CHAPTER 5 - DESCRIPTION OF SELECTED ALTERNATIVE

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CHAPTER 5 – DESCRIPTION OF SELECTED ALTERNATIVE

A. Site Layout and Future Expansion

The proposed site layout for the City of Airway Heights Wastewater Treatment, Reclamation, and Recharge Facility (WTRRF) is provided in Figure 5-1. The preliminary layout of the treatment and reclamation area is provided in Figure 5-2. The site layout is for an oxidation ditch-type extended aeration activated sludge treatment system, with biological nitrogen and phosphorus removal, tertiary treatment, and groundwater recharge facilities.

The southern one-third of the site is proposed for locating the groundwater recharge facilities. The preliminary locations of the infiltration basins are based on locating the basins within the vicinity of City Wells No. 1 and 4 so that much of the reclaimed water recharged to the groundwater can be recovered by the wells, and also at a minimum distance away from the wells to utilize treatment mechanisms within the soil matrix (such as biodegradation, chemical oxidation and reduction, sorption and ion exchange, filtration, and chemical precipitation) for further polishing and dilution of the reclaimed water prior to recovery. The preliminary layout of the proposed site maintains a minimum horizontal separation of 250 feet between the infiltration basins and the extraction wells. The City of Airway Heights wellhead protection program and WAC 246-290-135, Washington State Regulations for Public Water Supplies, requires a minimum of 100 feet between treated effluent and a public water supply well.

The rest of the site is laid out in consideration of surrounding land uses, topography, the proposed hydraulic profile, site accessibility, and future expansion requirements. The wastewater treatment and reclamation area is proposed to be located in the middle one-third of the site as shown in Figure 5-1. This portion of the facility will tend to produce the most nuisances (i.e., odors, noise, exterior lighting, traffic) to surrounding areas, and therefore, is located as far south as possible, away from residential areas and public spaces. Proposed landscaping berms are shown along the property lines and to the north of this area to minimize the visibility of the facility and reduce low level odor emissions. The treatment components that are expected to produce the most offensive odors, particularly the Headworks Building, Influent Pump Station, and Anaerobic Basins, are located in the center of the parcel away from the property lines. The entrance to the treatment and reclamation area is shown at Lawson Street. Lawson Street is paved and suitable for the type of heavy-weight vehicles that will require access to the site.

To utilize the existing topography to reduce construction costs and excess pumping costs, the facilities at the beginning of the treatment process train are preliminarily located at higher existing ground elevations than downstream processes. Treatment components that require deep structures are located at lower existing ground elevations. The location of the various treatment components may likely change based on subsurface soil types identified as part of a proposed site geotechnical investigation.

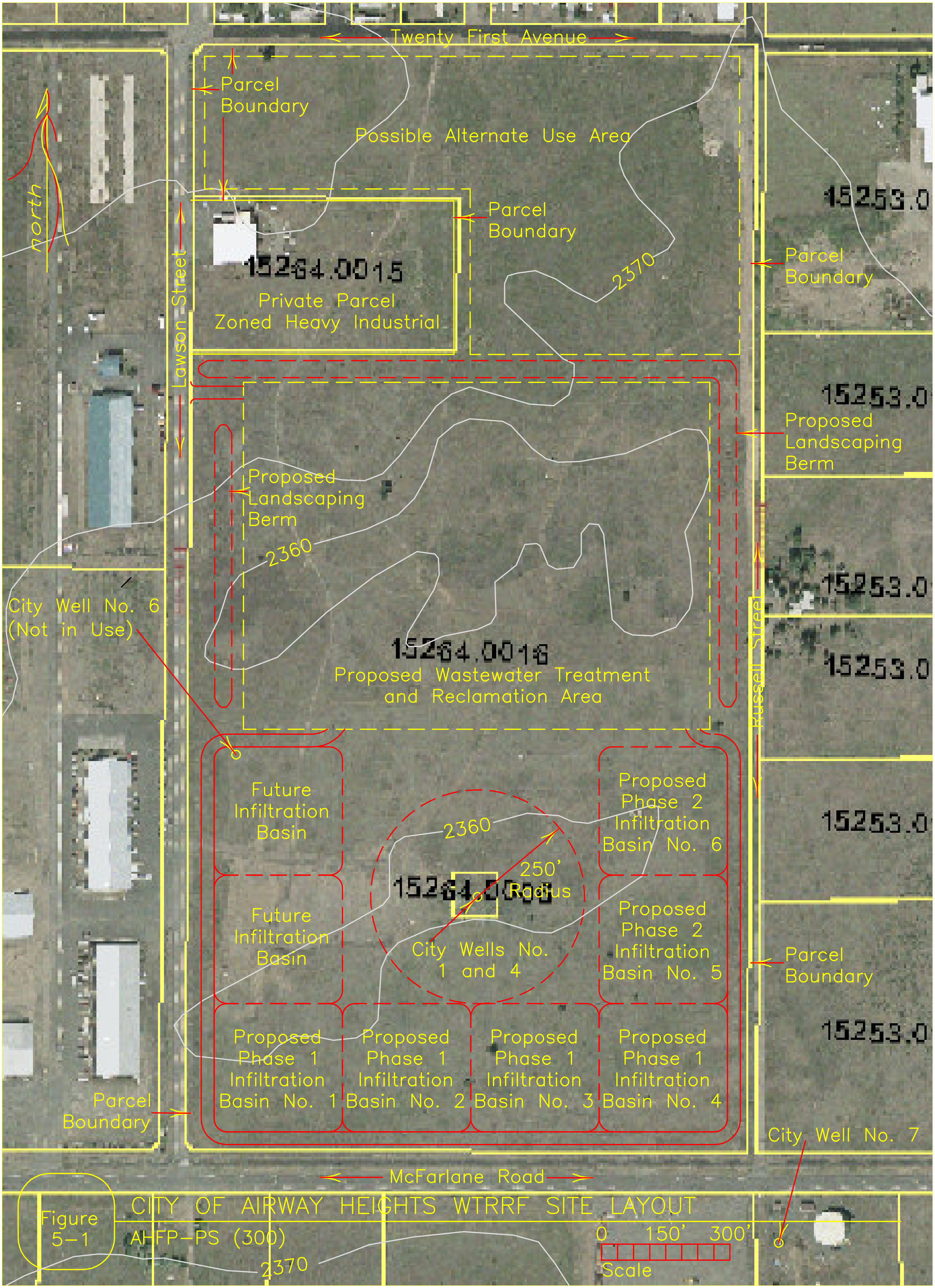

Figure 5-1

CITY OF AIRWAY HEIGHTS WTRRF SITE LAYOUT

AHFP-PS (300)

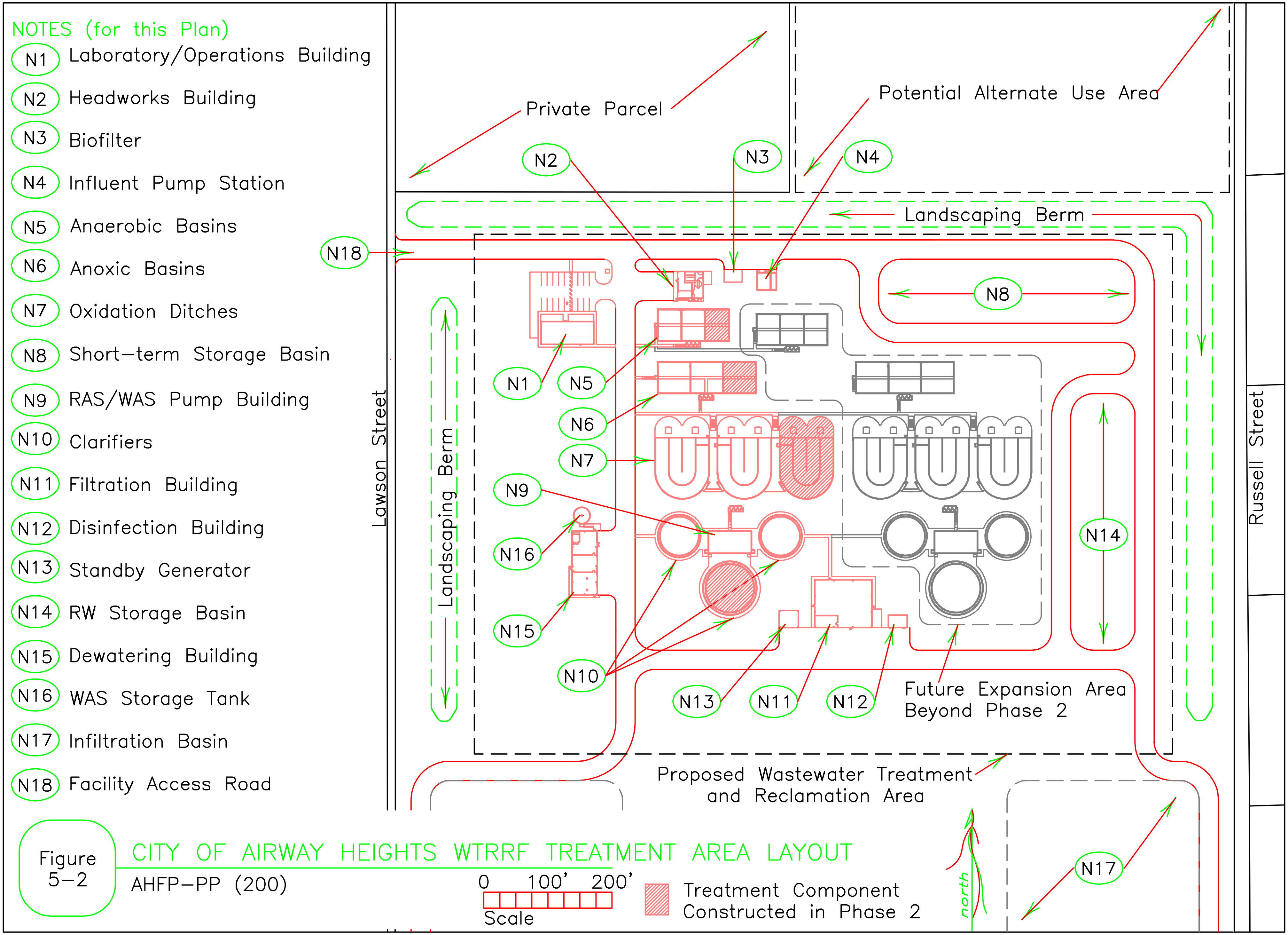

Figure 5-2 CITY OF AIRWAY HEIGHTS WTRRF TREATMENT AREA LAYOUT

The treatment and reclamation facilities are also laid out to minimize unnecessary space between treatment areas and to allow for additional expansion beyond Phase 2 in the future. Figure 5-2 shows a preliminary layout of potential expansion facilities beyond Phase 2. The treatment and reclamation area potentially has adequate space for doubling of the Phase 2 treatment capacity, up to approximately 3.0 MGD AAF. The area identified for locating the infiltration basins may only have adequate capacity for Phase 2 design flows (~1.5 MGD AAF). Infiltration basins required for future expansion beyond Phase 2 may have to be located elsewhere.

