. The percentile calculations assume the data are normally distributed, which is reasonable for the large amount of data available. Ecology has indicated that monitoring requirements may be included in future permits to measure the quality of treated CSO into the Spokane River and will be discussed with the City during permit development.

Secondary Effluent. Secondary effluent 90th percentile effluent concentrations were calculated using RPWRF data for 2009, 2010, and 2011. A statistical analysis showed very slight correlation between effluent concentrations and flow. As a result, no correction was applied for high flows. The data were calculated for average, maximum 30 days, maximum 7 days, and maximum 1 day periods to allow calculation of compliance with different NPDES permit conditions. Average values are used to calculate effluent when more than 30 days of discharge occur and to calculate seasonal averages. Maximum values are used to calculate the compliance with 30-, 7-, and 1-day NPDES limits. Separate values were calculated for the critical and non-critical seasons because NPDES permit conditions are different.

Differences were observed between the critical and non-critical seasons before 2011 because alum was used in the critical season to remove phosphorus in the secondary clarifiers. Data for years 2009 and 2010 are used to estimate non-critical season secondary effluent because these are the two most recent years without the effect of CEPT. Comparison of 2011 when CEPT was practiced and 2009 and 2010 without CEPT shows the differences are small with the exception of total phosphorus in the non-critical season. Non-critical season secondary effluent without CEPT has a 50th percentile value of 2.5 mg/L compared to 0.7 mg/L with CEPT.

TABLE 5-7
Effluent Assumptions

Treated CSO Effluent Concentrations (90th Percentile Maximum Day)				
	CEPT		**Primary**	
	Critical Season	**Non-Critical Season**	**Critical Season**	**Non-Critical Season**
CBOD (mg/L)	49	62	92	94
TSS (mg/L)	41	42	64	65
Ammonia-N (mg/L)	18	18	18	18
Total phosphorus (mg/L)	1.4	2.6	3.3	3.4
Cadmium (µg/L)	0.26	0.26	0.33	0.33
Lead (µg/L)	3.1	3.1	3.9	3.9
Zinc (µg/L)	78	78	100	100
PCBs (pg/L)	2,800	2,800	4,400	4,400
Secondary Effluent Concentrations (90th Percentile)				
	Average	**Maximum 30-Days**	**Maximum 7-Days**	**Maximum Day**
Critical Season				
CBOD (mg/L)	7.6	7.6	7.6	8.4
TSS (mg/L)	10	14	15	16
Ammonia-N (mg/L)	0.1			
Total phosphorus (mg/L)	0.5	0.56	0.61	0.66
Cadmium (µg/L)		0.081		0.082
Lead (µg/L)		0.632		0.674
Zinc (µg/L)		40.2		42.3
Non-Critical Season				
CBOD (mg/L)	8.4	12.2	12.9	16.7
TSS (mg/L)	10	15	16	18
Ammonia-N (mg/L)	0.1			
No CEPT non-critical season total phosphorus (mg/L)	2.5	2.78	3.02	3.07

TABLE 5-7
Effluent Assumptions

CEPT non-critical season total phosphorus (mg/L)	0.7	0.83	0.89	0.93				
No CEPT non-critical season:								
Cadmium (µg/L)		0.089		0.103				
Lead (µg/L)		0.912		1.15				
Zinc (µg/L)		58		64.9				
CEPT non-critical season:								
Cadmium (µg/L)		0.101		0.101				
Lead (µg/L)		0.653		0.69				
Zinc (µg/L)		49.5		51.9				
PCBs (pg/L)	600							
	Membrane Filtration Effluent Concentrations				**Conventional Filtration Effluent Concentrations**			
NLT Effluent Concentrations	**Average**	**Maximum 30-Days**	**Maximum 7-Days**	**Maximum Day**	**Average**	**Maximum 30-Days**	**Maximum 7-Days**	**Maximum Day**
CBOD (mg/L)	0.8				0.9			
TSS (mg/L)	0.3				2.0			
Ammonia-N (mg/L)	0.1				0.1			
Total phosphorus (mg/L)	0.018				0.030			
Cadmium (µg/L)		0.081		0.082		0.081		0.082
Lead (µg/L)		0.506		0.539		0.506		0.539
Zinc (µg/L)		37.0		38.9		37.0		38.9
PCBs (pg/L)[a]	170				170			

[a] It is only coincidental that the average of the data is 170 pg/L, the same as the regulatory standard.
pg/L = picograms per liter

NLT Effluent. Except for ammonia, effluent assumptions for membrane filtration and conventional filtration effluent were based on the NLT pilot study results provided by Esvelt Engineering. Secondary effluent ammonia concentration was assumed for NLT effluent because ammonia is soluble and not removed by either membrane filtration or conventional filtration. Both processes remove particulates, and ammonia is not precipitated or adsorbed by the chemical coagulant used for phosphorus removal.

5.3.2.3 Estimation of Treated CSO and Secondary Effluent

Treated CSO and secondary effluent were estimated for the year 2030 flows for the 100-mgd conventional filtration option and the 50-mgd membrane option. Historical flows to RPWRF for the period 2002-2011 were adjusted for implementation of the CSO Program and limiting the peak flow in Interceptor No. 2 to 120 mgd. Additional adjustments to these flows were made to account for the flow reduction resulting from operation of the County Facility, continued growth in the City and Spokane County, and water conservation.

Treated CSO was estimated for the conventional filtration option. Secondary effluent was not calculated for the conventional filtration option because the capacity of the filtration process is equal to the primary and secondary treatment processes. The evaluation considers only the influent flow and assumes flow in excess of 100 mgd is diverted to the CSO clarifiers. If the total volume diverted exceeds 4 MG, treated CSO is produced. Collected wastewater in the CSO clarifiers is pumped to the headworks to empty the clarifiers when the influent flow drops below 100 mgd.

Treated CSO and secondary effluent were estimated for the membrane option. Treated CSO occurs when the volume exceeds 2 MG at a flow greater than 125 mgd. Secondary effluent is discharged when the flow to the membranes exceeds membrane capacity. Primary Clarifier No. 5 and Secondary Clarifier No. 5 are normally empty, and the volume of the clarifiers is used to reduce the flow rate to the membranes.

CSO bypass and secondary effluent were calculated for each year for the conditions that occurred in 2002-2011 as a basis to simulate potential year 2030 flows. The purpose is to estimate the volume of treated CSO and secondary effluent in 2030 for each of the 10 conditions simulated using historical flows for the period 2002-2011.

Critical Season Treated CSO. Figure 5-3 shows the results of the analysis to calculate the annual volume of critical season treated CSO in 2030 for the two options simulating the conditions that occurred in 2002-2011. Figure 5-3 shows that critical season treated CSO is much higher for the conventional filtration option with 100-mgd primary and secondary treatment capacity compared with the membrane filtration option with 125-mgd primary and secondary treatment capacity. Maximum critical season treated CSO occurs in 2006, the wettest year in the 10-year period with high precipitation in January, June, and November.

Non-Critical Season Treated CSO. Figure 5-4 shows the results of the analysis for the annual volume of non-critical season treated CSO in 2030 for the two options simulating the conditions that occurred in 2002-2011. Figure 5-4 shows that almost no non-critical season treated CSO is predicted for the membrane filtration option with 125 mgd of primary and secondary treatment capacity. Non-critical season treated CSO in 2030 is predicted to occur with the conventional filtration option in 7 of 10 years with the maximum amount predicted for conditions that occurred in 2004.

Critical Dry Season Treated CSO. Figure 5-5 shows the results of the analysis for the annual volume of treated CSO for the dry season portion of the critical season. Spokane River flows are lowest during the dry season, which is July through September. Figure 5-5 shows that no treated CSO is predicted for the membrane filtration option during the dry season. Treated CSO is predicted to occur for the conditions that existed in 2002 and 2010 during the dry season for the conventional filtration option. The volume of treated CSO is small and operation of the CSO storage tank regulators may eliminate these by reducing the rate of discharge to I-02.

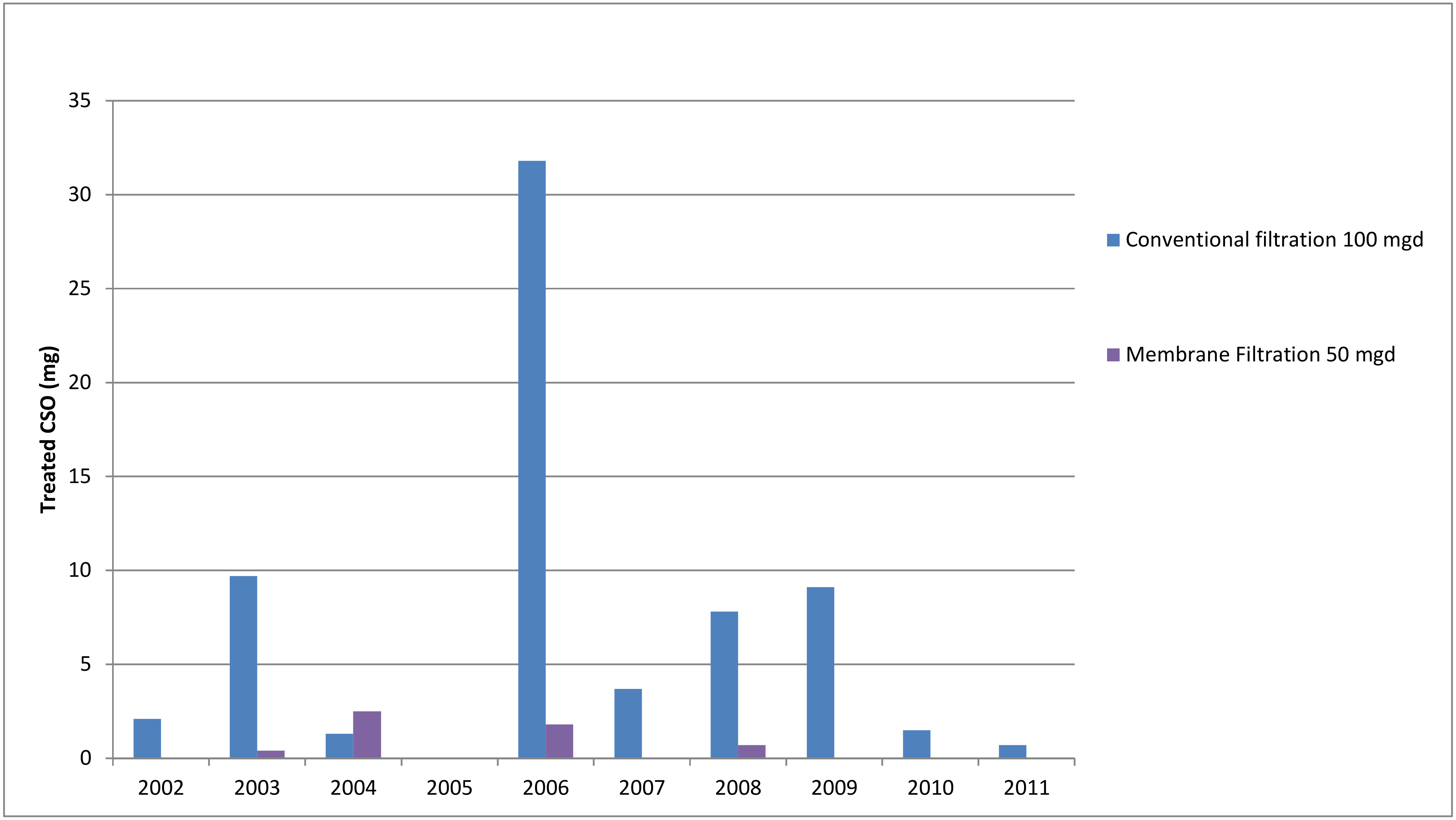


FIGURE 5-3
2030 Critical Season Treated CSO for 2002-2011 Simulated Flows

CH2MHILL

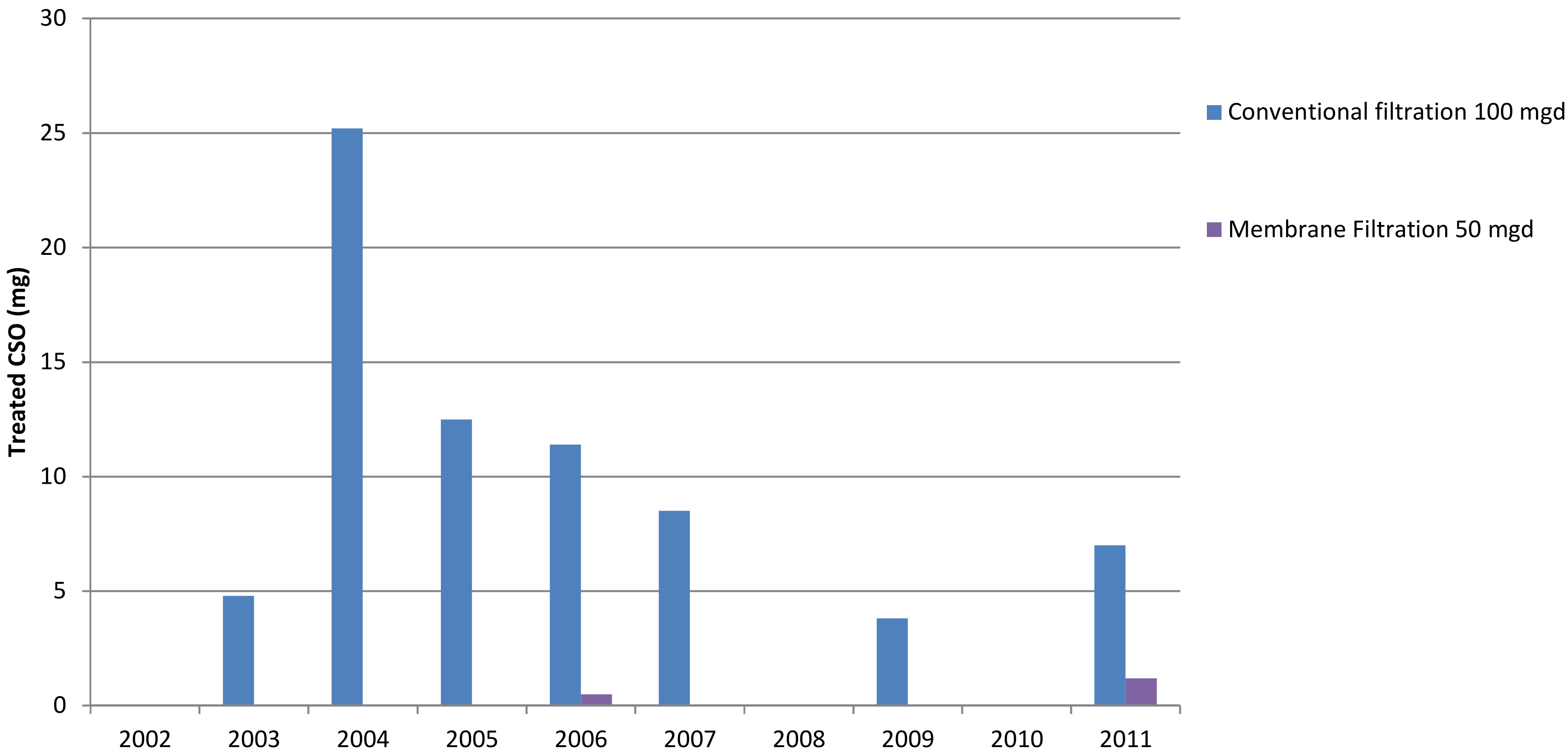


FIGURE 5-4
2030 Non-Critical Season Treated CSO for 2002-2011 Simulated Flows

CH2MHILL

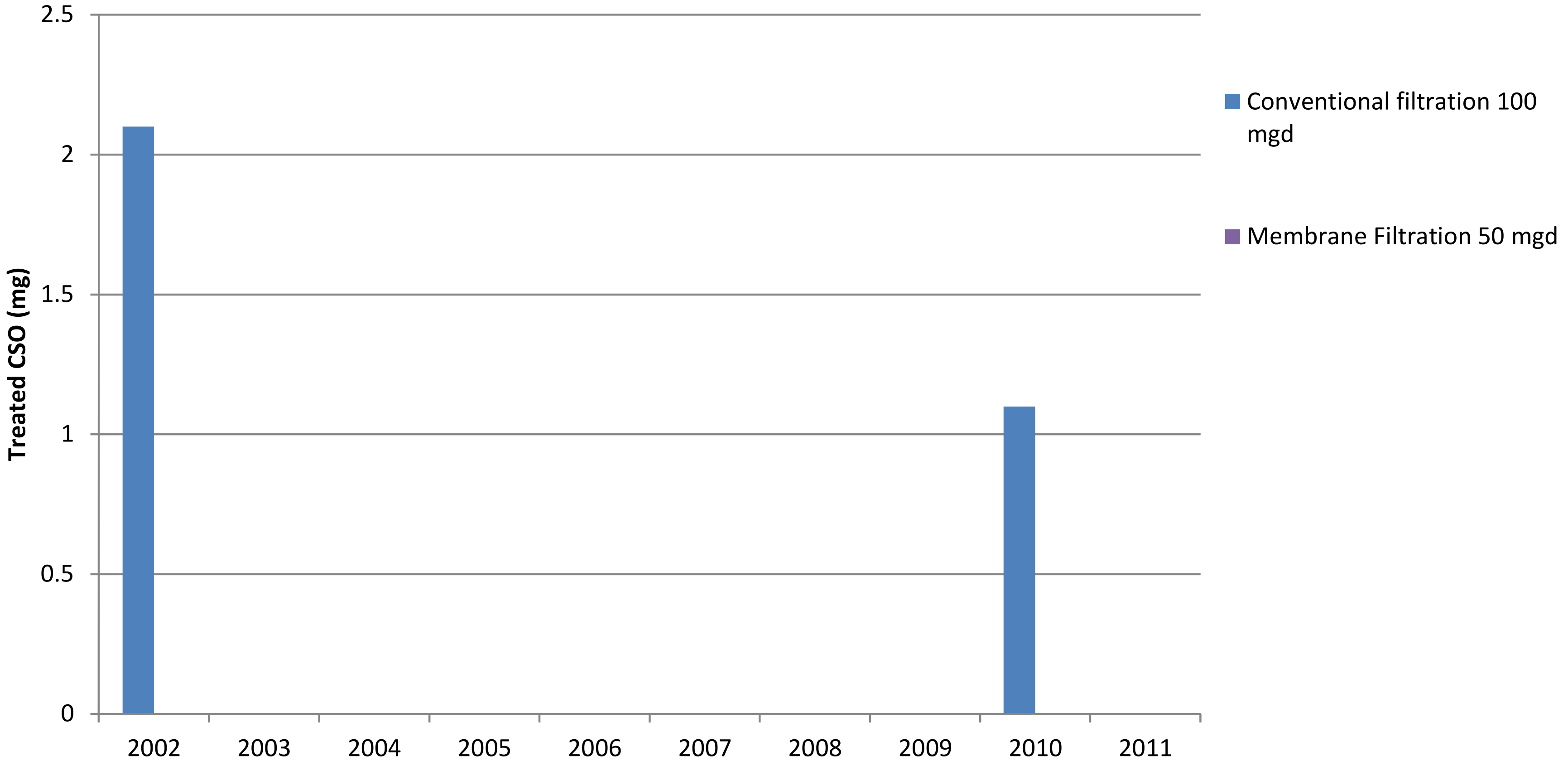


FIGURE 5-5
2030 Critical Dry Season Treated CSO for 2002-2011 Simulated Flows

CH2MHILL.

Secondary Effluent. Figure 5-6 shows the results of the analysis for the annual volume of secondary effluent for the membrane filtration option. The capacity of the conventional filtration option is equal to the primary and secondary treatment facilities and does not produce any secondary effluent in the critical season. Figure 5-6 shows the annual volume of secondary effluent predicted in 2030 varies from almost zero in low-flow years to approximately 300 MG for the conditions that occurred in the highest-flow year of 2011. For conditions that occurred in 2011, secondary effluent in 2030 would be about 2.9 percent of the total critical season flow. The average secondary effluent predicted is about 1.0 percent of the total critical season flow and this varies from 0.1 percent to 2.9 percent. 2008 was another high-flow year associated with high Spokane River flow, but the 2030 predicted annual volume of secondary effluent for this condition is about half of 2011. For conditions observed in 2006, the highest precipitation year, 2030 secondary effluent is predicted to be about half the volume of secondary effluent in 2008.

Figure 5-7 shows the results of the analysis for the annual volume of secondary effluent discharged during the dry season portion of the critical season. Critical season secondary effluent results from one or two high-intensity precipitation events each year.

Comparison of Secondary Effluent Discharged During the Critical Season and Spokane River Flow. In addition to calculating the annual volume of secondary effluent discharged during the critical season, the timing of discharges and concurrent Spokane River flows were evaluated. Figures 5-8 to 5-17 show daily volumes of secondary effluent discharged, average daily Spokane River flow, and 2030 average RPWRF influent flow. Review of the figures shows several things:

- Most of the secondary effluent discharges would occur when Spokane River flows are high (greater than 20,000 cfs) and would occur for an extended period in May and June.
- Secondary effluent discharges associated with precipitation would be short duration.
- Very little secondary effluent would be discharged in the dry season (July to October) when Spokane River flows are low, even in years with high Spokane River flows in May and June.

Approaches to Reduce Discharge of Secondary Effluent During the Critical Season. This section is applicable only to the membrane filtration option because the conventional filtration option treats all the secondary effluent (i.e., less than 100 mgd). The discussion that follows is relevant only to the membrane filtration option for NLT.

The City wants to phase construction of membranes and greatly reduce and eventually eliminate discharge of secondary effluent during the critical season. The City recognizes that discharge of secondary effluent during the critical season is not ideal, but does not want to pay the high cost of providing membrane treatment capacity for occasional excessive I/I related to high Spokane River flows, particularly when there are opportunities to reduce discharge of secondary effluent that provide multiple benefits and may cost less.

The first approach is reduction of I/I and particularly I/I associated with high Spokane River flows. Reduction of I/I provides the benefits of capacity in the interceptor and RPWRF for additional customers and potentially lower overall per capita cost. The City is planning a more aggressive I/I correction program and is budgeting for additional work to identify and correct sources of I/I.

