Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review

Date: **March 11, 2020**

Facility: **Silver Creek Water Reclamation Facility**
Snyderville Basin Water Reclamation District
UPDES No. UT0024414

Receiving water: **Silver Creek (1C, 2B, 3A, 4)**

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge
Outfall 001: Silver Creek

The maximum monthly mean discharge is 4.0 MGD and the maximum daily design discharge is 8.0 MGD. These discharge rates were provided by Snyderville Basin Water Reclamation District.

Receiving Water
The receiving water for Outfall 001 is an open channel that drains to Silver Creek, which is tributary to the Weber River and Echo Reservoir. The outlet channel was determined to be a natural tributary of Silver Creek, with the same classification as Silver Creek. A technical memo regarding the determination is included in Appendix D.

Per UAC R317-2-13.4.a, the designated beneficial uses for Weber River and tributaries, from Stoddard diversion to headwaters, is 1C, 2B, 3A, and 4.

- *Class 1C - Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.*
- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*
- *Class 3A - Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.*
- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

Protection of Downstream Uses

Per UAC R317-2-8, *all actions to control waste discharges under these rules shall be modified as necessary to protect downstream designated uses*.

Receiving Water Critical Flow/Water Quality

Typically, the critical flow for the wasteload analysis is considered the lowest average stream flow for seven consecutive days with a ten year return frequency (7Q10). For Silver Creek, flow records from USGS stream gage # 10129900 Silver Creek Near Silver Creek Junction, UT for the active period 10/1/2001 to 12/31/2012 were obtained. The gage is located immediately downstream of the discharge from the treatment plant. Average daily discharge records were obtained from the treatment plant for the same time period. The upstream flow in Silver Creek was calculated by subtracting the treatment plant discharge from the flow gage records. The 7Q10 was calculated using the EPA computer software DFLOW V3.1b. (Table 1).

Table 1: Seasonal critical low flow

Season	Flow (cfs)	
	Outlet Channel	Silver Creek
Summer	0	0
Fall	0	0
Winter	0	0
Spring	0	0

Receiving water quality data was obtained from monitoring site 4926800 Silver Creek above Silver Creek WWTP. The average seasonal value was calculated for each constituent with available data in the receiving water.

Impairment/TMDL

Silver Creek was listed as impaired for arsenic, cadmium, zinc, dissolved oxygen, pH, nitrate, total dissolved solids, and benthic macroinvertebrates on the 303(d) list in *Utah's 2016 Integrated Report* (DWQ).

The *Silver Creek Total Maximum Daily Load for Dissolved Zinc and Cadmium* (Michael Baker Jr. Inc. and Psomas, 2004) was approved by EPA in 2004.

Echo Reservoir was listed as impaired for dissolved oxygen, temperature, and total phosphorus. The *Rockport Reservoir and Echo Reservoir TMDL Final Report* (SWCA Environmental Consultants, 2014) has allocations for total phosphorus and total nitrogen loads.

Mixing Zone

The discharge is considered instantaneously fully mixed since there is no background flow in the receiving water during the critical condition. Therefore, no mixing zone is allowed.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), BOD_5, total phosphorus (TP), total nitrogen (TN), total ammonia (NH4), E. coli, pH and dissolved metals, as determined in consultation with the UPDES Permit Writer.

WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC_{50} (lethal concentration, 50%) percent effluent for acute toxicity and the IC_{25} (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC_{50} is typically 100% effluent and does not need to be determined by the WLA.

Table 2: WET Limits for IC_{25}

Season	Percent Effluent
Summer	100%
Fall	100%
Winter	100%
Spring	100%

Water Quality Modeling

A QUAL2Kw model of the receiving water was built and calibrated to synoptic survey data collected by DWQ staff in August of 2012 and is documented in the *QUAL2Kw Model Calibration Report for Silver Creek* (UDWQ 2019). The QUAL2Kw calibration model extends 1.9 kilometers along Silver Creek downstream from the treatment facility outfall to between the eastbound and westbound lanes of I-80.

The calibrated QUAL2Kw model was modified for the wasteload analysis. Since there is no flow in Silver Creek during critical low flow conditions, the WRF was made the headwaters of the wasteload model. The outlet channel from the WRF outfall to the confluence with Silver Creek was added to the wasteload model.

The QUAL2Kw model was used for determining the WQBELs for parameters related to eutrophication and in-stream DO criteria, as well as ammonia toxicity. Effluent concentrations were adjusted so that water quality standards were not exceeded in the receiving water. Where WQBELs exceeded secondary standards, the concentration in the model was set at the secondary standard.

In order to determine compliance with dissolved oxygen criteria in Silver Creek during the critical summer season, water quality modeling was conducted by SWCA Environmental Consultants using the QUAL2Kw model. SWCA coordinated with Snyderville Basin Sewer Improvement District (SBSID) to develop effluent limit combinations of CBOD, NH4, TN, TP, and DO that would meet the instream DO criteria. The results of the modeling analysis are summarized in *Silver Creek Water Quality Study Final Technical Report* (SWCA Environmental

Consultants, 2013). An additional effluent limit combination was run by UDWQ at the request of SBSID and was selected as the preferred scenario by SBSID. The effluent limits for CBOD, NH4, TN, TP and DO from the selected scenario are listed below in Table 4 and summarized in Appendix A.