The northern one-third of the facility has been preliminarily identified as a possible alternate use area. This area is the closest to commercial and residential areas located north of the site, and would be well suited as a buffer zone for possible facility nuisances. There is also currently approximately 5 acres within this area of the site that is privately owned and is zoned heavy industrial. Placing buffer areas next to the parcel's perimeter is also desirable. The City has expressed interest in constructing a public use area such as a park or a sports field. The use of this area as a public space may enhance the public acceptability of the project.

B. Process Schematic and Hydraulic Profile

The process schematic and hydraulic profile are provided in Figures 5-3 and 5-4. A brief description of the preliminary treatment and reclamation system process train are provided below.

Figure 4-6, Reclaimed Water and Sewer Forcemain Routing for Site Alternative no. 4, shows routing of the collection system forcemain along Twenty-First Avenue. From Twenty-First Avenue, the forcemain could extend southward along Russell Street, access the treatment and reclamation area in the northeast corner, and extend eastward prior to discharging into the Influent Pump Station wetwell. The Influent Pump Station will provide the required hydraulic head for the wastewater to flow via gravity through the headworks, biological treatment system, and secondary clarifiers. From the Influent Pump Station, the wastewater will be metered and sampled prior to flowing into the fine-screen channel and grit chamber. The influent can also bypass the fine screen channel though a bar rack if necessary. An additional channel will be provided in the Headworks Building for a future additional fine-screen. For odor control, open channels in the Headworks Building can be covered, and air in the channels and in the Influent Pump Station wetwell can be blown through a biofilter for treatment prior to exiting to the atmosphere.

From the headworks effluent channel, wastewater will flow into Distribution Box A and will be routed to one of three Anaerobic Basins (initially two for Phase 1 construction). Distribution Box A will also provide for routing the wastewater to a potential future biological treatment and clarification system process train beyond Phase 2. The influent wastewater will mix with microorganisms in the Anaerobic Basins to become "mixed liquor" or "activated sludge". The mixed liquor will then flow through the Anaerobic Basins in series or parallel prior to entering Distribution Box B.

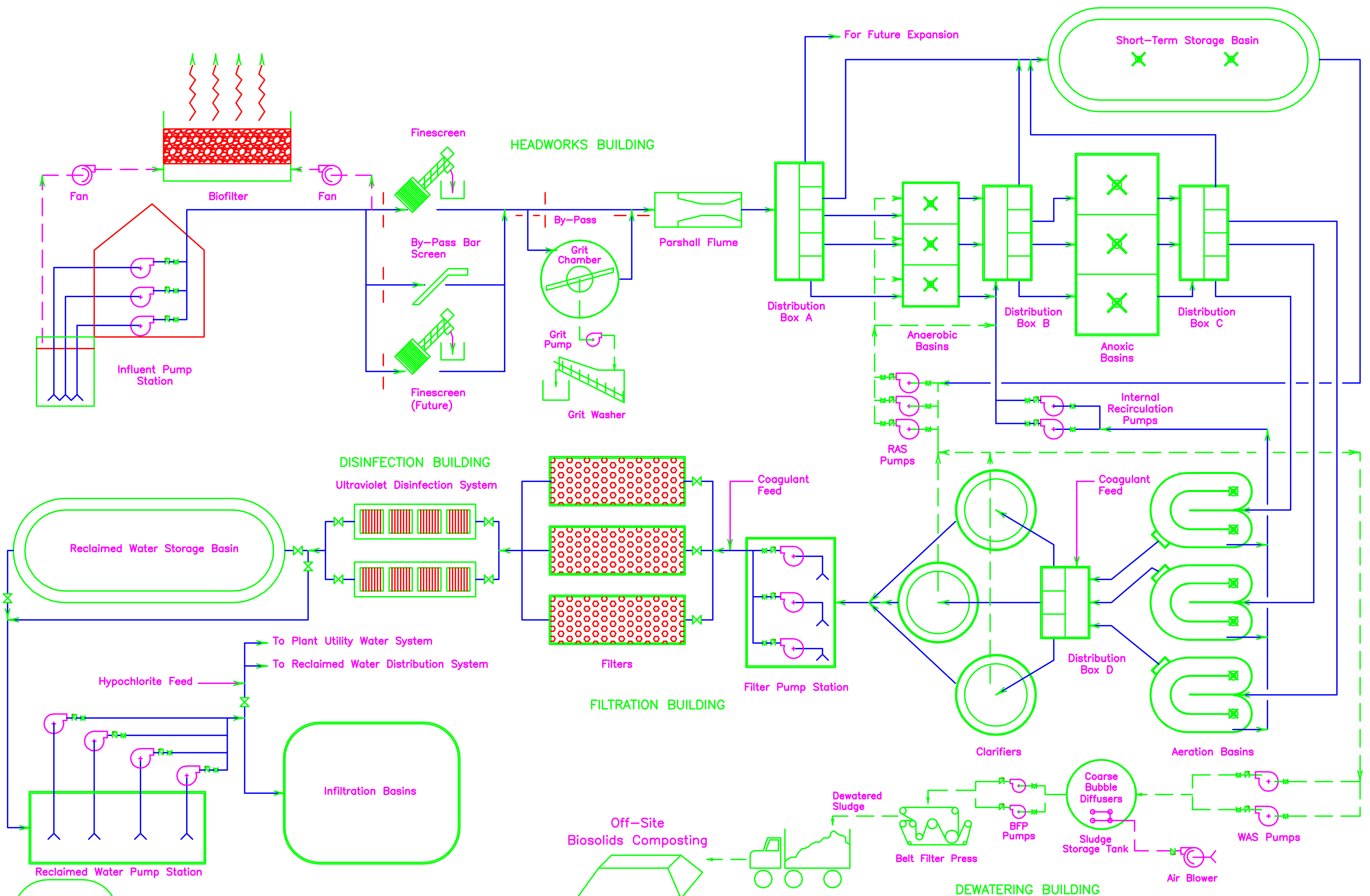

Figure 5-3

PROCESS SCHEMATIC

AHFPDiagrams-PS (12)

NO SCALE

Esvelt Environmental Engineering
7605 East Hodin Drive
Spokane, Washington 99212
(509) 926-3049 (Office)
(509) 922-3073 (Fax)

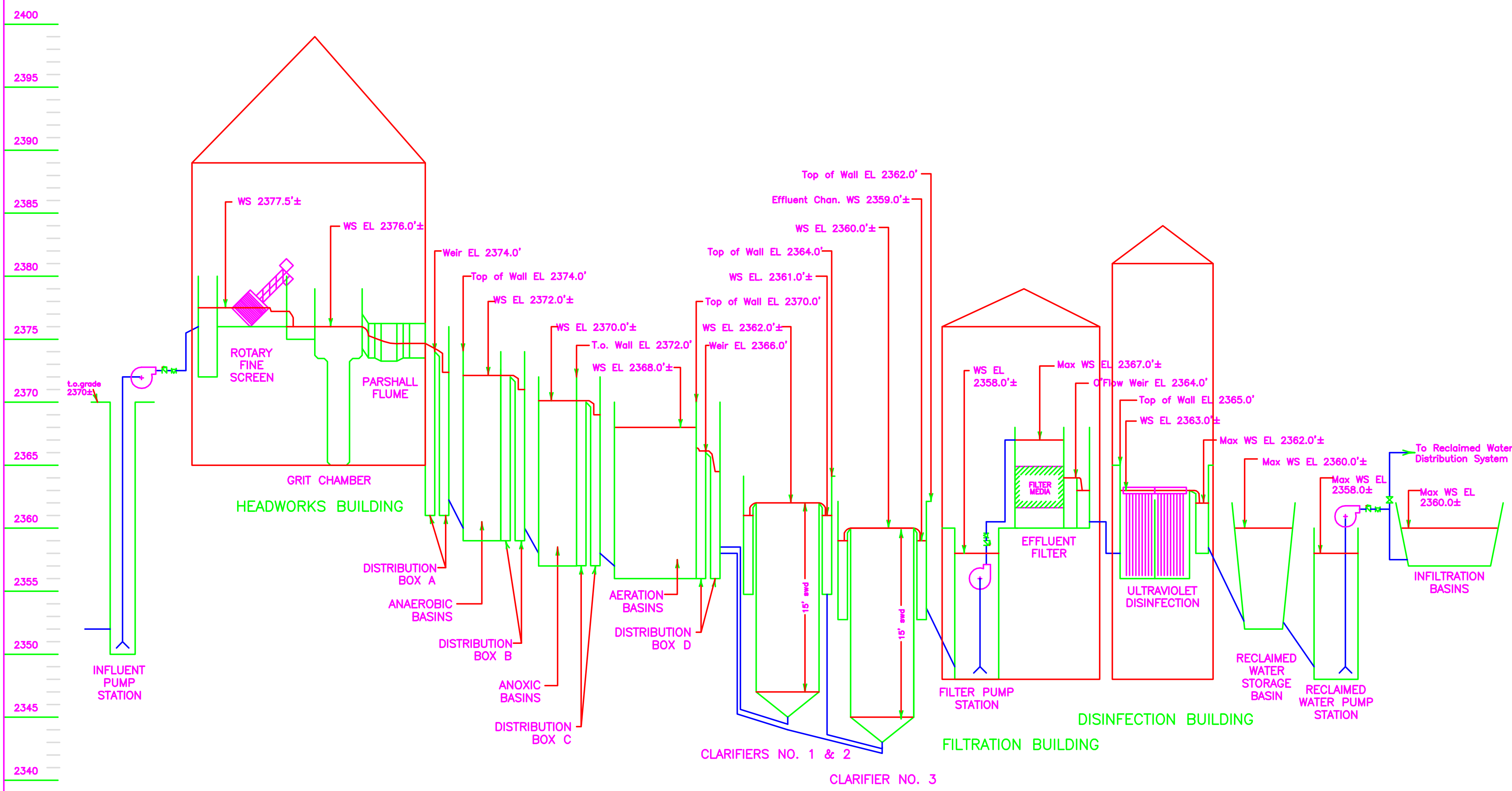

Figure 5–4

HYDRAULIC PROFILE

AHFPDiagrams–HP (12)

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Esvelt Environmental Engineering
7605 East Hodin Drive
Spokane, Washington 99212
(509) 926–3049 (Office)
(509) 922–3073 (Fax)

Distribution Box B will route the mixed liquor to one of three Anoxic Basins (initially two for Phase 1 construction), through which the mixed liquor will flow to Distribution Box C. In turn, Distribution Box C will route the mixed liquor to one of the three aeration basins (initially two for Phase 1 construction). Distribution Box C will also have the capability to route the mixed liquor to the Short-Term Storage Basin if an aeration basin must be removed from service for maintenance purposes. The type of aeration basin will depend on the final selected extended aeration activated sludge configuration. Oxidation Ditches are shown in Figure 5-2 for the aeration basins. The Internal Recirculation Pumps will recirculate a portion of the mixed liquor back from the aeration basins to the Anoxic Basins for nitrogen removal.