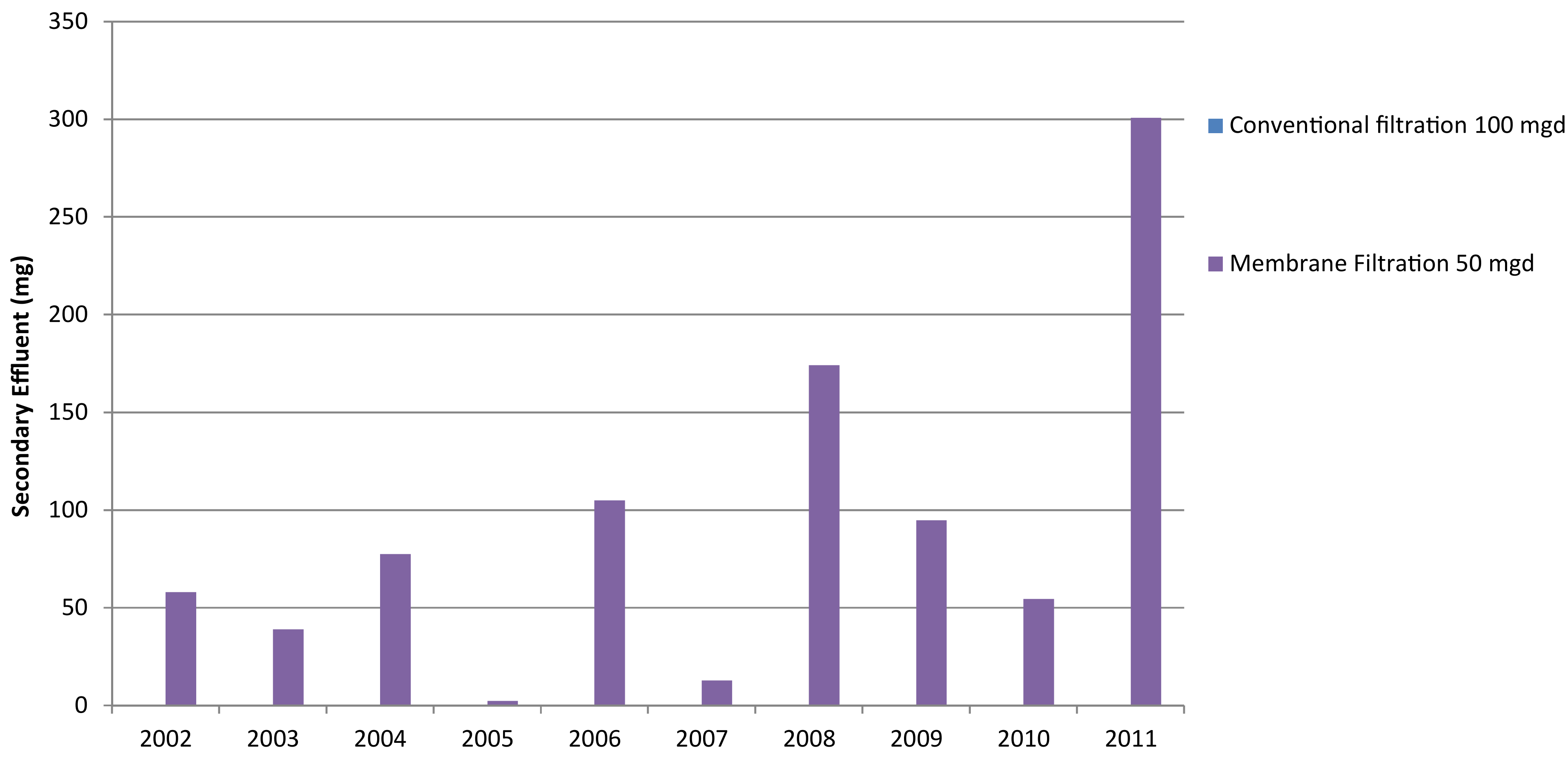


FIGURE 5-6
2030 Critical Season Secondary Effluent for 2002-2011 Simulated Flows

CH2MHILL

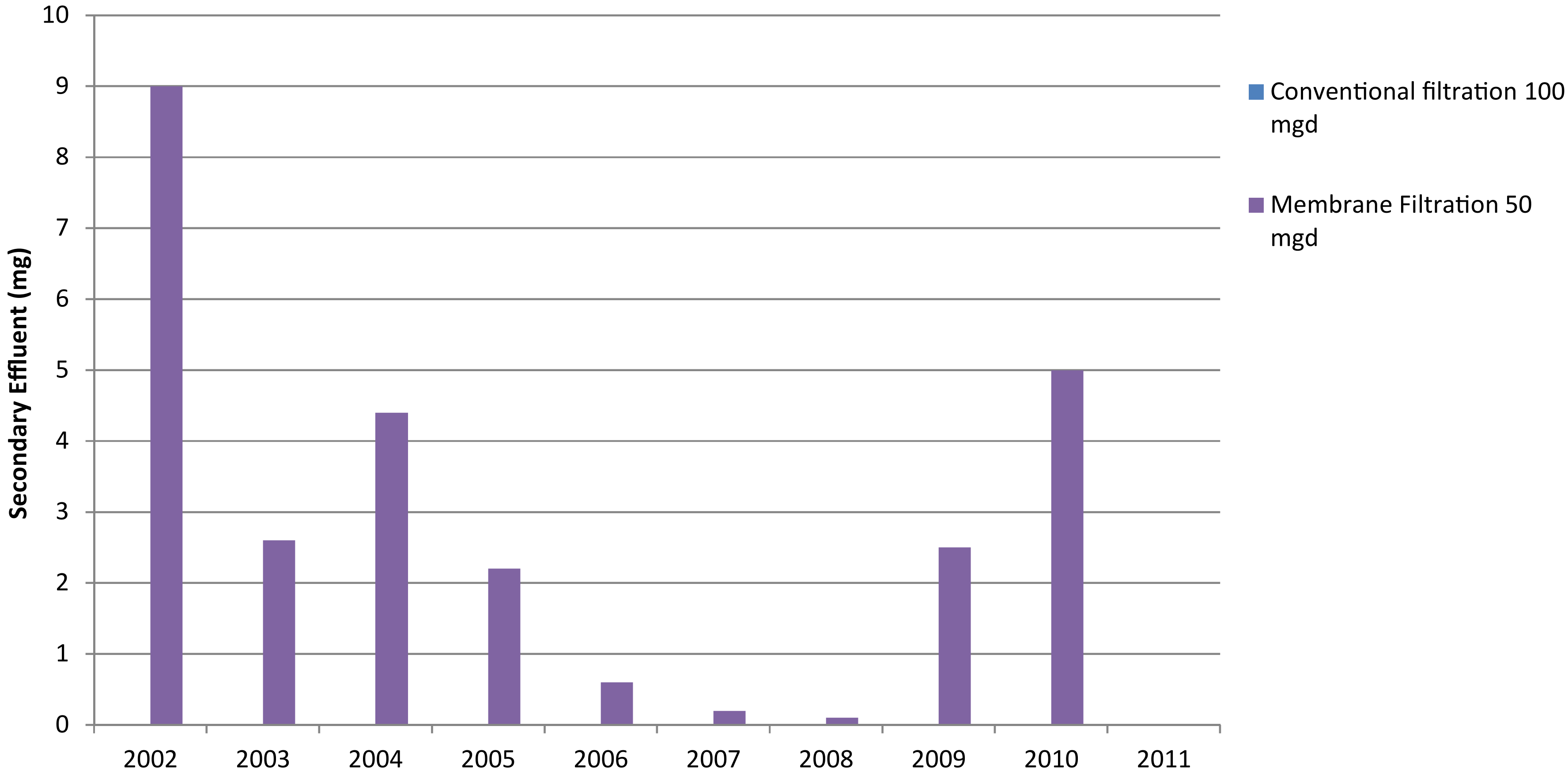


FIGURE 5-7
2030 Dry Season Secondary Effluent for 2002-2011 Simulated Flows

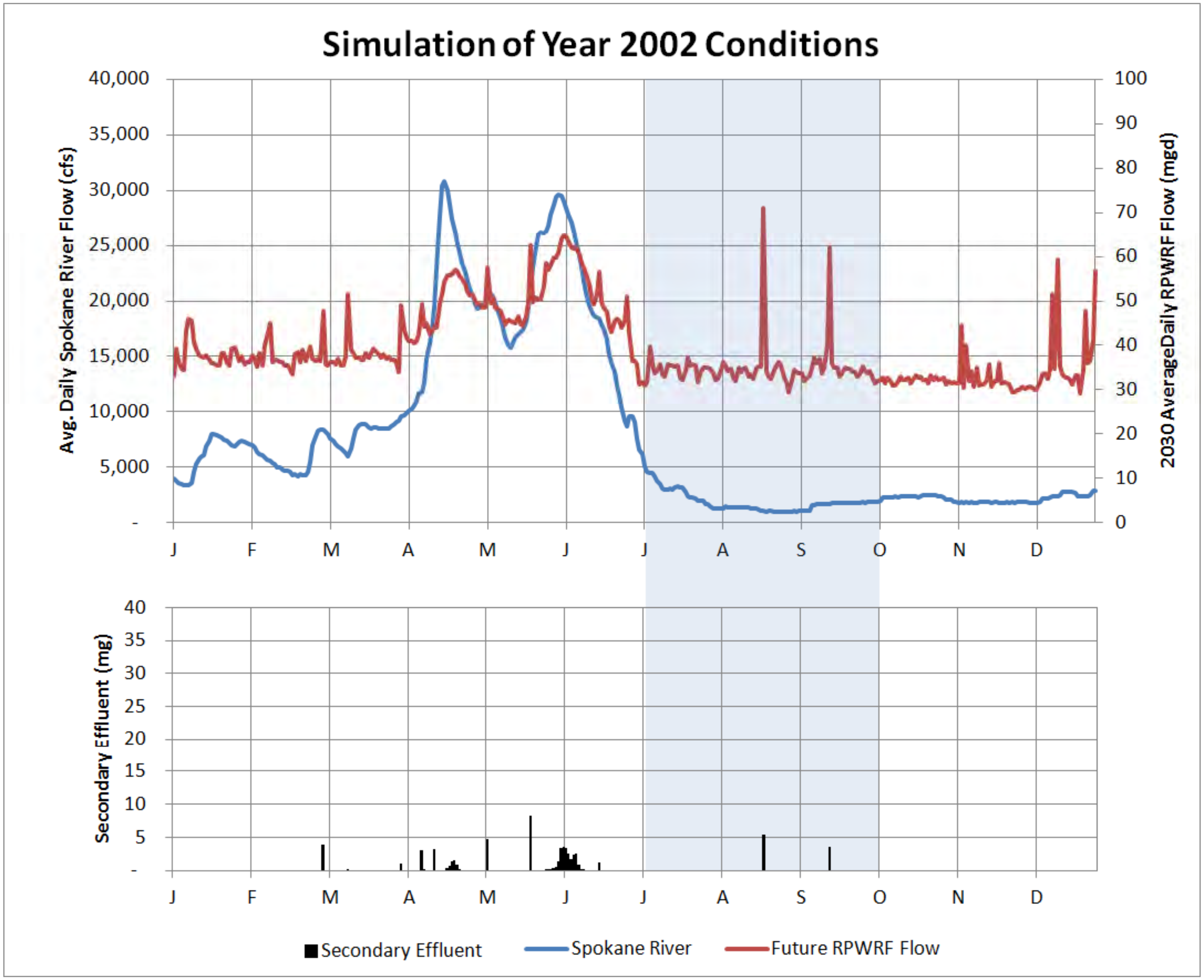


FIGURE 5-8
Simulation of Year 2002 Conditions

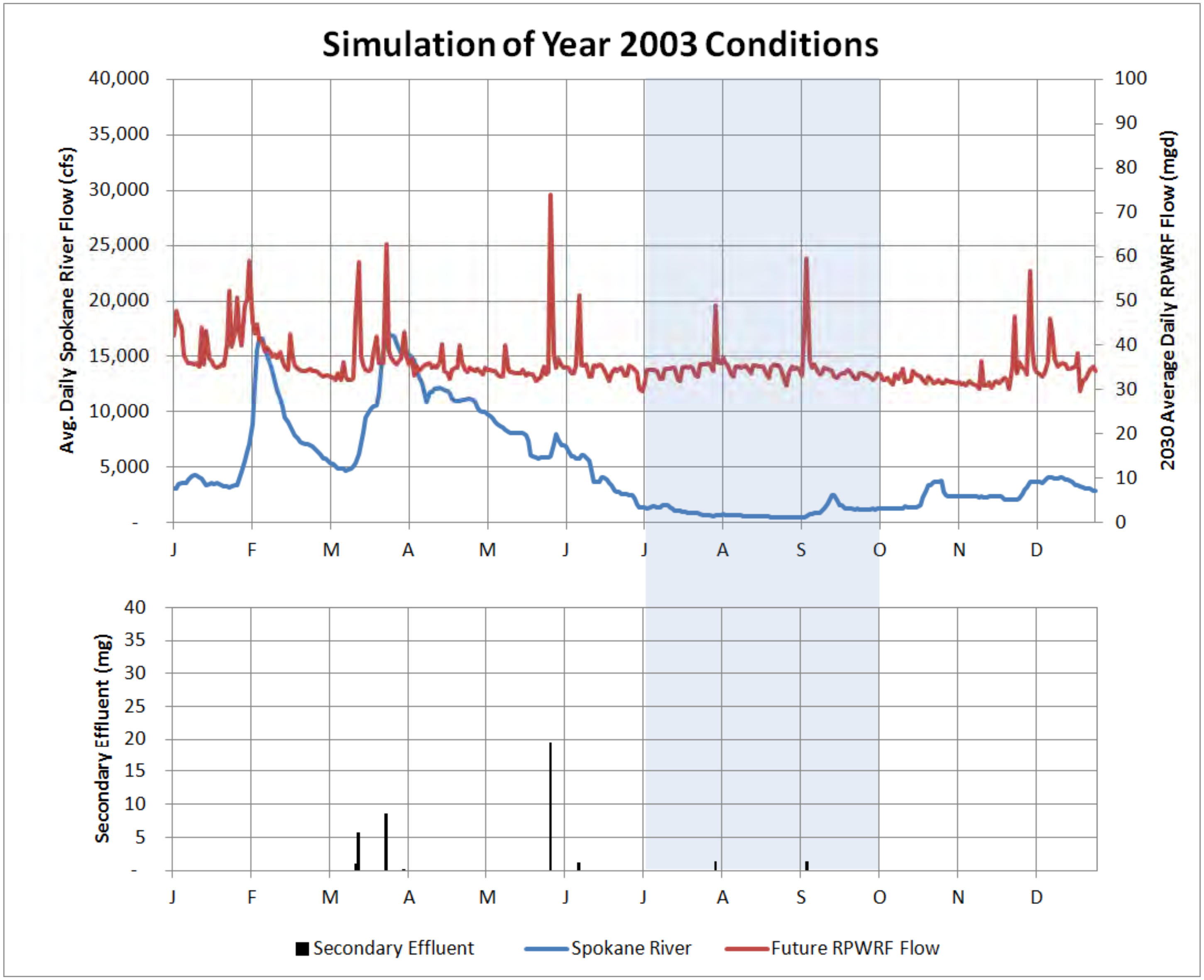


FIGURE 5-9
Simulation of Year 2003 Conditions

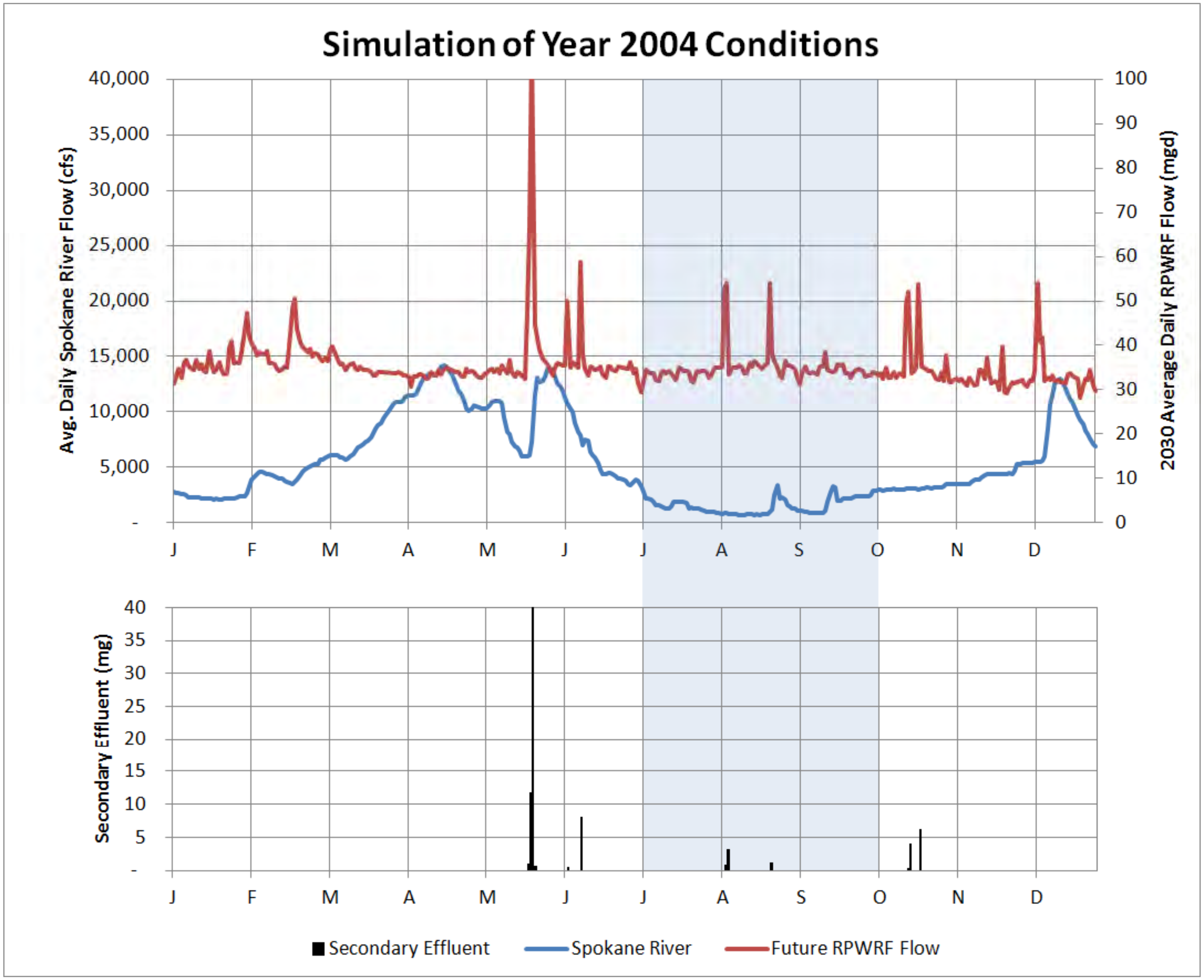


FIGURE 5-10

Simulation of Year 2004 Conditions

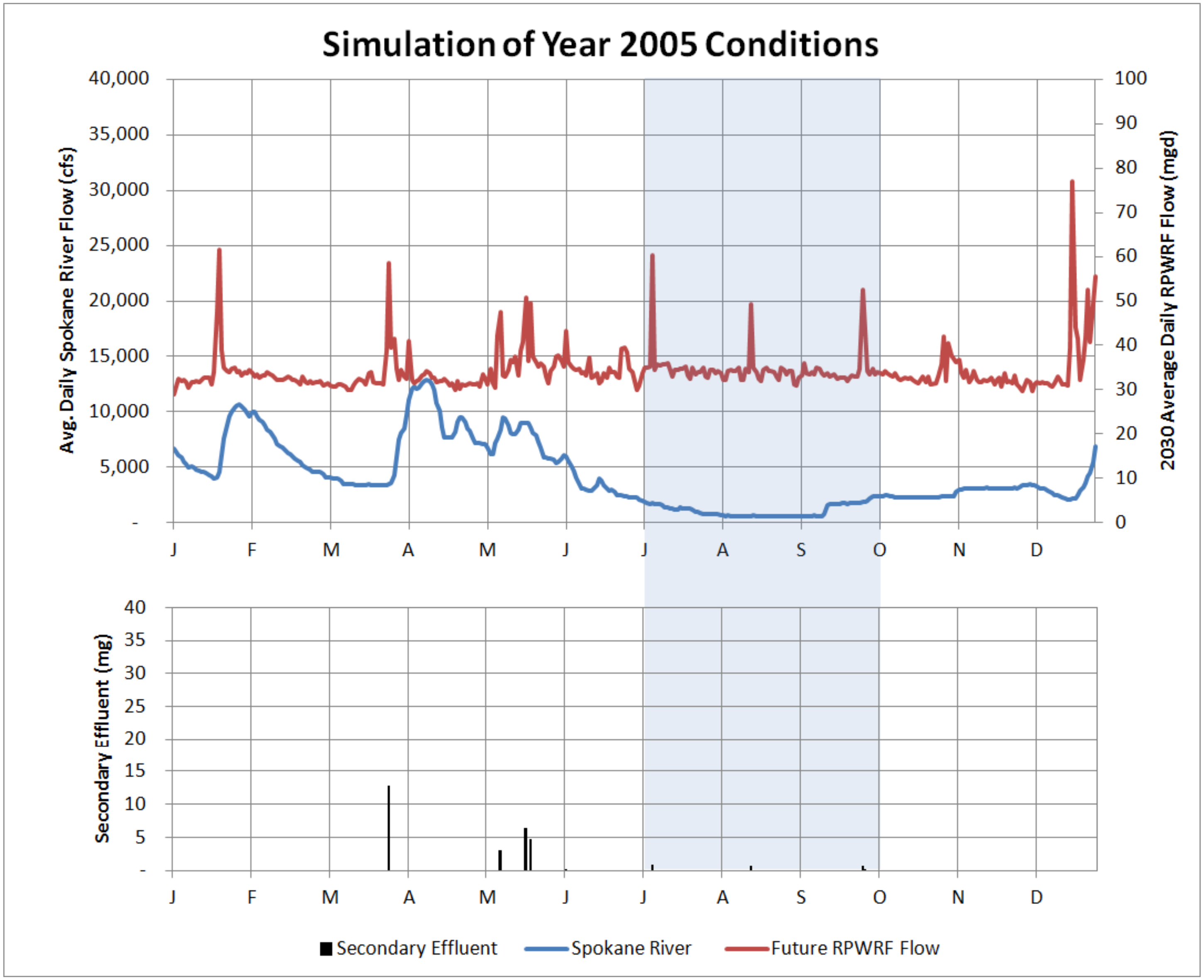


FIGURE 5-11
Simulation of Year 2005 Conditions

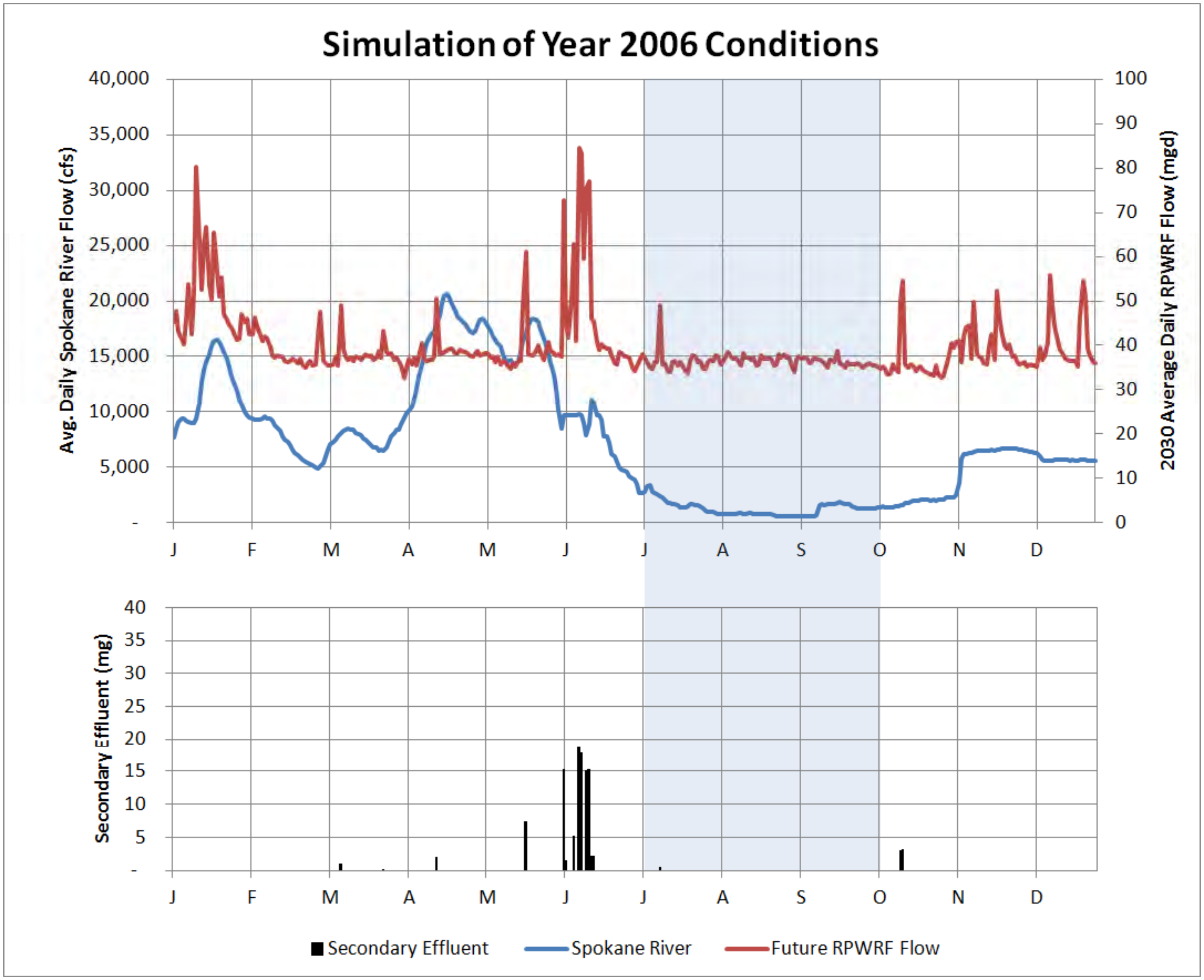


FIGURE 5-12
Simulation of Year 2006 Conditions

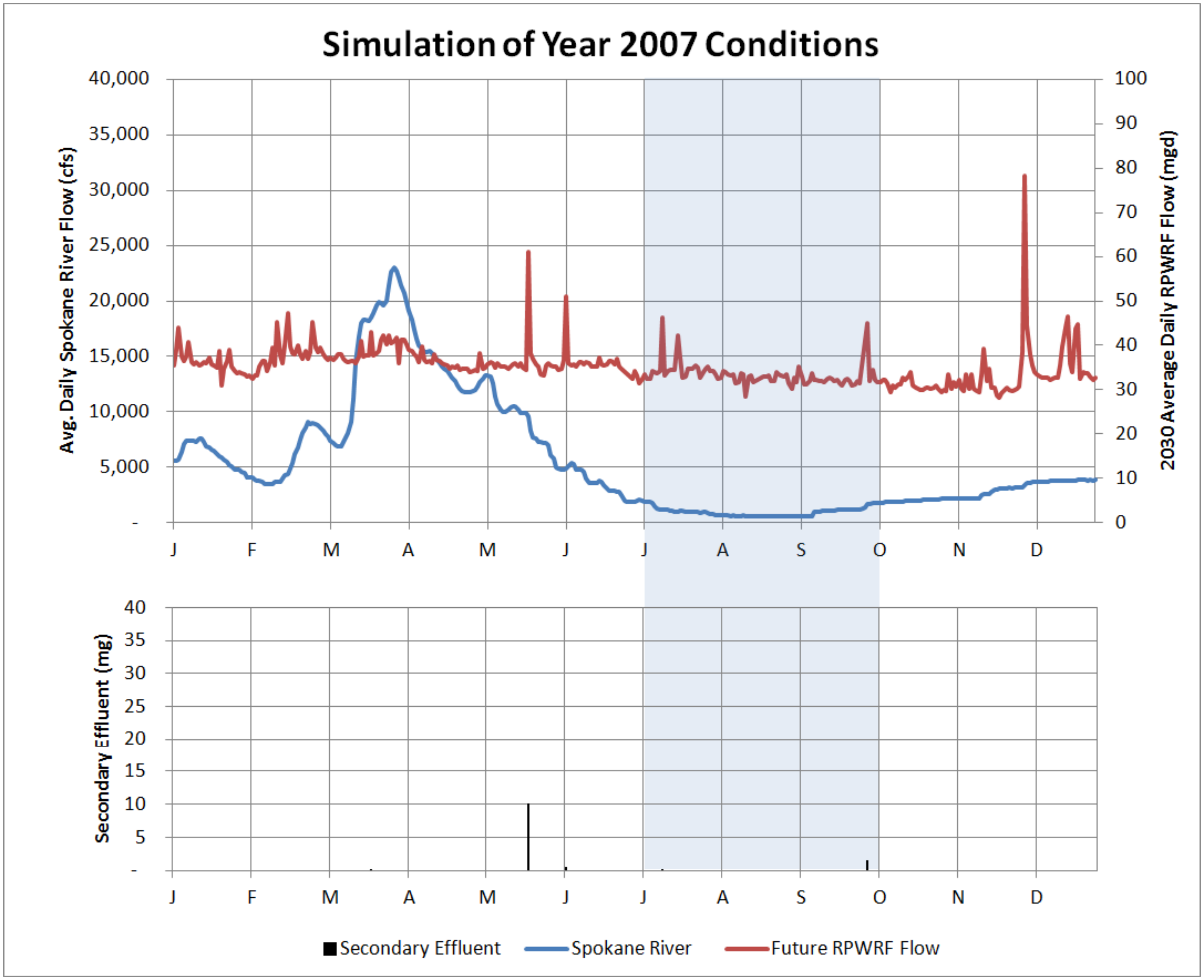


FIGURE 5-13
Simulation of Year 2007 Conditions

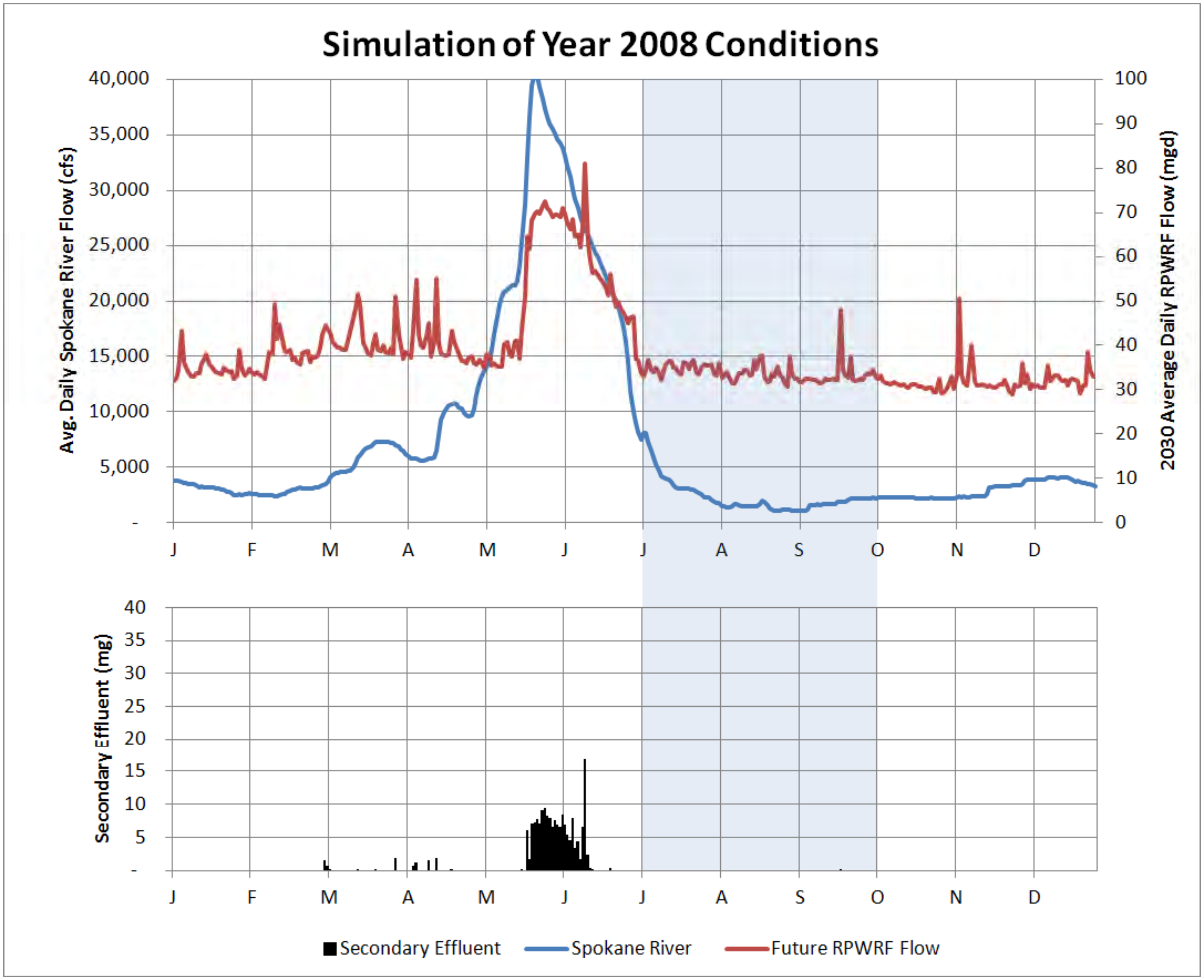


FIGURE 5-14
Simulation of Year 2008 Conditions

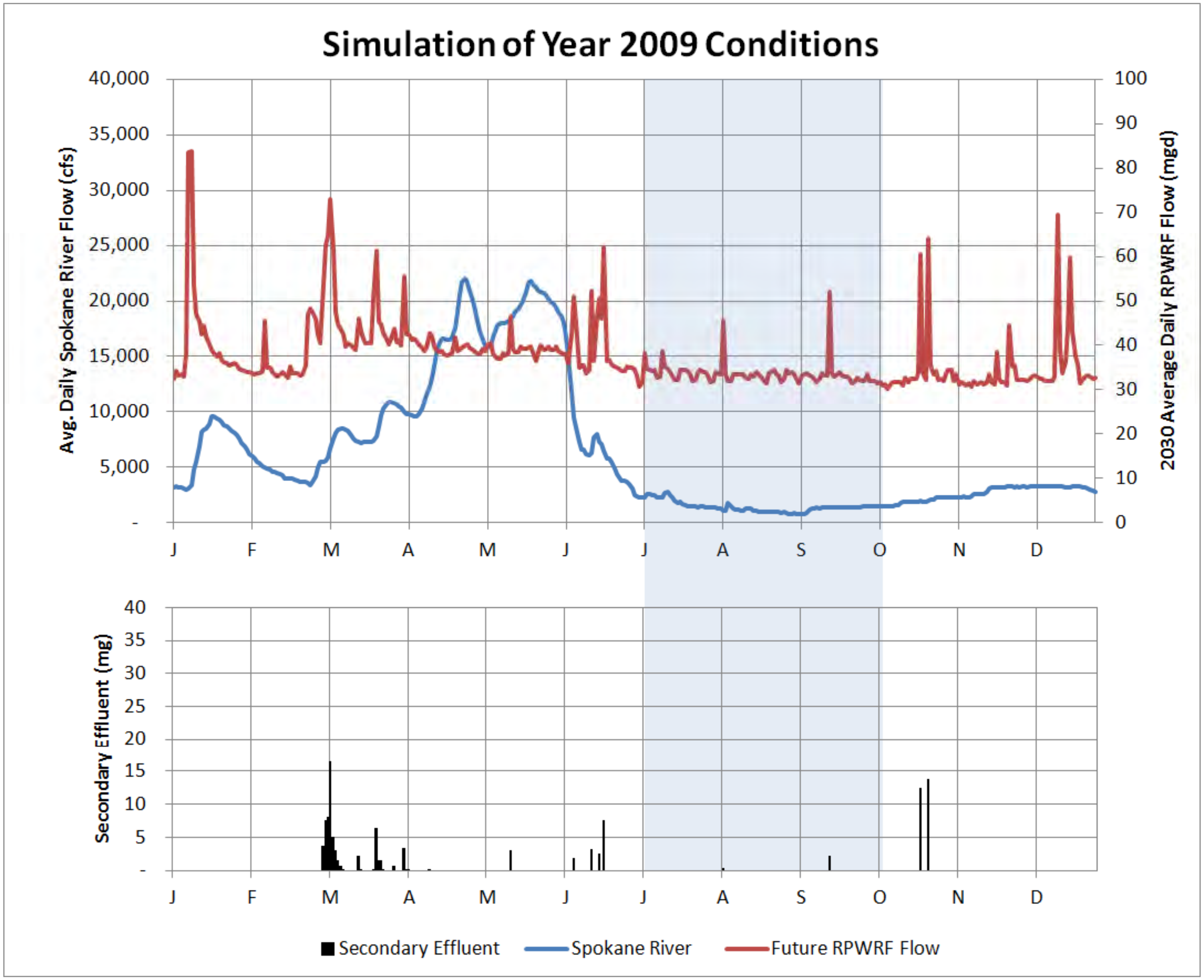


FIGURE 5-15
Simulation of Year 2009 Conditions

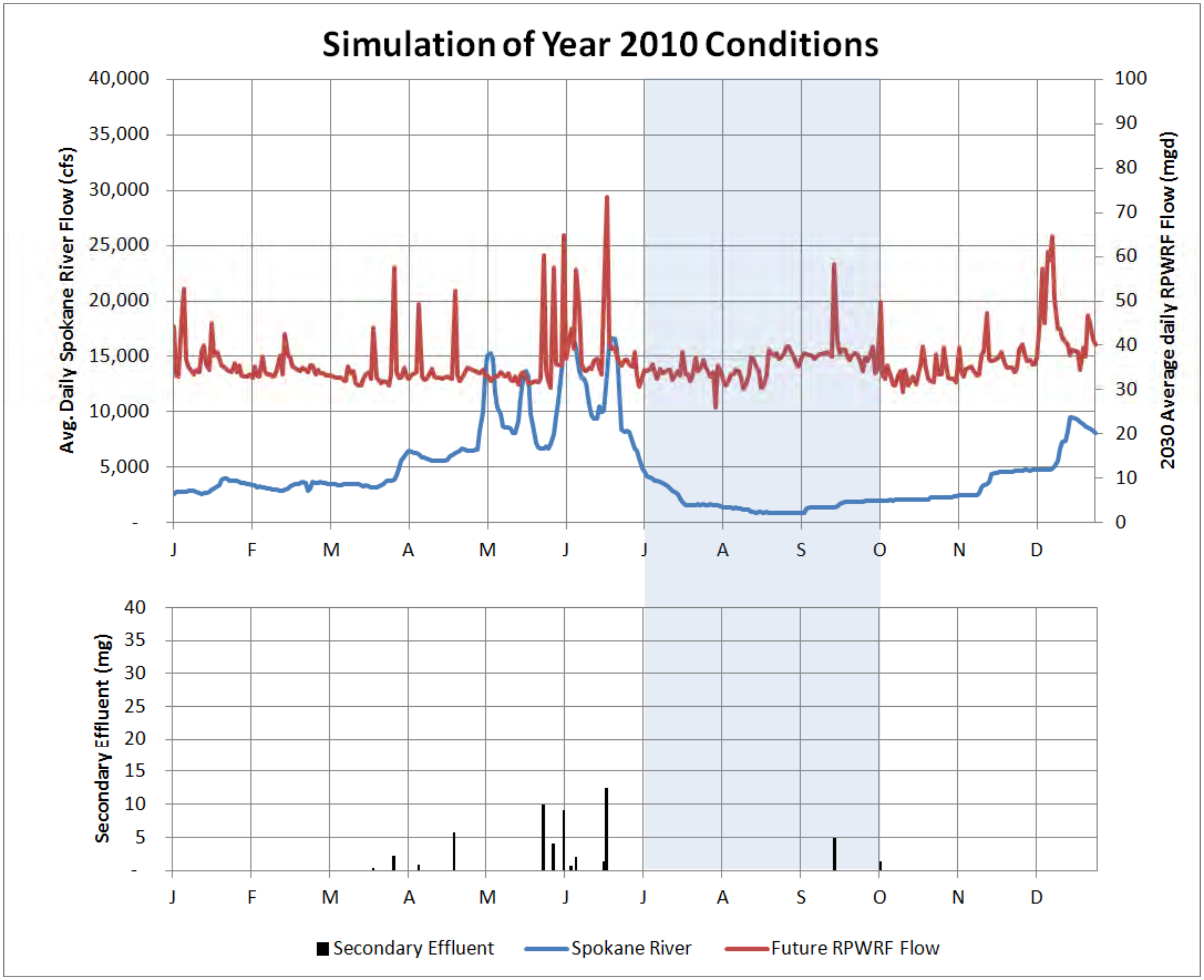


FIGURE 5-16
Simulation of Year 2010 Conditions

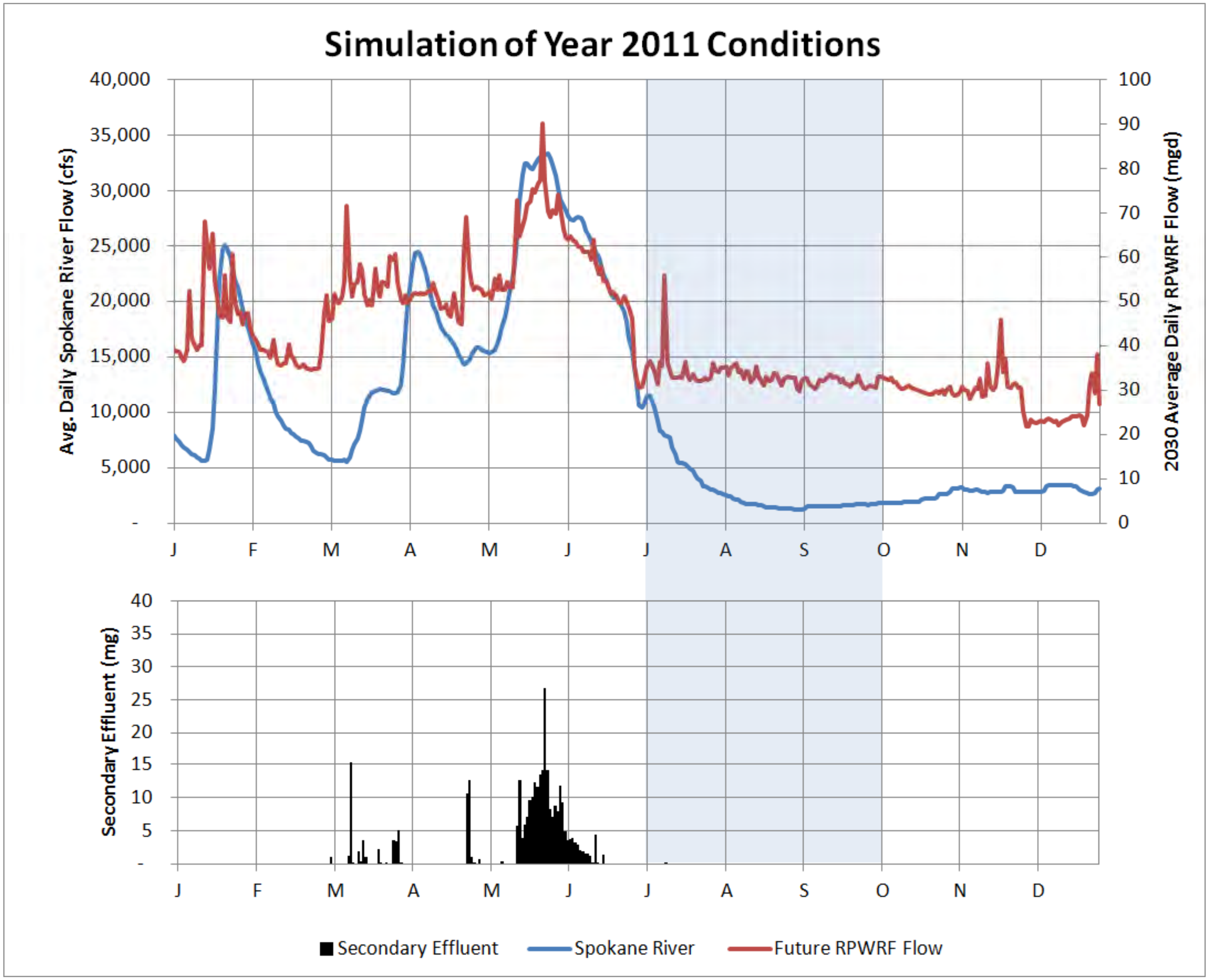


FIGURE 5-17
Simulation of Year 2011 Conditions

Second, while it is necessary to design the membrane facilities with the appropriate conservatism and redundancy, it is likely that actual operation of the NLT facilities will treat more secondary effluent and reduce the volume of secondary effluent discharged to the Spokane River during the critical season. A redundant membrane train is provided and assumed to not operate to evaluate compliance with the NPDES permit and the net environmental benefit analysis, but it is expected that this membrane train will be available much of the time and will be used to treat secondary effluent, reducing the amount of secondary effluent discharged to the Spokane River. Additionally, it is possible that experience will show that the membranes can be operated at higher flux rates and allow treatment of more secondary effluent, reducing the amount of secondary effluent discharged to the Spokane River.

Third, the City may implement a more aggressive water conservation program. The water conservation measures assumed in the development of design flows are based on national studies of water conservation, which considered reductions of water use due to gradual replacement of toilets, faucets, dishwashers, washing machines, etc. with more efficient appliances required by the current plumbing code and energy regulations. Water conservation can be accelerated by incentive programs as has been demonstrated by the LOTT wastewater utility in the Olympia, Washington, area. Currently, the City has no plans to implement a more aggressive water conservation program. If studies of options to reduce flows to the RPWRF show water conservation is cost-effective compared to other options, the City may implement an aggressive water conservation program in the future.

Fourth, the design of the CSO regulators may be able to adjust the rate of discharge to I-02 to minimize the discharge of secondary effluent at RPWRF while meeting CSO objectives. Design of the CSO regulators has not begun, and this should be a potential objective of their design.

Fifth, the City is committed to reducing stormwater when making street improvements. The City recognizes the multiple benefits of reducing stormwater and will investigate the potential with every street improvement.

There are undoubtedly many other opportunities that will be identified in the Integrated Clean Water Plan. Ideas like green roofs, permeable pavement, and elimination of building groundwater sump pump discharge will be discussed.

Overall, there are many opportunities to reduce flows to RPWRF that may greatly reduce and potentially eliminate discharge of secondary effluent to the Spokane River that will allow the City to phase construction of membranes. The membrane facility will be designed to allow expansion of capacity to allow elimination of secondary effluent if the flow reduction efforts are not sufficient by themselves.

The City will begin investigating alternatives to reduce flows to RPWRF immediately to improve knowledge of effectiveness and costs of flow-reduction alternatives. When critical season total phosphorus reaches 85 percent of the NPDES permit limit after the NLT facilities are optimized, the City will submit a plan to Ecology to show how the City will consistently meet the total phosphorus limit for RPWRF in the critical season. The plan will evaluate flow reduction using cost-effective measures from the previous list of alternatives compared to expansion of the NLT facilities and further optimization of the NLT facilities.

5.3.2.4 Estimation of Treated Effluent Quality for Both Options and for NPDES Compliance

Effluent quality was estimated for both options to determine compliance with the future NPDES permit. The future NPDES permit conditions are assumed to be the future permit conditions summarized in Chapter 3 that are effective March 1, 2018. This permit has requirements for CBOD, TSS, ammonia, total phosphorus, cadmium, lead, and zinc. Numerical limits have not been established for PCBs, but there is strong interest in PCBs and it is likely that numerical limits will be established in the future, so quantities of PCBs discharged were calculated for both options. The calculations are based on the flows predicted to occur in the year 2030. As has been discussed previously, the actual flow in the year 2030 cannot be predicted and could vary a great deal depending on Spokane River flow and precipitation in that year. Simulations of the potential flows in 2030 were used to predict future flows based on the actual flows observed at RPWRF for the period

2002-2011. This resulted in predictions of the quantity of treated CSO, secondary effluent, and NLT effluent in the year 2030 for each simulated flow condition. Section 5.3.2.2 described the effluent assumptions for each of these effluents. Effluent quality was calculated for each option by applying the effluent assumptions to the volume of each type of effluent and summing them to estimate the combined effluent.