The liquid level in the aeration basin will be controlled by an effluent weir, over which the mixed liquor will flow, prior to entering Distribution Box D. Distribution Box D is one of the potential locations for coagulant addition prior to filtration. Distribution Box D will route the mixed liquor to the Clarifiers so that the clarifiers can be operated in parallel or in series depending on the flow through the plant. The biological solids in the mixed liquor will settle to the bottom of the Clarifiers prior to being recirculated by the Return Activated Sludge (RAS) pumps back to the Anaerobic or Anoxic Basins or being wasted to the WAS Storage Tank by the Waste Activated Sludge (WAS) pumps. The RAS and WAS pumps will be located in RAS/WAS Pump Building.

The clarified "secondary" effluent will flow over the Clarifier weirs to a filter pump station wetwell located inside the Filtration Building. The filter pump station will pump the secondary effluent to the filtration system where the secondary effluent will flow by gravity through the filters and then through the ultraviolet (UV) disinfection system. If not previously added prior to clarification, coagulants will be injected into the secondary effluent pumped to the filtration system.

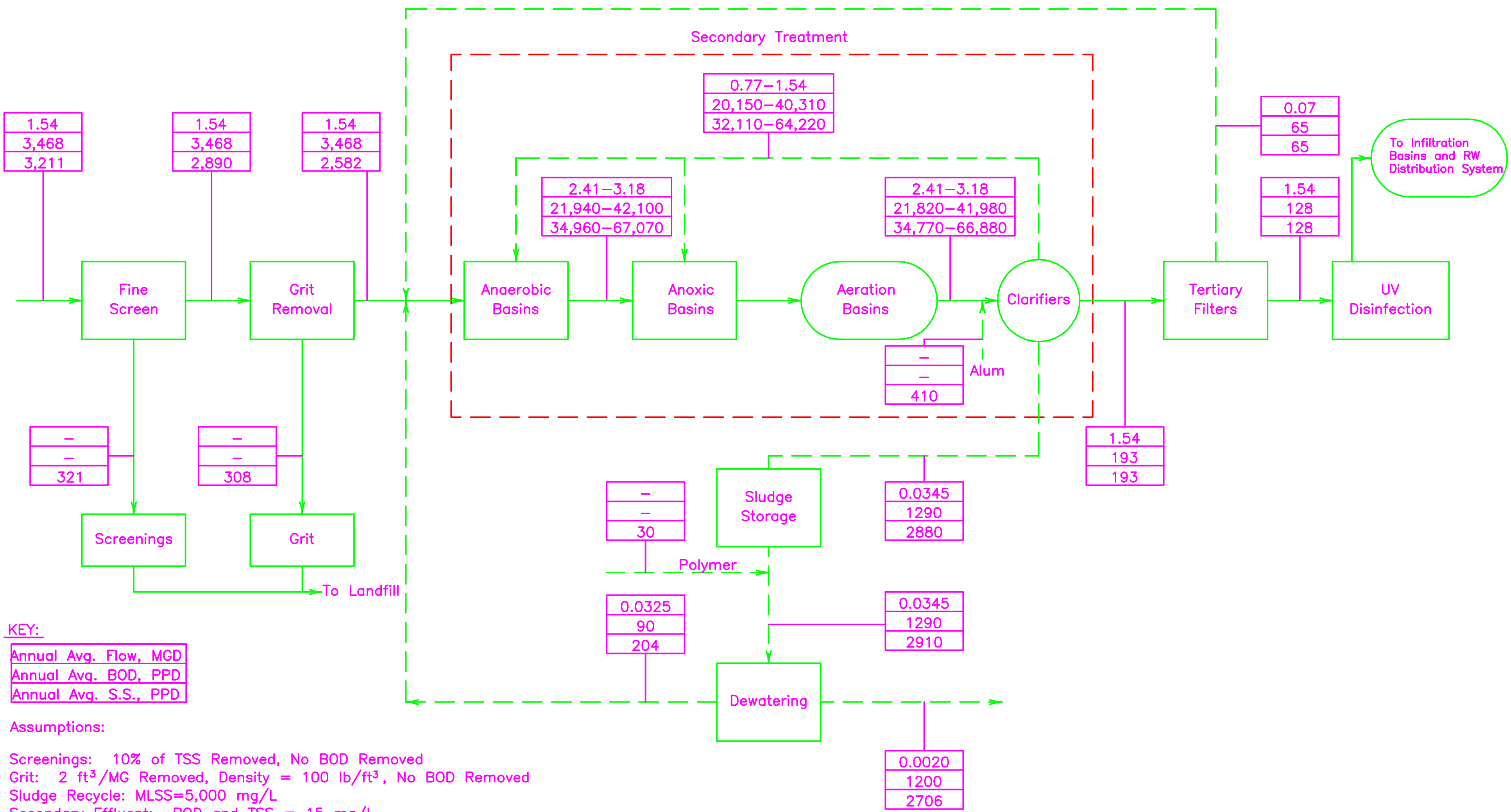
The UV system will be provided with a minimum of two channels, so that one channel can be removed from service for maintenance if necessary. An extra UV module will be provided in each channel, capable of treating the entire peak design flow with one of the modules out of service. Space will be provided for future expansion of the disinfection system.

From the UV disinfection system, the tertiary-treated and disinfected Class A reclaimed water will flow into the reclaimed water storage basin. The proposed basin is sized to provide up to three (3) days of reclaimed water supply at the current estimated seasonal average demand. The reclaimed water pump station will pump the reclaimed water from the storage basin to the reclaimed water distribution system or to the infiltration basins, depending on the distribution system demand. Sodium or calcium hypochlorite will be metered into the reclaimed water after being pumped to the reclaimed water distribution system, to provide the minimum required chlorine residual. A slight chlorine residual may also be necessary for maintenance of the reclaimed water storage basin. The system will be capable of bypassing the reclaimed water storage basin for maintenance purposes if necessary. A small portion of the reclaimed water will be recycled back to the treatment process to be used for plant washdown, chemical make-up and dilution water, foam control sprays, and site irrigation.

C. Solids Mass Balance and Sludge Disposal Plan

The solids mass balance is provided in Figure 5-5. The solids mass balance is based on the Phase 2 design annual average loading to the facility. Refer to Table 4-21 for estimated activated sludge production projections. Screenings removed by the fine screens will be washed, partially dewatered, conveyed, and deposited into screenings bins. Grit will be pumped from the grit chamber to the grit washer where it is washed, conveyed, and deposited into a grit bin. The screenings and grit will be transported to the regional incinerator for ultimate disposal. Most of the remaining organic solids that are not removed by the grit chamber or fine screens will serve as substrate (food) for the microorganisms, or mixed liquor, in the activated sludge process. The mixed liquor solids will settle in the clarifiers and be either recycled back to the Anaerobic or Anoxic basins, or pumped to the WAS Storage Tank by the WAS pumps. The WAS Storage Tank blower will blow air though coarse bubble diffusers into the WAS Storage Tank to maintain adequate mixing and keep the contents aerobic to prevent phosphorus release. The sludge will be pumped from the WAS Storage Tank to the belt filter press (BFP) by the sludge feed pumps. Polymer will be injected into the BFP sludge feed line. The dewatered sludge cake will drop from the BFP onto a conveyor that conveys the sludge cake to the sludge truck. The sludge cake will then transported off-site for treatment and disposal.

A description and comparison of the various biosolids management alternatives is provided in Chapter 4, Subsection F. The proposed alternative for sludge treatment is to either transport the sludge to the City of Cheney for composting with the City of Cheney's dewatered sludge, or transport the sludge to an off-site composting facility by a private contractor. It is recommended that the City of Airway Heights and the City of Cheney initiate negotiations for the City of Cheney treating the City of Airway Heights dewatered sludge. If for some reason, this option becomes unfeasible, the City of Airway Heights could contract with a private company to compost the City's sludge off-site.



Assumptions:

Screenings: 10% of TSS Removed, No BOD Removed
Grit: 2 ft^3/MG Removed, Density = 100 lb/ft^3, No BOD Removed
Sludge Recycle: MLSS=5,000 mg/L
Secondary Effluent: BOD and TSS = 15 mg/L
Filtrate: 25 GPM/ft2, 4 times/day, 2 min./backwash
Alum/Coagulant: Dose~32 mg/L
Reclaimed Water Effluent: BOD and TSS = 10 mg/L
Sludge Wasting: 25% Influent TSS Inert, 1% WAS, 65% MLSS Biodegradable, 1.42 lb. BODL/lb. MLSS, 0.68 lb. BOD5/lb. BODL
Dewatering: Sludge Cake = 16% Solids, Solids Capture = 93%, Polymer ~21 lb/ton
Estimated Total Sludge Production in 2030: WAS = 2055 PPD, Inert TSS = 415 PPD, Alum/Coagulant = 410 PPD

Figure 5–5

SOLIDS BALANCE

AHFPDiagrams–SB (12)

NO SCALE

Esvelt Environmental Engineering
7605 East Hodin Drive
Spokane, Washington 99212
(509) 926–3049 (Office)
(509) 922–3073 (Fax)

D. Design Criteria for Project Phasing

The design criteria and the projected design year for the various phases of the project are provided in Table 5-1.

Table 5-1. Design Flow and Loading for Project Phases				
Parameter[1]	**1st Year of Operation**	**Phase 1**	**Phase 2**	**Future Expansion[2]**
Projected Design Year	**2010**	**~2014[3]**	**2030**	**N/A**
Annual Average Flow, MGD	0.894	1.02	1.54	3.08
Maximum Month Average Flow, MGD	0.977	1.11	1.68	3.42
Maximum Day Average Flow, MGD	1.07	1.22	1.85	3.70
Peak Flow, MGD	2.24	2.55	3.85	7.70
Annual Average BOD, ppd (270 mg/l)	2,014	2,297	3,468	6,936
Maximum Month BOD, ppd (380 mg/l)	2,835	3,233	4,881	9,762
Maximum Day BOD, PPD	3,685	4,202	6,345	12,690
Annual Average TSS, PPD (250 mg/l)	1,865	2,127	3,211	6,422
Maximum Month TSS, PPD (350 mg/l)	2,611	2,977	4,495	8,991
Maximum Day TSS, PPD[7]	3,394	3,871	5,844	11,688
Annual Average TKN, PPD (44 mg/l)	328	374	565	1,130
Maximum Month TKN, PPD (50 mg/l)	373	425	642	1,284
Maximum Day TKN, PPD	485	553	835	1,670
Annual Average NH_3-N, PPD (60% TKN)	197	225	339	678
Maximum Month NH_3-N, PPD (60% TKN)	224	255	385	771
Maximum Day NH_3-N, PPD	291	332	501	1,002
Annual Average TP, PPD (6.6 mg/l)	49	56	85	170
Maximum Month TP, PPD (8.1 mg/l)	60	69	104	208
Maximum Day TP, PPD	79	90	135	270

1 Refer to Table 3-4, Wastewater Flow and Loading Projections for the City of Airway Heights, for peaking factors and assumptions used in determining design criteria.
2 Assumes doubling of design flow from 1.54 MGD to 3.08 MGD for possible future expansion.
3 Projections show that the annual average wastewater flow may reach 1.02 MGD near the end of 2013.
BOD = 5-Day Biochemical Oxygen Demand
TSS = Total Suspended Solids
TKN = Total Kjeldahl Nitrogen
NH_3-N = Ammonia-Nitrogen
TP = Total Phosphorus
PPD = Pounds Per Day

E. Design Criteria for Unit Processes

The WTRRF consists of the individual treatment components called "unit processes". The preliminary design criteria for the various unit processes are listed in Table 5-2. Some of the unit process design criteria may change if the City selects alternate types of process equipment for the various unit processes.

Table 5-2. Preliminary Design Criteria for Unit Processes

	Phase 1	Phase 2
Unit Process Design Parameter	**Value**	
Influent Pump Station		
Influent Pumps		
Number of Pumps	3	
Type	Self-Priming, Non-Clog Centrifugal	
Size, Inches	8	
Flow, GPM, Each	1,350	
Headworks Building		
In-Channel Fine Screen w/Screenings Compactor		
Minimum Capacity, MGD	3.85	
Maximum Headloss, Inches	18	
Maximum Screen Opening Size, mm	2	
Outside Diameter, Inches	60	
By-Pass Channel With Manually Cleaned Bar Rack		
Minimum Capacity, MGD	7.7	
Size, Inches	24	
Opening Size, Inches	3/4	
Vortex Grit Chamber With Washer/Conveyor		
Minimum Capacity, MGD	7.7	
Diameter, Feet	12	
Grit Pump		
Number of Pumps	2 (1 Uninstalled Standby)	
Type	End-Suction, Non-Clog Centrifugal	
Size, Inches	4	
Flow, GPM, Each	250	
Odor Control Biofilter		
Air Flow, CFM	2,500	
Surface Area, sq.ft.	560	
Maximum H_2S Emission Rate, PPY	175	
Biological Treatment System		
Anaerobic Basins		
Number of Anaerobic Basins	2	3
Total Volume of Anaerobic Basins, MG	0.330	0. 495
Volume Per Basin, MG	0.165	
Detention Time (AAF +50% RAS), HR	5.1	
Detention Time (MMF +50% RAS), HR	4.7	
Number of Mixers Per Basin	1	
Motor Size, HP, Each	10	

Table 5-2. Preliminary Design Criteria for Unit Processes		
	Phase 1	**Phase 2**
Unit Process Design Parameter	**Value**	
Anoxic Basins		
Number of Anoxic Basins	2	3
Total Volume of Anoxic Basins, MG	0.47	0.7
Detention Time (AAF +50% RAS+100% IR), HR	4.4	
Detention Time (MMF +50% RAS+100% IR), HR	4	
Number of Mixers Per Basin	1	
Motor Size, HP, Each	15	
Aeration Basin		
Number of Basins	2	3
Total Volume of Aeration Basin, MG	1.5	2.25
Side Water Depth Range of Aeration Basins, Feet	11¼-12	
Detention Time (AAF +50% RAS+100% IR), HR	14.0	
Detention Time (MMF +50% RAS+100% IR), HR	12.9	
Aerobic SRT (3,000 mg/L MLVSS) AABOD, Days	23	
Aerobic SRT (3,000 mg/L MLVSS) MMBOD, Days	16	
F:M (AA BOD, 3,000 mg/L MLVSS), d^{-1}	0.06	
F:M (MM BOD, 3,000 mg/L MLVSS), d^{-1}	0.09	
Yield Coefficient, lb.VSS/lb.BOD_5	0.72	
Number of Aerators Per Basin	2	
Aerator Type	Vertical Turbine	
Minimum Average Channel Velocity, ft/s	0.8	
Actual Oxygen Requirement, lb. O_2/Day	6,990	10,480
Standard Oxygen Requirement, lb. O_2/Day	12,850	19,270
Minimum Standard Oxygen Transfer Rate, lb. O_2/HP/HR	3.5	
Motor Size, HP, Each	75	
Internal Recirculation Pumps		
Number of Pumps	2	
Flow, GPM, Each	4,200	
Clarifiers		
Number of Clarifiers	2	3
Mechanism Type	Center-Feed w/Rapid Sludge Withdrawal	
Weir Type	Peripheral, Single	
Operation	Parallel or Series	
Clarifier Diameter, FT	2 @ 60 and 1 @ 75	
Side Water Depth of Clarifier, FT	15	
Maximum Weir Loading Rate (PF, Parallel), GPD/FT	6,280	
Maximum Overflow Rate (PF, Parallel), gallons/day-ft^2	382	
Pump Building		
RAS (Return Activated Sludge) Pumps		
Number of Pumps	3	4
Type	Self-Priming, Non-Clog Centrifugal	
Size, Inches	8	
Flow, GPM, Each	1,200	

Table 5-2. Preliminary Design Criteria for Unit Processes		
	Phase 1	**Phase 2**
Unit Process Design Parameter	**Value**	
WAS (Waste Activated Sludge) Pumps		
Number of Pumps	2	3
Type	Self-Priming, Non-Clog Centrifugal	
Size, Inches	4	
Flow, GPM, Each	400	
Scum Pumps		
Number of Pumps	2	
Type	Rotary Lobe	
Size, Inches	4	
Flow, GPM, Each	50	
Filtration Building		
Filter Pumps		
Number of Filter Pumps	2	3
Type	Submersible, Non-Clog ,Centrifugal	
Size, Inches	6	
Minimum Flow, GPM, Each	1,350	
Filters		
Number of Filters	2	3
Minimum Filter Bed Area, FT^2, Each	350	
Minimum Media Depth, FT	2	
Maximum Loading Rate, GPM/FT^2	4.0	
Maximum Effluent Turbidity, NTU	5	
Maximum Average Effluent Turbidity, NTU	2	
Coagulant Feed System		
Type of Coagulant	Liquid Polymer, PAC, and/or Aluminum Sulfate	
Number of Pumps	2	
Type	Progressive Cavity	
Hypochlorite (Sodium or Calcium) Feed System		
Dose, mg/L (up to 3.85 MGD)	9	
Maximum Gravimetric Feed Rate, PPH	12	
Number of Pumps	2	
Type	Positive Displacement, Diaphragm Type	
Flow Capacity, GPH, Each	16	
Disinfection Building		
Ultraviolet Disinfection		
Type	Low Pressure, High Intensity	
Minimum Number of Channels	2	
Total Number of Banks	6	8
Total Coliform Bacteria, Max. Weekly Median, CFU/100 ml	2.2	
Total Coliform Bacteria, Not to Exceed, CFU/100 ml	23	
Utility Water Pump Station		
Number of Pumps	2	
Type	Vertical Turbine	
Capacity, GPM, Each	200	
Reclaimed Water Pumps		
Number of Pumps	3	4
Type	Vertical Turbine	
Capacity, GPM, Each	900	

Table 5-2. Preliminary Design Criteria for Unit Processes		
	Phase 1	**Phase 2**
Unit Process Design Parameter	**Value**	
Reclaimed Water Storage and Recharge Facilities		
Reclaimed Water Storage Basin		
Type	Earthen-Diked, Membrane-Lined	
Volume, MG	1.54	
Infiltration Basins		
Minimum Number of Infiltration Basins	4	6
Estimated Area Per Basin, sq.ft.	100,000	
Dewatering Building		
WAS Storage Tank		
Volume, Gallons	87,000	
Diameter, Feet	30	
Side Water Depth, Feet	17	
Maximum Airflow, SCFM	465	
Aeration System Type	Coarse Bubble Diffusers	
SST Blower Type	Rotary Positive Displacement	
BFP Feed Pumps		
Number of Pumps	2	
Type	Double Disc Diaphragm or Rotary Lobe	
Size, Inches	6	
Flow Range, GPM, Each	100 – 250	
Polymer Make-Up System		
Type	Dry or Liquid	
Maximum Polymer Dosage, LB/Ton Dry Sludge	20	
Maximum Gravimetric Feed Rate, PPH	12.5	
Volume of Make-up/Aging Tank, Gallons	360	
Volume of Storage Tank, Gallons	360	
Polymer Metering Pumps		
Number of Pumps	2	
Type	Progressive Cavity	
Flow Range, GPH, Each	30 – 300	
Belt Filter Press (BFP)		
Width, Meter	2	
Inlet WAS Concentration Range, %	0.5 - 3	
Minimum Discharge Cake Solids Concentration, % DS	16	
Minimum Solids Capture, %	90	
Hydraulic Throughput Range, GPM	100 - 300	
Solids Throughput Range, LB/HR	500 - 1000	
Sludge Conveyor		
Volumetric Capacity, C.F./Hour	250	
Gravimetric Capacity, Ton/Hour	8	

F. Background Ground Water Quality

City of Airway Heights public water supply system monitoring data from the Washington State Department of Health (WA DOH) is provided in Table 5-3. The data includes the inorganic chemical analytical testing results for the City wells in the vicinity of the proposed WTRRF site (Wells No. 1, 3, 4, 5, and 7). The location of these wells and other wells within one-mile of the site is shown on Figure 2-7, City of Airway Heights Future Well Service at the Proposed Site.