CBOD. Both options are predicted to meet the seasonal limit for CBOD. The seasonal discharge is predicted to be less than 20 percent of the seasonal limit for both options.

TSS. Both options are predicted to meet the monthly and weekly permit requirements for TSS in the critical and non-critical seasons. NLT is not assumed to operate in the non-critical season, but the evaluation also calculated compliance with the estimated treated CSO and secondary effluent.

Ammonia. Ammonia removal is not improved by NLT since ammonia is soluble and NLT removes particulates and dissolved chemicals that are precipitated by alum. Both options are predicted to meet the critical season seasonal limit for ammonia.

Total Phosphorus. Both options are predicted to meet the seasonal limit for total phosphorus. The maximum predicted phosphorus discharged in 2011 due to high flows is 80 percent of the NPDES seasonal permit limit. In most years, total phosphorus discharged is about 50 percent of the seasonal NPDES permit limit.

Cadmium. Monthly permit exceedances are predicted to occur for cadmium in the critical and non-critical season based on effluent limits contained in the current NPDES permit for the year 2018. Ecology will review and revise effluent limits for metals, if necessary, during future permit cycles. The criteria for revision will be based on guidance provided in the *Water Quality Program Permit Writers Manual* (Ecology, 2011). NLT was not found to remove additional cadmium in the NLT pilot study, and this finding does not affect the selection of NLT processes. Review of the past 10 years of effluent cadmium data for RPWRF indicates that effluent cadmium concentrations have decreased. Review of data for the period July 1, 2011, to September 1, 2013, indicates RPWRF has exceeded monthly limits 2 times, and in the future, NPDES requirements reduce the non-critical limits to the current dry season limits, which would have caused 6 exceedances in the same period. No exceedances have occurred or would occur in the future for daily concentrations.

Lead. Membrane filtration is predicted to comply with lead permit limits and the conventional filtration option is predicted to have one exceedance of the daily permit limits based on effluent limits contained in the current NPDES permit for the year 2018. Ecology will review and revise effluent limits for metals, if necessary, during future permit cycles. The criteria for revision will be based on guidance provided in the Permit Writers Manual. No exceedances have been observed with the current NPDES limits. With future NPDES permit limits, RPWRF would have exceeded the monthly limit for one month. The one daily exceedance is a low-probability occurrence because it is predicted to occur only one out of 10 years and is based on the 90th percentile lead concentration occurring during a treated CSO discharge, which might not be sampled because few samples are taken per month.

Zinc. Monthly permit exceedances are predicted for zinc in the non-critical season for both options based on effluent limits contained in the current NPDES permit for the year 2018. Ecology will review and revise effluent limits for metals, if necessary, during future permit cycles. The criteria for revision will be based on guidance provided in the Permit Writers Manual. Based on the July 1, 2011, to September 1, 2013, time period, no daily or monthly exceedances have been observed with the current NPDES limits or are expected with the future NPDES limits. NLT is not operating in the non-critical season and the exceedance does not affect the selection of the NLT processes. The NLT pilot study found both filters and membranes removed zinc equally. Similar to cadmium, a review of RPWRF effluent zinc concentrations indicates zinc concentrations have been decreasing since 2001.

PCBs. PCB removal was found to be the same for the conventional filtration and membrane filtration processes. Differences in effluent PCBs discharged result from different volumes of treated CSO and secondary effluent discharged. PCBs are estimated annually since PCBs are not subject to seasonal factors developed for the dissolved oxygen TMDL.

Conclusions. Both options would comply with the NPDES permit with an adequate factor of safety in the year 2030 using simulated flows for conditions observed in the period 2002-2011. Monthly exceedances are predicted for cadmium in the critical and non-critical seasons and zinc in the non-critical season. The predicted cadmium and zinc permit exceedances will occur equally for both options and are not related to the selection of the NLT treatment alternative.

5.3.2.5 Net Environmental Benefit Evaluation

This section describes the comparison of the two options in terms of the three parameters of greatest interest: CBOD, total phosphorus, and PCBs. CBOD and total phosphorus requirements are identified in the dissolved oxygen TMDL for the Spokane River. PCBs are a major concern that will likely be regulated with numerical limits in the future.

CBOD. Figure 5-18 shows the predicted annual critical season discharge of CBOD for both options in the year 2030 based on simulated flows for the conditions observed in 2002-2011. It shows that predicted CBOD discharged is much lower than the seasonal limit for both options for the conditions simulated in all 10 years. 50-mgd membranes are predicted to discharge slightly less CBOD than 100-mgd filters most years. Membranes are predicted to discharge more CBOD in the flow condition simulated for 2011, which is a high-flow year.

Figure 5-19 shows the sum of all 10 years of simulated conditions. Membranes are predicted to discharge about 9 percent less CBOD than the larger size filters. This difference is not significant given the discharge of CBOD is only about 20 percent of the seasonal NPDES permit limit.

Total Phosphorus. Figure 5-20 shows the predicted annual critical season discharge of total phosphorus for both options in the year 2030 based on simulated flows for the conditions observed in 2002-2011. Both options are predicted to discharge much less total phosphorus than the seasonal limit. For 2030 flows simulated using 2011 conditions, 50-mgd membranes are predicted to discharge the most total phosphorus of all the conditions simulated and this is about 80 percent of the seasonal limit.

Figure 5-21 shows the sum of all 10 years of simulated conditions. Membranes are predicted to discharge about 20 percent less phosphorus on average than filters. This difference is significant and represents about 2 years total discharge of total phosphorus.

Figure 5-22 shows predicted total phosphorus discharge in the dry season portion of the critical season. This figure shows that the difference is much more pronounced in the dry season when Spokane River flows are lowest. During the dry season, membrane discharge of total phosphorus is 35 percent less than filters. This results from the earlier finding that secondary effluent discharge from 50 mgd of membranes is greatest when Spokane River flow is greater than 20,000 cfs.

PCBs. Figure 5-23 shows the predicted annual discharge of PCBs for both options in the year 2030 based on simulated flows for the conditions observed in 2002-2011. Both options are predicted to discharge similar quantities of PCBs. The NLT pilot study found both options have the same PCB removal effectiveness, so the differences are not due to the selection of technology. Filters will have larger volumes of treated CSO because the primary and secondary treatment capacity is less. Treated CSO has the highest concentration of PCBs of all the effluents produced. This is most significant in years with high volumes of CSO as simulated for 2006. Membranes will have higher volumes of secondary effluent for years of high Spokane River flow as simulated for 2008 and 2011. NLT is not assumed to operate in the non-critical season and both options are assumed to produce secondary effluent. Figure 5-24 shows the sum of all 10 years of simulated conditions. 50-mgd membranes are predicted to discharge about 0.09 gram less PCBs on average than 100-mgd filters for a 10-year period, or 0.009 gram per year. This is about a 0.06 percent different.

The membrane filtration option provides net environmental benefit compared to the conventional filtration option based on total phosphorus removal. The membrane filtration option removes 20 percent more phosphorus on average and 35 percent more during the dry season when Spokane River flows are lowest. Secondary effluent discharge that occurs when the membrane capacity is exceeded is most significant when Spokane River flows exceed 20,000 cfs. CBOD is estimated to be slightly lower for the membrane filtration option than the conventional filtration option, but the difference is not significant. PCB removal is very slightly lower for the membrane filtration option, but the difference is insignificant.

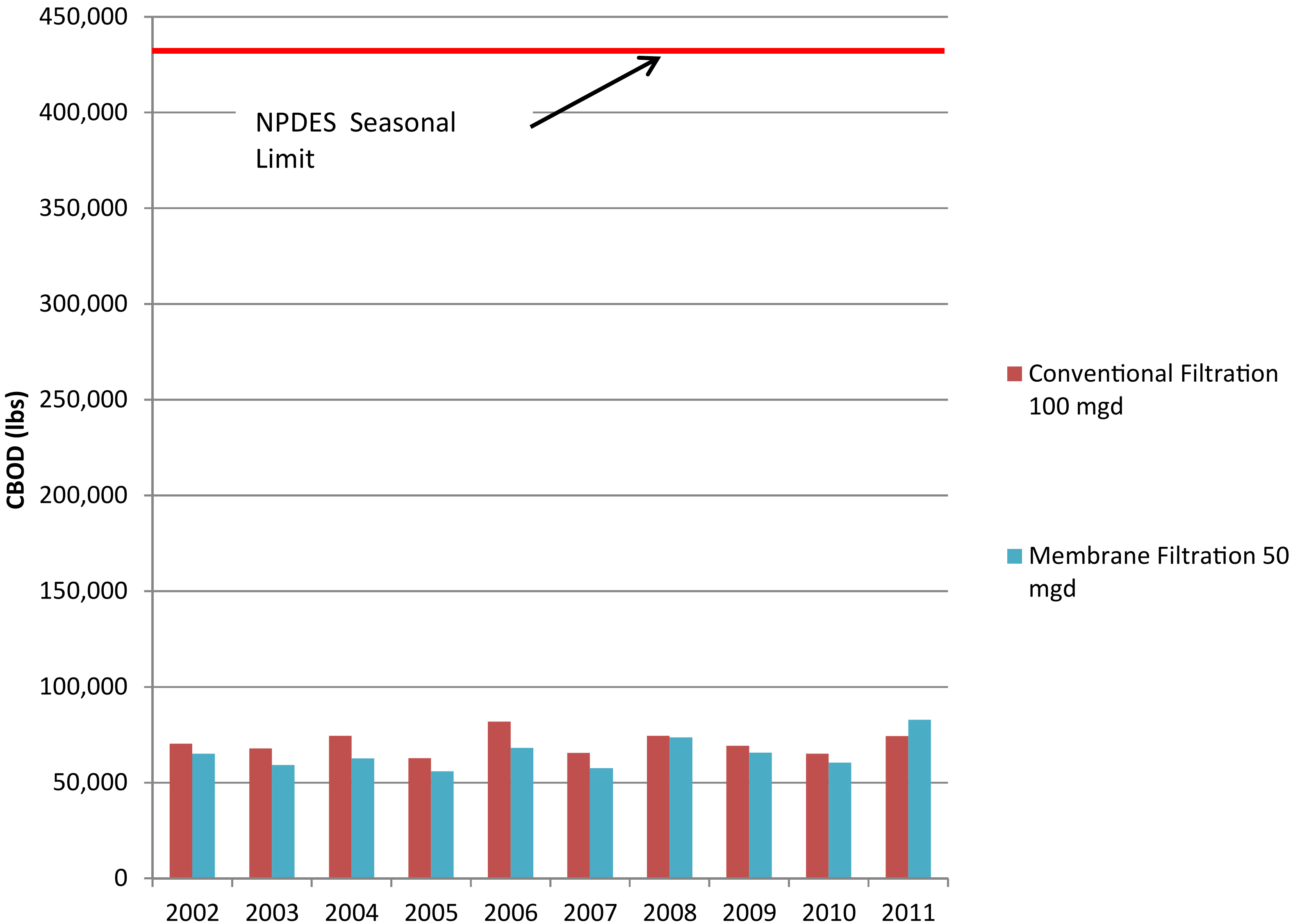


FIGURE 5-18
Year 2030 Critical Season CBOD Discharge for 2002 -2011 Flow Simulation

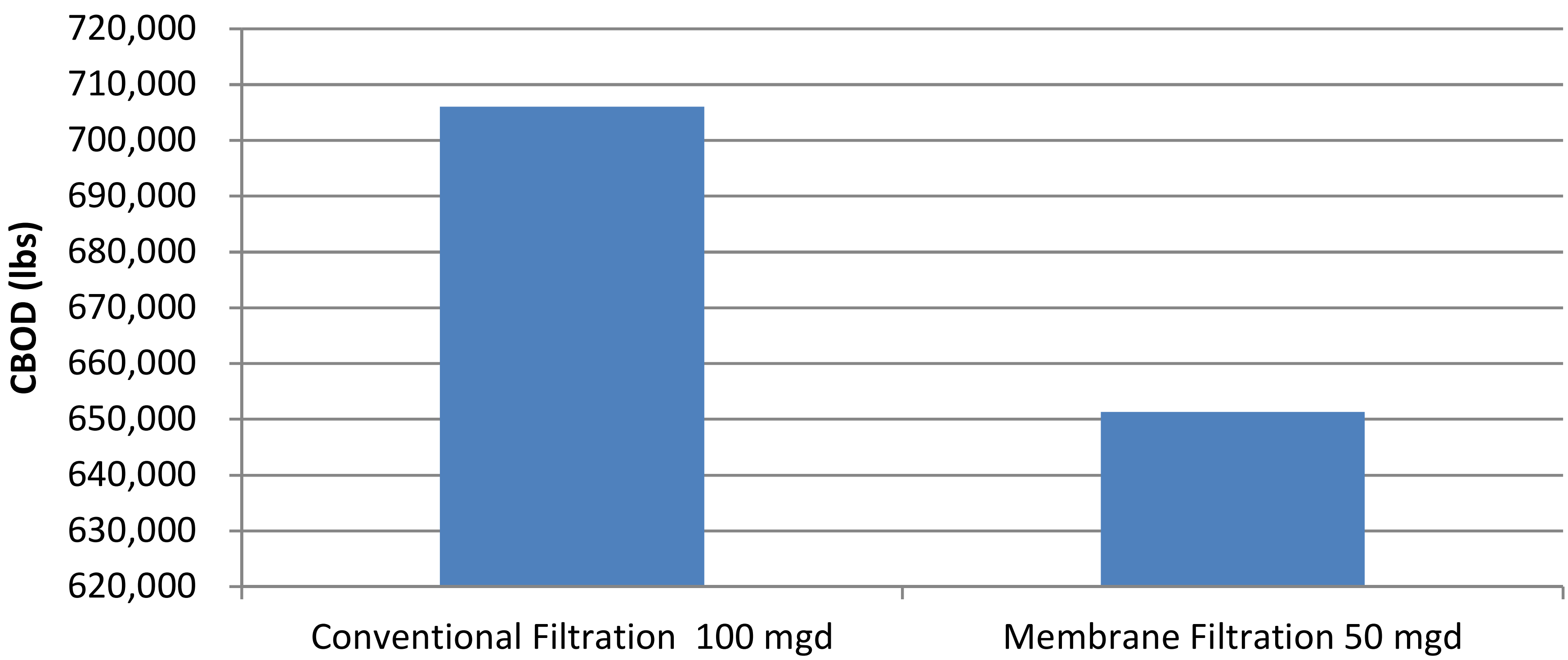


FIGURE 5-19
10 Year Total Critical Season CBOD

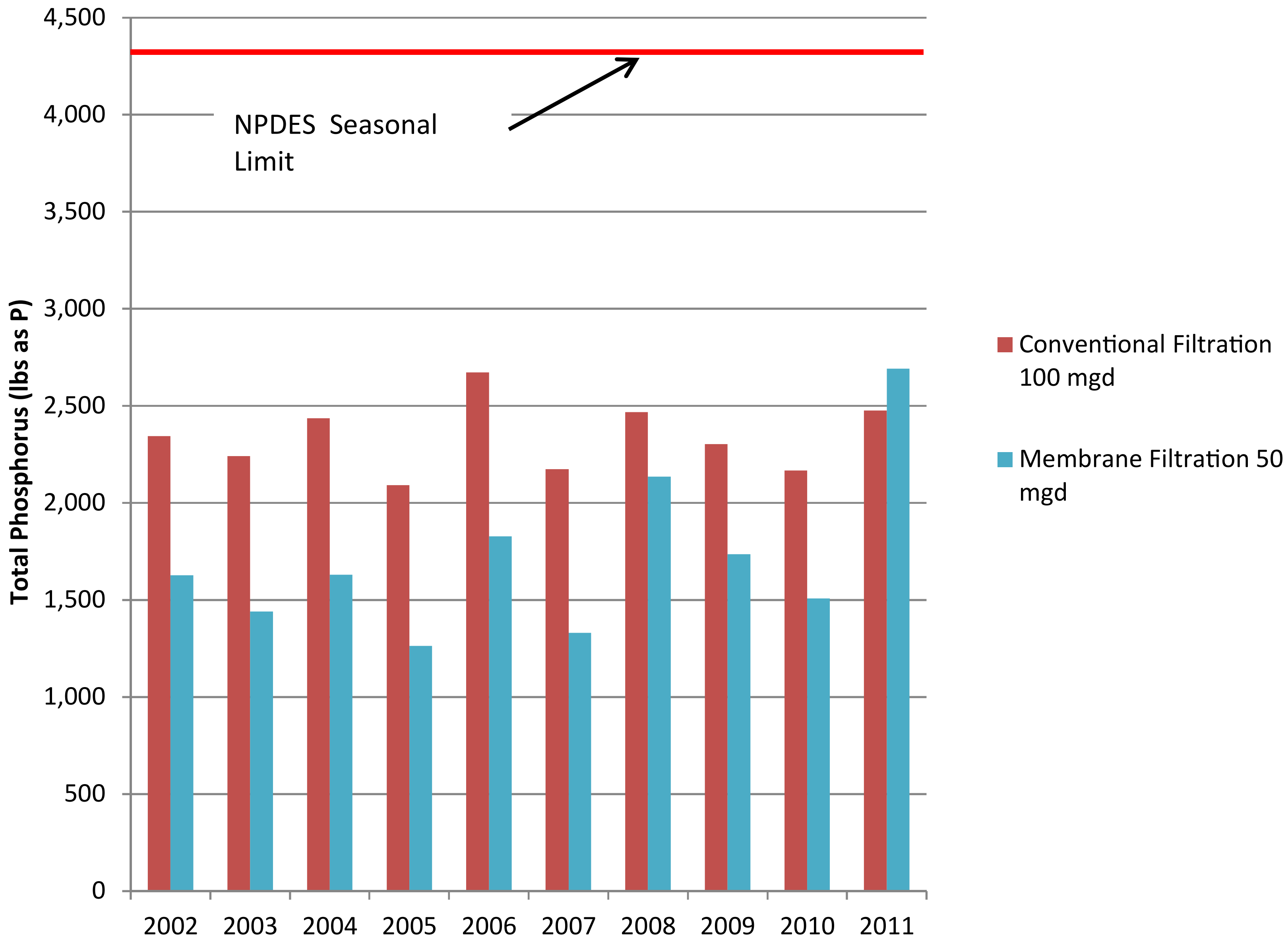


FIGURE 5-20
Year 2030 Critical Season Total Phosphorus Discharge for 2002 -2011 Flow Simulation

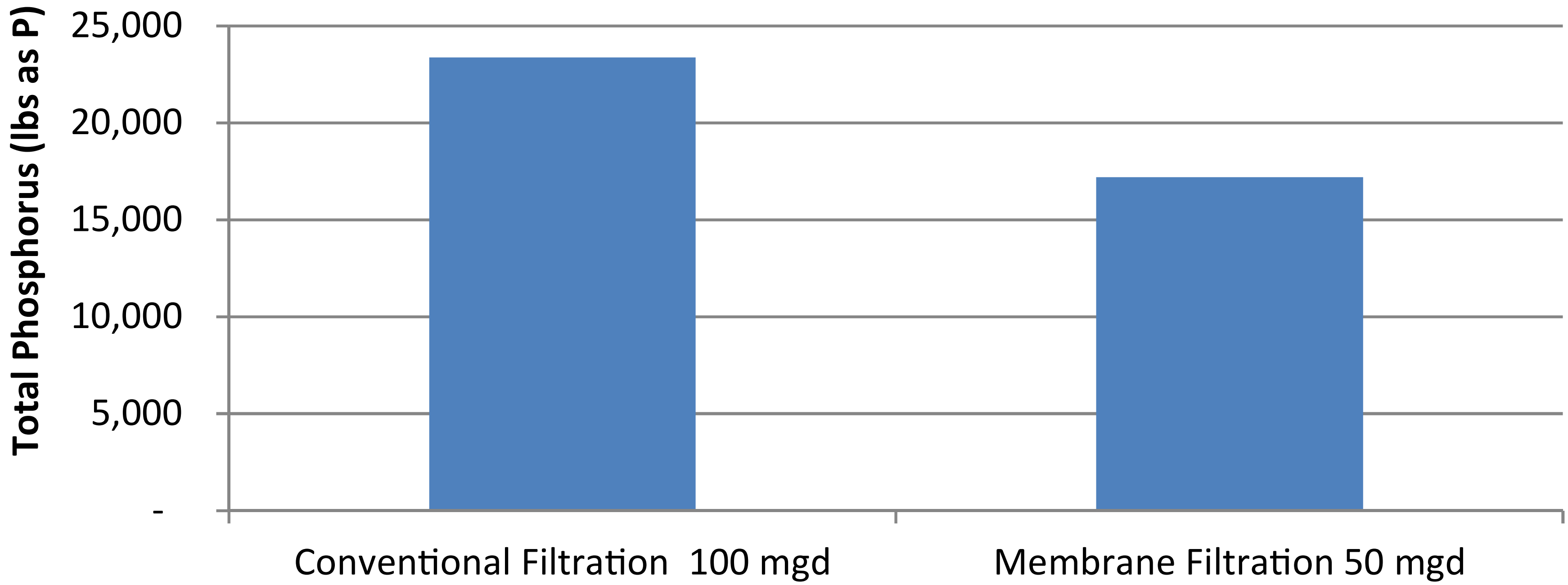


FIGURE 5-21
10 Year Total Critical Season Total Phosphorus

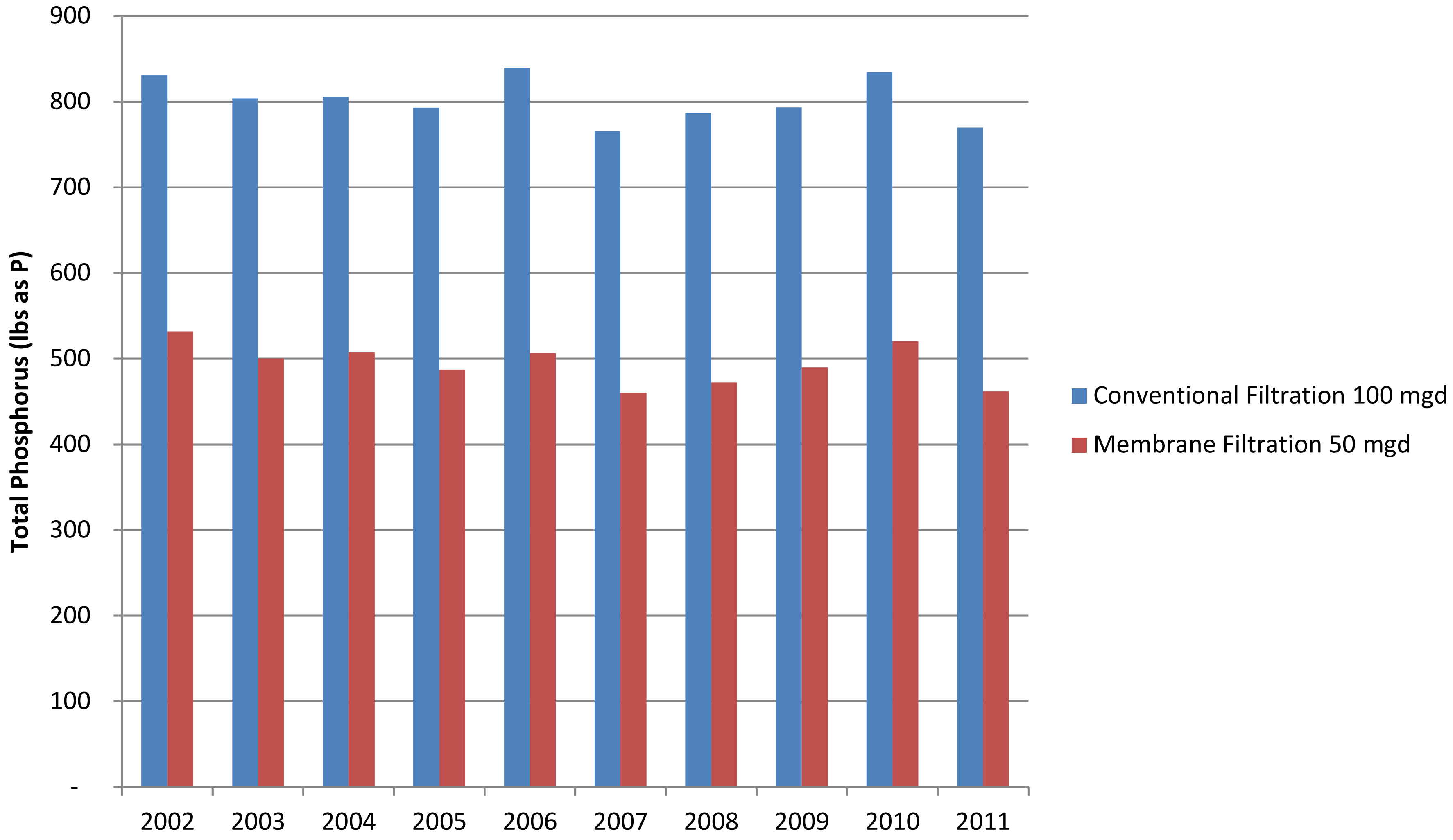


FIGURE 5-22
Dry Season RPWRF Total Phosphorus in Effluent

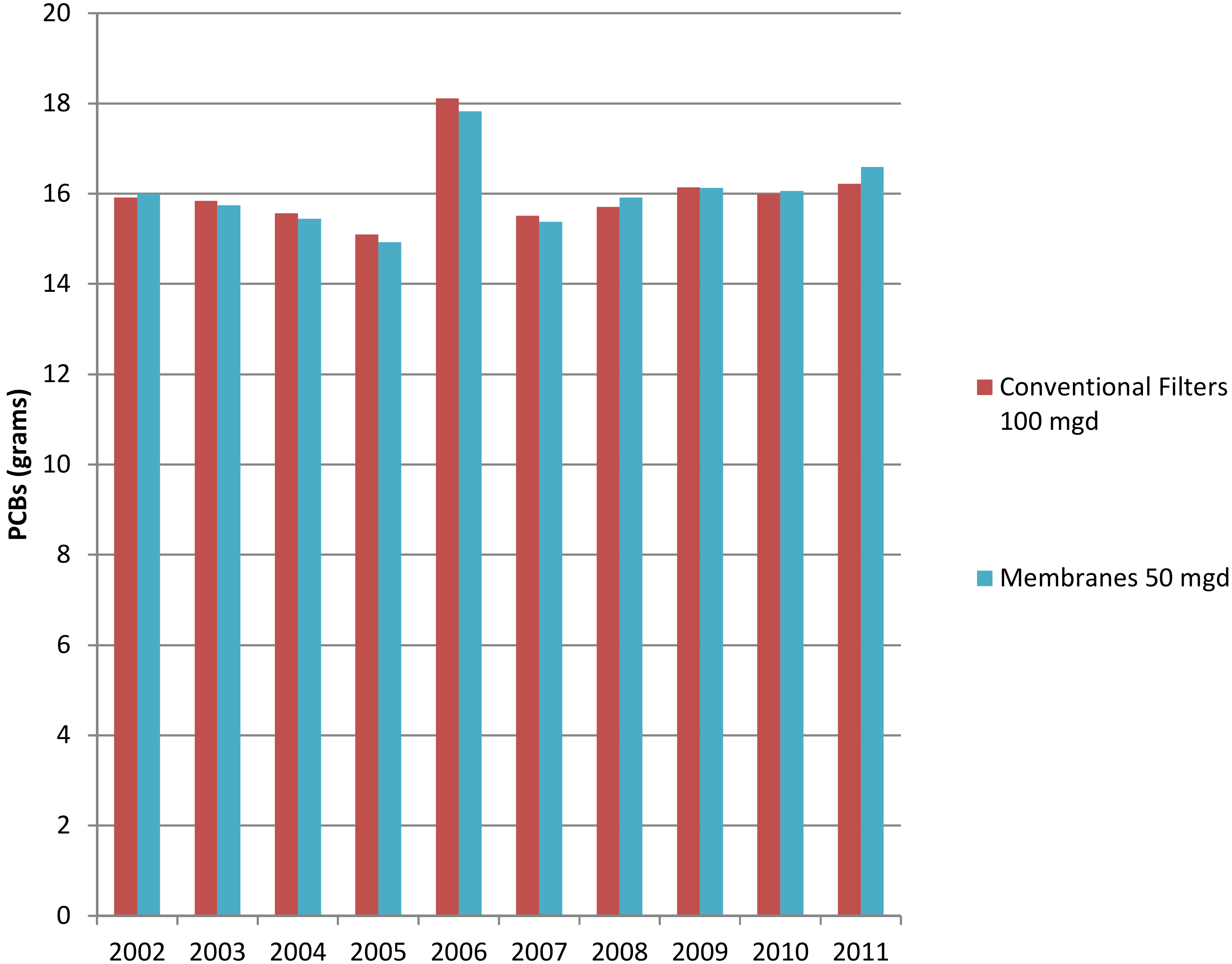


FIGURE 5-23
Year 2030 Annual PCB Discharge for 2002 -2011 Flow Simulation

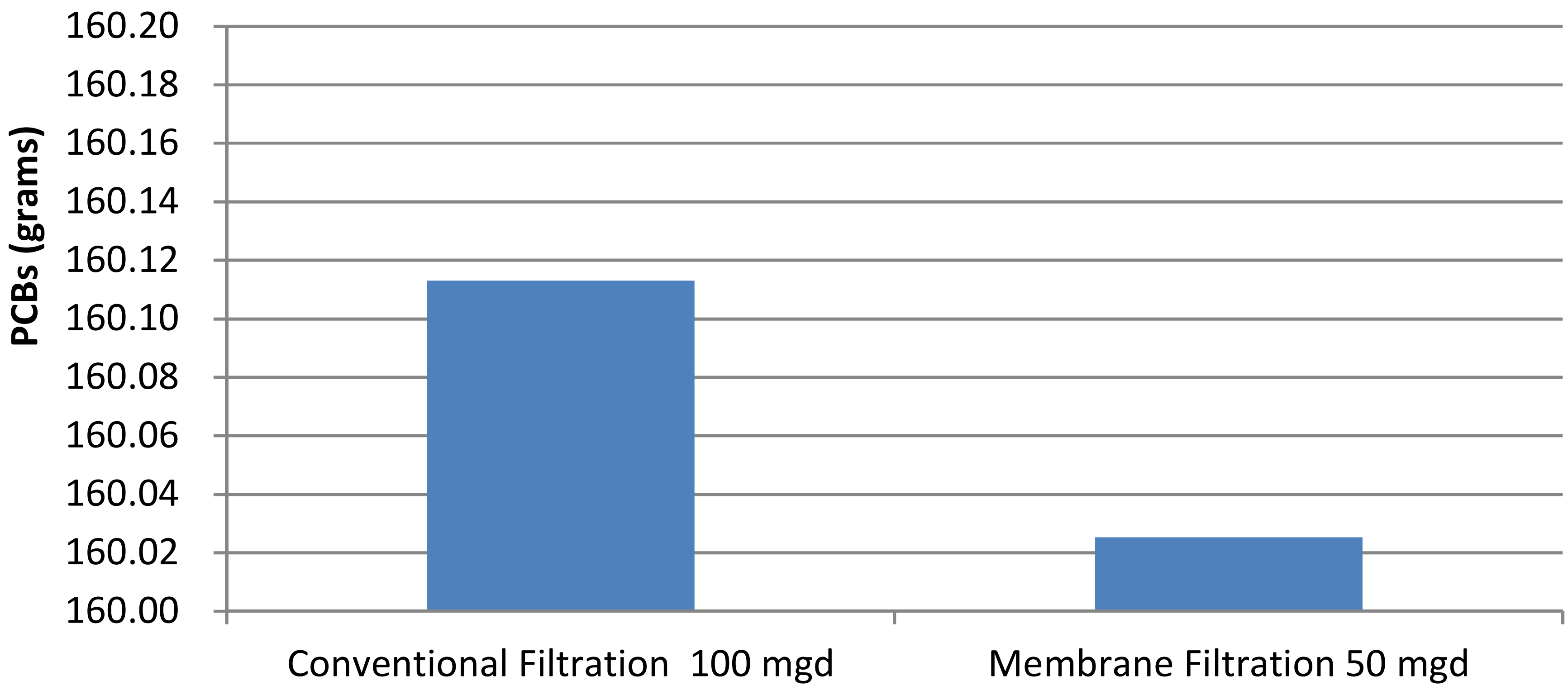


FIGURE 5-24
10-Year Total PCBs

5.3.2.6 Economic Evaluation

This section discusses the economics of the 100-mgd conventional filtration option and the 50-mgd membrane filtration option. The evaluation includes development of initial capital, annual O&M, and replacement costs for both options. These are used to develop an assumed cash flow for each option, which was used to calculate life-cycle costs expressed as net present worth. Life-cycle costs are the basis for determining the cost-effectiveness of the two options. The cost of total phosphorus removal per pound of phosphorus removed was then calculated.

Initial Capital Costs. Initial capital costs for the two options are $110.9 million for membrane filtration and $128.5 million for conventional filtration in October 2013 dollars. Initial capital costs for the conventional filtration option are the same as presented earlier. Initial capital costs for the membrane filtration option include the following changes from 100-mgd peak flow capacity membrane filtration option:

- Addition of primary Clarifier No. 5
- Four rapid-mix and flocculation trains (one fewer)
- Ten membrane trains (six fewer)

The initial capital costs are presented in October 2013 dollars and the methodology and accuracy is the same as was discussed earlier.

Annual O&M Costs. Annual O&M costs for the conventional filtration option are unchanged at $2.5 and $3.0 million per year, and for the membrane filtration option are reduced to $1.2 and $1.5 million per year for 2018 and 2030, respectively. The O&M costs for the conventional filtration option are the same as presented earlier. The methodology of developing the annual O&M costs for the membrane filtration option is the same as described earlier. Costs are the same except as listed below:

- Lower membrane cleaning chemical amounts because of fewer membrane trains
- Lower preventative maintenance and repair costs because of fewer maintenance trains

Annual O&M costs for the membrane filtration option excluding membrane replacement costs were lower than for the conventional filtration option and are further reduced by 19 percent by reducing the membrane trains from 16 to 10.

Replacement Costs. Membrane replacement in 10 years is assumed as a lump sum as was done earlier. Membrane replacement costs are less because the number of membranes is reduced by reducing the number of membrane trains from 16 to 10.

Cash Flow and Life-Cycle Cost. Cash flow projections for both options were developed using the same approach as described earlier for the 100-mgd peak flow capacity analysis.

The net-present-worth calculation of life-cycle costs is the same as described previously, and the conventional filtration option life-cycle cost of $140 million is unchanged. The net-present-worth life-cycle cost of the membrane filtration option is $118 million, and now the membrane filtration option is cost-effective.

Cost Per Pound Total Phosphorus Removed. The City also wants to select the option that most economically removes phosphorus, and calculation of the cost per pound of phosphorus removed is a good measure of this cost-effectiveness. Figure 5-25 shows that the membrane filtration option has a lower cost of phosphorus removal than the conventional filtration option. The costs in Figure 5-25 are the total present worth of each option divided by the total pounds of phosphorus removed by each option. The membrane filtration option removes phosphorus for about 18 percent less cost. The absolute cost per pound of total phosphorus removed varies depending on the assumptions used in the calculations, but the relative comparison of costs is not changed.

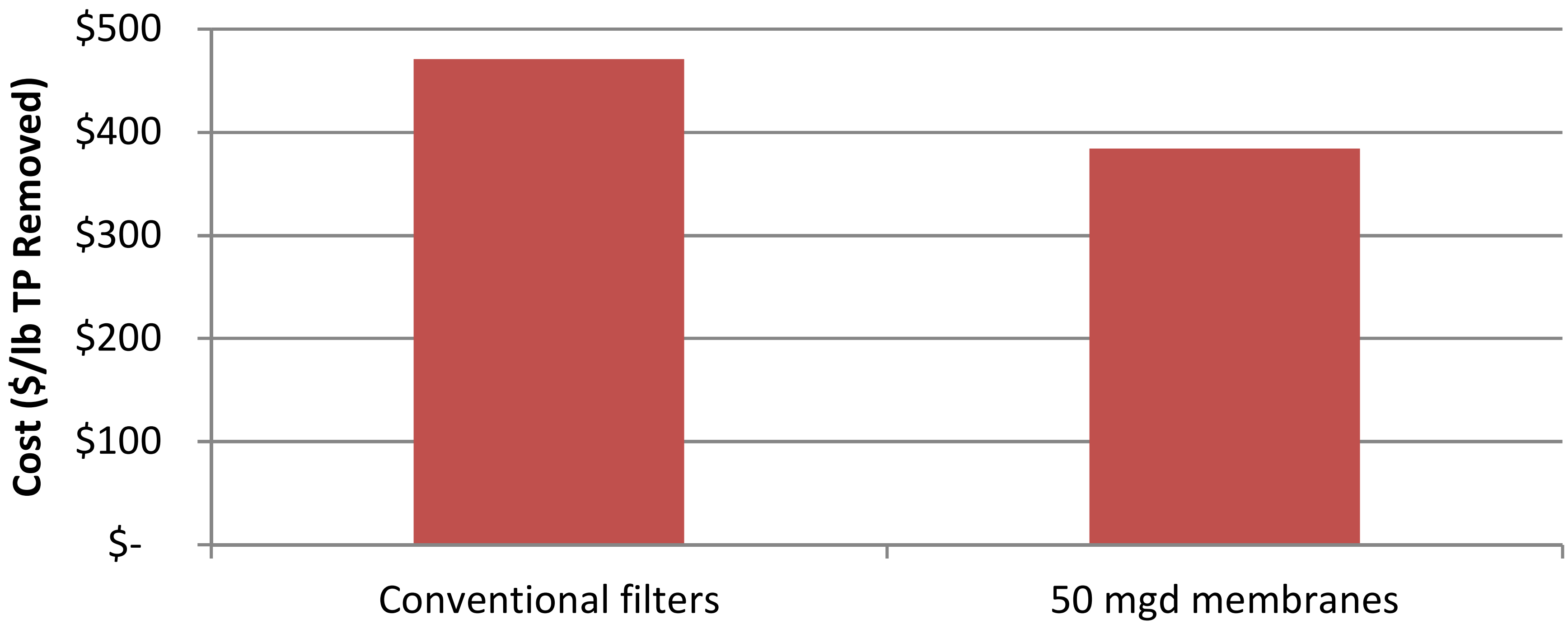


FIGURE 5-25
Cost of Phosphorus Removal during Critical Season

5.3.2.7 Non-Monetary Evaluation

Table 5-8 compares the non-monetary advantages and disadvantages of the membrane filtration and conventional filtration options.

TABLE 5-8
Comparison of Advantages and Disadvantages of Membrane and Conventional Filtration Options

Advantages	Disadvantages
Filters are most proven for this size project.	Membranes are newer technology with limited experience for this size project.
Membranes are less sensitive to coagulant dose, making them easier to operate and providing more consistent effluent.	Filters are more sensitive to coagulant dose, making them more difficult to operate and providing less consistent effluent.
Membranes require less site area, providing more flexibility to meet future requirements and lower site risk.	Filters use up remaining RPWRF site and would require expensive retaining walls, reducing flexibility to meet future requirements and increasing risk to A.L. White Parkway and Interceptor I-02.
Filters' components are available from many manufacturers,	Membranes are proprietary and may be sole source procurement for submerged membranes (preferred).
Filters do not require expensive media replacement before 20 years,	Membranes require expensive membrane replacement at 10 years.
Membrane effluent quality is suitable for reverse osmosis treatment required for direct groundwater recharge,	Filter effluent quality is not suitable for reverse osmosis treatment required for direct groundwater recharge.

A key difference between the options is the amount of site area required for 100-mgd peak capacity of sedimentation followed by conventional filtration compared to 125-mgd peak capacity of membranes (at 24-gfd flux rate, 16 membrane trains can provide peak capacity of 125 mgd). Conventional filters require more site area because of the need for sedimentation prior to filtration to remove solids to 5 mg/L to avoid solids overloading. The conventional filtration option requires the entire area remaining at RPWRF and construction of a major retaining wall below A.L. White Parkway. This leaves no additional site area to expand the filters or add a new treatment process in the future. The major retaining wall is a risk during construction to the stability of A.L. White Parkway and the main sewer interceptor to RPWRF.

Membranes were found to have operational advantages during the NLT pilot study. Membranes produced a more consistent effluent quality and were less sensitive to coagulant dose than sedimentation followed by filters, making membranes easier to operate.

Filters are the more proven technology with decades of experience compared to less than 20 years for membranes, particularly at the size of RPWRF. Membranes are a newer technology and have been successfully applied in similar applications and scale to RPWRF. The County Facility uses similar membranes in a slightly different process to achieve low phosphorus, and Brightwater in King County uses similar membranes in a different process at a similar scale to RPWRF.

Filter media is much less expensive and doesn't require replacement at 10-year intervals as membranes currently do. Membrane replacement is costly and the current manufacturer's guarantee is 10 years. It is possible actual membrane life will be more or less than 10 years. As an example, when fine bubble diffusers were originally installed at RPWRF to improve aeration efficiency, the diffuser membranes were guaranteed for 5 years and they have been in service for nearly 15 years. Membrane life is likely to improve as the technology evolves, but the best estimate today is a life of 10 years based on the manufacturer's guarantee.

Membranes have a fixed pore size and produce a higher quality effluent than filters. Membranes are suitable for pretreatment ahead of reverse osmosis. Reverse osmosis is required for direct injection recharge of groundwater and this could be a future option that the City may wish to consider as a way to reduce discharge of effluent to the Spokane River and reuse the water.

5.3.2.8 Conclusions and Recommendations

The comparison of the conventional filtration option (100-mgd peak flow capacity of sedimentation followed by filtration) with the membrane filtration option (expansion of primary and secondary treatment capacity to 125 mgd and 50 mgd of average firm net capacity of membranes) finds the following:

1. Both options will meet the NPDES permit.
2. The membrane filtration option provides a net environmental benefit compared to conventional filtration for phosphorus with a slight advantage for CBOD and equivalent removal of PCBs.
3. A very large portion of secondary effluent discharged with the membrane filtration option in the critical season is associated with high Spokane River flows greater than 20,000 cfs in May and June.
4. The membrane filtration option reduces phosphorus discharged to the Spokane River 35 percent compared to conventional filtration in the dry season of July to October when Spokane River flows are lowest.
5. The City has a number of alternatives to reduce flows to RPWRF that will reduce and potentially eliminate discharge of secondary effluent in the critical season in the future.
6. The membrane filtration option nearly eliminates treated CSO in the non-critical season.
7. The membrane filtration option is cost-effective compared to the conventional filtration option on life-cycle costs expressed as net present worth.
8. The cost per pound of phosphorus removed is lower for membrane filtration option compared to the conventional filtration option.

The City has decided to implement NLT using the 50-mgd membrane filtration option. This includes construction of a fifth primary clarifier to increase the capacity of the primary and secondary treatment processes to 125 mgd. Primary Clarifier No. 5 and Secondary Clarifier No. 5 should normally be empty and offline to be available to reduce peak flows to the membrane facility. An automatic system of flow meters, butterfly valves, and gates should be installed to make this flow equalization work with minimal operator attention. The initial membrane process should be designed with 10 process trains assuming one train is offline for maintenance and another train is offline for deconcentrating at the firm net capacity rating. The average flux should be capable of 24-hour-per-day operation for 60 continuous days. The peak flux should be based on intermittent operation for 12 hours per day. The membrane facility should be designed and constructed to allow expansion to 16 membrane trains in the future with a peak flow capacity of 125 mgd net. The City should implement programs to reduce flows to RPWRF, particularly in May and June associated with Spokane River flows greater than 20,000 cfs.

5.4 Other RPWRF Improvements

In addition to NLT, other improvements are needed at RPWRF to provide capacity to treat wastewater to the year 2030, provide supporting functions to NLT, and maintain the RPWRF infrastructure as it ages. Financial constraints require prioritizing the improvements. These improvements were evaluated in FPA No. 2 and are re-evaluated in this section to consider the effect of the reduction of flows and waste loads discussed in Chapter 4, selection of a NLT technology and prioritization of improvements to satisfy financial constraints. Improvements to the activated sludge secondary treatment process, solids handling, odor control and infrastructure and energy improvements will be re-evaluated in this section.

Facilities evaluated in FPA No. 2 that are not re-evaluated and that are under construction are not described in this plan. These improvements include:

- Plant standby power upgrades
- Digester gas compressor room upgrades
- GBTs (gravity belt thickeners) 5 and 6

These facilities are described in FPA No. 2, and since there are no changes and the facilities are under construction, there is no need to describe them again in this facility plan amendment.

5.4.1 Activated Sludge

The activated sludge process is a system that includes aeration basins, aeration system, secondary clarifiers, return activated sludge pumping, and waste activated sludge pumping. All parts are interrelated and must be evaluated as a complete system. The hydraulic capacity of 25 mgd per secondary clarifier is not changed and as a result the secondary clarifiers and return activated sludge pumps do not change. These facilities impose a constraint on the aeration basins of a maximum MLSS concentration of 3,000 mg/L as determined in FPA No. 2. Aeration basin capacity to treat BOD, TSS and ammonia are affected by the change in influent waste load and removal efficiency of the primary treatment process. The following facilities need to be re-evaluated:

- CEPT
- Solids recycle pump station
- Aeration basin no. 5
- Modification of aeration basins no. 1-4

The evaluation is complicated because of all the inter-relationships. The evaluation was done using CH2M HILL's Pro2D treatment plant modeling tool to evaluate the activated sludge with appropriate parameters to evaluate the effect of each facility modification with the reduced flows and waste loads. Qualitatively the following summarizes some important considerations for each.

CEPT improves primary treatment removal of BOD and TSS, reducing the loading on the aeration basins and thus increasing the capacity of the activated sludge process. CEPT requires addition of alum and polymer and this is a significant operating cost of over $100,000 per month. CEPT will be operated as the initial step of phosphorus removal during the critical season, but won't be operated in the non-critical season until the loading on the aeration basins reaches capacity.

Solids recycle pump station returns the recycled TSS and BOD from the GBTs and BFPs to the headworks where primary or CEPT treatment is provided ahead of the aeration basins. Currently, the solids recycle is added to the secondary influent. With CEPT this is a very significant load on the aeration basins.

Aeration Basin No. 5 is needed when the MLSS concentration reaches 3,000 mg/L. The maximum MLSS concentration occurs with all aeration basins in service from November to July. It is assumed that diffuser and aeration basin maintenance will be done in the period July to November when wastewater temperatures are warmest and solids retention times (SRT) are lowest. The SRT required is based on nitrification requirements. Nitrification is designed for the entire year. Ammonia effluent discharge standards do not require nitrification for the period November through February, but low effluent ammonia concentrations are required beginning March 1 and nitrification must be maintained through the cold winter months to be able to meet the March 1 requirements. Wastewater temperatures are too low in the January and February time periods to reestablish nitrification prior to March 1 if nitrification was curtailed for the winter.

Modification of aeration basins no. 1-4 was recommended in FPA No. 2. The modifications include:

- Baffling the aeration basins to create an anoxic zone
- Installing mixers in the anoxic zone to suspend MLSS

- Install mixed liquor recirculation pumps to return ML from the aerobic zone to provide nitrate
- Baffling the aerobic zone to enhance nitrification and allow operation in step feed
- Modification of the influent feed to allow step feed operation

The primary benefit of the modification is providing the anoxic zone which has the following benefits:

- Alkalinity production equivalent to annual addition of 318,000 gallons per year magnesium hydroxide in 2030
- Aeration reduction of 11,000 scfm in 2030
- Total nitrogen reduced in the effluent to 10-15 mg/L as N

Step feed has not been used in Aeration Basin No. 6 because of excellent settling activated sludge, but would be very desirable during extended periods of high flow in May and June if more typical settleability was occurring.

The following summarizes the results of the evaluation of activated sludge improvements:

- Aeration Basin No. 5 is not needed until after the year 2030.
- Solids recycle pump station is needed to avoid the need to operate CEPT in the non-critical season by the year 2024.
- CEPT is needed in the non-critical season when aeration basins Nos. 1-4 are modified.
- CEPT is not needed in the non-critical season until after the year 2030 unless aeration basins Nos. 1-4 are modified.
- Modification of aeration basins Nos. 1-4 generate benefits worth over $700,000 per year in reduced magnesium hydroxide (alkalinity) and electricity for aeration (over 260 kW). The capital cost in October 2013 dollars is about $8.5 million including engineering, legal and administration, and sales tax. The total present worth life-cycle cost analysis shows that these improvements are essentially a break-even investment without consideration of potential energy savings grants from Avista. These improvements trigger the need for non-critical-season CEPT that will increase alum costs by over $400,000 per year, which reduce the savings from this improvement. These improvements are recommended when nitrogen removal or non-critical-season CEPT is begun or if step-feed operation or anoxic selectors for activated sludge settleability improvement is desired in the future.

It is recommended that the solids recycle pump station be constructed immediately. Aeration Basin No. 5, non-critical season CEPT and modifications to aeration basins No. 1-4 can be deferred and may not be needed until after the year 2030.

5.4.2 CSO Clarifier No. 6

CSO Clarifier No. 6 will continue to be used for storage and treatment of flows greater than 125 mgd. The existing clarifier mechanism no longer works and is corroding. The mechanism is not needed for CSO Clarifier No. 6 to function since only small amounts of solids accumulate and are removed manually by hosing by operators when the clarifier is drained after high flows have subsided. The clarifier also has internal steel launders and weirs supported by a steel structure that is corroding. The launders leak, reducing the storage capacity of the clarifier. The drain pump is almost 40 years old. It is recommended that a condition assessment be conducted to determine the structural adequacy of the steel components and drain pump. It is likely that the steel components should be demolished, a new outlet structure constructed, and a new drain pump installed.

5.4.3 Solids-Handling

The solids-handling system includes thickening, anaerobic digestion, and dewatering. Two additional 3-meter (m) GBTs are being constructed at RPWRF bringing the total to six. This is the maximum number of

GBTs that can be installed in the solids process building and the analysis in FPA2 shows this has capacity for the additional solids from NLT beyond the year 2030. A third egg-shaped digester (ESD) was recommended to be constructed at RPWRF to provide the capacity needed for current waste loads and a fourth ESD was recommended before the year 2030. This will be re-evaluated with the reduced waste loads presented in Chapter 4. FPA2 also recommended improvements to the digester gas system, which is needed to process gas produced during anaerobic digestion of solids. Digester gas contains methane that must be combusted before it can be discharged to the air. RPWRF has eight 2-m BFPs and this is the maximum that can be installed in the solids process building. FPA2 shows that this capacity is sufficient for NLT beyond the year 2030.

5.4.3.1 Anaerobic Digesters

RPWRF has two ESDs that have a volume of 2.85 mg each at the maximum operating level and two conventional digesters that have reached the end of their useful life. Digesters no. 1 and 2 are conventional digesters and not currently used at RPWRF. It was determined after an accident in 2004 involving Digester no. 3 that Digesters no. 1 and 2 require expensive improvements before they can be used as anaerobic digesters. Analysis of digester alternatives recommended construction of a new silo digester because of the high cost of improving digesters no. 1 and 2, limited additional useful life after improvements are made and higher risk to the City if digesters no. 1 and 2 were used again. FPA no. 2 recommended construction of a third ESD to be the same as existing ESDs no. 4 and 5. An analysis showed that a silo digester constructed of reinforced concrete could be added at significantly lower cost than an ESD. The reasons for the lower cost were elimination of an expensive and risky retaining wall needed to allow construction of an ESD at the same elevation as existing ESDs no. 4 and 5, elimination of an expensive gallery and location of facilities in the existing DT building. A silo digester could be constructed of a larger diameter allowing the foundation to be raised above the bottom of the existing digester no. 3. Analysis was conducted to determine when the fourth digester would be required.

The two ESDs provide adequate detention time when both digesters are in service, but the volume is not sufficient to remove a digester for service to perform inspections and maintenance. It is essential that inspections and maintenance be performed on anaerobic digesters and a new digester is needed as soon as possible since the existing two ESDs have been in service since 2010. The criteria for evaluation of the digesters is as follows:

• Total minimum SRT	15 days
• Minimum SRT in any digester	10 days
• Maximum Volatile Solids loading	0.2 lb/ft^3/day
• Volume when operating with a secondary digester	2.85 mg
• Volume when operating without a secondary digester	2.55 mg
• Volume of secondary digester	2.0 mg

The 15-day minimum SRT is needed to meet Process to Significantly Reduce Pathogens (PSRP) to allow land application of Class B biosolids without extensive laboratory testing for pathogens. The 10 day minimum SRT and maximum volatile solids loading are needed to prevent overloading of a digester. At the maximum liquid level the volume of the ESD and silo digesters is 2.85 mg. A lower liquid level is needed when the digesters are operating without a secondary digester to provide volume for foaming and storage of solids for dewatering.

The analysis showed that adding a third silo digester with capability to operate as a secondary digester is sufficient to provide sufficient capacity to stabilize solids including NLT solids beyond the year 2030. Sufficient digester volume will be available to allow removal of a digester for inspection and maintenance. The loading on the two remaining digesters allows the digesters to operate in series with one primary at maximum volume and the other as a secondary digester. It is not necessary to operate the two digesters in parallel as primary digesters until after the year 2030. This means that the new silo digester does not require mixing or heating until after the year 2030. It also means that the external recirculation heating of ESDs no. 4 and 5 using tube-in-tube heat exchangers is not needed until after the year 2030.

It is recommended that a new 2.85 silo digester be constructed as soon as possible to allow inspection and maintenance of ESDs No. 4 and 5. Mixing and heating equipment is not needed for Silo Digester No. 3 until after the year 2030 because it can operate as a secondary digester.

5.4.3.2 Digester Gas System

Digester gas operating pressure, digester gas storage, boiler fuel gas operating pressure, and waste gas disposal were evaluated in FPA2. The recommendation was to operate at higher digester gas pressures (normally 16 inches water column); continue using the existing sphere with high-pressure compressors for storage and boiler supply, but conduct a full-scale test to supply a cogeneration boiler with a medium-pressure compressor; and eliminate the high-pressure waste gas burners and add another low-pressure waste gas burner to serve to the year 2030. Using the existing sphere with high-pressure compressors was the lowest life-cycle cost and highest-ranked alternative, but the full-scale test on the cogeneration system is intended to prove the concept of reducing the energy for compressing digester gas for boiler operation. Subsequently, the City decided not to construct a cogeneration system at this time due to financial prioritization toward projects that lead to improved river water quality. To avoid missing an opportunity to reduce energy consumption, the City decided to continue the test on one of its regular boilers. It was recommended to test a new lower-pressure boiler burner in an existing large boiler that could use 2.5 pounds per square inch gauge (psig) digester gas. This would allow use of a less expensive digester gas compressor (i.e., medium-pressure compressor). If successful, the operation of the digester gas compressor and storage system will change. Digester gas would be compressed to 2.5 psig for use in the boilers. Digester gas would be compressed to 45 psig to fill the storage sphere to provide uniform digester gas fuel to the boiler and would not operate continuously.

Currently, the operating pressure of the digester gas system is approximately 7 inches water column. This low operating pressure was established to limit the upward force on the concrete domes of Digesters Nos. 1 and 2 to help prevent accidents. Digesters Nos. 1 and 2 have been removed from normal service and their gas systems have been disconnected from ESDs Nos. 4 and 5. Now, the pressure relief valves on ESDs 4 and 5 can be reset and the operating pressure can be increased to 16 inches water column per the recommendation made in FPA2. This will increase the operating range for the digester gas compressors used to fill the digester gas storage sphere and increase the capacity of the low-pressure waste gas burner. In FPA2, it was recommended that the high-pressure waste gas burner be converted to operate off the digester pressure of 16 inches. After working through the design details and costs, the manufacturer was unable to meet the needs of the City by converting this burner. Therefore, it is recommended to demolish the existing high-pressure waste gas burner and install a low-pressure waste gas burner identical to the existing one. Improved safety in an emergency is a primary benefit because the gas will flow to the waste gas burner without needing a compressor, as is required for the high-pressure waste gas burner. This reduces the amount of compressor capacity required and also eliminates the need to have this equipment on emergency power.

In addition to the waste gas burner, additional improvements will be needed to the digester gas system. A test will be conducted on reducing the digester gas pressure to the boilers by using a new boiler burner. The purpose is to eliminate the need to compress gas using the digester gas storage compressors and use the digester gas storage compressors only for pressurizing the storage sphere to reduce energy consumption. Depending on the outcome of the test, additional low-pressure digester gas blowers and new boiler burners may be needed. The timing of the need for these improvements is not yet known because the test has not been completed. Construction of these improvements is scheduled to be complete August 2014. The test will likely occur over 1 to 2 years and be complete by August 2016.

5.4.3.3 Primary Solids Degritting

Primary solids degritting was considered as a potential improvement to RPWRF to minimize cleaning of anaerobic digesters. Aerated grit chamber modifications as part of the Headworks Screening project in 2010 may have reduced the grit removal efficiency, especially of finer grit. Following those modifications, the flow patterns in the chambers were altered, allowing the City to see a surface plume of finer grit traveling through its grit basins. Although primary solids degritting could have removed these finer grit particles, a simpler solution was developed, recommended, and implemented immediately. Grit baffles were added to reduce short-circuiting in the grit chambers. Following these improvements, each month the City inspected the blend tanks receiving primary solids and waste activated sludge and found only very small amounts of finer grit. Before the baffles were added, the City regularly found large amounts of finer grit in these blend tanks. Because of the major improvement to finer grit removal in the grit chambers, primary solids degritting is not anticipated at this time and therefore not recommended.

5.4.4 Odor Control

The City continues to implement the *Odor Control Master Plan* (CH2M HILL, 2003) for the liquids processes. Previously, the City implemented odor control for the solids-handling processes of gravity belt thickening and belt filter press dewatering using biofilters. The City has already implemented odor control for the primary clarifiers using carbon scrubbers. Odor control for the headworks, the next highest priority odor source identified in the *Odor Control Master Plan*, and a subsequent odor control master plan update have been postponed due to financial prioritization toward projects that lead to improved river water. A date for implementation will be considered at a later time.

5.4.4.1 Headworks

As soon as funding is available, headworks odor control is recommended to control odors from the headworks building and the aerated grit chambers. Odorous air will be collected from covered raw wastewater channels, perforated-plate screens, screenings hoppers, grit cyclones and separators, grit hoppers, and truck garage in the headworks building. The aerated grit chambers will be covered and odorous air collected. Activated carbon is recommended for treatment of odorous air. Different activated-carbon odorous-air treatment configurations were evaluated and a single horizontal-bed configuration is recommended. Multiple odorous-air treatment vessels are recommended with sufficient capacity to allow treatment of all the odorous air with a vessel out of service for activated-carbon replacement.

In FPA2, alternative locations were evaluated for location of the odorous-air fans and activated-carbon vessels. It was recommended that the fans and activated-carbon vessels be located on the second level of the CEPT and chemical storage facility to be located east of the headworks building. As a result of the final analysis of the CEPT full-scale pilot and the phosphorus pilot plant operation, the recommended chemical dosage requirements for CEPT and NLT have been significantly reduced. Therefore, the chemical storage volume requirements have decreased too. Additionally, a conceptual design of a single facility housing the headworks odor control, CEPT, and chemical storage processes revealed challenges and high costs for a retaining wall that has to support the main 60-inch-diameter sewer line entering the RPWRF. Lastly, financial prioritization toward projects that lead to improved river water quality dictates finding less costly approaches to other infrastructure. It is recommended that the facility siting concepts for a headworks odor control facility in relation to the CEPT and chemical storage facility be revisited. The process recommendations for headworks odor control remain unchanged.

5.4.4.2 Biosolids Loading Area

It is recommended that the biosolids loading area be enclosed for odor control. Currently, the doors to the biosolids loading area must remain open because the trucks are too long to be loaded with the doors closed. This allows odors to escape when biosolids are loaded into the trucks used to haul biosolids to land application. Extension of the biosolids loading area requires extension of the building in the north-south direction to allow loading of biosolids into either the truck or trailer when the trucks enter the facility from either direction. Some improvements to the pavement are needed to allow the proper truck access from either direction. A new odor-control fan is needed to ventilate the enclosed truck-loading area. The existing biofilter has adequate capacity for the additional odorous air, but the odorous air ductwork needs to be replaced for the larger airflow.

5.4.4.3 Odor Control Master Plan

It is recommended that the odor control master plan be updated following completion of the headworks odor control improvements. The original odor control master plan was developed when odors from RPWRF were much greater. It is common for neighbors to acclimate to reduced odors and begin to detect other odors that were masked by the stronger odors that will be controlled by the solids, primary clarifier, and headworks odor control improvements. Odor-control standards may need to be adjusted and additional odors controlled to achieve a satisfactory level of odor control for RPWRF. Updating the odor control master plan is a systematic approach to addressing this potential concern.

5.4.5 Infrastructure and Energy Efficiency Improvements

It has been over 35 years since the RPWRF was upgraded to secondary treatment. A number of these facilities will be at the end of their useful life soon. Other improvements should be done at this time because they are logically done at the same time the infrastructure is improved. Additionally, there is interest in developing facilities that reduce energy consumption or produce energy. There are several improvements that are being recommended that improve aging infrastructure or are sustainable. Infrastructure improvements include process building improvements, building heating, and emergency power. Energy efficiency improvements evaluated include improved insulation, energy-efficient windows, cogeneration, low-head hydroelectric generation, and effluent heat recovery. In addition to specific improvements, energy efficiency is a consideration for all improvements in the selection of processes, materials, and equipment. The goal is to provide the City with improvements that consider long-term operation and maintenance costs with particular emphasis on energy efficiency.

Many of the recommended infrastructure and energy-efficiency improvements have been postponed due to financial prioritization toward projects that lead to improved river water quality and a date for implementation will be considered at a later time. Any recommended improvements that can be implemented now will be noted in Chapter 6.

5.4.5.1 Process Building Improvements

The building skin of the process building is coated steel and the useful life of this type of construction is approximately 40 years. The process building will be 40 years old in 2017. The *Aesthetic Master Plan* (CH2M HILL, 2006) developed architectural guidelines that will be incorporated into the replacement of the process building skin. The guidelines call for use of brick, green metal roofs, and weathered copper metal walls with elimination of the rounded edges. The new metal siding will have improved insulation for energy efficiency and existing windows will be replaced with more energy-efficient windows. Process building improvements are postponed, but as funding becomes available, it is recommended that the process building be rehabilitated. There are a number of other improvements needed to the process and administration buildings that should be done at the same time because they affect the building skin, including:

- Addition of a covered area for biosolids trucks
- Improvement of the polymer loading dock
- Extension of the process building
- Addition of sprinklers to the administration building

A covered area attached to the south side of the process building is recommended for storage of biosolids trucks. Maintenance requires a covered area for various routine maintenance activities to the biosolids trucks such as changing tires. A covered area that is clean and relatively dry is sufficient for these activities.

Improvements to the polymer loading dock are recommended to allow larger trucks easier access to the process building. Large amounts of polymer are needed for solids thickening and dewatering. The current loading dock is perpendicular to the process building and this limits the maximum size truck that can be used, creates a difficult maneuver for the truck driver, and blocks traffic through the RPWRF site. Modification of the loading dock to an angle will increase the size of truck that can be used, reduce the maneuvering difficulty, and remove the obstruction to traffic while a truck is unloaded.

RPWRF staff request that the process building be extended north when the building skin is replaced because this is inexpensive building space and staff would like to relocate equipment that is currently located in hallways.

RPWRF staff request addition of fire sprinklers to the administration building. The process building has sprinklers but the administration building does not. F.M. Global (the City's insurance company) and the City's risk manager have requested the RPWRF add sprinklers. A fire in the administration building could damage the control room in the process building and cause severe problems in operating the wastewater treatment plant, possibly resulting in major NPDES permit exceedances.

5.4.5.2 Digester Thickening Building, AG Pump Stations, and Chlorine Building Improvements

Like the process building, the building skin of the digester thickening building, AG pump stations, and chlorine building is coated steel and the useful life of this type of construction is approximately 40 years. The buildings will be 40 years old in 2017. The *Aesthetic Master Plan* developed architectural guidelines that will be incorporated into the replacement of the building skin. The guidelines call for use of brick, green metal roofs, and weathered copper metal walls with elimination of the rounded edges. The new metal siding will have improved insulation for energy efficiency and existing windows will be replaced with more energy-efficient windows. These building improvements are postponed, but as funding becomes available, it is recommended that the digester thickening building, AG pump stations, and chlorine building be rehabilitated.

5.4.5.3 Building Heating

It is recommended that buildings heated with electricity and natural gas be modified to use steam when cost-effective. Steam is used for most of the heating at RPWRF because steam is generated using digester gas as a fuel. Digester gas is produced in the treatment of solids generated by wastewater treatment.

The chlorine building uses electricity for building heating. The HVAC system was designed for a hazardous location because the building previously stored chlorine and sulfur dioxide gas. This usage requires very high ventilation rates and consumes a lot of electricity. It is proposed that steam heating replace the electric resistance heating and the ventilation rates be reduced for a non-hazardous building use. Steam is generated using digester gas and the change will reduce electricity costs. Replacement of the chlorine building heating and ventilation equipment is recommended to reduce energy consumption and eliminate the electric resistance heating currently used.

5.4.5.4 Cogeneration

Cogeneration using a steam turbine is recommended for using digester gas at RPWRF but will be postponed until funding becomes available. The following alternatives were evaluated for using digester gas:

- Steam turbine
- Engine generators
- Microturbines

A steam turbine was the lowest-cost, highest-ranked alternative. A benefit of a steam turbine is that low-pressure steam can be recovered and used for heating. Steam is used at RPWRF for heating the solids going to anaerobic digestion and for buildings. Heating is a large energy requirement for RPWRF and limits the amount of electricity that could be recovered from engine generators and microturbines. Both the engine generator and microturbine alternatives require substantial investments in equipment and digester gas conditioning. There is not sufficient digester gas to allow operation of the engine generators and microturbines at their rated electrical generation capacity and also produce the necessary heat for the digester and building heating.

5.4.5.5 Low-Head Hydroelectric Generation

Low head hydroelectric generation is not recommended because of the high capital cost of the facility. Restrictions on locating the facility close to the Spokane River make construction costs very high and the payback period too long.

5.4.5.6 Effluent Heat Recovery

Effluent heat recovery is not recommended because of the high capital cost of the equipment. Initially, effluent heat recovery was found cost-effective, but a more detailed design found the equipment costs much higher than originally assumed.

SECTION 6

Final Recommended Alternative

This chapter presents the site layout, flow diagram, sizing/design parameters, design life, ability to expand, and O&M/staffing needs for the recommended alternative. First the improvements for the NLT alternative are presented. Then improvements for the other RPWRF facilities are presented. These improvements were included in FPA2, but revisions to flows and waste loads in FPA3 and budget constraints have resulted in some modifications to the FPA2 concept. Improvements to RPWRF that were approved in previous facilities plan amendments and have been completed or are under construction prior to FPA3 are not described in detail but are listed at the end of this chapter.

6.1 NLT Improvements

This section will describe the NLT improvements. The improvements recommended in Chapter 5 and needed for NLT are listed below:

- Primary Clarifier No. 5
- CEPT
- Chemical storage for NLT
- Solids recycle pump station
- Silo Digester No. 3 (including new waste gas burner)
- CSO Clarifier No. 6 improvements

Additional improvements needed at RPWRF that will be constructed at the same time as the NLT improvements are described in Section 6.2. Facilities that are not needed until after the year 2030 but are essential for the long-term capacity of RPWRF are described in Section 6.4. Facilities that may be needed before 2030 and are deferred because of financial limitations are described in Sections 5.4.3, 5.4.4, and 5.4.5 and in detail in FPA2 in Chapter 5, Recommended Improvements.

6.1.1 Site Layout and Sizing/Design Parameters

Figure 6-1 shows the RPWRF site plan with all recommended improvements. Figure 6-1 also shows the locations of key future facilities that will be needed after 2030 to increase the RPWRF capacity such as Aeration Basin No. 5 and Silo Digester No. 2. The improvements needed for NLT are described in this section. The remaining improvements are described in the Section 6.2, Other Improvements.

6.1.1.1 NLT Facilities

Figure 6-2 shows the site plan for 50-mgd membrane NLT facilities. NLT facilities are located at the east end of the RPWRF site. The proposed facilities are within the 250-foot shoreline management jurisdiction but are located within the RPWRF property boundaries in an area that has been greatly disturbed. The NLT facilities are located well above the 100-year floodplain.

Flow to NLT is by gravity. Membranes require pumping either to or from the membranes. The layout shown on Figure 6-2 is based on immersed membranes, as used in the NLT pilot plant, that use pumps to pull a negative pressure on the membranes and pump the effluent to the chlorine contact basins. The layout provides space for up to 16 membrane trains, which would allow intermittent short-term peak capacity to 125 mgd. The initial 10 installed membrane trains would provide a firm sustained capacity of approximately 50 mgd and an intermittent peak capacity of over 90 mgd with no trains out of service for maintenance. Firm capacity allows one membrane train out of service for maintenance. One train is performing deconcentration and not processing influent wastewater. Deconcentration is the draining of the membrane tank to remove accumulated solids. Four of five-rapid mix and flocculation trains are installed to provide peak capacity of 100 mgd and adequate flocculation time at the average 50-mgd flow condition for optimum phosphorus removal. Table 6-1 summarizes the sizing and design criteria for the NLT membrane facilities.