The 2003 City of Airway Heights Annual Drinking Water Quality Report indicates that there were no measured levels above the detection limits in the City's water supply for total coliform, fecal coliform, radioactive contaminants, inorganic contaminants (besides nitrate), synthetic organic contaminants (SOCs) (including pesticides and herbicides) in 2003. The report indicated that fluoride was measured at 0.3 PPM from two source samples taken on 1/17/01.

Other analytical testing results from monitoring of Wells No. 1 and 4 include the following:

- Testing of samples collected on 6/10/00, 3/14/01, 9/26/01, 3/20/03, 6/19/03, 9/16/03, 12/11/03 by FAFB did not detect any volatile organic chemicals (VOCs) or trihalomethanes (THMs).
- Testing of samples collected on 7/9/01, 7/10/01, 7/11/01, and 7/16/01 by the City of Airway Heights did not detect any VOCs, SOCs, carbamates, herbicides, and radionuclides.
- Testing of samples collected on 6/12/96 by FAFB measured trichloroethene at 1.1 ug/L (below the regulated maximum contaminant level of 5 ug/L). No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 9/26/96 by FAFB measured trichloroethene at 1.1 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 12/17/99 by FAFB measured trichloroethene at 0.41 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 9/13/00 by FAFB measured trichloroethene at 0.51 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 12/14/00 by FAFB measured trichloroethene at 0.52 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 12/06/01 by FAFB measured trichloroethene at 0.55 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 12/18/02 by FAFB measured trichloroethene at 0.5 ug/L. No other VOCs or THMs were measured in this sample.
- Testing of a sample collected on 2/19/03 by the City of Airway Heights measured chloroform at 1.6 ug/L. No other VOCs or THMs were measured in this sample.

Table 5-3. Monitoring Data From City of Airway Heights Groundwater Supply Wells							
City Well No.	**Collection Date**	**Src No.**	**Nitrate Concentration (ppm) as N**	**Nitrite Concentration (ppm) as N**	**Sulfate Concentration (ppm)**	**TDS Concentration (ppm)**	**Ammonia (ppm)**
1	09/18/91	01	2.90				
1	11/18/92	01	2.60		12.0		
1	02/26/95	01	3.66				
1	02/23/95	01		NULL			
1 & 4	01/17/01	08	1.80	0.50	17.0	240	NULL
1 & 4	12/26/02	08	2.70	NULL			
1 & 4	02/12/03	08	5.50	NULL			
1 & 4	06/27/03	08	6.80	NULL			
1 & 4	09/30/03	08	4.20	NULL			
1 & 4	12/03/03	08	5.40	NULL			
1 & 4	03/22/04	08	4.50	NULL			
3	09/18/91	03	9.00				
3	02/23/95	03	10.40	0.05	19.6	NULL	
3	07/05/95	03	1.00	NULL			
3	02/06/96	03	12.60	NULL			
3	07/08/97	03	11.30	NULL			
3	09/02/98	03	13.00	NULL			
3	03/01/00	03	9.00	0.01	10.0	190	NULL
3	07/17/00	03	5.60	NULL			
3	10/03/00	03	10.00	NULL			
3	01/17/01	03	9.40	NULL			
3	04/03/01	03	9.00	NULL			
3	07/11/01	03	12.00	NULL			
3	10/29/01	03	9.90	NULL			
3	05/07/02	03	14.80	NULL			
3	12/26/02	03	12.00	NULL			
3	03/22/04	03	14.00	NULL			
5	09/18/91	05	3.30				
5	06/30/93	05			30.0		
5	02/23/95	05	3.69	0.05	11.0	NULL	
5	01/17/01	05	0.50	0.50	12.0	160	NULL
5	12/26/02	05	6.30	NULL			
5	02/12/03	05	4.50	NULL			
7	08/02/94	07	5.60	0.50	NULL	NULL	NULL
7	09/06/94	07	5.60	0.50	14.0	120	NULL
7	05/30/00	07	2.10	0.01	20.0	200	NULL
7	05/01/01	07	3.10	NULL			
7	12/26/02	07	0.50	NULL			

G. Existing and Future Required Hydrogeologic Information

The preliminary location of the infiltration basins for groundwater aquifer recharge are based on preliminary geotechnical information obtained from hydrogeology studies (Science Applications International Corporation (SAIC), 1992[1], Deobald and Buchanan, 1995[2], and Geoengineers, 2003[3]) and well logs in the vicinity of the proposed site. The infiltration basins are shown over the approximate location of the prominent paleochannel described by Deobald and Buchanan that winds under the City of Airway Heights towards Deep Creek. SAIC provided approximate contours of the bedrock surface and potentiometric groundwater surface of the paleochannel directly below the proposed site. These contours show the elevation of the bedrock at the perimeter of the paleochannel floor at 2200 feet above mean sea level (MSL) (approximately 160 feet below grade), and the 1991 groundwater levels at approximately 2,270 feet above MSL (approximately 90 feet below grade) at the perimeter of the paleochannel floor.

The water well report for Well No. 1 does not contain a well log. It does record the 1982 static water level (SWL) at 119 feet below grade. The 1967 well log for Well No. 4 lists the first water bearing material at 136 feet below grade. Bedrock was not encountered within the depth of Well No. 4 (200 feet). City Well No. 6, which is no longer in service, is located approximately 650 feet to the northwest of Wells No. 1 and 4, and is shown on Figure 5-1. The well log for Well No. 6 indicates that "hard basalt" was first encountered at 97 feet below grade, and the 1981 static water level was 264 feet below grade. City Well No. 7 is located within 1200 feet to the southeast of Wells No. 1 and 4 and is also shown on Figure 5-1. The well log for Well No. 7 indicates that "hard basalt" was first encountered at 130 feet below grade, and the 1994 static water level at this location was 340 feet below grade.

A detailed hydrogeologic study is proposed to be included as part of the pre-design process which would evaluate the following:

1. Soil types and porosity;
2. Soil permeability;
3. Surface infiltration rates;
4. Depth to groundwater and hydraulic gradients;
5. Groundwater depth and gradient;
6. Groundwater flow;
7. Subsurface basalt topography;
8. Water balance analysis of the proposed recharge aquifer;
9. Residence time of the reclaimed water in the underground prior to withdrawal; and
10. Site constructibility characteristics related to soil types and depths.

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1 SAIC, Installation Restoration Program (IRP), Remedial Investigation Report, Craig Road Landfill, Fairchild AFB, Washington, 1992.
2 Deobald and Buchanan, Hydrogeology of the West Plains Area of Spokane County, Washington, May 1995.
3 Geoengineers, Inc., Hydrogeologic Evaluation for City of Airway Heights, 2003.

H. Water Rights Impairment Analysis

Under RCW 90.46.130, the City of Airway Heights is required to demonstrate that it will not impair any existing water rights downstream from any existing freshwater discharge points, unless compensation or mitigation is agreed to by the holder(s) by the affected water right(s). The City of Airway Heights must therefore submit an "impairment analysis" to the WA DOE to show that it is not impairing downstream water rights in the Spokane River by moving its discharge from the City of Spokane Riverside Park Water Reclamation Facility (RPWRF) (which discharges to the Spokane River) to a groundwater recharge aquifer or to a reclaimed water distribution system.

A letter dated December 17, 2004 to the City of Airway Heights from the WA DOE Water Resources Program suggests that removal of City of Airway wastewater flows from the City of Spokane RPWRF, and thereby from the Spokane River, may result in impairment of surface water rights in the River. This letter is included in Appendix I. Because of the complexity of this issue, it is recommended that the WA DOE Water Resources Program comments be addressed in the Pre-Design phase of the project.

I. Staffing Requirements

Staffing is planned to consist of operators with certification levels in accordance with WAC 173-230, Certification of Operators of Wastewater Treatment Plants. WAC 173-230-140, Classification of Wastewater Treatment Plants, determines the Class of the treatment facility and therefore the minimum required certification levels of the operators. Because the proposed WTRRF is a tertiary treatment facility with a design flow of less than or equal to 5 MGD, the facility will be classified as a minimum Class III facility.

173-230-040 requires that “the operator in charge of the wastewater treatment plant must be certified at least at a level equal to or higher than the classification of the plant. When the plant is operated on more than one daily shift, the operator in charge of each shift must be certified at a level not lower than one level below the classification of the plant.”

Accordingly, the proposed City operation and maintenance budget estimate includes the estimated salary for a Class III “lead operator”. The lead operator, or “operator in responsible charge", is defined in the regulations as the “the individual who is routinely on-site and in direct charge of the overall operation of a wastewater treatment plant.” The lead operator will be required to have the qualifications associated with a Class III certification, and experience with the treatment processes being designed for the proposed facility.

The proposed operation and maintenance budget estimate also includes the estimated salary for two full-time operators with minimum Class II certifications to assist the lead operator and to help fill operational needs for weekends and holidays. Half-day operation is planned for the weekends and holidays, when only routine testing will be performed. When the lead operator is not available, such as in the event of illness or vacation, the operator in responsible charge of that shift will be required to have a minimum Class II certification.

The budget estimate also includes one full-time operator with a Class I certification and/or experience as a laboratory technician. This person would likely perform much of the routine daily laboratory testing.