6.1.1.2 Primary Clarifier No. 5

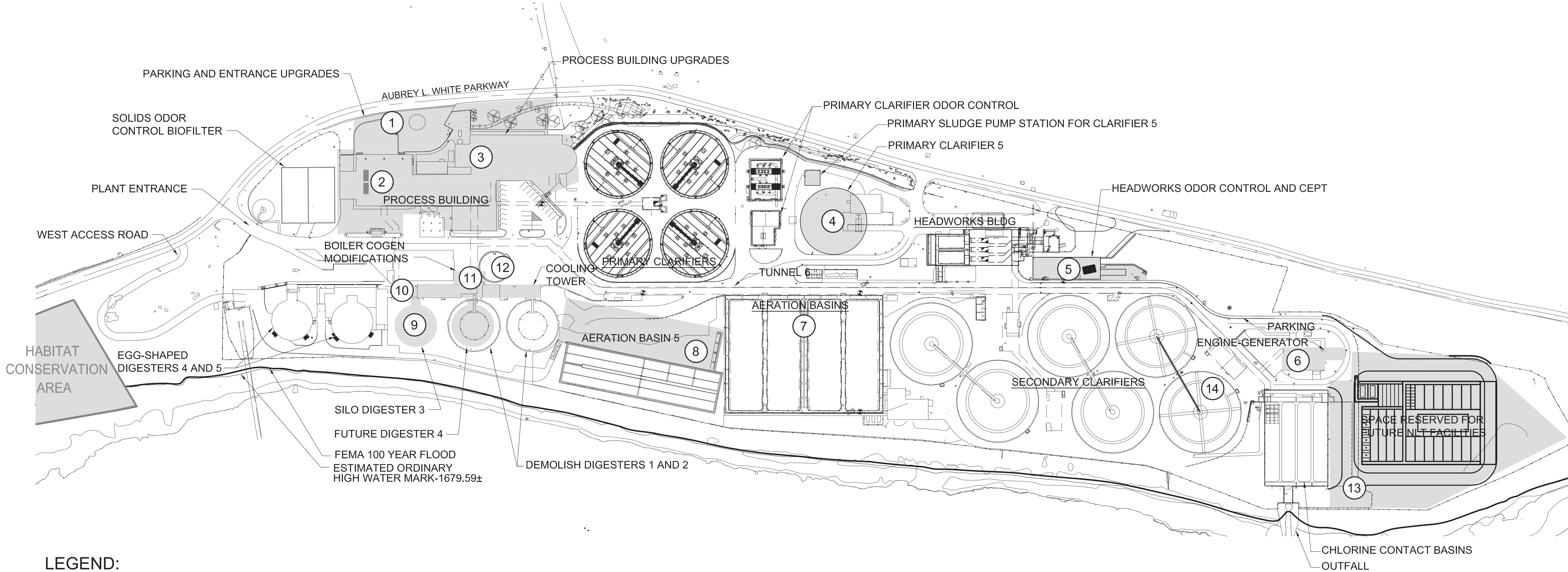
Flow to Primary Clarifier No. 5 will be through a new 42-inch-diameter pipeline with flow controlled by a butterfly valve. The 42-inch-diameter influent pipeline is routed around the area to the east of Primary Clarifier No. 5 to allow for construction of a future facility. Flow will be maintained to a setpoint measured by a magnetic flow meter that modulates the butterfly valve. This system will operate in parallel with the flow control system to the existing four primary clarifiers, which uses a butterfly valve controlled by a Venturi flow meter.

The operator will enter a total maximum setpoint flow of 25 mgd per primary or secondary clarifier online. The control system will proportion the flow to two parallel sets of existing primary clarifiers, operating up to the maximum, to provide an equal flow to each clarifier. Once the maximum flow is reached, the butterfly valve will close to limit flows to the existing primary clarifiers to the maximum allowable. Additional flow above the maximum that cannot be stored in Primary Clarifier No. 5 will spill over the existing weir on the discharge of the aerated grit chambers to the CSO clarifier. This approach has been successfully practiced at RPWRF since 1977.

Primary Clarifier No. 5 will be a 125-foot-diameter clarifier similar to the existing primary clarifiers. Primary Clarifier No. 5 will have an interior launder with a McKinney baffle. This design eliminates the need for compacted fill under the launder and avoids the settling that has occurred adjacent to the existing clarifiers due to poor soil compaction under the launders. Use of an internal launder with McKinney baffle also eliminates the need for the Stamford baffle used on the existing clarifiers because the internal launder and baffle deflects the upward flow away from the effluent weirs the same as the Stamford baffle. Standard design practice is to use 125 feet as the effective diameter of the clarifier with an internal launder design. It will have an aluminum odor cover of the same design as for the existing primary clarifiers. The odor control fans, grease and mist eliminators, and activated carbon scrubbers were designed with adequate capacity to serve Primary Clarifier No. 5.

Primary Clarifier No. 5 will normally be empty and not in service because it is needed only when influent flows exceed 100 mgd, which is rare. It will be used for in-line flow equalization for the membrane process when flows exceed the capacity of the membranes. The automatically controlled butterfly valve will open and control flows to Primary Clarifier No. 5 when the flow exceeds the capacity of the membranes. The control system will maintain equal flows to all five primary clarifiers. Primary Clarifier No. 5 will fill to reduce the flow to the membranes. A 1,500-gpm clarifier dewatering pump will empty Primary Clarifier No. 5 after the flows have reduced below a setpoint less than the membrane capacity. The Primary Clarifier No. 5 dewatering pump will discharge to the grit chambers.

The primary solids pump station is located adjacent to the northwest quadrant of Primary Clarifier No. 5. A new primary solids pump station is needed for Primary Clarifier No. 5 because there is no space in the existing facility for new primary solids and skimmings pumps to serve another clarifier and the distance is too far for primary solids and skimmings piping. The eastern side of Primary Clarifier No. 5 is reserved for a future facility. There is insufficient room for the pump station in the southwest quadrant. Provision was made in the construction of the primary clarifier odor control fan building to extend all the pipes necessary to connect to the primary solids pump station and provide space for future electrical needs. All facilities will be located below grade except for a cover for the stairway to protect the stair from snow. A skimmings wet well identical to the wet wells being designed for the existing primary solids pump station will be installed adjacent to Primary Clarifier No. 5 and the primary solids pump station. It will use glass-lined ductile iron pipe and hot water sprays to minimize grease buildup in the skimmings pipelines and scum trough. The wet well level will be maintained to keep the skimmings pipelines completely drained. A subnatant pump will automatically pump the subnatant back to the aerated grit chamber effluent channel. Skimmings will be manually pumped once per shift to the digesters. Two primary solids pumps will be installed to pump primary solids to the GBTs for cothickening with waste activated sludge.

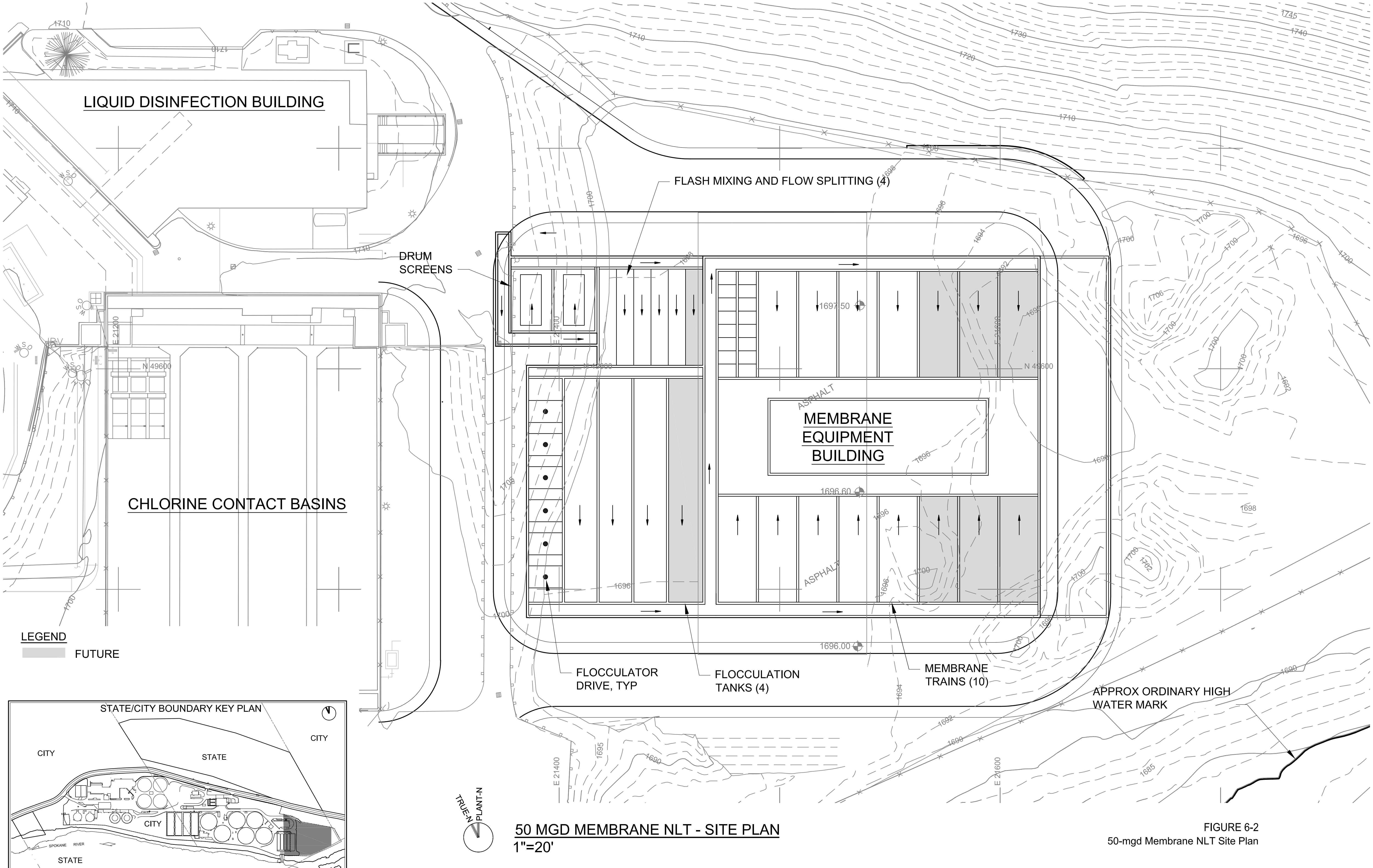


LEGEND:

1. ROAD, PARKING, LANDSCAPING
2. GRAVITY BELT THICKENERS 5 AND 6
3. ARCHITECTURAL IMPROVEMENTS
4. PRIMARY CLARIFIER #5
5. CEPT/HEADWORKS ODOR CONTROL FACILITY
6. CHLORINE BUILDING STEAM HEATING AND ENGINE GENERATOR
7. AERATION BASINS 1-4 MODIFICATIONS
8. AERATION BASIN #5
9. NEW DIGESTER #3
10. DIGESTER GAS IMPROVEMENTS
11. CO-GENERATION
12. SOLIDS RECYCLE PUMP STATION
13. NLT FACILITIES
14. CSO CLARIFIER NO. 6 REHABILITATION

RPWRF OVERALL SITE PLAN THROUGH 2030
NTS

FIGURE 6-1
Overall Site Plan



50 MGD MEMBRANE NLT - SITE PLAN
1"=20'

FIGURE 6-2
50-mgd Membrane NLT Site Plan

CH2MHILL

The primary skimmings and solids pumps will be the same type as installed in the modified primary solids pump station for the existing four primary clarifiers.

Table 6-2 lists the design criteria for primary clarification.

TABLE 6-1
Criteria for 50-mgd Membrane Alternative

Parameter	Design Criterion
Screening:	
Number of units	2
Capacity, each (mgd)	75
Type	Drum
Perforation diameter (millimeter)	1
Rapid mixing:	
Number of units	4
Capacity each (mgd)	25
G (sec-1)	1,000
Flocculation:	
Number of trains	4
Flocculators per train	6
Type	Vertical paddle mixers
G (sec-1)	80
Detention time at 50 mgd (min)	20
Membranes:	
Trains	16 (10 installed)
Cassettes per train	16 (15 installed)
Membrane area (ft^2/cassette)	28,160
Design flux (gfd):	
60-day, 24 hours/day sustained	16.0
Peak 12-hour intermittent	24.0 (July 1 through September 30 only)
Membrane trains out of service:	
May/June	1 for deconcentrating
March/April and July through October	1 for maintenance and 1 for deconcentrating
Allowance for recycle from membranes	10 percent of incoming flow to membranes

TABLE 6-2
Primary Clarification Criteria with Five Primary Clarifiers, Primary Clarifier No. 5, and Primary Solids Pump Station

Parameter	Design Criterion
Primary clarification with 5 primary clarifiers in year 2030:	
Maximum overflow rate (25 mgd/clarifier)	2,040 gal/ft^2/day
Primary Clarifier No. 5:	
Diameter	125 feet
Sidewater depth	10 feet
Primary Clarifier No. 5 primary solids pump station:	
Primary solids pumps	
Number	2
Capacity , each	100-250 gpm
Type	Screw-induced centrifugal
Primary clarifier drain pump:	
Number	1
Capacity	1,500 gpm
Primary skimmings:	
Scum trough nozzles:	
Nozzles per trough	4
Capacity per nozzle	2 gpm @ 180° F
Wet wells:	
Number	1
Capacity, each	4,000 gallons
Subnatant pumps:	
Number	2
Capacity, each	200 gpm
Skimmings pumps:	
Number	2
Capacity, each	75 gpm

6.1.1.3 CEPT/Chemical Storage Facility

As discussed in Chapter 5, the headworks odor-control facilities, CEPT chemical storage and feed equipment, and NLT chemical storage can be combined into a single building adjacent to the headworks building. The location is good for all three purposes and the combination offers the following benefits:

- The building will provide a single unloading point for alum, which is needed for CEPT and NLT, and will eliminate alum truck traffic in the RPWRF.
- Plant chemical storage will be consolidated.
- The single building minimizes the footprint of the needed facilities, saving space onsite.
- The City will save construction costs by constructing a single building.

It is recommended that an evaluation be made of locating CEPT and NLT chemical storage facilities at the existing chorine building location and separate from the headworks odor control process to determine if cost savings are possible. There are several reasons to further evaluate the location of these facilities:

- An expensive retaining wall would be required to construct this facility at the existing headworks building location and there are risks to adjacent existing structures from construction of this wall.
- There are suitable existing roadways for delivery of bulk chemicals located away from the congested administration/process building and main circulation roadways.
- The alum dose for NLT is much lower than the original rates anticipated by the NLT pilot engineer prior to pilot testing, and the impact of truck traffic on RPWRF operations is much lower than originally projected.
- Potentially, all similar chemicals, such as sodium hypochlorite, could be stored at one central location, eliminating duplication of facilities.
- The chorine building location is centrally located to CEPT and NLT.

Headworks odor control facilities will be deferred until after 2018, but CEPT and NLT chemical storage facilities if located adjacent to the headworks building must provide sufficient space to allow addition of the needed odor control facilities in the future. The area shown on Figure 6-1 for headworks odor control/CEPT/NLT chemical storage is the prime location for future headworks odor control. Odor control facilities could be on top of the CEPT/NLT chemical storage building, or in this space without chemical storage if CEPT/NLT chemical storage is moved to the chlorine building location. The area east of Primary Clarifier No. 5 may also be sufficient for some of the headworks odor control facilities and should be investigated.

This FPA3 is based on the use of alum for CEPT and NLT because alum is currently used at the plant, the NLT pilot testing primarily used alum, and preliminary analysis of the cost of coagulant for CEPT found alum to be lower cost than ferric chloride, although ferric chloride is used at the County Facility and has been very effective. All chemical storage and feeding facilities will be constructed of materials and sizes compatible with alum and ferric chloride, wherever possible.

Figure 6-1 shows the new headworks odor control and CEPT building and truck access for chemical unloading. Alum deliveries will generate truck traffic during the critical season when both CEPT and NLT are operating. Alum trucks will unload into the upper level on the north side of the new building, directly off of Aubrey L. White Parkway, eliminating alum truck traffic through RPWRF. The delivery point on the hillside above the new building also avoids the need to park alum trucks on the south side of the process building where they would create a significant blockage to traffic flow in this important onsite corridor. Alternatively, alum and sodium hydroxide could be unloaded at the location of the chlorine building using existing roads. This would increase the truck traffic into RPWRF.

Mixing alum and sodium hydroxide must be avoided since alum is an acid and sodium hydroxide is a strong base, and any mixing would create a great deal of heat that could cause serious damage to storage tanks and possibly injury or even death to nearby workers. The unloading facility must be designed to prevent accidental filling of the incorrect tank. The two chemicals must be physically separated to prevent mixing of the two chemicals. Storage tanks could be located outdoors with adequate heating and insulation to prevent crystallization.

Polymer facilities should provide capability to mix polymer solution using dry and liquid forms of concentrated polymer. The polymer facilities must be located indoors and separated from the other chemical storage areas.

Membranes also use citric acid and sodium hypochlorite. These two chemicals also must be kept separated. Sodium hypochlorite is used at RPWRF for disinfection and use of existing storage tanks should be considered.

A decision was made to use 25 percent sodium hydroxide solution rather than the 50 percent solution available from the supplier. The lower strength solution requires twice as much storage, but it solidifies at a lower temperature (0°F for 25 percent solution compared to 50°F for 50 percent solution), making storage and handling much easier. The storage rooms and outside delivery points will be designed for chemical containment and will meet code requirements to prevent loss of chemical in the event of a damaged storage tank or truck spill.

Six CEPT alum chemical feed pumps will be installed to allow two pumps for each channel downstream of the headworks Parshall flumes. The Parshall flume hydraulic jump will be used for rapid mixing the alum with the wastewater. This mixing point was being tested in the full-scale CEPT test in 2011 and 2012.

Polymer storage will be provided for super sacks of dry polymer or totes of liquid polymer stacked two high in two rows. Two polymer make-up systems will be provided with their own monorail for moving either super sacks or totes to the required position above or adjacent to the make-up system. Four polymer feed pumps will be provided to allow dedicated polymer feed to each channel downstream of the headworks Parshall flumes and provide a backup pump. An alternative polymer feed point half-way down the aerated grit channels and primary clarifier distribution box is being tested in the full-scale test of CEPT and will be included in the final CEPT design if testing shows it is beneficial.

Table 6-3 lists the design criteria for the CEPT and chemical storage facilities.

TABLE 6-3
CEPT and Chemical Storage Facility Design Criteria

Parameter	Design Criterion
Alum dose:	
CEPT:	
Average	50 mg/L
Maximum	70 mg/L
NLT:	
Average	15 mg/L
Maximum	30 mg/L
Polymer dose (CEPT):	
Type	Anionic
Average	0.3 mg/L
Maximum	0.6 mg/L
Sodium hydroxide dose (NLT):	
Average	6 mg/L
Maximum	12 mg/L
Alum consumption, critical season:	
Alum concentration	5.4 lb/gal
CEPT:	
Average	3,100 gal/day
Maximum day	10,300 gal/day

TABLE 6-3
CEPT and Chemical Storage Facility Design Criteria

Parameter	Design Criterion
NLT:	
Average	940 gal/day
Maximum day	4,400 gal/day
Sodium hydroxide consumption, critical season (NLT):	
Concentration	25 percent, 2.7 lb/gal sodium hydroxide
Average	750 gal/day
Maximum day	3,500 gal/day
Polymer consumption, non-critical season (CEPT):	
Average	125 lb/day, dry equivalent anionic
Maximum	425 lb/day, dry equivalent anionic
Alum storage tanks:	
Number	3
Capacity, each	14,000 gallons
Storage time, critical season:	
Average	10.5 days
Maximum	3 days
Sodium hydroxide storage tanks (NLT):	
Number	2
Capacity, each	14,000 gallons
Storage time, critical season:	
Average	37 days
Maximum	8 days
Polymer storage (super sacks or totes) (CEPT):	
Number	28, 2 rows stacked 2 high
Alum feed pumps (CEPT):	
Number	6
Type	Peristaltic
Capacity	250 gal/hour
Turndown	10:1 minimum with variable-frequency adjustable speed
Alum feed pumps (NLT):	
Number	6 pumps
Capacity	To be determined in NLT design
Sodium hydroxide feed pumps (NLT):	
Number	4 pumps
Capacity	To be determined in NLT design

TABLE 6-3
CEPT and Chemical Storage Facility Design Criteria

Parameter	Design Criterion
Polymer make-up systems (CEPT):	
Number	2
Polymer type	Dry or liquid (dispersion or emulsion)
Capacity, each	500 lb/day
Polymer feed pumps (CEPT):	
Number	4
Type	Progressing-cavity
Make-up concentration	0.25 to 0.5 percent dry polymer equivalent
Capacity, each	350 gal/hour
Turn down	10:1 minimum with variable frequency adjustable speed

Year 2030 design flows are described in Chapter 4. Alum and polymer doses for CEPT were determined in the laboratory during jar testing and confirmed in full-scale testing in 2011 and 2012. Assumed alum doses for NLT are from the results of the NLT pilot test. Assumed sodium hydroxide doses are based on the NLT pilot test for the critical season. It is likely that sodium hydroxide will be needed for CEPT in the non-critical season, but the quantities will be much less than in the critical season because the alum doses are much smaller.

Table 6-2 shows the year 2030 storage times for alum and sodium hydroxide. Washington State Department of Ecology's 2008 *Criteria for Sewage Works Design* (known as the Orange Book) states in section T4-1.1.2, Storage:

1. Unless reliability of the supply and conditions indicate less storage is appropriate, storage should be provided to supply sufficient chemicals to satisfy the maximum 30-day demand period.

The storage proposed is less than the 30-day storage suggested in the criteria, but is adequate because both alum and sodium hydroxide are stored in the Spokane area in quantities greatly exceeding the 30-day criteria. Alum is manufactured in the Spokane Valley by the current alum supplier to RPWRF. The City has never run out of alum in over 30 years of use. Alum deliveries are contractually required within 3 to 4 days of ordering, but deliveries could be made within 24 hours in an emergency. At maximum demand, one to two truckloads will be delivered daily. Sodium hydroxide is stored in railcars at 50 percent concentration in Spokane Valley. Typically two to three railcars with 15,000 gallons each are available. Shipping within 24 hours is available. Extended periods of maximum demand will occur during periods of Spokane River flows greater than 25,000 cfs and these can be predicted well in advance. Onsite storage is sufficient to handle short-term high demand caused by snowmelt and precipitation.

The available storage will be adequate to allow flexibility to respond to severe weather, holidays, and other scheduling needs. RPWRF has never had a delivery concern with alum. It is not practical to store 30 days' supply of alum and sodium hydroxide on the RPWRF site given the space limitations of the site. Polymer, however, has been in short supply at times, and the polymer storage provided will provide economies of delivery and provide a buffer in times of short supply.

Alum and sodium hydroxide feed pumps will be chemical metering pumps similar to the pumps used for sodium hypochlorite. Six pumps will be provided to feed alum to each of the three headworks Parshall flume channels and provide backup pumps. Day tanks for CEPT will not be provided because the full-scale test has demonstrated that feeding from the storage tanks works well. The alum feed pumps need to be oversized because the flow distribution to the three channels is not uniform and higher feed rates are required than the average depending on the specific channels in service.

NLT alum and sodium hydroxide feed pumps will be provided for each feed point and to provide the proper range of operation. It is assumed that the alum and sodium hydroxide feed pumps will be specified by the NLT designer. An alternative approach of providing bulk chemical storage and transfer pumps to day tanks for NLT at the NLT facility should be evaluated during NLT design.

The polymer make-up system will be designed for either dry or liquid anionic polymers. Two parallel make-up systems will be provided, each with capacity for the maximum polymer requirement. The dry polymer system will be designed for super sacks. The liquid polymer system will be designed for totes. A dedicated monorail hoist will be provided for each make-up system to handle super sacks and totes. The liquid make-up system will be designed for dispersion or emulsion polymers and will be capable of handling very viscous polymer blends. Adequate polymer aging should be provided, based on a variety of polymer manufacturer requirements, to provide flexibility in bidding polymer suppliers. Polymer feed pumps will feed polymer at 0.25 to 0.5 percent solution to any of three channels downstream of the headworks Parshall flumes or at other locations as determined in the full-scale test.

FPA2 has preliminary drawings of a new headworks odor control/CEPT/chemical storage facility that can be compared to separate headworks odor control and CEPT/ NLT chemical storage at the chlorine building location.

6.1.1.4 Solids Recycle Pump Station

The solids recycle pump station will convey solids recycle from the GBT and BFP drainage systems to the headworks. A new 24-inch-diameter pipeline will convey solids recycle to Gravity Thickener No. 1. Gravity Thickener No. 1 will be used as a wet well for the solids recycle pump station. An alternative approach of a new pump station using submersible pumps constructed in the area south of the process building was considered as an alternative, but RPWRF staff preferred a dry pit pump approach for improved maintenance. The pumps will be located in the 1717 level of the digester thickening building. Four variable-speed pumps will be used to handle the wide range of flows with a single pump out of service. A new 24-inch-diameter pipeline will convey solids recycle through Tunnel 6 to the headworks influent.

At peak influent flows, the solids recycle pump station will be automatically shut down to avoid triggering a bypass of the influent screens. If the gravity thickener water level reaches the effluent weirs, solids recycle will be transported by the gravity pipeline to mix with primary effluent on its way to A-box and the aeration basins. This would occur very infrequently for short periods of time. Table 6-4 shows the design criteria for the solids recycle pump station.

6.1.1.5 Silo Digester No. 3/Waste Gas Burner No. 3

Anaerobic digester facilities planning was modified to reduce the cost of additional anaerobic digestion capacity to replace digesters No. 1 and 2 that have reached the end of their useful life and would require expensive improvements to use as digesters. Silo Digester No. 3 is needed to allow maintenance of ESDs No. 4 and 5. One ESD does not provide adequate capacity to stabilize solids with one ESD out of service for maintenance. The original plan was construction of another egg-shaped digester (ESD No. 3), but this was changed to a functionally equivalent and less expensive alternative of a silo digester. Cost savings were achieved by eliminating a very expensive retaining wall and equipment gallery by raising the foundation elevation. Silo Digester No. 3 needs to be completed and in service by the end of 2015. Silo Digester No. 3 is needed regardless of whether NLT is implemented or not, but the additional solids associated with NLT contribute to higher loadings on the existing ESDs, increasing the need for a third digester. Modifications to ESDs Nos. 4 and 5 will convert a pumped transfer system to a gravity transfer system to improve operational safety of the existing egg-shaped digesters. ESDs No. 4 and 5 currently rely on a pumped transfer system that is not failsafe compared to a gravity transfer system.

TABLE 6-4
Solids Recycle Pump Station Design Criteria

Parameter	Design Criterion
Design flows:	
GBTs:	
Primary solids	1,250 gpm (5@250 gpm/clarifier)
Waste activated sludge	2,500 gpm (5@500 gpm/clarifier)
Belt wash water	750 gpm (5@150 gpm/GBT)
BFPs:	
Digested Biosolids	1,760 gpm (8@220 gpm/BFP)
Belt wash water	800 gpm (8@100 gpm/BFP)
Total flow	7,060 gpm
Solids recycle pumps:	
Number	4 (3 duty and 1 backup)
Capacity, each	2,350 gpm

Silo Digester No. 3 will be constructed without heating and mixing and operate only as a secondary digester at least until year 2030. Silo Digester No. 3 will be constructed as soon as possible to allow removal of ESD No. 4 or 5 from service for maintenance if required. A second phase of construction includes upgrading ESDs Nos. 4 and 5 to replace pumped transfer with gravity transfer and replace a high-pressure waste gas burner with a low-pressure waste gas burner. The City has contingency plans for disposing of raw or partially digested solids that do not meet Class B biosolids criteria in the unlikely event that ESD No. 4 or No. 5 must be removed from service before Silo Digester No. 3 is operational. Possible alternatives include the Barr-Tech composting facility located near Sprague, Washington; landfill; or the waste-to-energy facility.

The City has decided to demolish Digester No. 2 prior to the construction of Silo Digester No. 3, in the same contract, because of reduced impacts to the operation of RPWRF and reduced construction costs for Silo Digester No. 3. The City has currently postponed demolition of Digester No. 1 until Digester No. 3 is in service. During final design of Silo Digester No. 3, construction access benefits regarding demolition of Digester No. 1 will be considered and implemented if deemed cost-effective.

Silo Digester No. 3 will have a concrete foundation poured on top of the old digester bottom cone to avoid excavating next to the digester thickening building. Future heating and mixing systems will be housed in the digester thickening building, and no additional gallery space is required. The silo digester will be an 80-foot-diameter cast-in-place concrete cylinder but will have 45-degree angle or tapered walls in the top 10 feet, a 60-foot-diameter steel dome, and an enclosed pipe chase to meet the intent of the *Aesthetic Master Plan*. A bridge will connect the top of Silo Digester No. 3 with the existing elevator tower and with other bridges leading to the existing stair tower. A new Silo Digester No. 2 will have a design similar to No. 3 . A new stair tower and two new bridges will be constructed between the new silo digesters when Silo Digester No. 2 is constructed after 2030.

Normal operation (with two ESDs and one silo digester) will be two ESDs operating full as a primary digester and one silo operating at reduced level as a secondary digester. The reduced level of the secondary digester provides volume for foam accumulation and for intermittent operation of BFP dewatering. Gravity transfer of digesting solids from the primary digester to the secondary digester will be used instead of the pumped transfer currently used. Pumped transfer was used in the design of ESDs Nos. 4 and 5 because the elevation of ESDs Nos. 4 and 5 is higher than digesters Nos. 1 and 2, creating a potential overfilling hazard. Therefore, the existing pump transfer system in the ESD gallery will be demolished and all transfers between digesters will be by gravity. Since digesters Nos. 2, 3, 4, and 5 will be the same elevation, there is no danger of overfilling and gravity transfer is preferable. The high-low intertie allows transfer of digesting solids at high rates at the base of the digesters, and high rates of digester gas transfer at the top of the digesters. Digester gas will result from rapid changes in liquid level when transferring digesting solids.

Table 6-5 lists design criteria for Silo Digester No. 3. The existing high-pressure Waste Gas Burner No. 3 will be replaced with a low-pressure waste gas burner matching existing low-pressure Waste Gas Burner No. 4. Currently, burners Nos. 3 and 4 have a common pilot lighting system that will be separated into two, one for each burner. Table 6-5 lists design criteria for low-pressure waste gas burners Nos. 3 and 4.

TABLE 6-5
Design Criteria for Silo Digester No. 3 and Low-Pressure Waste Gas Burner Nos. 3 and 4

Parameter	Design Criterion
Silo Digester:	
Number	1
Volume, each	2.85 MG at maximum liquid level, 2.0 MG as secondary digester
Solids retention time:	
Minimum per digester	10 days
Minimum total	15 days
Volatile solids loading	0.2 lb/ft^3/day
Waste gas burners:	
Existing low-pressure	1,115 scfm @ 7 inches of water column
New low-pressure	1,115 scfm @ 7 inches of water column

6.1.1.6 CSO Clarifier No. 6

CSO Clarifier No. 6 is an essential element of NLT. As discussed in Chapter 5, maintenance is needed for continued use. The existing mechanism must be evaluated and demolished if necessary. Recoating the steel structures is not recommended. A new effluent launder may be needed if the steel structure must be demolished. A new drain pump may also be needed if the condition is poor or replacement parts are no longer available.

6.1.2 Flow Diagram

Figures 6-3 and 6-4 are flow diagrams for RPWRF with NLT. Figure 6-3 shows the headworks, primary clarifiers, and activated sludge process. Headworks is unchanged and has a capacity of 150 mgd, which exceeds future expected peak flows from Interceptor No. 1 (10 mgd) and Interceptor No. 2 (120 mgd) with a factor of safety for unexpected events. A fifth primary clarifier will be constructed and secondary Clarifier No. 5 will be operated as a secondary clarifier, increasing the peak primary and secondary treatment capacity to 125 mgd. Since flows to RPWRF greater than 100 mgd are rare, normally primary and secondary Clarifier No. 5 will not be in service and kept empty to allow use for in-line flow equalization.

Primary Clarifier No. 5 will have a separate pipeline, flow meter, and control valve to control flow. Flow to primary clarifiers Nos. 1-4 is controlled by a Venturi flow meter and butterfly valve. Flow to clarifiers

Nos. 1-4 is by a hydraulic flow split relying on symmetry. It is not possible to add Primary Clarifier No. 5 to this flow control and splitting arrangement. Normally Primary Clarifier No. 5 will be offline and empty. If flow to the primary clarifiers exceeds the capacity of the membranes, Primary Clarifier No. 5 will automatically come online and receive an equal amount of flow as primary clarifiers Nos. 1-4. It will reduce the flow to secondary treatment and NLT until Primary Clarifier No. 5 is full.

All flow will go through primary and secondary treatment until the total flow exceeds 125 mgd. At 125 mgd, the two butterfly valves will limit the flow to primary and secondary treatment to 125 mgd and the excess will spill over a fixed weir at the end of the grit chambers and flow by gravity to CSO Clarifier No. 6. CSO Clarifier No. 6 has a volume of 2 MG until the level increases to cause flow from the clarifiers to the chlorine contact basins. If the total volume diverted to CSO Clarifier No. 6 is less than 2 MG, no discharge to the chlorine contact basins occurs and the stored wastewater is pumped to the headworks for full treatment. Wastewater in excess of 2 MG will flow by gravity to the chlorine contact basins for disinfection. This wastewater is considered a “bypass” by EPA and Ecology and must be reported as such. This wastewater receives the minimum primary treatment and disinfection and is called CSO bypass.

The only change to the activated sludge process is use of secondary Clarifier No. 5 as a secondary clarifier to increase the capacity of RPWRF to 125 mgd peak flow. Currently secondary Clarifier No. 5 is used as a CSO clarifier and can be used as a backup clarifier to secondary clarifiers Nos. 1-4. Normally secondary clarifier No. 5 will be offline and empty. If flow to the primary clarifiers exceeds 100 mgd, a gate on B-box will automatically open to allow mixed liquor suspended solids to flow to secondary Clarifier No. 5 and increase the secondary clarifier capacity to 125 mgd. If flow to the membrane facility is greater than capacity and less than 100 mgd, a butterfly valve on the secondary effluent control box to NLT will open and begin filling secondary Clarifier No. 5 reducing the flow to NLT. When secondary Clarifier No. 5 water surface reaches a maximum elevation, a second automatic valve will open, discharging secondary effluent to the chlorine contact basins for disinfection, and the valve leading into secondary Clarifier No. 5 will automatically close. Filling secondary Clarifier No. 5 will reduce the flow to NLT and minimize the volume of secondary effluent that does not receive NLT treatment. The return activated sludge pump will empty secondary Clarifier No. 5 to C-box, distributing flow to aeration basins when plant flows decrease to less than the membrane capacity.

Figure 6-4 shows the flow diagram for NLT and disinfection. The secondary effluent control box is the first facility after secondary clarification. This box operates similarly to the CSO diversion weir at the end of the aerated grit chambers. When flow to the membrane process exceeds the capacity of the membranes, excess flow will spill over a fixed weir and flow by gravity either to the secondary Clarifier No. 5 or to the chlorine contact basins for disinfection. Flow to the membrane NLT facility first passes through drum screens with 1-millimeter holes to remove debris that could accumulate in the membrane basins and damage the membranes. A bypass channel will be provided to allow flow to bypass the screens by flowing over a weir designed to limit the headloss through the screen facility. The NLT pilot membranes operated without screens and while provision of screens is considered prudent in light of the high cost of membranes, some bypass of the screens is considered acceptable in lieu of providing a firm 125-mgd screen capacity. Two 75-mgd drum screens are included to provide over 125 mgd peak flow capacity and firm capacity for 75-mgd.

The next process is rapid mixing, where alum will be added to the secondary effluent. To ensure that the chemical dose is applied equally, flow will be automatically split to each rapid mixer by an automatically controlled butterfly valve controlled by a magnetic flow meter. Four rapid mix trains are included to provide 100 mgd of peak flow capacity. An uninstalled rapid mixer, automatic butterfly valve, and magnetic flow meter will be specified to allow replacement if a failure occurs, in order to maintain the peak flow capacity. Three trains can hydraulically pass 100 mgd.

Flocculation is the final process ahead of membranes. Flocculation provides additional reaction time for the slow phosphorus reactions that reduce phosphorus to very low concentrations as desired at RPWRF. A detention time of 20 minutes is desirable at average flows. A lower detention time is acceptable at higher flows because the higher flows occur fewer hours per year and higher effluent phosphorus can be accepted.

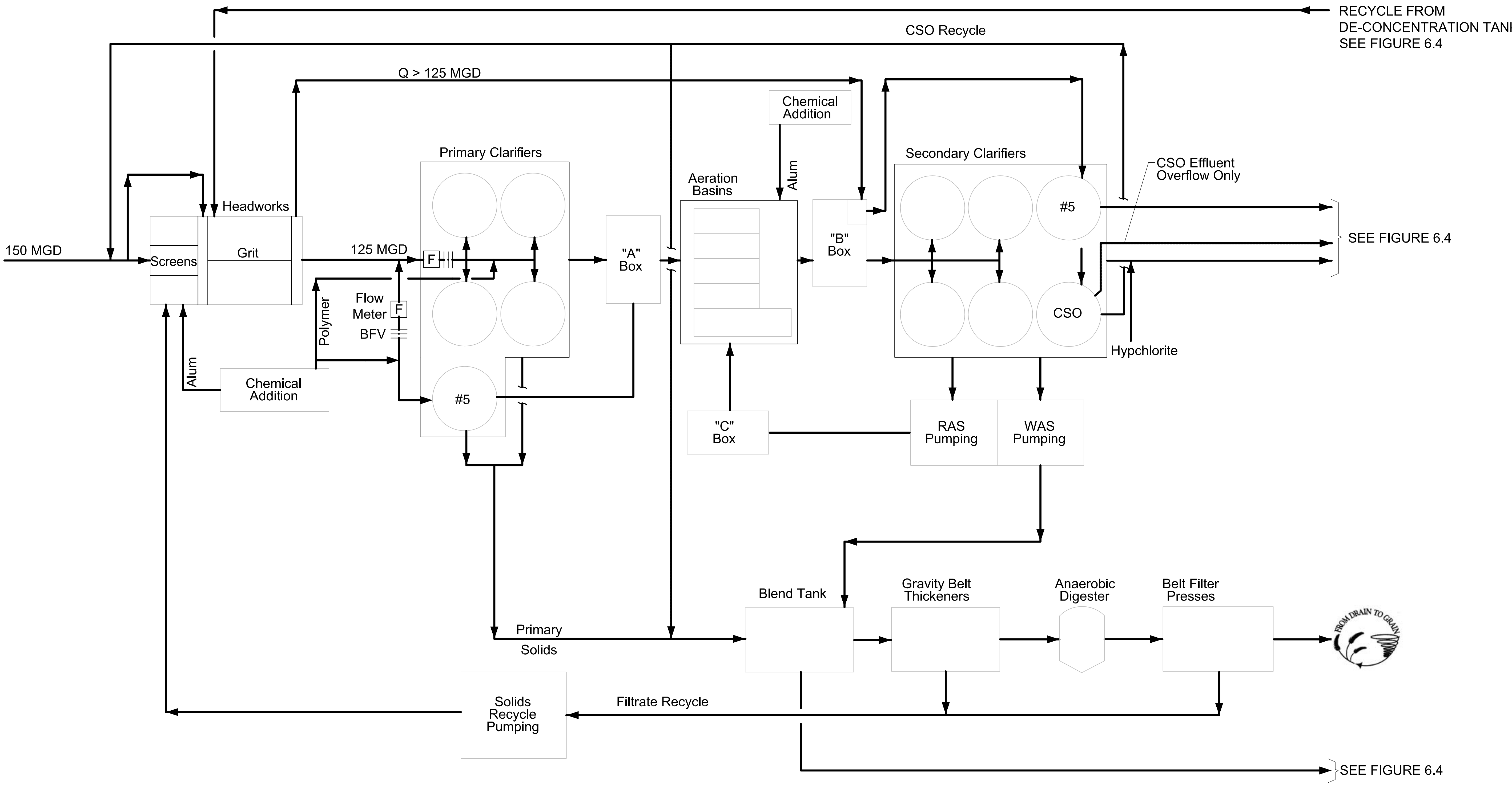


FIGURE 6-3
Process Flow Diagram for Headworks,
Primary Clarifiers, and Activated Sludge Process

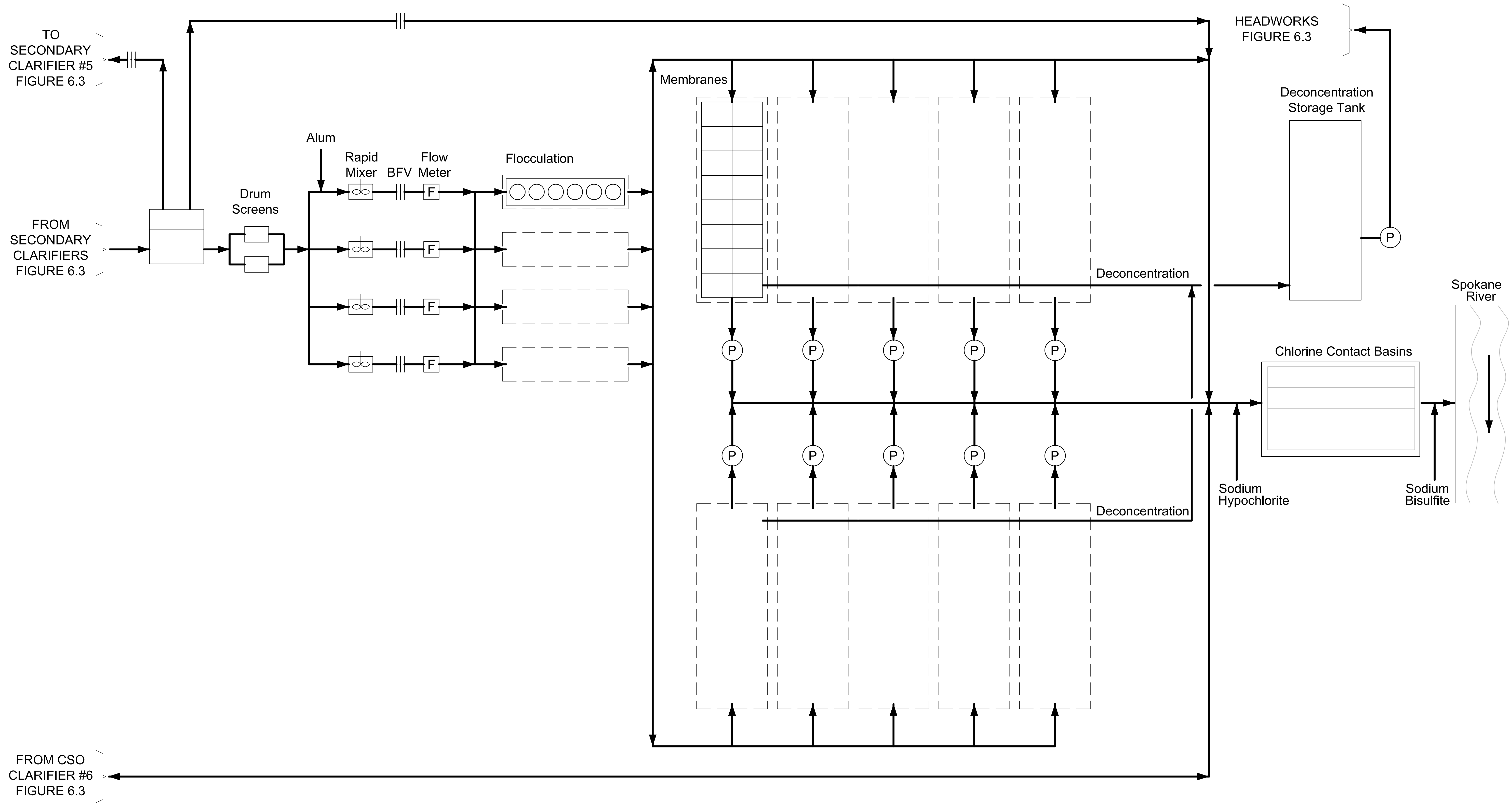


FIGURE 6-4
Process Flow Diagram for NLT and Disinfection

An uninstalled flocculator drive will be specified to allow replacement if a failure occurs in order to maintain peak flow capacity. Three trains can hydraulically pass 100 mgd.

Membranes are the next process. This description is based on use of immersed membranes by GE Zenon. Alternative pressurized membranes may be evaluated as an alternative by the NLT designer as an initial step of design. Initially, 10 of 16 membrane trains will be installed to provide a firm sustained capacity of 50 mgd.

Additional membrane trains can be installed to increase the sustained flow capacity and increase the intermittent peak capacity to 125 mgd. It is assumed that 15 of 16 spaces for cassettes will be installed in each membrane train. Each membrane train has a permeate pump that pulls a negative pressure on the membrane and pumps the effluent to the chlorine contact basins for disinfection. There are several support systems including aeration, membrane controls, and cleaning systems that are supplied by the membrane supplier that are not described here and will be specified by the NLT designer. Periodically, the membrane tanks will be drained by gravity to the deconcentration storage tank to remove accumulated solids. The solids and liquid will be pumped back to the headworks for solids removal and treatment with primary and waste activated sludge.

Chlorine disinfection using sodium hypochlorite will continue to be practiced using the existing chlorine contact basins. Sodium bisulfite is added at the chlorine contact basin effluent weirs to react with chlorine residual and reduce this to nearly zero concentration to control the toxicity of the effluent.

6.2 Other Improvements

This section describes improvements that are not specifically required for NLT, but are likely required prior to 2030. These include stormwater, parking, and landscape improvements; Silo Digester No. 3; Waste Gas Burner No. 3; and other miscellaneous improvements that may be needed, but the timing is not known at this time.

6.2.1 Stormwater, Parking, and Landscaping Improvements

Stormwater, parking, and landscaping improvements were moved from Package B to Package C because of timing of potentially available funds. Stormwater runoff from the visitor parking lot is currently collected and discharged into the Spokane River. Pavement and landscaping will be designed to minimize stormwater runoff with the use of permeable pavements and storm gardens to eliminate a direct connection to the Spokane River. Parking improvements will provide sufficient parking space for visitors and staff, provide safe access for school buses transporting students to RPWRF for tours, and provide fire department access. The current administration building entrance needs to be reoriented 90 degrees from the north wall to the west wall to properly fit with the parking lot and landscaping improvements and meet the *Aesthetic Master Plan*. This improvement will be done with parking and landscaping improvements. Landscaping improvements using concepts developed in Package A will extend to the western entrance of the RPWRF, include a storm garden, and significantly reduce yard maintenance and irrigation demands.

6.2.2 Silo Digester No. 3/Waste Gas Burner No. 3

These improvements are needed with or without NLT, but the extra solids loading resulting from NLT increases the need. Silo Digester No. 3 is needed to allow maintenance of ESDs No. 4 and 5 since one ESD is not sufficient to stabilize the solids. Waste Gas Burner No. 3 is needed to replace the high-pressure waste gas burner that is not usable with the conversion to low-pressure waste gas.

6.2.3 Miscellaneous Improvements

A number of miscellaneous improvements are likely to be needed prior to 2030 that are being deferred or for which the exact schedule for completion is not currently known. Most of these are categorized as maintenance activities. Examples include replacement of the metal skin of existing buildings and additional low-pressure digester gas blowers and boiler burners. The existing metal buildings were constructed in 1977, approaching 40 years of age which is the normal maximum useful life for this type of construction. The metal skin is showing signs of corrosion, but the ability to repair leaks may allow extending the time until total replacement is needed. The digester gas system is going to be tested, and, depending on the outcome of the tests, additional low-pressure blowers and boiler burners may be required. There are likely other maintenance improvements that will be required that have not been identified at this time.

6.3 Design Life

The design of NLT and support facilities is through the year 2030, but as will be discussed in Section 6.4, RPWRF can be expanded to provide capacity for all wastewater treatment many years past that date. The peak flow capacity of 150 mgd to the headworks and 125 mgd primary and secondary treatment is well matched to the capacity of the two interceptors that flow to RPWRF. The 125-mgd primary and secondary treatment capacity is the maximum that can be located on the RPWRF site. Additional site area would be required to expand beyond this capacity and that would require encroachment into Riverside State Park. In the long term, BOD and TSS capacity is limited by the capacity of the aeration basins. Use of CEPT maximizes the capacity of the aeration basins. Capacity can be maximized by constructing Aeration Basin No. 5 and use of innovative technologies in the aeration basins and sidestream treatment. Disinfection facilities match the peak flow capacity of the headworks and have space for expansion if needed beyond 2030. Space exists for construction of sufficient anaerobic digestion to stabilize the maximum quantity of solids that would be generated. The membrane capacity can be expanded by adding up to six additional membrane trains, increasing the sustained flow capacity, and increasing the intermittent peak capacity to 125 mgd to match the primary and secondary treatment capacity. The City will be evaluating reduction of I/I and this reduction has the potential to extend the design life of the installed membrane facilities and the life of the RPWRF site. Spokane County plans to expand the County Facility to limit their flow to RPWRF to less than 10 mgd. Depending on growth in the RPWRF service area, the life of RPWRF is much greater than 20 years if all potential remaining facilities are expanded to their maximum capacity.

6.4 Ability to Expand

As described in the previous section, there are several facilities that can be expanded to provide greater treatment capacity and additional wastewater treatment. Additional BOD and TSS treatment can be provided by construction of Aeration Basin No. 5, adjacent to Aeration Basin No. 6. Non-critical season capacity can be obtained by using CEPT in the non-critical season to defer construction of Aeration Basin No. 5 if the City desires. Fixed media are being developed that can allow operation of aeration basins for nitrification at lower SRTs and thus increase the capacity of existing tankage. Sidestream treatment can also be added to increase aeration basin capacity.

Aeration basins Nos. 1-4 can be modified in the future as described in FPA2 to add anoxic zones and baffles in the aerobic zones to provide additional treatment. Aeration Basin No. 6 has an anoxic zone that reduces effluent total nitrogen, increases alkalinity, and reduces the amount of aeration required. It is possible that nitrogen may become the limiting nutrient in Lake Spokane as the amount of phosphorus is reduced and nitrogen removal will be found necessary.

Space exists for up to three additional 2.85-MG anaerobic digesters, which is much more than needed for the foreseeable future. The GBTs and BFPs have adequate capacity to handle maximum future solids loads.

The membrane process can be expanded to 125 mgd peak flow to match the primary and secondary treatment capacity. Up to six additional membrane trains can be installed to increase the sustained treatment capacity. I/I removal in the collection system can potentially reduce the sustained high flows to RPWRF and reduce the need to expand membrane capacity at RPWRF.

Figure 6-2 shows that there is additional space at the east end of RPWRF that could be used for an additional treatment process or expansion of membranes if needed in the future.

Although the liquid chemical disinfection process has the capacity to treat 150 mgd, it can be upgraded to an ultraviolet facility for typical flows and use a smaller-footprint liquid chemical facility for peak flows. There is space within the existing building for liquid chemical equipment at the east end of RPWRF and within the chlorine contact basins for ultraviolet upgrades or another contact basin if needed in the future.

6.5 Construction Packaging

NLT will be constructed near the end of construction of other RPWRF improvements that are part of the second phase of work called RPWRF Phase 2. Phase 2 is an extension of RPWRF improvements that began in 1997. Three design packages of Phase 2 have been constructed or are under construction and are known as Headworks and Packages A and B. Some of the improvements needed for NLT have been included in two construction packages known as Packages C and D. These improvements were originally identified in FPA2, and the “packaging” is as listed below. Conceptual, preliminary, and final designs of each improvement are in various stages of completion for Packages C and D.

Package C

- Silo Digester No. 3 with upgrades to ESDs Nos. 4 and 5
- Waste gas burner improvements
- Stormwater, parking, and landscaping improvements

Package D

- Primary Clarifier No. 5
- CEPT/chemical storage facility
- Solids recycle pump station
- CSO Clarifier No. 6 improvements

NLT Facility

- Secondary effluent box
- Drum screens
- Rapid mixing and flow splitting
- Flocculation
- Membrane facilities
- Yard piping
- Site work

6.6 O&M/Staffing Needs

The City added RPWRF staff in 2004 in anticipation of NLT. Because the technology and capacity of NLT was unknown at that time, the City did not quantify the specific needs. Subsequently, the City completed an NLT pilot and a staffing analysis of its operation was prepared by the NLT pilot consultant and will be available soon. It has not been decided whether additional staff will need to be hired to operate and maintain NLT and provide additional laboratory support. To make a decision on staff needs for NLT, the City will review the pilot staffing analysis along with the additional labor hours estimated to operate NLT as follows:

Operations labor	1,490 hours per year
Laboratory	60 hours per year
Maintenance mechanic	1,680 hours per year
I&C/electrical technician	770 hours per year
HVAC technician	960 hours per year
Total	4,960 hours per year

6.7 Feasibility of Implementation

NLT has been studied and evaluated at RPWRF for over 10 years. The evaluation completed for FPA3 clearly shows that additional treatment and continued discharge to the Spokane River using a net environmental benefit approach is the cost-effective alternative for complying with the March 1, 2018, deadline established by Ecology. FPA3 provides a pathway to future beneficial use of reclaimed water, if that is a desired result. Effluent limits, especially seasonal limits, for RPWRF to protect Spokane River water quality have been established by an exhaustive TMDL that required 10 years to finalize. The required NLT facilities can be located within the property boundaries of the RPWRF in an area that has been previously disturbed. Funding strategies are being developed and sources have been identified. The recommended alternative is the most feasible alternative for implementation.

6.8 Environmental Impacts

The recommended alternative has the least environmental impact of the alternatives evaluated. As pointed out in Section 6.7, the recommended alternative is located within the property boundaries of RPWRF in an area that has already been disturbed. It is within the 250-foot shoreline management jurisdiction and outside the 100-year floodplain. Determinations of Non-significance through the NEPA/SEPA/SERP processes have been made for this area in the 1999 Facilities Plan and subsequent project-specific SEPA reviews. A Habitat Conservation Area at the west end of the RPWRF was established about 10 years ago to mitigate the current and recently planned construction at the RPWRF. The site is located away from the main Spokane River channel and is screened from recreational users of the river. The NLT facilities have a low profile with no tall structures. The new silo digester will have a similar upper profile, height, and aesthetic appearance as the ESDs. The facilities will have essentially no impact on air quality. Water quality requirements have been extensively studied and effluent limits were established based on a thorough TMDL process. Implementation of the recommended alternative facilitates future use of reclaimed water.

6.9 Projects Completed Or Under Construction

Improvements to RPWRF that were approved in previous facilities plan amendments No. 1 and No. 2 and have been completed or are under construction prior to FPA3 are:

- **Headworks.** Influent flow control facility, three 75-mgd ¼-inch perforated plate screen systems, two screenings washer-compactors, one manual channel, grit system equipment replacement, and grit chamber renovation
- **Package A**. Primary clarifier odor control, secondary piping reconfiguration, parking improvements, CEPT test equipment, primary solids pump station rehabilitation, and skimmings system upgrade
- **Package B**. Standby power upgrades, GBTs Nos. 5 and 6, digester gas compressor room improvements, addition of lubricant storage, improvement of the maintenance loading dock, expansion of the locker facilities, improvement of access to the process and administration buildings HVAC equipment, and chlorine building HVAC improvements
- **Plant Engineering.** Miscellaneous small projects like seal and flush water improvements, power center upgrades, demister maintenance access improvements, and gate replacements

SECTION 7
Financial Analysis

This chapter presents the costs for the recommended improvements; discusses user charges, financial capability, and a capital financing plan; and presents the implementation plan for Packages C and D and for completion of NLT by March 1, 2018.

7.1 Costs

This section presents the capital and annual operation and maintenance costs for the recommended improvements. Capital costs are presented for Packages C and D that will be completed as part of Phase 2 PMO and for NLT as a separate project. The cost estimates in this FPA3 were developed using standards developed by the American Association of the Advancement of Cost Engineering International (AACEI), formerly referred to as the American Association of Cost Engineers. The AACEI cost estimate classification system has five levels of accuracy. Figure 7-1 shows how the accuracy of the cost estimate increases as the level of engineering and project definition increases.

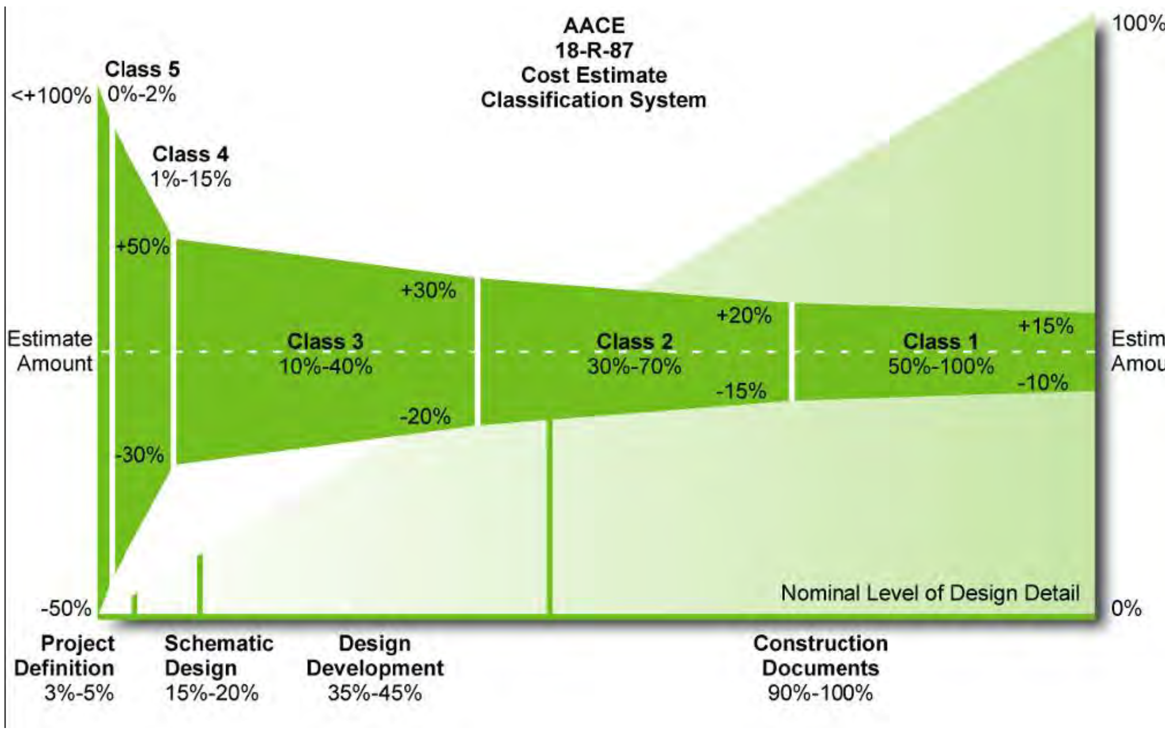


FIGURE 7-1
Construction Cost Estimate Accuracy Ranges

The engineering in this facilities plan amendment varies with the specific facility, but is in the range of 0 to 2 percent complete. As a result, the cost estimates in this facilities plan amendment are Class 5 estimates. Class 5 estimates have an accuracy level of +100 percent to -50 percent. All the construction cost estimates in this facilities plan amendment have been adjusted to October 2013 dollars using the Seattle Engineering Record Construction Cost Index of 9689.

1. A Class 5 cost estimate is a study or feasibility level cost estimate. The estimates in this facilities plan amendment were developed using quantity takeoffs of major items, equipment quotes for major equipment, scale-up factors, and parametric and modeling techniques. Construction costs were taken from RS Means Construction Cost Data. The level of engineering limits the accuracy of this

type of estimate because a large number of assumptions must be made about the facility that will actually be constructed. Class 5 estimates use large allowances for facilities that are undefined and large contingencies for unknowns. As additional engineering is performed, the actual facility to be constructed becomes increasingly defined and the allowances and contingencies are reduced and the accuracy of the estimate increases. For comparison, Class 1 construction documentation cost estimates require 100% construction bid documents and the construction plans and specifications are 100% complete.

The final costs of the project will depend on actual labor and material costs at the time of bid, actual site conditions, productivity, competitive market conditions, final project scope, final schedule, and other variable factors. As a result, the final project costs will vary from those presented herein. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

The construction cost estimates presented in this facilities plan amendment include contractor overhead and profit, general conditions, mobilization, bonds, insurance, and contingency in October 2013 dollars. Construction cost estimates in this facilities plan amendment do not include project costs such as design, administrative, legal, or services during construction. Construction costs also do not include land acquisition (right-of-way) costs, hazardous materials mitigation, permitting, and operations and maintenance costs. The construction costs also do not include sales tax, which is currently 8.7 percent of the construction cost. No adjustments have been made for market conditions since these vary depending on the specific time each project is bid and there is no way to estimate market conditions this far in advance.

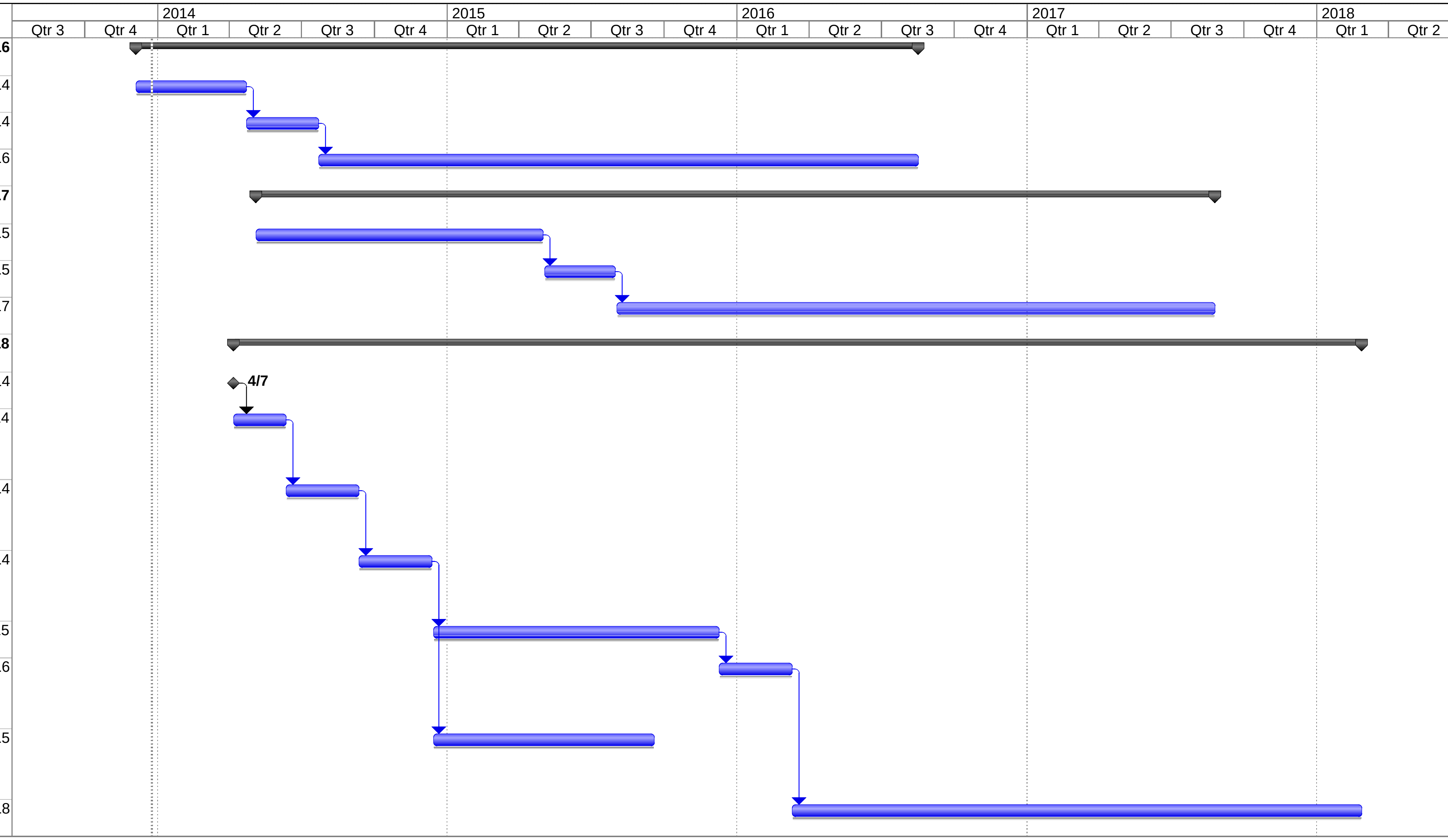
Table 7-1 summarizes the markups applied to the cost estimate to develop the construction and total project costs. The markups are based on typical values for these types of projects at this level of project definition.

TABLE 7-1
Cost Markups Summary

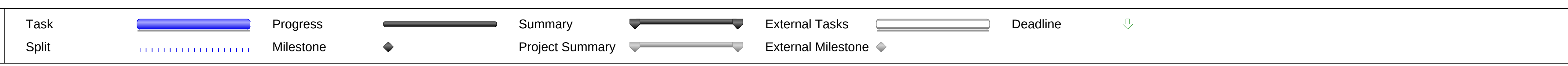
Markup	Percentage
Construction Cost Markups:	
Contractor Overhead & Profit	15%
General Condition	5%
Mobilization/Bond & Insurance	5.7%
Construction Cost Estimate Contingency	30%
Total Project Cost Markups:	
Engineering, legal and administration	25%
Change orders	3%
Sales tax	8.7%
Escalation rate	3% per year to estimated mid-point of construction

Table 7-2 summarizes the construction and total project cost estimates for the recommended projects in this facilities plan amendment. Each estimate is based on the conceptual design presented in Chapter 6. Construction costs are all in October 2013 dollars. Total project costs are in escalated dollars that are different for each construction package based on the mid-point of construction shown in the implementation schedule, Figure 7-2.

ID	Task Name	Duration	Start	Finish
1	**Package C**	**704 days**	**Thu 12/5/13**	**Tue 8/16/16**
2	Silo digester no. 3 design	99 days	Thu 12/5/13	Tue 4/22/14
3	Bidding and award	65 days	Wed 4/23/14	Tue 7/22/14
4	Construction	540 days	Wed 7/23/14	Tue 8/16/16
5	**Package D**	**865 days**	**Mon 5/5/14**	**Fri 8/25/17**
6	Design	260 days	Mon 5/5/14	Fri 5/1/15
7	Bidding and award	65 days	Mon 5/4/15	Fri 7/31/15
8	Construction	540 days	Mon 8/3/15	Fri 8/25/17
9	**NLT***	**1016 days**	**Mon 4/7/14**	**Mon 2/26/18**
10	Notice to proceed	0 days	Mon 4/7/14	Mon 4/7/14
11	Develop equipment prepurchase document Assumes expedited selection of membrane manufacturer.	48 days	Mon 4/7/14	Wed 6/11/14
12	Advertise, bid and award equipment prepurchase contract	66 days	Thu 6/12/14	Thu 9/11/14
13	Vendor prepare equipment prepurchase shop drawings	66 days	Fri 9/12/14	Fri 12/12/14
14	Design of balance of plant	258 days	Mon 12/15/14	Wed 12/9/15
15	Bidding and award balance of plant	66 days	Thu 12/10/15	Thu 3/10/16
16	Fabrication and delivery of prepurchased equipment	200 days	Mon 12/15/14	Fri 9/18/15
17	Construction and start-up	512 days	Fri 3/11/16	Mon 2/26/18



Project: FPA 3 Implementation Sched
Date: Tue 12/24/13



*Schedule may be addressed in the Integrated Plan. The Integrated Plan is currently in development and will be submitted to Ecology in early 2014.

FIGURE 7-2
FPA3 Implementation Schedule

CH2MHILL.

WBG012313172655SPK Fig7-2_FPA3_Implementation_Schedule.ai 12.13.13 ez

TABLE 7-2
Construction and Total Project Cost Estimate

Project	Construction Cost[a, b]	Total Project Cost
Package C:		
Schedule A Silo Digester No. 3 with Upgrades to ESDs Nos. 4 and 5	$11,030,000	$11,030,000
Schedule B Waste Gas Burner Improvements	$1,040,000	$1,040,000
Schedule C Stormwater, Parking, and Landscaping Improvements	$650,000	$650,000
Package C Total Construction Cost	**$12,720,000**	$12,720,000
Escalation to August 2015		$708,000
Subtotal		$13,428,000
Change Orders		$403,000
Subtotal		$13,831,000
Engineering, Legal, and Administration		$3,457,750
Sales Tax		$1,203,000
Package C Total Project Cost (August 2015 dollars)		**$18,492,000**
Package D:		
Schedule A Primary Clarifier No. 5	$4,393,000	$4,393,000
Schedule B CEPT/NLT Chemical Storage	$5,480,000	$5,480,000
Schedule C Solids Recycle Pump Station	$1,709,000	$1,709,000
Schedule D CSO Clarifier No. 6	$2,000,000	$2,000,000
Package D Total Construction Cost	**$13,582,000**	$13,582,000
Escalation to August 2016		$1,186,000
Subtotal		$14,768,000
Change Orders		$443,000
Subtotal		$15,211,000
Engineering, Legal, and Administration		$3,803,000
Sales Tax		$1,323,000
Package D Total Project Cost (August 2016 dollars)		**$20,337,000**
NLT:		
NLT Total Construction Cost - 50-mgd Average Capacity Membrane Facility	**$81,354,000**	$81,354,000
Escalation to August 2017		$9,761,000
Subtotal		$91,115,000
Change Orders		$2,733,000
Subtotal		$93,848,000
Engineering, Legal, and Administration		$23,462,000
Sales Tax		$8,165,000
NLT Total Project Cost (August 2017 dollars)		**$125,475,000**
Facilities Plan Amendment No. 3 Total	**$107,656,000**	**$164,304,000**[c]

[a] Construction costs are expressed in October 2013 dollars (ENR CCI 9689) unless otherwise noted.
[b] City of Spokane sales tax, currently 8.7%, and engineering, legal, and administration are not included.
[c] Sum of inflated cost estimates is expressed in 2015, 2016, and 2017 dollars.