J. Estimated Laboratory Tests Required for Permit Compliance

Table 5-4 provides the estimated discharge permit required tests and schedule for the proposed WTRRF. The tests included in Table 5-4 account for approximately one-third of the tests recommended for proper monitoring and control of the proposed facility. A minimum of one full-time operator is recommended to be budgeted for laboratory testing due to the large quantity of testing required for proper operation of the facility.

All permit required testing must be performed by a laboratory accredited under the provisions of *Accreditation of Environmental Laboratories*, Chapter 173-50 WAC. The laboratory at the new facility would be required to be accredited prior to performing any laboratory tests for permit compliance. Any permit required testing for which the laboratory is not accredited must be sent to an off-site accredited laboratory.

Table 5-4. Estimated Permit Required Tests and Schedule

Test and Units	Sample Type/Sample Point	Frequency	Sample Type	Report
Flow, MGD	Influent to WTRRF/Headworks Parshall Flume	Continuous	Flowmeter Measurement	Total Daily, Average and Maximum Day Flow for Month, MGD
	Filter Influent/Filter Influent Flowmeter			
	Effluent to Infiltration Basins/Infiltration Basins Flowmeter			
	Effluent to Reclaimed Water System/Reclaimed Water Flowmeter			
	Effluent to Site Irrigation System/Irrigation System Flowmeter			
5-Day Biochemical Oxygen Demand (BOD_5), mg/l	Influent to WTRRF/Headworks Sampler	2/week	24-hr Composite Sample	Results, day of sample, mg/l and PPD, Monthly Average, mg/l and PPD
	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler			
Total Suspended Solids (TSS), mg/l	Influent to WWT&RF/Headworks Sampler	2/week	24-hr Composite Sample	Results, day of sample, mg/l and PPD, Monthly Average, mg/l and PPD
	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler			
Total Nitrogen (TN), mg/l, includes: Total Kjeldahl Nitrogen (TKN), mg/l, Nitrate Nitrogen (NO_3-N), mg/l, and Nitrite Nitrogen (NO_2-N), mg/l	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler	1/week	24-hr Composite Sample	Results, day of sample, mg/l
	Monitoring Wells	1/quarter	Grab	
Total Coliform Bacteria (TC), cfu/100 ml	Reclaimed Water/Reclaimed Water Pump Station Wet Well	Daily	Grab	Results, day of sample, cfu/100 ml, 7-day median, cfu/100 ml
	Monitoring Wells	1/quarter		
Turbidity, NTU	Tertiary Effluent/Filter Effluent Turbidimeter	Continuous[1]	Turbidimeter Measurement	Daily Maximum Measurement, NTU Average, NTU
Dissolved Oxygen (DO), mg/l	Reclaimed Water/Reclaimed Water Pump Station Wet Well	Daily	Grab	Results, day of sample, mg/l
pH, S.U.	Reclaimed Water/Reclaimed Water Pump Station Wet Well	Daily	Grab	Results, day of sample, S.U.
Total Dissolved Solids (TDS), mg/l	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler	1/month	24-hr Composite Sample	Results, day of sample, mg/l
	Monitoring Wells	1/quarter	Grab	

Table 5-4. Estimated Permit Required Tests and Schedule

Test and Units	Sample Type/Sample Point	Frequency	Sample Type	Report
Chloride, mg/l	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler	1/month	24-hr Composite Sample	Results, day of sample, mg/l
	Monitoring Wells	1/quarter	Grab	
Total Metals[2], µg/l	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler	1/quarter	24-hr Composite Sample	Results, ug/l, when obtained, with DMR
	Monitoring Wells	1/year	Grab	
Priority Pollutant Analysis	Reclaimed Water/Reclaimed Water Pump Station Wet Well Sampler	1/year	24-hr Composite Sample	Results, ug/l, when obtained, with DMR
	Monitoring Wells			
Coagulant Usage, lbs.	Coagulant Feed to Filter	Daily	Coagulant Usage Reading	Results, day of measurement, pounds of coagulant used

Notes.

1 Continuous means a minimum of once every four hours.
2 Heavy Metals = Arsenic (AS), Cadmium (Cd), Copper (Cu), Lead (Pb), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), and Zinc (Zn).

K. Influent Priority Pollutant Data and Expected Removal

Table 5-5 lists the priority pollutant sampling data for the City of Airway Heights wastewater discharged to the City of Spokane collection system for years 2002 and 2003. The samples were collected by the City of Spokane as part of its pretreatment program. Analyses of metals were performed in the City of Spokane RPWRF's laboratory using EPA Method 200.7/6010B, Inductively Coupled Plasma-Atomic Emissions Spectrometry (ICP-AES). Analysis for mercury was performed using EPA Method 245.1/7470A, Mercury in Water by Manual Cold Vapor Atomic Absorption (CVAA). All other pollutants including volatile organic compounds (VOCs), semi-volatile organic compounds, chlorinated pesticides, polychlorinated biphenyls (PCBs), and cyanide were performed by SVL Analytical, Inc. of Kellogg, ID, Columbia Analytical Services of Kelso, WA, or Anatek Labs, Inc. of Spokane, WA. A total of 174 organic compounds (69 VOCs, 76 semi-volatile organic compounds, and 29 chlorinated pesticides/PCBs) and 13 inorganic compounds were analyzed, which is greater than the 126 priority pollutants regulated under federal pretreatment standards (40 CFR Part 423 Appendix A).

Table 5-6 provides the maximum and minimum concentrations detected for each analyte and lists the Washington State ground water and drinking water quality criteria in WAC 173-200 and WAC 246-290 for comparison. Compounds that were not detected in any of the sampling episodes were not included in the table. The table also lists the expected removal mechanisms for each pollutant based on its biodegradability, volatility, and ability to be removed through physical and chemical mechanisms (i.e., oxidation, coagulation, sedimentation, and filtration). The expected degree of removal were based on information from *The Treatability Manual*, Office of Research and Development, U.S. Environmental Protection Agency, EPA-600/2-82-001c, 1983. The water quality criteria that are in bold are those criteria that are exceeded by the influent priority pollutant concentrations one or more times. Those pollutants that exceed these criteria include arsenic, methylene chloride, bis(2-ethylhexyl)phthalate, pentachlorophenol, heptachlor epoxide, and chlordane (gamma).

The Maximum Contaminant Level (MCL) in the National Primary Drinking Water Regulations, CFR141.62, for arsenic was reduced in 2002 from 0.050 mg/L (50 ug/L) to 0.010 mg/L (10 ug/L), with compliance required by January 23, 2006. Arsenic can be removed from aqueous solutions to below the MCL through oxidation of arsenite (AsO_3) to arsenate (AsO_4), coagulation with metal salts (such as iron, manganese, or alum), and filtration for physical removal of the metal and arsenate complexes. In the proposed treatment system, the best results for arsenic removal would be through oxidation of the arsenite to arsenate in the secondary effluent by adding an oxidant (such as sodium hypochlorite or potassium permanganate), coagulation with ferric chloride or ferric sulfate, and tertiary filtration. Testing could be performed during the first year of operation to determine the combination of chemicals that will yield the best performance. Testing of arsenic removal through aluminum sulfate (alum) addition could also be performed, although removal efficiency drops off dramatically at pH levels above 7.0 S.U. (Montgomery, *Water Treatment Principles & Design*, 1985). Therefore, alum may not be as effective as ferric chloride or ferric sulfate addition.

The proposed treatment system is considered to be a Best Available Technology (BAT) for removal of arsenic in drinking water under CFR141.62. The lowest effluent arsenic concentration that could be achieved through this type of treatment system is estimated to be between 0.01 to 0.005 mg/L (Eckenfelder, *Industrial Water Pollution Control*, 2000). Thus, the proposed system would likely not meet the 0.00005 mg/L (0.05 ug/L) arsenic ground water quality criteria listed in WAC 173-200-040, Water Quality Standards for Ground Waters of the State of Washington.

Recent monitoring of arsenic in the proposed site groundwater has not detected arsenic levels above 0.01 ug/L (2003 City of Airway Heights Annual Drinking Water Quality Report), although additional monitoring is recommended to determine the actual site background arsenic concentrations. If the background concentrations of arsenic are found to be higher than the ground water quality criteria listed in WAC 173-200-040, the WA DOE may allow a higher arsenic effluent standard. The WA DOE may also require compliance of the site ground water arsenic concentrations in the proposed ground water monitoring wells in lieu of required compliance at the point of discharge (tertiary effluent). This would allow dilution of the tertiary effluent with the site ground water prior to measurement. Because the system is expected to reduce arsenic concentrations in the tertiary effluent to below the federal drinking water standard, this may be acceptable to the WA DOE.

This is the method of compliance for the City of Yelm, WA, Water Reuse Project, where tertiary treated effluent recharges ground water by infiltration basins. At the City of Yelm ground water recharge system, metals, inorganics, and total dissolved solids are all monitored in the ground water monitoring wells only. The maximum ground water limitation for arsenic in the Yelm monitoring wells is 0.05 mg/L (50 ug/L). The distance to the nearest ground water wells to the infiltration area is estimated to be approximately 400 feet. There are two City potable water supply wells located approximately 500 feet and down gradient from the infiltration basins.

Also, it is unclear if existing analytical methods for arsenic can accurately detect arsenic in water at concentrations as low as 0.05 ug/L. Table 5-7, Analytical Methods Currently Approved for the Analysis of Arsenic in Drinking Water, is excerpted from Table 2.1 in the *Analytical Methods Support Document for Arsenic In Drinking Water EPA-815-R-00-010* (USEPA Office of Water, Office of Ground Water and Drinking Water, December 1999). The lowest Method Detection Limit (MDL), (i.e. the minimum concentration of a substance that can be reported with 99% confidence that the analyte concentration is greater than zero), listed in the table for any of the methods is 0.5 ug/L, which is ten (10) times greater than the ground water quality criteria for arsenic (0.05 ug/L). If the lowest MDL is indeed 0.5 ug/L, it is expected that this would then become the applicable enforceable ground water criteria for arsenic.

Of the VOCs, only methylene chloride was detected at levels above drinking water and ground water quality regulatory criteria. Since methylene chloride was detected only once in six sampling episodes, and is highly volatile and biodegradable, it is not considered likely that this contaminant will remain in the tertiary treated effluent recharged to ground water.