The mid-point of construction is August 2015, 2016, and 2017 for Package C, Package D, and NLT, respectively. Table 7-3 summarizes additional annual O&M costs associated with the NLT improvements. Annual O&M costs are in October 2013 dollars and the change in cost represents a change in the quantity required and does not include the effect of inflation.

TABLE 7-3
Additional Annual O&M Costs for 50-mgd Membrane NLT Improvements
(October 2013 dollars)

Component	2018	2030
Labor[a]	$209,000	$209,000
Electricity	$164,000	$175,000
Chemicals		
Alum	$248,000	$264,000
Sodium hydroxide	$145,000	$154,000
Citric acid	$80,000	$85,000
Sodium hypochlorite	$43,000	$46,000
Preventative maintenance and repair materials	$204,000	$437,000
Solids handling	$97,000	$104,000
Total	$1,190,000	$1,474,000

[a] Represents the value of labor allocated to NLT and not additional staff needs.

7.2 User Charges, Financial Capability, and Capital Financial Plan

The City funds RPWRF capital improvements predominantly with sewer rates paid by customers connected to the collection system. Any debt obligations incurred must also be repaid from rate revenue. In addition to the upgrades described in this Facilities Plan Amendment No. 3, the City faces significant costs for controlling CSOs and stormwater and installing recommended improvements at the RPWRF. Sewer rate increases of 15.00 percent, 16.85 percent, and 13.50 percent were enacted in 2009, 2010, and 2011, respectively, to enable the City to better meet these financial obligations. Future rate increases are planned to be limited to the rate of inflation. The City is anticipating funding many improvements for CSO facilities, stormwater facilities, and RPWRF improvements using SRF loans to maximize improvements with the least impact to user rates. The Integrated Plan is evaluating all CSO, stormwater, and NLT improvements to provide the maximum overall water quality benefit and will evaluate all three programs in terms of user charges, financial capability, and capital financial planning.

7.3 FPA3 Implementation Plan

Figure 7-2 shows the implementation schedule for the recommended facilities in this facilities plan amendment.

Package C final design is scheduled to be complete at the end of April 2014, which would allow the contract to be awarded by the end of July 2014. Construction would be completed by September 2016, and Silo Digester No. 3 could potentially be available for service as a secondary digester by the end of 2015.

Package D contains facilities needed for the start of NLT. Primary Clarifier No. 5 is needed to increase the primary treatment capacity to 125 mgd as part of the recommended 50-mgd NLT membrane filtration option. CEPT and chemical storage are needed for NLT to operate. CEPT reduces the phosphorus level to NLT and is needed for NLT to meet discharge standards. Chemical storage for NLT is included in this facility and chemicals are required for NLT to meet discharge standards. The solids recycle pump station is needed to provide CEPT treatment to the solids recycle flow stream. Design of Package D will be started after the design of Package C is completed. Staggering the design schedule for Package D from Package C will reduce the conflicts for RPWRF staff time for input and review of design products and allow Package D to bid after the award of the Package C construction contract. Package D construction is scheduled to be complete September 2017 to allow startup with the NLT process.

The schedule for NLT is based on dates in the June 2011 NPDES permit. The schedule assumes that design and procurement (i.e., prepurchase) of the major equipment begin in April 2014 and that it takes one year to obtain approved shop drawings and one year for equipment delivery. It assumes that the design of the balance of the plant begins about half-way through the shop drawing preparation for the NLT prepurchased equipment and is completed in one year. The “balance of the plant” refers to the sitework, structures, mechanical, and electrical facilities needed for a complete, operational facility. The design of the balance of the plant is assumed completed 9 months after shop drawings are finalized so that the design is developed for the specific equipment to be provided. The general contractor bidding the balance of plant contract, including equipment installation, will have the shop drawings to assist in preparation of the bid. The delivery of equipment is scheduled after award of the balance of plant contract so the installing contractor will assume the prepurchase contracts and can schedule delivery of equipment as needed for construction. Completion of construction and startup is shown for March 1, 2018, to comply with the Ecology schedule set forth in the RPWRF NPDES permit.

CHAPTER 8

Other

This chapter addresses additional requirements of the Ecology Facilities Plan Checklist that have not been presented in previous chapters.

8.1 Water Quality Management Plan Conformance

This facilities plan amendment was developed to maintain capacity to treat estimated wastewater quantities and comply with the June 2011 NPDES permit effluent limits for the RPWRF until 2016.

8.2 Environmental Compliance

Federal and state law requires that states conduct environmental reviews of all SRF projects, which includes this facilities plan amendment (FPA3). Therefore, before an SRF agreement can be signed, concurrence must be obtained from the Washington State Department of Ecology on environmental documents and determinations prepared and issued by the SRF applicant. Concurrence is obtained through the State Environmental Review Process (SERP), which helps to ensure that SRF recipients select environmentally sound alternatives for the planning, design, construction, and implementation of SRF projects. To complete SERP, applicants must comply with the State Environmental Policy Act (SEPA), the National Environmental Policy Act (NEPA), and other applicable environmental statutes, regulations, and executive orders.

8.2.1 National Environmental Policy Act

The National Environmental Policy Act under 42 U.S. Code 4321 requires consideration of environmental impacts of a proposal when the action occurs on federal land, a federal permit is required, or federal funding is used by the project. In Washington State these federal funds are administered by Ecology for water reclamation facility projects. Ecology uses the SERP to conduct an environmental evaluation of a project under the National Environmental Policy Act. Any SERP or public involvement related to that process would be conducted when applicable at some future date.

8.2.2 State Environmental Policy Act

The State Environmental Policy Act (SEPA) under Chapter 43.21C RCW requires consideration of environmental impacts of a proposal before making local and state decisions, including the issuance of permits. A SEPA checklist was prepared for the Facilities Plan that included a fifth primary clarifier, a new anaerobic digester, and effluent filtration for phosphorus removal located within the existing plant site. The scope of the checklist is sufficiently broad to consider the environmental impacts of all of the proposed improvements in FPA3. A copy of the SEPA checklist is included in Appendix A. The Facilities Plan is a nonproject, programmatic action and separate environmental filings will be made for individual projects undertaken as a result of implementing the recommendations set forth in the Facilities Plan. Permits applicable to the RPWRF include an NPDES permit, a State Waste Discharge Permit, a Water Quality Certification from Ecology, a Notice of Construction for air emissions from Spokane Regional Clean Air Agency, and Shorelines and Floodplain Development permits from the City of Spokane.

8.2.3 Permits

Shorelines compliance is included among these environmental regulations and since the 1999 Facilities Plan, the RPWRF obtained shorelines permits and amendments in 2005 that included:

- Shoreline Substantial Development Conditional Use Permit
- Variance to shoreline 50-foot setback and 15-foot buffer
- Zoning Special Permit Amendment

Appendix B includes the shoreline permit and 2005 amendments. These permits allow NLT facility improvements within the shoreline's 50-foot setback and 15-foot buffer. Any amendment to the shorelines permit that may be needed for NLT will be requested during design of the NLT facilities.

8.2.4 Environmental Elements

Environmental elements that typically are of most concern for water reclamation projects are water quality/resources, water rights, odors, noise, aesthetics, land use including shorelines and floodplain development, and archeological and historical sites. Other issues include endangered species/habitats, wetlands, transportation, light/glare, and use of prime or unique farmlands, depending upon the type and location of project proposed.

8.2.5 Compliance

FPA3 amends the 1999 Facilities Plan, which was a nonproject, programmatic action. Ecology concurred on May 16, 2000, that "the State Environmental Policy Act (SEPA) process is complete" and that the Facilities Plan "is in compliance with the State Environmental Review Process (SERP)." FPA3 is fully within the scope of the Facilities Plan as demonstrated below. Specific examples of the scope in the Facilities Plan compared to FPA 3 are listed below and the premises are generally the same:

- Total population served and projected to be served: 370,000 in the Facilities Plan compared to 260,000 in FPA3
- Projected annual average design flow: 54.4 MGD in the Facilities Plan compared to 41.2 MGD in FPA3
- Peak design flow: 146 MGD in the Facilities Plan compared to 150 MGD in FPA3
- Projected annual average BOD loading: 85,100 lb/day in the Facilities Plan compared to 57,600 lb/day in FPA3
- Project annual average TSS loading: 85,100 lb/day in the Facilities Plan compared to 59,200 lb/day in FPA3
- Primary clarifiers: 5 in the Facilities Plan compared to 5 in FPA3
- Aeration basins: 6 in the Facilities Plan compared to 5 in FPA3
- Secondary clarifiers: 6 in the Facilities Plan compared to 5 in FPA3
- Filtration for phosphorus removal: Yes in the Facilities Plan compared to yes in FPA3
- Storm clarifier: 1 in the Facilities Plan compared to 1 in FPA3
- Anaerobic digesters: 4 in the Facilities Plan compared to 3 in FPA3
- Improvements to solids thickening and dewatering: Yes in the Facilities Plan compared to yes in FPA3
- Improvements within existing RPWRF site boundaries: Yes in the Facilities Plan compared to yes in FPA3

The SEPA and SERP reviews for the 1999 Facilities Plan are therefore still valid for FPA3. As required for the 1999 Facilities Plan, separate environmental filings will be made for individual projects undertaken as a result of implementing the recommendations set forth in FPA3.

CHAPTER 9

References

Bovay Northwest. 1999. *City of Spokane Wastewater Facilities Plan* (Facilities Plan). November 1999.

Buchanan, J. 1986. *Groundwater Nitrate Contamination in Deer Park, WA.* Prepared for Washington Department of Ecology.

CH2M HILL. 2000. *Wellhead Protection Program.* Prepared for Washington Department of Ecology, January, 2000.

CH2M HILL. 2003. *Odor Control Master Plan.* Prepared for City of Spokane. December 2003.

CH2M HILL. 2004. *Spokane River and Long Lake Reservoir Use Attainability Analysis.* Prepared for Spokane River UAA Sponsoring Committee. December 2004.

CH2M HILL. 2006. *Aesthetic Master Plan.* Prepared for City of Spokane. October 2006.

CH2M HILL. 2010. *Spokane Riverside Park Water Reclamation Facility Plan Amendment* [No. 1]. Prepared for City of Spokane. March 2010.

CH2M HILL. 2012. *Riverside Park Water Reclamation Facility Wastewater Facilities Plan Amendment No. 2* (FPA2). September 2012.

CH2M HILL. 2013a. *Evaluation of Agricultural Land Application/Reuse Alternatives.* Prepared for City of Spokane.

CH2M HILL. 2013b. *Evaluation of Flow Augmentation and Groundwater Recharge Using Class A Reclaimed Water.* Prepared for City of Spokane.

City of Spokane. 2012. *City of Spokane's Comprehensive Plan*. Revised Edition January 2012.

Executive Order 11988. *Floodplain Management.* May 24, 1977.

Lincoln County Conservation District et al. 2010. *Prefeasibility Assessment Report for the Lincoln County Passive Rehydration Project.* Prepared for Washington Department of Ecology. December 2010.

Miller, S. 2002. *Groundwater Protection – An Integrated Approach, 20 Years of Spokane Valley Aquifer Protection.* Research and Extension Regional Water Quality Conference 2002.

Northwest Land & Water, Inc. 2011. *Hangman Creek Watershed (WRIA 56) Hydrogeologic Characterization & Monitoring Well Drilling Final Report.* Prepared for Spokane County Conservation District, June 1, 2011.

Spokane Aquifer Joint Board. 2013. www.spokaneaquifer.org. Accessed on December 3, 2013.

Spokane County. 2012. *Spokane County Comprehensive Plan*. http://www.spokanecounty.org/bp/content.aspx?c=2915. Updated 2012.

Spokane County Water Resources et al. 2011. *West Plains Hydrogeologic Database*. Prepared for WRIA 54 Watershed Implementation Team. http://www.spokanecounty.org/WQMP/project54/asp/home.asp.

Sweet-Edwards/EMCON, Inc. 1991. *Deer Park Ground Water Characterization Study Preliminary Hydrogeologic Summary Report.* Prepared for Spokane County. October 11, 1991.

U.S. Department of Energy. 1988. *Site Characterization Plan, Reference Repository Location, Hanford Site, WA.* Consultation draft. Office of Civilian Radioactive Waste Management, Washington D.C. DOE/RW-0614, v. 1-9.

U.S. Fish and Wildlife Service. 2013. Turnbull National Wildlife Refuge, Washington. www.fws.gov/refuge/Turnbull. Accessed December 13, 2013.

Washington State Department of Archaeology and Historic Preservation. 2013. Washington Information System for Architectural and Archaeological Records Data (WISAARD). https://fortress.wa.gov/dahp/wisaard/. Accessed December 3, 2013.

Washington Department of Ecology (Ecology). 2006. *Draft Spokane River Water Quality Managed Implementation Plan Proposal*. January 2006.

Washington Department of Ecology (Ecology). 2008. *Criteria for Sewage Works Design* (Orange Book). Revised August 2008. https://fortress.wa.gov/ecy/publications/summarypages/9837.html.

Washington Department of Ecology (Ecology). 2011. *Water Quality Program Permit Writers Manual* . Revised December 2011. https://fortress.wa.gov/ecy/publications/summarypages/92109.html.

Water Research Foundation. 2010. *North America Residential Water Usage Trends Since 1992.* Prepared by Coomes et al., University of Louisville Civil and Environmental Engineering. Sponsored by Water Research Foundation and EPA.

Appendix A
SEPA Checklist

COPY

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

4601 N. Monroe, Suite 202 • Spokane, Washington 99205-1295 • (509) 456-2926

May 16, 2000

Mr. Richard Raymond, P.E.
Capital Improvements Program/GIS
City of Spokane
808 W. Spokane Falls Blvd.
Spokane, WA 99201-3343

RE: Notification of Compliance with State Revolving Fund Environmental Requirements for: City of Spokane – WW Facilities Plan (Nov. 1999); City Project No. 14065; CCWF Grant No.: G9300 049

Dear Mr. Raymond:

Enclosed for your information and record files is a copy of Ecology's concurrence that the State Environmental Policy Act (SEPA) process is complete and that the above referenced project is in compliance with the State Environmental Review Process (SERP).

Please call me at (509) 625-5178 if you have any questions.

Sincerely,

Calvin L. Ferguson

Calvin L. Ferguson, P.E.
Project Engineer
Water Quality Program

CLF:slt

Enclosure: Approved SRF "Project Environmental Classification/Documentation Concurrence" form, dated May 16, 2000

cc w/enclosure: Tom Arnold, City of Spokane
Karen Beatty-Lee, Ecology/WQP-FMS
Ken Merrill, Ecology/WQP-ERO [Permit File WA-0024473 [SAWTP)]

WASHINGTON STATE WATER POLLUTION CONTROL REVOLVING FUND
PROJECT ENVIRONMENTAL CLASSIFICATION/DOCUMENTATION CONCURRENCE

Grant Number: G9300 049

Applicant: City of Spokane

Project Title: Wastewater Facilities Plan (Nov 1999)

The Water Quality Program has reviewed the attached documents and concurs that the proposed project:

1. ☐ Meets the criteria for a Categorical Exemption per WAC 197-11-800 ( )* and no further environmental documentation is required.
2. ☐ Requires the preparation of an environmental checklist and Determination of Nonsignificance.
3. ☐ Requires the preparation of an environmental checklist and Determination of Significance and that an Environmental Impact Statement will subsequently be prepared.
4. ☐ Approval of the scoping process document.
5. ☐ Approval to circulate checklist and Determination of Nonsignificance.
6. ☐ Approval to circulate Environmental Impact Statement.
7. [x] SEPA process complete.

   Type of environmental document prepared:

   SEPA Evironmental Checklist; Dated and Signed: July 15, 1998
   Determination of Nonsignificance; Dated and Signed: July 22, 1998
   SERP Environmental Issues Checklist; Issued: May 15, 2000

8. ☐ NEPA process complete.

   Type of environmental document prepared:

   Date Approved:

9. [x] The subject project is in compliance with the State Environmental Review Process.

5-16-00
Date of Approval

Carl Nuechterlein, Section Manager
Eastern Regional Office
Water Quality Program
Department of Ecology

* Write in specific exemption category

[14065 Fac Plan Nov99-SERP conc.doc]

WASHINGTON STATE WATER POLLUTION CONTROL REVOLVING FUND
STATE ENVIRONMENTAL REVIEW PROCESS
ENVIRONMENTAL ISSUES CHECKLIST

Project Name: **WASTEWATER FACILITIES PLAN (dated NOV-1999)**

Applicant: City of Spokane, WA Grant Number: G9300 049
Date Issued: May 15, 2000

Reviewed By: Cal Ferguson Date: May 15, 2000

In Compliance: [**X**] Not In Compliance: [**O**]

BACKGROUND

X Purpose and need.

The "Wastewater Facilities Plan" is a nonproject, programmatic action; it provides recommendations for future management and operational improvements for both the wastewater collection system and the Spokane Advanced Wastewater Treatment Plant (SAWTP). It also addresses current and anticipated regulations, outlines system expansion alternatives, and recommends future capital improvements and implementation schedules. Separate environmental filings will be made for individual projects undertaken as a result of implementing the recommendations or alternatives set forth in the facilities plan.

X Description of future environment without the project.

X Description of existing environment.

X Analysis of alternatives including where applicable: 1) flow and waste reduction measures, including infiltration/inflow reduction and pretreatment requirements; 2) alternative locations, capacities, and construction phasing of facilities; 3) alternative waste management techniques, including pretreatment, treatment and discharge, wastewater reuse, land application, and individual systems; 4) alternative methods for management of sludge; and improving effluent quality through more efficient operation and maintenance.

See the SRF Environmental Checklist and the facilities plan for a discussion of alternatives.

X Documentation.

A State Environmental Policy Act checklist and Determination of Nonsignificance were prepared and issued for the project on July 22, 1998.

X Public notice and participation.

Public notice and participation was made available through public meetings and compliance with State Environmental Policy Act.

ENVIRONMENTAL ELEMENTS

X Earth.

There will be a minor impact from future construction activities associated with the removal and replacement of earth.

X Clean Air Act, 42 U.S.C. 7506(c).

See "SEPA" environmental checklist for a more complete discussion regarding this item.
The project is located in an attainment area.
Future construction activities are not expected to adversely impact air quality.}
Odors from operating the wastewater treatment plant (WWTP) or the WW collection system are not expected to be significantly different from those currently produced.
New construction at the WWTP will include odor control/scrubber facilities.

X Safe Drinking Water Act, Section 1424(e), and PL 92-523, as amended.

Surface water discharges from the WWTP will be treated to meet NPDES permit requirements.
The facilities plan outlines proposed measures which, when implemented, should control or reduce impact to surface waters, ground water and runoff water.

X Wild and Scenic Rivers Act, PL 90-542, as amended.

The Spokane River is not included in the Department of Ecology's listing of wild and scenic rivers in Washington State.

X Coastal Barrier Resources Act, 16 U.S.C. 3501 et seq.

There are no designated Coastal Barrier Islands in Washington State. The project will not affect any barrier islands.

X Executive Order 11990, Protection of Wetlands.

Project specific construction plans and specifications will be required to specify the applicable mitigation measures necessary to assure wetland protection.

X Appropriate water conservation measures.

Because of the interchangeability between the Spokane River and the Spokane Valley-Rathdrum Prairie Aquifer (EPA designated sole source aquifer), the infiltration and inflow reduction measure outlined in the facility plan is intended to, when implemented, help conserve and provide additional protection to the aquifer (ground water).

X Executive Order 11988, Floodplain Management

The project does not lie within a 100-year flood plain.

X Plants.

X Animals.

X Endangered Species Act 16 U.S.C. 1531 et. seq.
Fish and Wildlife Coordination Act, PL 85-624, as amended.

Plants: *No threatened or endangered plant species are known to be on or near the project site.*

Animals: *Bald Eagles are known to be on or near the project site.*

X Energy and natural resources.

Future project construction may require the use of petroleum, steel, wood, concrete, sand, soil, and other standard construction materials and products. These uses are not considered substantial.

Electrical power will be required for operation of process equipment, lighting, etc.; electrical power needs are supplemented by existing co-generation facilities. Natural gas is required for heating of buildings, which is supplemented by the production of methane gas at the WWTP.
Gasoline, diesel fuel and oil will be used primarily by equipment during construction of future facilities.

X Appropriate energy reduction measures.

Energy efficient equipment will be specified whenever possible.
The treatment facility will be operated in manner so as to minimize energy use.
Use of digester methane gas in heating and electrical power generation at the SAWTP.
Replacement of inefficient equipment as part of the WW facilities rehabilitation.
Use of energy efficient materials during construction.

X Environmental health.

Effluent from SAWTP will be treated to meet NPDES permit requirements.
Specific environmental health hazards will be addressed in the construction plans and specifications on a project specific basis.

X Noise.

Unavoidable short-term noise from construction equipment is expected.
Construction noise will be controlled by construction contract limitations contained in the plans and specifications.
During the hours of plant operation there will be some unavoidable noise from plant /treatment process equipment; however, it is anticipated that it will not be noticeable outside the plant boundary.

X Land use.

The project is consistent with existing land uses.

X Farmland Protection Policy Act, 7 U.S.C. 4201 et seq.

There are no prime or unique farmlands located in the project area. No farmlands will be impacted by the project.

X Coastal Zone Management Act of 1972, PL 92-538, as amended.

There are no designated Coastal Barrier Islands in Washington State. The project is not located within a designated Coastal Zone Management Area and will not affect any barrier islands. Therefore, Coastal Zone Management Certification is not required.

X Shoreline management.

Some proposed capital improvements outlined in the Facilities Plan may occur within 200 feet of a shoreline (see Facilities Plan for details).
Where applicable, a Joint Aquatic Resource Application [JARPA] will be submitted on a project specific basis that will address the following permits:

- *Hydraulic Permit Approval*
- *Shorelines*
- *Floodplain Management*
- *Section 401 (Water Quality)*
- *Section 404 (Wetlands)*
- *other required permits*

X Housing.

X Aesthetics.

X Light and glare.

X Multiple use including recreation, other open space, and environmental education.

Recreational opportunities in the vicinity of proposed capital improvements outlined in the facilities plan include hiking, biking, various water activities, etc. However, since wastewater being processed at the existing WWTP poses a health hazard if it comes into contact with the public, multiple use of the SAWTP is not included in the scope of the project.

X Archaeological and Historic Preservation Act of 1974, PL 93-291. Executive Order 11593, Protection and Enhancement of the Cultural Environment. National Historic Preservation Act of 1966, PL 89-665, as amended.

No archaeological or historic resources are known to exist on the site.

X Transportation.

The project will not require any new roads or streets, or improvements to existing roads or streets (except as may be required for restoration of existing road surfacing due to installation of water, sewer, gas, electric, telephone or other utilities which are an integral part of the total project).

X Public Services.

The project will not increase the need for additional public services such as fire or police protection, health care, schools, etc.

X Utilities.

X Evaluating environmental consequences of proposed action. (Measures to mitigate adverse impacts, irreversible or irretrievable commitments of resources to the project, and the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity).

X Minimizing adverse effects of the proposed action.

Standard construction mitigation measures to control temporary impacts on transportation, earth, air quality, water quality and noise will be included in design and construction documents prepared for the project.

*********FEDERAL TAX ID NO. 910420030

AFFIDAVIT OF PUBLICATION

STATE OF WASHINGTON
County of Spokane, ss.

Name: SPOKANE CITY PLANNING & ENGINEER **Acct:** C023605

P.O.: **No. Lines:** 98

Total Cost: $97.04 **Log No:** SP4355

I, Jennee M. Bartos
do solemnly swear that I am the Principal Clerk of the **SPOKESMAN-REVIEW**, a newspaper established and regularly published, once each day in the English language, in and of general circulation in the City of Spokane, Spokane County, Washington; and in the City of Coeur d'Alene, Kootenai County, Idaho; that said newspaper has been so established and regularly published and has had said general circulation continuously for more than six (6) months prior to the 23rd day of July, 1941; that said newspaper is printed in an office maintained at its place of publication in the City of Spokane, Washington; that said newspaper was approved and designated as a legal newspaper by order of the Superior Court of the State of Washington for Spokane County on the 23rd day of July, 1941, and that said order has not been revoked and is in full force and effect; that the notice attached hereto and which is a part of the proof of publication, was published in said newspaper, one time(s), the publication having been made once each time on the following dates:

July 24, 1998

That said notice was published in the regular and entire issue of every number of the paper during the period of time of publication, and that the notice was published in the newspaper proper and not in a supplement.

Subscribed and sworn to before me at the City of Spokane, this 24 day of July, 1998

Staci J. Brown

Notary Public in and for the State of Washington, residing at Spokane, Wash.

OFFICIAL
STACI J. BROWN
NOTARY PUBLIC–STATE OF WASHINGTON
COUNTY OF SPOKANE
My Commission Expires May 1, 2000

CITY OF SPOKANE
DETERMINATION OF NONSIGNIFICANCE
SPOKANE ENVIRONMENTAL ORDINANCE

DESCRIPTION OF PROPOSAL: The City of Spokane's Wastewater Facility Plan (Plan) identifies wastewater treatment plant, combined sewer overflow reduction, and collection system programs required to accommodate current and future public wastewater needs in accordance with the National Pollution discharge Elimination System (NPDES) regulatory permit requirements. The Plan identifies and prioritizes capital improvement projects as well as maintenance and rehabilitation of existing facilities. The Plan also incorporates the findings and recommendations of the City's Combined Sewer Overflow (CSO) Reduction Program which was approved by the Department of Ecology (DOE) in 1994. The Plan has been coordinated with Spokane County and is currently under final review by the DOE.

PROPONENT:
City of Spokane, Washington

LOCATION OF PROPOSAL, including street address, if any: The Wastewater Facility Plan includes the sewer system within the City of Spokane Sewer Service Area and Interim Urban Growth Area Boundary (IUGA) as well as the City's Advanced Wastewater Treatment Plant (AWWTP) located at 4401 N. Aubrey L. White Parkway, Spokane, WA 99205.

LEAD AGENCY: City of Spokane, Department of Wastewater Management.

DETERMINATION: The lead agency for this proposal has determined that it does **not** have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency, which materials are available to the public on request.

COMMENT PERIOD: Comments must be submitted in writing, not later than 5:00 P.M., August 7, 1998 to the responsible official listed below, if they are intended to alter the DNS. The lead agency will not act on this proposal until then.

APPEALS: You may appeal this DNS, in writing, to the responsible official listed below, no later than August 24, 1998. You should be prepared to make specific factual objections. Contact Gerald G. Shrope at (509) 625-6270 to ask about, or make arrangements for reading the SEPA appeals procedure.

RESPONSIBLE OFFICIAL:

Name: Gale Olrich
Position/Title:
Director Wastewater Management
Phone: (509) 625-7900
Address: 909 East Sprague Avenue, Spokane, WA 99202

DATE ISSUED: July 22, 1998
SIGNATURE: /s/ Gale Olrich
SP4355
106780

CITY OF SPOKANE
DETERMINATION OF NONSIGNIFICANCE
SPOKANE ENVIRONMENTAL ORDINANCE

DESCRIPTION OF PROPOSAL: The City of Spokane's Wastewater Facility Plan (Plan) identifies wastewater treatment plant, combined sewer overflow reduction, and collection system programs required to accommodate current and future public wastewater needs in accordance with the National Pollution Discharge Elimination System (NPDES) regulatory permit requirements. The Plan identifies and prioritizes capital improvement projects as well as maintenance and rehabilitation of existing facilities. The Plan also incorporates the findings and recommendations of the City's Combined Sewer Overflow (CSO) Reduction Program which was approved by the Department of Ecology (DOE) in 1994. The Plan has been coordinated with Spokane County and is currently under final review by the DOE.

PROPONENT: City of Spokane, Washington

LOCATION OF PROPOSAL, including street address, if any: The Wastewater Facility Plan includes the sewer system within the City of Spokane Sewer Service Area and Interim Urban Growth Area Boundary (IUGA) as well as the City's Advanced Wastewater Treatment Plant (AWWTP) located at 4401 N. Aubrey L. White Parkway, Spokane, WA. 99205.

LEAD AGENCY: City of Spokane, Department of Wastewater Management

DETERMINATION: The lead agency for this proposal has determined that it does **not** have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency, which materials are available to the public on request.

COMMENT PERIOD: Comments must be submitted in writing, not later than 5:00 P.M., August 7, 1998 to the responsible official listed below, if they are intended to alter the DNS. The lead agency will not act on this proposal until then.

APPEALS: You may appeal this DNS, in writing, to the responsible official listed below, no later than August 24, 1998. You should be prepared to make specific factual objections. Contact Gerald G. Shrope at (509) 625-6270 to ask about, or make arrangements for reading the SEPA appeals procedure.

.###

RESPONSIBLE OFFICIAL:

Name: Gale Olrich
Position/Title: Director Wastewater Management
Phone: (509) 625-7900
Address: 909 East Sprague Avenue, Spokane, WA 99202

DATE ISSUED: July 22, 1998 **SIGNATURE:** Gale Olrich

##

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

Wastewater Facilities Plan - Spokane Advanced Wastewater Treatment Plant (SAWTP). This is a nonproject, programmatic action. Separate filings will be made for individual projects undertaken as a result of implementation of this plan.

2. Name of Applicant:

City of Spokane
Contact: Gerry Shrope

3. Address and phone number of applicant and contact person:

W. 808 Spokane Falls Blvd.
Spokane, WA 99201
(509) 625-6270

4. Date checklist prepared: **July, 1998**

5. Agency requesting checklist: **Washington State Department of Ecology**

6. Proposed timing or schedule (including phasing, if applicable):

The City of Spokane Wastewater Facilities Plan (the Facility Plan) provides recommendations for capital improvements from the present through year 2015.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? **Yes.** If yes, explain.

The Facility Plan provides a roadmap for the City to meet increasing wastewater flows through year 2015 based upon significant increases in service connections and more restrictive treated effluent discharge criteria. The City plans to implement the recommendations of the Facility Plan as the need arises.

8. List any environmental information you know about that has been prepared, directly related to this proposal.

The Facilities Plan, Growth Management Act, and other City planning documents.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? **Yes** If yes, explain.

Environmental Protection Agency National Point Discharge Elimination System (NPDES) permitting affects the operation and further development of the SAWTP through effluent discharge requirements and limitations.

10. List any government approvals or permits that will be needed for your proposal, if known.

NPDES permit.

11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

The Facility Plan focuses on the following:

- **Development of a comprehensive collection system model to use in analyzing existing and future collection system capacities.**
- **Prediction of present and future wastewater flows.**
- **Identification of major collection system subareas with excessive groundwater infiltration and surface water inflow.**
- **Evaluation of combined sewer overflows (CSO) during wet season flow events.**
- **Identification of facility modifications and improvements required to provide additional capacity as wastewater treatment needs increase.**
- **Development of a Capital Improvement Program (CIP), including costs and schedule for the wastewater management system.**
- **Evaluation of the SAWTP under present and future waste loads.**

- **Establishment of a monitoring program to determine the impact of combined sewer overflows and normal effluent discharge on the Spokane River water quality.**

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonable available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

    Spokane Advanced Waste Water Treatment Plant
    4401 N. Aubrey L. White Parkway
    Spokane, WA 99205

    Section 3, T 25 N, R 42 E

TO BE COMPLETED BY APPLICANT

B. ENVIRONMENTAL ELEMENTS

1. **Earth**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other **Flat with steep slopes directly behind the site (off site).**

b. What is the steepest slope on the site (approximate percent slope)?

Approximately 15%± excluding river banks. Steep, nearly vertical, slopes exist off site to the northeast.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

Fill consisting of gravelly loam.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

e. Describe the purpose, types, and approximate quantities of any filling or grading proposed. Indicate source of fill.

This is a programmatic checklist. Specific construction projects will be undertaken over the next 10 years plus, which will require site filling and grading. Actual filling and grading quantities are unknown at this time.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Soil erosion can occur during construction activities and will be minimized with best management practices in accordance with all current regulations.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 60% at completion of all proposed construction.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Drainage swales and geotextiles will be employed where appropriate; many of the proposed additions to SAWTP include uncovered concrete tanks (clarifiers, aeration basins, etc.).

2. **Air**

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Air emissions will be limited to normal construction fugitive dusts. No untreated air emissions are anticipated after construction is completed except for normal odor emissions from wastewater treatment operations.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Yes-occasional odors from collection system.

c. Proposed measures to reduce or control emissions or other impacts to air, if any.

Energy recovery systems are installed to recover methane gas from digesters. Odor control is included as part of the Facility Plan's capital program.

3. **Water**

a. Surface

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? **Yes** If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The Spokane River lies immediately southwest of the SAWTP.

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? **Yes** If yes, please describe and attach available plans.

Some of these proposed capital improvements may involve renovation and/or construction of treatment or collection systems within 200 feet of the Spokane River (see the Facility Plan for details).

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill materials.

N/A

(4) Will the proposal require surface water withdrawals or diversions? **No**. Give general description, purpose, and approximate quantities if known.

(5) Does the proposal lie within a 100 year floodplain? **No** If so, note location on the site plan.

(6) Does the proposal involve any discharges of waste materials to surface waters? **Yes** If so, describe the type of waste and anticipated volume of discharge.

The discharge of advanced/secondary treated wastewater is characterized and quantified in the NPDES permit.

b. Ground:

(1) Will ground water be withdrawn, or will water be discharged to ground water?

One of the primary purposes of this plan is to minimize the quantity of ground water inadvertently withdrawn into the City's collection system through faulty pipe segments. There will be no groundwater purposely withdrawn that is part of this project.

Give general description, purpose, and approximate quantities, if known.

An estimated ten million gallons per day inflow/infiltration presently enters the collection system. The capital improvement program will significantly reduce this when fully implemented.

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals....; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

N/A

c. Water Runoff (including storm water):

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (including quantities, if known). Will this water flow into other waters? **Yes** If so, describe.

See the Facility Plan for details.

(2) Could waste materials enter ground or surface waters? **If a collection system leaks.** If so, generally describe. **See the Facility Plan.**

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Details are provided in the Facility Plan.

4. **Plants**

a. Check or circle types of vegetation found on the site **(SAWTP and collection system)**:

[X] deciduous tree: alder, maple, aspen, other
[X] evergreen tree: fir, cedar, pine, other
[X] shrubs
[X] grass
[ ] wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
[ ] water plants: water lily, eelgrass, milfoil, other

[X] other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

Minor amounts of vegetation within the SAWTP may be disturbed in the process of revising existing systems or adding additional unit processes.

c. List threatened or endangered species known to be on or near the site.

None known.

Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any.

Nonimpervious areas of the site will be landscaped and part will be maintained in a natural state.

5. **Animals**

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

Birds: hawk, heron, eagle, songbirds
Mammals: deer, bear, elk, beaver
Fish: bass, salmon, trout, herring, shellfish

b. List any threatened or endangered species known to be on or near the site.

Bald Eagle.

c. Is the site part of a migration route? If so, explain.

No.

d. Proposed measures to preserve or enhance wildlife, if any:

This area is already partially developed and further improvements limited to the existing site are not anticipated to adversely affect the wildlife.

6. **Energy and Natural Resources**

a. What kinds of energy (electrical, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Energy for plant operations will be commercial electrical power supplied by Washington Water Power supplemented by methane gas produced at the plant and by electrical power produced at the plant through cogeneration facilities, which utilize methane gas produced at the plant. Natural gas, gasoline, diesel fuel, and oil will be used during construction of facilities, primarily by construction equipment.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe:

No.

c. What kinds of energy conversion features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Methane gas generated from the digesters is used in SAWTP boilers to reduce electricity demands. Excess methane gas is used to produce electrical power via the SAWTP cogeneration facilities.

7. **Environmental Health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Does not apply - covered under project specific requirements.

(1) Describe special emergency services that might be required.

Does not apply - covered under project specific requirements.

(2) Proposed measures to reduce or control environmental health hazards, if any:

N/A

b. Noise

(1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Noise will not affect this project other than normal noises associated with construction.

(2) What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Project construction will create noise. It is anticipated that noise will occur during normal working hours.

(3) Proposed measures to reduce or control noise impacts, if any:

None.

8. **Land and Shoreline Use**

a. What is the current use of the site and adjacent properties?

Project Site - Municipal/Wastewater Treatment.
Adjacent Properties - State Park.

b. Has the site been used for agriculture? If so, describe.

No.

c. Describe any structures on the site.

See the Facility Plan for a complete description of the structures at the SAWTP.

d. Will any structures be demolished? If so, what?

Yes-obsolete structures at the SAWTP may be demolished to make room for new systems.

e. What is the current zoning classification on the site?

Residential.

f. What is the current comprehensive plan designation of the site?

Residential.

g. If applicable, what is the current shoreline master program designation of the site?

N/A

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No.

i. Approximately how many people would reside or work in the completed project?

The facility would be operated by existing City of Spokane staff. Approximately 70 persons are presently employed at the site.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any.

N/A

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

N/A

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

N/A

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The tallest structure on site is approximately 35 ft. in height. Exterior materials are primarily concrete, extruded metal and brick. Proposed new structures may be of similar height and materials.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Maintain a clean and orderly facility.

11. **Light and Glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Area and walkway lighting will be present during non-daylight hours for safety and plant operations.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

N/A

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?

Hiking, biking, water activities, etc.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

N/A

13. **Historic and Cultural Preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

None known.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None.

c. Proposed measures to reduce or control impacts, if any:

N/A

14. **Transportation**

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Aubrey White Parkway.

b. Is site currently served by public transit? If no, what is the approximate distance to the nearest transit stop?

No. Two miles.

c. How many parking spaces would the completed project have? How many would the project eliminate?

60± existing spaces.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways. If so, generally describe (indicate whether public or private).

No.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

No additional trips.

g. Proposed measures to reduce or control transportation impacts, if any.

None.

15. **Public Services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

As the wastewater collection and treatment facilities are expanded, there will be a need for additional operational and maintenance staff.

b. Proposed measures to reduce or control direct impacts on public services, if any.

N/A

16. **Utilities**

a. Utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

Electricity, natural gas, potable water, refuse pick-up, telephone, and sewer systems.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Construction activities will be described with each individual project action.

UTILITIES:

Electrical Power: Washington Water Power is the primary provider. The plant also produces electrical power through methane gas (produced on site) fired cogeneration facilities.

Water: City of Spokane

Sewer: City of Spokane

Telephone: U.S. West Communications

Refuse Service: City of Spokane

Natural Gas: SAWTP (methane from digesters)

C. **SIGNATURE**

(WAC 197-11-960) Section 11.10.230(1)

I, the undersigned, swear under the penalty of perjury that the above responses are made truthfully and to the best of my knowledge. I also understand that, should there be any willful misrepresentation or willful lack of full disclosure on my part, the agency may withdraw any determination of nonsignificance that it might issue in reliance upon this checklist.

Date: July 15, 1998 Proponent: Capital Programs Development, City of Spokane

Proponent: Gerry G. Shrope, P.E. Address: West 808 Spokane Falls Boulevard

Phone: (509) 625-6270 Spokane, WA 99201-3343

Person completing form: John C. Patrouch, P.E. Bovay Northwest, Inc. Date: 07/15/98

Phone: (509) 838-4111 John C. Patrouch

(Signature of Person Completing Form)

FOR STAFF USE ONLY

Staff Member(s) Reviewing Checklist: ____________________

Based on this staff review of the environmental checklist and other pertinent information, the staff:

A. X Concludes that there are no probable significant adverse impacts and recommends a determination of nonsignificance.

B. _____ Concludes that probable significant adverse environmental impacts do exist for the current proposal and recommends a mitigated determination of nonsignificance with conditions.

C. _____ Concludes that there are probable significant adverse environmental impacts and recommends a determination of significance.

D. **SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS**

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

As the Spokane regional wastewater collection system expands through addition of newly sewered areas, discharges to air and water will increase proportionally. The same will be true of storage of hazardous chemicals on site used in treatment, such as chlorine. Noise may also increase, primarily during construction activities.

Proposed measures to avoid or reduce such increases are:

Such increases are necessary and cannot be avoided. Air and water discharges are governed by specific permit limitations. Storage, use and disposal of hazardous materials are governed by a Process Safety Management Plan and by federal and state regulations. Construction noise will be controlled by construction contract limitations.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Some disturbance of vegetation will be necessary during construction activities. Aquatic life is affected by the discharge of treated effluent.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

Protection of aquatic life and water quality are governed by operational conditions and effluent limitations contained within the NPDES permit issued by Washington Department of Ecology. Protection and restoration of vegetation and prevention of soil erosion during construction will be addressed with each separate project action.

3. How would the proposal be likely to deplete energy or natural resources?

As plant flow increases with collection system expansion, additional electrical energy will be required to operate the facility. A proportional increase in use of operational materials and chemicals will also be required.

Proposed measures to protect or conserve energy and natural resources are:

Use of digester methane gas in heating and electrical power production. Replacement of inefficient motors and pumps as part of rehabilitation. Use of energy efficient materials in construction.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   Any additional impacts to the adjacent parklands are expected to be minimal.

   Proposed measures to protect such resources or to avoid or reduce impacts are:

   None required.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   No additional impact.

   Proposed measures to protect such resources or to avoid or reduce impacts are:

   None.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   Increased use of electrical energy and chemical supplies and an increase in operational staff size may be required as the SAWTP treatment capacity increases over the next 20 years.

   Proposed measures to reduce or respond to such demand(s) are:

   See D3.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

   The programs proposed within the Facility Plan provide for meeting current and known pending environmental rules and regulations.

I, the undersigned, swear under the penalty of perjury that the above responses are made truthfully and to the best of my knowledge. I also understand that, should there be any willful misrepresentation or willful lack of full disclosure on my part, the agency may withdraw any determination of nonsignificance that it might issue in reliance upon this checklist.

Date: July 15, 1998 Proponent: Capital Programs Development, City of Spokane

Proponent: Gerry G. Shrope, P.E. Address: West 808 Spokane Falls Boulevard

Phone: (509) 625-6270 Spokane, WA 99201-3343

Person completing form: John C. Patrouch, P.E. Date: 07/15/98
Bovay Northwest, Inc.

Phone: (509) 838-4111 John C. Patrouch
(Signature of Person Completing Form)

FOR STAFF USE ONLY

Staff Member(s) Reviewing Checklist: ____________

Based on this staff review of the environmental checklist and other pertinent information, the staff:

A. X Concludes that there are no probable significant adverse impacts and recommends a determination of nonsignificance.

B. __ Concludes that probable significant adverse environmental impacts do exist for the current proposal and recommends a mitigated determination of nonsignificance with conditions.

C. __ Concludes that there are probable significant adverse environmental impacts and recommends a determination of significance.

Appendix B
Shoreline Permit

CITY OF SPOKANE HEARING EXAMINER

Re: Shoreline Substantial Development Conditional Use Permit, Variance, and amendment to Special Permit Application by the City of Spokane for the Riverside Park Water Reclamation Facility	))))))	FINDINGS, CONCLUSIONS, AND DECISION FILE NO. Z2005-59-HESP/SL/VA

SUMMARY OF PROPOSAL AND DECISION

Proposal: The applicant seeks approval to add four new solids digesters to upgrade solids processing at the existing sewage treatment plant. These digesters will be constructed over a period of years. The variance is necessary because the digesters will be built within 100 feet (but outside of 50 feet) of the ordinary high-water mark of the Spokane River.

Decision: Approval, subject to conditions.

FINDINGS OF FACT
BACKGROUND INFORMATION

Applicant: City of Spokane
Riverside Park Water Reclamation Facility (RPWRF)
c/o Lars Hendron
4401 North Aubrey L. White Parkway
Spokane, WA 99205

Agent: Greta Gilman
Jim Correll
CH2M Hill
9 South Washington Street, Suite 400
Spokane, WA 99201

Property Address: 4401 North Aubrey L. White Parkway

Property Location: The RPWRF is located adjacent to the Spokane River between the river and Aubrey L. White Parkway. It is approximately half way between Downriver Municipal Golf Course and the Bowl and Pitcher portion of Riverside State Park

Legal Description: The property is located in Section 3, Township 25 North, Range 42 EWM in the City and County of Spokane, Washington.

Zoning: R1 (Single-family Residential Zone)

Comprehensive Plan Map Designation: The site is designated in the City's new Growth Management Comprehensive Plan as "Institutional."

Site Description: The site is irregular in shape and almost fully developed with the City's wastewater treatment plant. There is an undeveloped area on the northwest corner of the site which is to be designated as a habitat conservation area. There is another unoccupied area at the southeast end of the site. The site slopes moderately from the road down to the river and contains approximately 57 acres in size. An aerial view of the site and surrounding area is attached to Exhibit #33, and another aerial view of the site which labels all functions is in the record as part of Exhibit #34.

Surrounding Conditions: The property surrounding the site on all sides is zoned R1. Adjacent on the northeast is a steep bluff which is designated in the Comprehensive Plan as "Conservation Open Space." On top of the bluff there are single-family residences. State and City park areas are located to the southeast and northwest and across the Spokane River which is adjacent. To the southeast is the Downriver Golf Course and to the northwest is the Bowl and Pitcher portion of Riverside State Park, which includes a campground and picnic area.

Project Description: The City has operated the RPWRF on this site since 1958, but it was upgraded substantially to approximately its current configuration in 1977. The City is planning further upgrades in order to meet Washington State Department of Ecology (DOE) water quality standards, as well as to react to the failure of a concrete digester on site in May of 2004. The City's immediate plan is to construct two egg-shaped digesters on site. A site plan showing the digesters is in the record as Exhibit #1E. Also, in Exhibit #1J, there are digester cross sections and artist renderings of what the digesters will look like both on site and viewed from other locations, such as the top of the bluff to the east. The City, therefore, seeks a special permit and shoreline substantial conditional use permit to allow the construction of the digesters. There is also a proposed boiler/cogeneration facility planned for the site. The shoreline variance is necessary because some of the improvements will be located within the 100-foot setback from the Spokane River. There are already several improvements on site which are within that 100-foot setback, but this upgrading of the facility will add the digesters into that area. There does not appear, however, to be anything closer than 50 feet from the river.

PROCEDURAL INFORMATION

Authorizing Ordinances: Spokane Municipal Code Sections 11.02, 11.02.0452, 11.02.0454, 11.15.292, 11.19, and 11.19.310.

Hearing Date: July 28, 2005

Notices: Mailed: 1-12-05, 6-6-05, 6-16-05, and 7-7-05
Posted: 1-13-05, 6-7-05, 7-7-05, 7-8-05, and 7-12-05

Site Visit: The Hearing Examiner has done several site visits to this location over the years. The Examiner has also viewed the plant from various locations including the bluff above the river to the east and the road across the river to the west.

SEPA: A Determination of Nonsignificance was issued by the City on July 25, 2005.

Testimony:

Steve Haynes
City of Spokane Planning Services
808 West Spokane Falls Boulevard
Spokane, WA 99201

Jim Correll
CH2M Hill
9 South Washington Street #400
Spokane, WA 99201

Robert Perron
Landscape Architect for
CH2M Hill

Bonita K. Olson
4539 W. Northwest Boulevard
Spokane, WA 99205

Amber Waldorf
The Lands Council
423 West First Street
Spokane, WA 99201

Betty Gaither
4547 W. Northwest Boulevard
Spokane, WA 99205

Lars Hendron
City of Spokane Wastewater Mgmt.
909 East Sprague Avenue
Spokane, WA 99202

Dave Green
CH2M Hill
9 South Washington Street #400
Spokane, WA 99201

Bonnie Beavers
Sierra Club
35 West Main Avenue, Suite 300
Spokane, WA 99201

Lloyd K. Gaither
4547 W. Northwest Boulevard
Spokane, WA 99205

Mike Stewart
4141 W. Northwest Boulevard
Spokane, WA 99205

Exhibits:

1. Application, including:
   - 1A. General application
   - 1B. Shoreline conditional use permit application
   - 1C. Joint aquatic permits application
   - 1D. Variance application

1E. Containment plan
1F. Digester sections
1G. Aerial view of proposed project
1H. Panoramic photo from hilltop above RPWRF
1I. Seven photographs -- color options and variations
1J. Proposed digesters -- design graphics and landscape plan

2. Fire Department comments
3. Solid Waste Department comments
4. Air Pollution Control Authority comments
5. Notice map and area map
6. Notices
7. Affidavits of Mailing
8. Affidavits of Posting
9. Planning Services Staff Report
10. Determination of Nonsignificance
11. Environmental Checklist
12. Sign-in sheet, questionnaire, and audio tape from community meeting
13. Conceptual Design Report for the Solids Process Upgrade Project prepared by CH2M Hill, February, 2005
14. Digester Amendment Schedule prepared by the applicant, 5-2-05
15. Scope of Services prepared by David Evans and Associates, 4-13-05
16. Scope of Services prepared by CH2M Hill, April 2005
17. Undated letter to Steve Haynes from Mike Petersen, The Lands Council, commenting on the application
18. E-mail dated 2-1-05 to Joe Shogun from Bonnie K. Olson opposing the project
19. Letter dated 2-20-05 to Steve Haynes from The Neighbors of the Riverside Park Water Reclamation Facility opposing the project
20. Memorandum dated 3-7-05 to Dale Arnold from Dave Green, CH2M Hill, re: Rough cost estimate for lowering the height of the two new digesters
21. Memorandum dated 4-25-05 to Steve Haynes from Lars Hendron submitting the shoreline permit application
22. Memorandum dated 5-6-05 to Steve Haynes from Lars Hendron re: clarification of rationale for digester location
23. Letter dated 5-31-05 to Greta Gilman from Steve Haynes re: notice of application
24. Letter dated 6-24-05 to Steve Haynes from Mike Stewart re: opposition to the project
25. Letter dated 6-27-05 to Steve Haynes from Paul and Maxine Jackson re: opposition to the project
26. Letter dated 6-28-05 to Steve Haynes from Bonnie W. Beavers on behalf of the Sierra Club, Upper Columbia River Group, and Neighbors of Riverside Park Water Reclamation Facility re: concerns and objections

27. Letter dated 7-1-05 to Greta Gilman from Steve Haynes re: notice of public hearing
28. Memorandum dated 7-13-05 to Steve Haynes from Jim Correll, CH2M Hill, responding to the 6-28-05 Center for Justice letter
29. July 16, 2004 letter to Steve Haynes from Bonita K. Olson opposing the project
30. Memorandum dated 7-21-05 to Steve Haynes from Jim Correll re: response to the Lands Council letter
31. E-mail exchange dated 7-22-05 between Lars Hendron and Lloyd and Betty Gaither re: concerns
32. Public hearing notification list
33. Design Review Committee recommendations dated 7-27-05
34. Hard copy of electronic visual presentation given at the hearing by the applicant

FINDINGS AND CONCLUSIONS

Special Permit and Shoreline Substantial Development Conditional Use Permit

To be approved, the proposed special permit and shoreline substantial development conditional use permit must comply with all of the criteria set forth in Spokane Municipal Code Section 11.02.0452. The Hearing Examiner has reviewed the proposed special permit application and the evidence of record with regard to this section and makes the following findings and conclusions

1. The use is listed as requiring a zoning special permit or shoreline conditional use permit in the regulations.

The applicants seek an amendment to their special permit to allow the proposed improvements. They were originally given a special permit to develop this treatment plan. The Hearing Examiner has the authority, pursuant to SMC 11.19.310, to grant and amend special permits for sewage treatment plant facilities. See SMC 11.19.310Q. In addition, since the proposal is located within the shoreline area, it is governed by the City's Shoreline Master Program. The regulations of the Master Program do allow sewage treatment plants by conditional use permit in the downriver environment, which is where this plant is located. See SMC 11.15.292B2. Therefore, this criterion has been met.

2. Except for planned unit developments, the proposed use complies with all applicable use and development standards.

As noted above, a utility facility such as this is allowed by special permit in any zone. The code does not set forth any specific development standards, but simply states that the Hearing Examiner should attach such conditions and standards as the Examiner may deem necessary for each approval. Further, the Shoreline Management

Regulations, set forth in SMC 11.15.290, require that the facility should not detract from the aesthetic qualities of an area and also that certain erosion control standards must be followed with the construction of such facilities. The Examiner will require that appropriate erosion control measures are taken during construction of the proposed improvements. The proposed improvements will all be located within the existing wastewater treatment complex and will offer an overall benefit to the operational capabilities of the plant. Since the proposed digesters will be located within the 100-foot setback from the ordinary high-water mark of the Spokane River, a variance from that specific standard is required. That variance will be considered later in this decision. The impacts of the plant due to odor and the height of the digesters, will be discussed under Criterion #5.

3. The proposed use complies with the goals, policies, and map designation of the Comprehensive Plan that apply to it and to the area in which it is proposed to be located.

The City's 2001 Comprehensive Plan has a section on capital facilities and utilities. There is also a sub-section, Section 5.10, that addresses sanitary sewer and the City's needs for the future. It is stated in that section that the City will soon outgrow its treatment plant and additional capacity will be necessary to serve the growing population in the urban area. The system improvements proposed here are meant to address that future growth while also reacting to the failure of a digester on site last year. The plan is to construct two digesters immediately, a third new one in 2015, and another one further in the future. The Examiner finds, therefore, that the proposed expansion is consistent with the Comprehensive Plan. There are other policies of the Comprehensive Plan which are relevant and which support this expansion, and they are addressed in the Planning Services Staff Report, Exhibit #9, pages 3 and 4. The Hearing Examiner hereby adopts and incorporates that discussion herein.

4. The proposed use is timely considering the capacity of the transportation systems, public facilities and services existing in the area, including such improvements that are funded in the City's Capital Improvement Programs.

The proposal was reviewed by all City departments and outside agencies with jurisdiction over land development and there were no adverse comments which would convince the Hearing Examiner that other public facilities or transportation systems are inadequate to serve this proposal. There is no increase anticipated in the number of employees, so traffic should not increase. The improvements proposed are meant to improve the capacity of this particular public facility. No other deficiencies were noted and the Hearing Examiner finds that this proposed use is timely.

5. Conditions can be placed on the proposed use to avoid significant adverse impacts or interference with the use of neighboring property or the surrounding area, considering the design and intensity of the proposed use with uses existing in the area.

Staff has reviewed the proposal under the State Environmental Policy Act and issued a Determination of Nonsignificance on July 25, 2005. It was Staff's conclusion that the proposal would have no probable significant adverse environmental impacts. The City did a habitat management plan for a previous approval in 2002. See Hearing Examiner File No. Z2002-07-HESP/SL/VA. That management plan is being implemented. In addition, Staff and the Design Review Committee have made other recommend actions for certain conditions of approval and they will be conditions of this approval.

The primary impacts cited by adjacent neighbors are odor and view obstruction. Odor is an ongoing problem with the plant and the applicant stated that it has done an odor reduction plan and is in the process of implementing it. Unfortunately, because of the collapse of a digester in 2004, this particular proposal must take precedent over further work on the odor reduction plan, which means that the next stage in odor reduction will not be completed until 2008. The applicant and its engineers did state, however, that the construction of the first two digesters will, in themselves, reduce odors to some degree. This proposal, at least, will not make the odor situation worse, and the City must continue working to reduce odors from the plant, in accordance with its plan.

The proposed digesters will have an impact on certain residents' view of the river. There are several residences located on the bluff above the plant. They have expansive views of the entire valley and some views of the Spokane River. Some testified that their view of the Spokane River would be reduced, in some cases to a significant degree, because of the proposed height for the digesters. There are numerous artist renderings in the record showing how views will be impacted from various points along the bluff, as well as other locations on the opposite side of the river where there are trails and recreation facilities. The City and its engineers understand those concerns, but after much study have determined that this type of digester is the best choice based on a number of factors. They are preparing a mitigation plan which includes a brick treatment to the base of the digester, different color schemes which may make the digesters blend in more with the surrounding natural area, and also significant landscaping. The applicant has stated, and the Hearing Examiner will require, that during the preparation of this mitigation plan affected residents be given an opportunity to participate and comment. Conditions will be placed on this approval in order to mitigate as much as possible the effect of the height of the digesters. The Examiner acknowledges, however, that while views will not be blocked, they will be impacted in various ways for some of the residences on top of the bluff.

6. For shoreline conditional use permits the following additional criteria apply:

a. The proposed use will not interfere with the normal public use of public shorelines.

This plant was established, originally in 1958, prior to the City's Shoreline Master Plan being adopted and it has never provided a public trail or access to the shoreline. There is property to the east and west of the plant, owned by the City, which is being kept in a natural state. Public access to the river may be developed in these areas at a later time. For safety reasons, however, the City has never provided a public trail or access to the shoreline through the plant property and the Hearing Examiner finds that it does not need to do so now. The fact that all proposed improvements will be contained within the plant's current perimeter demonstrates that the use will not interfere, any more than it already does, with the public use of the shoreline.

b. The cumulative impact of several additional conditional use permits on the shoreline in the area will not preclude achieving the goals of the Shoreline Master Program.

All improvements proposed for this expansion will be contained on the current site. No expansion outside the current site is anticipated, and it is also not anticipated that additional sewage treatment plants will be permitted within this shoreline area. In fact, this proposal is meant to address increased population growth for the foreseeable future and to eliminate the need to site additional treatment plants along the shoreline areas within the City. Therefore, this criterion has been met.

Shoreline Variance

To be approved, the proposed variance must comply with all of the criteria set forth in Spokane Municipal Code Section 11.02.0454. The Hearing Examiner has reviewed the proposed variance and the evidence of record with regard to this Section and makes the following Findings and Conclusions:

1. A variance or modification of the standard or requirement is not prohibited by the land use codes.

SMC 11.02.0210B2 states:

2. A person needs a variance or a certificate of compliance from the Planning Director or Hearing Examiner to render lawful proposed or existing structures which do not comply with the locational or dimensional standards of the zoning code.

The applicant seeks to vary a locational and dimensional standard of the shoreline code. The proposal would place structures within the 100-foot setback from the ordinary high-water mark. There are already structures within that area, but the proposal will add to those which exist. This is a locational and dimensional standard which would anticipate a variance application. There is nothing in the zoning code nor the shoreline master program to prohibit a variance of this type and, as noted above, these types of dimensional variances are specifically authorized under certain conditions.

2. No other procedure is provided in this chapter to vary or modify the standard or requirement, or compliance with such other procedure would be unduly burdensome.

There is no other procedure in the City's code to vary this particular setback standard. Neither the zoning code nor the shoreline ordinance sets forth any other procedure other than the variance procedure.

3. Strict application of the standard or requirement would create an unnecessary hardship due to one or more of the reasons listed below. Mere economic hardship or self-created hardship are not considered hardships for the purposes of this section.

a. The property cannot be developed to the extent similarly zoned property in the area can be developed because the physical characteristics of the land, the improvements, or uses located on the land do not allow such development.

The plant has been in this location in various forms since 1958. The plant, in its current configuration, was constructed in 1977 before the establishment of the 100-foot setback. There are, therefore, structures within the 100-foot shoreline area. Because of the nature of the improvements, the digesters must be placed near existing structures within that 100-foot shoreline in order to meet the operational needs of the plant. There was ample testimony from the City's Engineer that piping and other infrastructure is in place to serve the two digesters. If the digesters were located elsewhere on site, substantial costs would be associated with altering the current infrastructure.

The Hearing Examiner finds that a practical difficulty arises if the owner of the plant cannot place the structures in the area proposed, in that it could affect the operational capabilities of the plant. If the plant cannot be upgraded and expanded to meet water quality standards and accommodate future growth, it may be that another plant would have to be located somewhere else along the shoreline. It is a substantial benefit to the public to have expansion occur at this existing site, rather than have another plant located elsewhere along the river. The Hearing Examiner finds that this constitutes enough of an unnecessary hardship to justify the variance.

b. Compliance with the requirement or standard would eliminate or substantially impair a natural, historic, or cultural feature of area-wide significance.

There was no evidence presented that there are natural, historic, or cultural features of area-wide significance on this site which would be impaired or eliminated.

4. Notwithstanding the proposed modification of the standard or requirement, all of the following objectives shall be reasonably satisfied:

a. Surrounding properties will not suffer significant adverse impacts.

The Hearing Examiner finds this criterion has been met and, in so doing, hereby adopts and incorporates the Planning Services Department Findings on this criterion, set forth in the Planning Services Staff Report, Exhibit #9, page 6.

b. The appearance of the property or use will not be adversely affected.

There was testimony by neighbors at the hearing to the effect that the appearance of the site will be adversely affected because of the height of the digesters. As stated, the new digesters will be approximately 60 feet taller than the existing digesters. The Examiner is sympathetic with the fact that the height of the new digesters will impact, to some degree, views from on top of the bluff. The Examiner cannot find, however, that the taller digesters adversely affect the appearance of this property.

The site is a fully operational sewage treatment plant with various facilities located throughout. The Hearing Examiner finds that adding the digesters, pictures of which are abundant in the record, does not adversely affect the appearance any more than the addition of other necessary functions and facilities. A treatment plant such as this is industrial in nature and the appearance of a use like this will never be aesthetically pleasing but it is a necessary facility for a City.

The City and its engineers did state that they will bury the proposed digesters as far below ground as feasible but the burying of the digesters is constrained somewhat by groundwater. Placing the digesters below the groundwater elevation is not feasible. In addition, the City is developing a mitigation plan to mitigate the impact of the digesters and the plant itself through coloring and landscaping. The Examiner will require that the City and its engineers insure that public participation takes place in the development of that mitigation plan.

c. The ability to develop the property in compliance with other standards will not be adversely affected.

There was no evidence presented to demonstrate that this proposed expansion will make it impossible to comply with other standards.

5. The cumulative impact of several additional variances on the shoreline in the area will not preclude achieving the goals of the Shoreline Master Program.

See findings under Shoreline Conditional Use Permit Criterion #6b.

DECISION

Based on the findings and conclusions above, it is the decision of the Hearing Examiner to approve the proposed shoreline substantial development conditional use permit, variance, and special permit application, subject to the following conditions:

1. Approval is for an expansion of the existing Riverside Park Water Reclamation Facility substantially in accordance with the plans and application set forth in the file. This approval also allows the construction of digester structures within the 100-foot shoreline

area, as long as they are contained within the existing site. The Hearing Examiner recognizes that these improvements will take place over an extended period of time. This approval allows the expansion to occur over that period of time. If changes are proposed to the expansion, they shall be submitted to Planning Services for review and approval. If those changes are found to be substantial, then Planning Services shall submit them to the Hearing Examiner for review and approval.

2. The applicant shall comply with all conditions of previous approvals, including compliance with the habitat management plan prepared for the 2002 permit.

3. The plant will coordinate with the appropriate Indian Tribal Authorities to ensure that any archaeological artifacts that may be unearthed during excavation can be identified and recovered as appropriate. Any archaeological artifacts that may be discovered during earth movement on site shall be immediately reported to the City-County Historic Preservation office and work shall cease in the affected area.

4. The applicant shall comply with the erosion control measures set forth in SMC 11.15.290. The applicant will also take all necessary measures to control erosion during construction.

5. The applicant shall continue to develop its mitigation plan to mitigate the impacts of the new structures and the plant itself. This will include coloring, lighting, building treatment, and substantial landscaping. The applicant shall seek public input in the development of this mitigation plan.

6. The Applicant will use best efforts to implement its odor reduction plan as quickly as possible.

7. The applicant shall comply with the recommendations of the Design Review Committee. They are:

> *1. The Committee recommends that the "basalt base" not be an option that is pursued.*
>
> *2. The final design should not seek to overly hide the functional nature of the digesters.*
>
> *3. The final design should seek to create a composition that offers variation in textures and materials for the base and the "fin." A synthesis of brick and concrete with a less formal articulation and colors that are darker and less saturated than shown [basalt colors would be acceptable] in the renderings would be appropriate for the base.*
>
> *4. Plantings that could grow up and along the base of the digesters would help to soften the base.*

8. This approval does not waive the applicant's obligation to comply with all other requirements of the Spokane Municipal Code as well as requirements of City Departments and outside agencies with jurisdiction over land development

9. Prior to the issuance of any building or occupancy permits, the applicant shall submit evidence to this file that the property owner has signed and caused the following statement to be recorded with the Spokane County Auditor's Office:

COVENANT

> Development of this property is subject to certain conditions on file with the City of Spokane Planning Department and the Office of the City of Spokane Hearing Examiner. The property may not be developed except in accordance with these conditions. A copy of these conditions is attached to this Covenant.

This statement shall be identified as a Covenant. The owner's signature shall be notarized.

10. This approval is subject to the above-stated conditions. By accepting this approval the applicant acknowledges that these conditions are reasonable and agrees to comply with them. The filing of the above required covenant constitutes the applicant's written agreement to comply with all conditions of approval. The property may not be developed except in accordance with these conditions and failure to comply with them may result in the revocation of this approval.

DATED this 2nd day of August 2005.

Greg Smith
City of Spokane Hearing Examiner

NOTICE OF RIGHT TO APPEAL

Appeals of decisions by the Hearing Examiner are governed by Spokane Municipal Code 11.02.0730.

Decisions of the Hearing Examiner regarding shoreline conditional use permits and variances are reviewed by the Washington State Department of Ecology. After review, they may be appealed to the Washington State Shoreline Hearings Board. **All appeals must be filed with the Shoreline Hearings Board within thirty (30) calendar days of the date of the Ecology decision.**

****

Decisions by the Hearing Examiner regarding special permits are final. They may be appealed by any party of record by filing a Land Use Petition with the Superior Court of Spokane County. **THE LAND USE PETITION MUST BE FILED AND THE CITY OF SPOKANE MUST BE SERVED WITHIN TWENTY-ONE (21) CALENDAR DAYS OF THE DATE OF THE DECISION SET OUT ABOVE.** The date of the decision is the 2nd day of August 2005. **<u>THE DATE OF THE LAST DAY TO APPEAL IS THE 23RD DAY OF AUGUST 2005, AT 5:00 P.M.</u>**

In addition to paying any Court costs to appeal the decision, the ordinance requires payment of a transcript fee to the City of Spokane to cover the costs of preparing a verbatim transcript and otherwise preparing a full record for the Court.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N. Monroe Street • Spokane, Washington 99205-1295 • (509) 329-3400

September 7, 2005

I certify that I mailed a copy of this document to the persons and addresses listed thereon, postage prepaid, in a receptacle for United States mail in Spokane, Washington on September 7, 2005

S.D.

Steve Franks, Planning Director
808 W. Spokane Falls Blvd.
Spokane, WA 99201-3329

Lars Hendron
808 W. Spokane Falls Blvd.
Spokane, WA 99201-3329

Dear Mr. Franks and Mr. Hendron:

59

Re: City of Spokane Permit - Z2005-9SL/VA/HESP
City of Spokane - Applicant
Shoreline Substantial Development/Conditional Use Permit 2005-ER-10031-1

The Department of Ecology has reviewed the above referenced Conditional Use permit to: construct new and replacement digesters within the existing footprint of the Riverside Park Water Reclamation Facility along the shoreline of the Spokane River.

We concur that the proposal, as conditioned by the City of Spokane, meets the intent of the master program and the criteria set forth in WAC 173-27 for granting a shoreline Substantial Development and Conditional Use Permit.

However, we find no necessity for issuance of a Variance. We find no requirement for a 100 foot setback from the ordinary high water mark for sewage treatment facilities within the shoreline area of the Spokane River and therefore see no need for a variance.

This approval is given pursuant to requirements of the Shoreline Management Act of 1971. Other federal, state, or local approvals may be required.

Those developments and activities authorized by the subject permit may not begin until twenty-one (21) days from the transmittal date of this approval letter, or until conclusion of any review proceeding (appeal) initiated within the twenty-one day period. The Shorelines Hearings Board will notify you by letter if this permit is appealed. To be sure that the Shorelines Hearings Board has not received an appeal, we advise you to call them at (360) 459-6327 before you begin work.

If you have any questions on the above action, please contact Michael Maher at (509) 329-3584.

Sincerely,

Brian G. Farmer

Brian G. Farmer
Section Manager
Shorelands and Environmental Assistance Program

CUPA.DOC
Enclosure

PLANNING SERVICES
808 W. SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3329
(509) 625-6060
FAX (509) 625-6013
www.spokaneplanning.org

SHORELINE MANAGEMENT ACT OF 1971

SUBSTANTIAL DEVELOPMENT CONDITIONAL USE PERMIT

Application No. Z2005-59-SL/VA/HESP
Administering Agency: City of Spokane
Approved on: August 2, 2005

Pursuant to RCW 90.58, a shoreline substantial development permit is hereby granted to the City of Spokane to construct three digesters at the Riverside Park Wastewater Treatment Facility (RPWRF) located at 4401 N Aubrey L White Parkway, in the northeast quarter of Section 3, Township 25 North, Range 42 East of the Willamette Meridian.

The project will be within shorelines of state-wide significance (RCW 90.58.030). The project will be located within the Downriver Conservancy environment designation.

A SEPA DNS was issued on July 25, 2005.

This permit has been approved by the City of Spokane Planning Director. The permit has been approved after a thorough analysis and finding that the development is consistent with the Shoreline Master Program and meets the criteria for a Shoreline Permit.

This permit is granted pursuant to the Shoreline Management Act of 1971 and nothing in this permit shall excuse the applicant from compliance with any other federal state or local statutes ordinances or regulations applicable to this project but not inconsistent with the Shoreline Management Act (Chapter 90.58 RCW)

Development shall be undertaken pursuant to the terms and conditions of the Hearing Examiners Decision.

This permit may be rescinded pursuant to RCW 90.58.140(8) in the event the permitee fails to comply with the terms or conditions hereof.

CONSTRUCTION PURSUANT TO THIS PERMIT WILL NOT BEGIN OR IS NOT AUTHORIZED UNTIL TWENTY ONE (21) DAYS FROM THE DATE OF FILING AS DEFINED IN RCW 90.58.140(6) AND WAC 173.14.090. THE FINAL ORDER OF THE LOCAL GOVERNMENT WITH THE REGIONAL OFFICE OF THE DEPARTMENT OF ECOLOGY AND THE ATTORNEY GENERAL, OR UNTIL ALL REVIEW PROCEEDINGS INITIATED WITHIN THIRTY (30) DAYS FROM THE DATE OF SUCH FILING HAVE TERMINATED; EXCEPT AS PROVIDED IN RCW 90.58.140(5)(a)(b)(c).

August 5, 2005
DATE:

Steven J Franks By SLH
Steven J Franks PLANNING DIRECTOR