Of the semi-volatile organic compounds, bis(2-ethylhexyl)phthalate and pentachlorophenol were detected at levels above drinking water and ground water quality regulatory criteria. Since pentachlorophenol was detected only once in eight sampling episodes, it is not considered likely that this contaminant will be consistently detected in the tertiary treated effluent recharged to ground water. In addition, since pentachlorophenol was detected near the acceptable limit and is moderately biodegradable, it is likely that this compound will be removed through biodegradation within the proposed extended aeration activated sludge system.

However, bis(2-ethylhexyl)phthalate was consistently detected in the influent in seven of the eight sampling episodes, and above the drinking water and ground water quality criteria in six of the samples. Bis(2-ethylhexyl)phthalate is not highly biodegradable or volatile. It may be removed to some degree in the extended aeration oxidation system and through coagulation with polymer addition and filtration (*The Treatability Manual*, Office of Research and Development, U.S. Environmental Protection Agency, EPA-600/2-82-001c, 1983). Detection and treatment or removal of this compound at its source through a pretreatment program is also a recommended "treatment" strategy.

Of the chlorinated pesticides and polychlorinated biphenyls (PCBs) tested, heptachlor epoxide and chlordane (gamma) were detected at levels above ground water quality criteria, but below drinking water quality standards. These compounds were detected only once in eight sampling episodes, and are not considered likely to be consistently detected in the tertiary treated effluent recharged to ground water. These compounds are not particularly biodegradable or volatile, and are not expected to be removed through coagulation or filtration. Therefore, detection and removal of these compounds at their source through a pretreatment program is highly recommended.

Table 5-5. Influent Priority Pollutant Sampling Data for the City of Airway Heights Influent Wastewater (2002-2003)											
Analyte	**Sampling Date**									**Units**	**Method Detection Limit[1] As Of Jan 02/May 02/ Jan 03[2]**
	2/21-22/02	**4/24-25/02**	**7/9-10/02**	**11/6-/7/02**	**2/17-18/03**	**4/24-25/03**	**7/7-8/03**	**8/26-27/03**	**8/26-27/03**		
Metals											
1. Silver (Ag)	<0.018	<0.009	<0.009	<0.009	<0.003	<0.003	<0.003	-	-	mg/L	0.018/0.009/0.003
2. Aluminum (Al)	1.477	1.081	1.583	1.057	1.347	1.11	1.464	-	-	mg/L	0.013/0.013/0.012
3. Arsenic (As)	0.052	<0.025	<0.025	0.026	<0.016	0.019	<0.016	-	-	mg/L	0.031/0.025/0.016
4. Cadmium (Cd)	0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	-	-	mg/L	0.001/0.001/0.002
5. Chromium (Cr)	0.003	0.003	0.003	0.006	<0.001	0.003	0.003	-	-	mg/L	0.002/0.002//0.001
6. Copper (Cu)	0.071	0.047	0.06	0.058	0.038	0.039	0.052	-	-	mg/L	0.004/0.004/0.001
7. Mercury (Hg)	<0.0002	-	-	0.00011	0.00008	<0.000007	<0.000007	-	-	mg/L	0.0002/0.0002/0.000007
8. Molybdenum (Mo)	<0.011	<0.004	<0.004	0.006	<0.003	<0.003	<0.003	-	-	mg/L	0.011/0.004/0.003
9. Nickel (Ni)	0.010	<0.002	0.004	0.006	0.005	<0.003	<0.003	-	-	mg/L	0.006/0.002/0.003
10. Lead (Pb)	0.023	<0.014	<0.014	0.048	<0.009	0.017	<0.009	-	-	mg/L	0.021/0.014/0.009
11. Selenium (Se)	<0.042	<0.032	<0.032	<0.032	<0.018	<0.018	<0.018	-	-	mg/L	0.042/0.032/0.018
12. Zinc (Zn)	0.175	0.134	0.376	0.484	0.158	0.119	0.145	-	-	mg/L	0.002/0.002/0.001
Volatile Organics											**Practical Quantification Limit[3]**
1. Acetone	60.2	66.2	41.8	55.2	94.5	-	57.1	-	-	ug/L	2.5
2. Chloroform	ND	ND	ND	0.5	ND	-	ND	-	-	ug/L	0.5
3. Methylene Chloride	ND	13.3	ND	ND	ND	-	ND	-	-	ug/L	5.0
4. Toluene	ND	ND	ND	0.9	ND	-	ND	-	-	ug/L	0.5
5. 1,3-Dichlorobenzene	ND	ND	ND	0.7	ND	-	ND	-	-	ug/L	0.5
All Others[4]	ND	ND	ND	ND	ND	-	ND	-	-	ug/L	Varies

Table 5-5. Influent Priority Pollutant Sampling Data for the City of Airway Heights Influent Wastewater (2002-2003)											
Analyte	**Sampling Date**									**Units**	**Method Detection Limit[1] As Of Jan 02/May 02/ Jan 03[2]**
	2/21-22/02	**4/24-25/02**	**7/9-10/02**	**11/6-/7/02**	**2/17-18/03**	**4/24-25/03**	**7/7-8/03**	**8/26-27/03**	**8/26-27/03**		
Semivolatile Organics											
6. Benzyl Alcohol	9.74	6.24	12.1	ND	ND	-	9.76	-	8.92	ug/L	5.0
7. Benzoic Acid	662	523	58.1	773	364	-	260	-	305	ug/L	10.0
8. Bis(2-ethylhexyl)phthalate	36.1	8.99	8.71	5.8	ND	-	7.63	51	14.1	ug/L	1.0
9. Diethyl Phthalate	ND	ND	ND	7.0	ND	-	7.66	ND	5.92	ug/L	1.0
10. Di-n-octylphthalate	ND	ND	5.07	ND	ND	-	ND	ND	ND	ug/L	1.0
11. 3-& 4-Methylphenol	83.1	66.5	74.8	110	77.9	-	49.5	120	54.0	ug/L	1.0
12. Pentachlorophenol	ND	ND	ND	1.6	ND	-	ND	ND	ND	ug/L	1.0
13. Phenol	22.2	17.6	16.1	6.1	ND	-	24.1	ND	19.3	ug/L	1.0
14. 1,2,4-Trichlorobenzene	5.77	ND	ND	ND	ND	-	ND	ND	ND	ug/L	5.0
15. Total Phenols	0.028	0.056	0.022	0.06	0.025	-	0.054	-	-	ug/L	0.02
All Others[4]	ND	ND	ND	ND	ND	-	ND	ND	ND	ug/L	Varies
Organochlorine Pesticides/PCBs											**Practical Quantification Limit[3]**
16. beta-BHC	ND	ND	ND	ND	ND	-	0.136	ND	ND	ug/L	0.04
17. Heptachlor Epoxide	ND	ND	ND	ND	ND	-	0.162	ND	ND	ug/L	0.04
18. Chlordane (gamma)	ND	ND	ND	ND	ND	-	1.95	ND	ND	ug/L	0.4
All Others[4]	ND	ND	ND	ND	ND	-	ND	ND	ND	ug/L	Varies
Other Inorganics											
1. Cyanide	<0.01	<0.01	<0.01	ND	<0.01	-	0.105	ND	ND	mg/L	<0.01

ND = Not Detected,   - No Analysis Performed

1. Method Detection Limit is the minimum concentration of a substance that can be reported with 99% confidence that the analyte concentration is greater than zero (for a specific analytical method) (40 CFR Part 136 Appendix B).
2. In May 2002, the RPWRF Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES) was standardized for a background correction of all analyzed elements and also corrected for interferences caused by aluminum and iron. These calibrations modified the method detection limits for the metals analyses for April, July, and November of 2002. Method detection limits were modified again for the 2003 sampling data.
3. The Practical Quantification Limit is defined as the lowest concentration of an analyte that can be reliably measured within the specified limits of precision and accuracy during routine laboratory operating conditions (i.e., the level that most laboratories can be expected to meet during day-to-day operations).
4. The other organic priority pollutants tested during the sampling episodes include the following:

19. Dichlorodifluoromethane
20. Chloromethane
21. Vinyl Chloride
22. Bromomethane
23. Chloroethane
24. Trichlorofluoromethane
25. 1,1-Dichloroethene
26. Carbon Disulfide
27. Trans-1,2-Dichloroethene
28. Acrylonitrile
29. MTBE
30. 1,1-Dichloroethane
31. 2,2-Dichloropropane
32. Methyl Ethyl Ketone
33. Cis-1,2-Dichloroethene
34. Bromochloromethane
35. 1,1,1-Trichloroethane
36. Carbon Tetrachloride
37. 1,1-Dichloropropene
38. Benzene
39. 1,2-Dichloroethane
40. Trichloroethene
41. 1,2-Dichloropropane
42. Dibromomethane
43. Bromodichloromethane
44. 2-Chloroethyl Vinyl Ether
45. Cis-1,3-Dichloropropene
46. MIBK (4-Methyl-2-Pentanone)
47. Trans-1,3-Dichloropropene
48. 1,1,2-Trichloroethane
49. Tetrachloroethene
50. 1,3-Dichloropropane
51. 2-Hexanone
52. Dibromochloromethane
53. 1,2-dibromoethane
54. Chlorobenzene
55. 1,1,1,2-Tetrachloroethane
56. Ethylbenzene
57. m+p-Xylene
58. o-Xylene
59. Styrene
60. Bromoform
61. Isopropylbenzene
62. Bromobenzene
63. 1,1,2,2-Tetrachloroethane
64. 1,2,3-Trichloropropane
65. n-Propylbenzene
66. 2-Chlorotoluene
67. 4-Chlorotoluene
68. 1,3,5-Trimethylbenzene
69. Tert-Butylbenzene
70. 1,2,4-Trimethylbenzene
71. sec-Butylbenzene
72. p-Isopropyltoluene
73. 1,4-Dichlorobenzene
74. 1,2-Dichlorobenzene
75. n-Butylbenzene
76. 1,2-Dibromo-3-Chloropropane
77. 1,2,4-Trichlorobenzene
78. Hexachlorobutadiene
79. Naphthalene
80. 1,2,3-Trichlorobenzene
81. 2-Methylnapthalene
82. 1-Methylnapthalene
83. Acenaphthene
84. Acenaphthylene
85. Aniline
86. Anthracene
87. Benzidine
88. Benzo(k)Fluoranthene
89. Benzo(b)Fluoranthene
90. Benzo(ghi)Perylene
91. Benzo(a)Anthracene
92. Benzo(a)Pyrene
93. Bis(2-Chlorethoxy)Methane
94. Bis(2-Chloroisopropyl)Ether
95. Bis(2-Chloroethyl)Ether
96. 4-Bromophenyl Phenyl Ether
97. Butylbenzylphthalate
98. 4-Chloroaniline
99. 2-Chloronaphthalene
100. 4-Chloro-3-Methylphenol
101. 2-Chlorophenol
102. 4-Chlorphenyl Phenyl Ether
103. 4-Chlorothioanisole
104. Chrysene
105. Dibenz(ah)Anthracene
106. Dibenzofuran
107. Di-n-Butyl-Phthalate
108. 1,3-Dichlorobenzene
109. 1,2-Dichlorobenzene
110. 1,4 Dichlorobenzene
111. 3,3-Dichlorobenzidine
112. 2,4-Dichlorophenol
113. 2,6-Dichlorophenol
114. 2,4-Dimethylphenol
115. Dimethyl Phthalate
116. 4,6-Dinitro-2-Methylphenol
117. 2,4-Dinitrophenol
118. 2,4-Dinitrotoluene
119. 2,6-Dinitrotoluene
120. 1,2-Diphenylhydrazine
121. Fluoranthene
122. Fluorene
123. Hexachlorobenzene
124. Hexachlorobutadiene
125. Hexachlorocyclopentadiene
126. Hexachloroethane
127. Indeno(123,cd)Pyrene
128. Isophorone
129. 1-Methylnaphthalene
130. 2-Methylnaphthalene
131. 2-Methylphenol
132. Naphthalene
133. 2-Nitroaniline
134. 3-Nitroaniline
135. 4-Nitroaniline
136. Nitrobenzene
137. 2-Nitrophenol
138. 4-Nitrophenol
139. N-Nitrosodibutylamine
140. N-Nitrosodimethylamine
141. N-Nitrosodiphenylamine
142. N-Nitrosodipropylamine
143. Phenanthrene
144. Pyrene
145. Pyridine
146. 1,2,4-Trichlorobenzene
147. 2,4,5-Trichlorophenol
148. 2,4,6-Trichlorophenol
149. alpha-BHC
150. gamma-BHC (Lindane)
151. Heptachlor
152. Aldrin
153. Chlordane (alpha)
154. Chlordane (technical)
155. delta-BHC
156. Endosulfan-I
157. 4,4'-DDE
158. Dieldrin
159. Endrin
160. Endosulfan II
161. 4,4'-DDD
162. 4,4'-DDT
163. Endrin Aldehyde
164. Endosulfan Sulfate
165. Methoxychlor
166. Endrin Ketone
167. Toxaphene
168. Arochlor 1016
169. Arochlor 1221
170. Arochlor 1232

171. Arochlor 1242

172. Arochlor 1248

173. Arochlor 1254

174. Arochlor 1260

Table 5-6. Summary of Influent Priority Pollutant Sampling Data, Effluent Regulatory Criteria, and Expected Removal Mechanisms								
Analyte	**Units**	**Maximum Concentration**	**Minimum Concentration**	**Ground Water Quality Criteria WAC 173-200**	**Drinking Water Quality Criteria 40CFR141.61 &62 WAC 246-290**	**Removal Through Biodegradation**	**Removal Through Volatilization**	**Removal Through Oxidation/Coagulation/ Settling/Filtration**
Metals								
1. Silver (Ag)	mg/L	<0.018	<0.003	0.05	0.1	NS	NS	S
2. Aluminum (Al)	mg/L	1.583	1.057	-	-	NS	NS	S
3. Arsenic (As)	mg/L	0.052	<0.016	**0.00005**	**0.01**	NS	NS	S
4. Cadmium (Cd)	mg/L	0.002	<0.001	0.01	0.005	NS	NS	S
5. Chromium (Cr)	mg/L	0.006	<0.001	0.05	0.1	NS	NS	S
6. Copper (Cu)	mg/L	0.071	0.038	1.0	-	NS	NS	S
7. Mercury (Hg)	mg/L	0.00011	<0.000007	0.002	0.002	NS	NS	S
8. Molybdenum (Mo)	mg/L	<0.011	<0.003	-	-	NS	NS	S
9. Nickel (Ni)	mg/L	0.010	<0.002	-	0.1	NS	NS	S
10. Lead (Pb)	mg/L	0.048	<0.009	0.05	-	NS	NS	S
11. Selenium (Se)	mg/L	<0.042	<0.018	0.01	0.05	NS	NS	S
12. Zinc (Zn)	mg/L	0.484	0.119	5.0	5.0	NS	NS	S
Volatile Organics								
1. Acetone	ug/L	94.5	41.8	-	-	S	MS	NS
2. Chloroform	ug/L	0.5	ND	7.0	-	S	S	NS
3. Methylene Chloride	ug/L	13.3	ND	**5.0**	**5.0**	S	S	NS
4. Toluene	ug/L	0.9	ND	-	1000	S	S	NS
5. 1,3-Dichlorobenzene	ug/L	0.7	ND	4.0	-	NS	S	NS

Table 5-6. Summary of Influent Priority Pollutant Sampling Data, Effluent Regulatory Criteria, and Expected Removal Mechanisms								
Analyte	**Units**	**Maximum Concentration**	**Minimum Concentration**	**Ground Water Quality Criteria WAC 173-200**	**Drinking Water Quality Criteria 40CFR141.61 &62 WAC 246-290**	**Removal Through Biodegradation**	**Removal Through Volatilization**	**Removal Through Oxidation/Coagulation/ Settling/Filtration**
Semivolatile Organics								
6. Benzyl Alcohol	ug/L	12.1	ND	-	-			NS
7. Benzoic Acid	ug/L	773	58.1	-	-	S	NS	NS
8. Bis(2- yl)phthalate	ug/L	36.1	ND	**6.0**	**6.0**	MS	NS	MS
9. Diethyl Phthalate	ug/L	7.66	ND	-	-	S	NS	MS
10. Di-n-octylphthalate	ug/L	5.07	ND	-	-	MS	NS	MS
11. 3-& 4-Methylphenol	ug/L	110	49.5	-	-	S	NS	NS
12. Pentachlorophenol	ug/L	1.6	ND	-	**1.0**	MS	NS	NS
13. Phenol	ug/L	24.1	ND	-	-	S	NS	NS
14. 1,2,4-Trichlorobenzene	ug/L	5.77	ND	-	70.0	S	S	NS
15. Total Phenols	ug/L	0.06	0.022	-	-	S	NS	NS
Organochlorine Pesticides/PCBs								
1. beta-BHC	ug/L	0.136	ND	-	-	NS	NS	NS
2. Heptachlor Epoxide	ug/L	0.162	ND	**0.009**	0.2	NS	NS	NS
3. Chlordane (gamma)	ug/L	1.95	ND	**0.1**	2	NS	NS	NS
Other								
1. Cyanide	mg/L	0.105	ND	-	0.2	S	S	MS

ND = Not Detected
S = Significant Removal Mechanism (>50%)
MS = Moderately Significant Removal Mechanism (20-50%)
NS = Not a Significant Removal Mechanism (<20%)

Table 5-7. Analytical Methods Currently Approved for Analysis of Arsenic in Drinking Water

(From Table 2.1 in Analytical Methods Support Document for Arsenic In Drinking Water[9])

			MDL (µg/L)
Multi-Analyte Methods	EPA 200.8[1]	Inductively coupled plasma/mass spectrometry (ICP/MS)	1.4
	EPA 200.7[2]	Inductively coupled plasma/atomic emission spectrometry (ICP/AES)	8
	SM 3120 B[3]	ICP/AES	50
Single-Analyte Methods	EPA 200.9[4]	Graphite furnace atomic absorption spectrometry (GFAA)	0.5
	SM 3113 B[5]	GFAA	1
	ASTM D 2972-93, Test Method C[6]	GFAA	5
	SM 3114 B[7]	Gaseous hydride atomic absorption (GHAA)	0.5
	ASTM D 2972-93, Test Method B[8]	GHAA	1

1 **EPA Method 200.8**, "Determination of Trace Elements In Water and Wastes By Inductively Coupled Plasma-Mass Spectrometry," Revision 5.4, Methods for the Determination of Metals in Environmental Samples-Supplement I, EPA/600/R-94-111, May 1994.

2 **EPA Method 200.7,** "Determination of Metals and Trace Elements In Water and Wastes By Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 4.4, EMMC Version, Methods for the Determination of Metals in Environmental Samples-Supplement I, EPA/600/R-94-111, May 1994.

3 **Standard Methods 3120 B,** "Inductively Coupled Plasma (ICP) Method" Standard Methods for the Examination of
Water and Wastewater, 19th ed., American Public Health Association, 1995.

4 **EPA Method 200.9**, "Determination of Trace Elements By Stabilized Temperature Graphite Furnace Atomic Absorption," Revision 2.2, Methods for the Determination of Metals in Environmental Samples-Supplement I, EPA/600/R-94-111, May 1994.

5 **Standard Methods 3113 B**, "Electrothermal Atomic Absorption Spectrometric Method," Standard Methods for the Examination of Water and Wastewater, 19th ed., American Public Health Association, 1995.

6 **ASTM D 2972-93, Test Method C** "Atomic Absorption, Graphite Furnace," Annual Book of ASTM Standards, Waster and Environmental Technology," Vol. 11.01, 1998, American Society for Testing and Materials, Philadelphia, PA.

7 **Standard Methods 3114 B**, "Manual Hydride Generation/Atomic Absorption Spectrometric Method," Standard Methods for the Examination of Water and Wastewater, 19th ed., American Public Health Association, 1995.

8 **ASTM D 2972-93, Test Method B**, "Atomic Absorption, Hydride Generation," Annual Book of ASTM Standards, Waster and Environmental Technology," Vol. 11.01, 1998, American Society for Testing and Materials, Philadelphia, PA.

9 USEPA Office of Water, Office of Ground Water and Drinking Water, Analytical Methods Support Document For Arsenic in Drinking Water, EPA-815-R-00-010, December 1999.