Effluent limits for conservative constituents were determined using a mass balance mixing analysis (UDWQ 2012). The mass balance analysis is summarized in Appendix B.

The wasteload files are available for review by request.

Ammonia

The QUAL2Kw model was also utilized to determine seasonal limits for ammonia. Ammonia exerts an oxygen demand on the water column through nitrification to nitrate and is toxic to aquatic life above certain thresholds that are pH and temperature dependent. Seasonal limits were determined for meeting in-stream DO criteria and for meeting in-stream toxicity criteria.

The treatment process proposed for the Silver Creek WRF is very similar to the process at the East Canyon WRF; therefore, the pH and temperature values for the discharge were based on monitoring data from the East Canyon WRF for 2013. Seasonal average pH and temperature were used for determining chronic limits (30-day average) and maximum pH was used for determining acute limits (1-hour).

In 2013, EPA adopted new criteria for ammonia that are lower than current criteria based on the presence of unionid mussels and nonpulmonate snails. States are required to adopt the criteria or establish alternative, scientifically defensible criteria. Utah is initiating studies to support adoption of new ammonia criteria. For planning purposes, ammonia limits to meet the new criteria were calculated (Table 3). The limits were determined by calculating the criteria based on the pH and temperature of the discharge and did not consider in-stream processes that affect ammonia, pH and temperature. The analysis assumed presence of the most sensitive species and is summarized in Appendix C.

Table 3: Ammonia Limits to Meet EPA 2013 Ammonia Criteria

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Ammonia (mg/l) [Toxicity]			1 hour			
Summer (Jul-Aug)	12.1	12.1		2.1	2.1	
Fall (Sep-Oct)	15.2	15.2		2.7	2.7	30 days
Winter (Dec-Mar)	9.6	9.6		3.5	3.5	
Spring (Apr-Jun)	12.6	12.6		3.0	3.0	

Metals

Water quality standards for the protection of aquatic life are based on dissolved metals, as the dissolved fraction is a better representation of the biologically active portion of the metal than is the total recoverable fraction. Dissolved metals standards for cadmium, chromium (III), copper, lead, nickel and zinc are hardness dependent. In waters with hardness greater than 400 mg/l as

$CaC0_3$, calculations are to assume a hardness of 400 mg/l as $CaC0_3$. The maximum hardness of 400 mg/l was used for the receiving water and the effluent.

By regulation (40 CFR 122.45(c)), the permit limit must be expressed as total recoverable metal. This regulation exists because chemical differences between the effluent discharge and the receiving water body are expected to result in changes in the partitioning between dissolved and adsorbed forms of metal. A metals translator is required to calculate a total recoverable permit limit to meet a dissolved metal water quality standard. The translator is the fraction of total recoverable metal in the downstream water that is dissolved. Per *The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion* (EPA, 1996), the translator may be estimated in three ways. (1) It may be assumed to be equivalent to the criteria conversion factors (Table 2.14.3a and 2.14.3b under UAC R317-2-14). (2) It may be developed directly as the ratio of dissolved to total recoverable metal. (3) Or it may be developed through the use of a partition coefficient that is functionally related to the number of metal binding sites on the adsorbent in the water column (i.e., concentrations of TSS, TOC, or humic substances). For this wasteload allocation, the criteria conversion factors were used for metals translators.

Effluent Limits

Water quality based effluent limits are summarized in Table 4. Detailed list of effluent limits can be found in the appendices.

The load limit for zinc, total phosphorus and total nitrogen from the TMDLs is based on both current and future load allocations based on facility expansion.

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Wasteload Analysis
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Table 4: Water Quality Based Effluent Limits Summary

Effluent Constituent	Acute			Chronic			Source
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period	
Flow (MGD)		8.0	1 day		4.0	30 days	SBWRD
Dissolved Oxygen (mg/L)	4.0	5.5[c]	Max	6.5	6.5[e]	30 days	Appendix A
$CBOD_5$ (mg/L)					10[e]	30 days	Appendix A
Ammonia (mg/l)							
Summer (Jul-Aug)		13.0[d]			1.0[e]		
Fall (Sep-Nov)	Varies	15.0[d]	1 hour	Varies	2.5[e]	30 days	Appendix A
Winter (Dec-Mar)		8.0[d]			3.0[e]		
Spring (Apr-Jun)		11.0[d]			2.5[e]		
Nitrate (mg/L)	10.0[b]	10.0	Max				Appendix A
Total Nitrogen (mg/L)							
Summer (Jul-Aug)					10[e]		
Fall (Sep-Nov)					10.5[e]	30-days	Appendix A
Winter (Dec-Mar)					11[e]		
Spring (Apr-Jun)					10.5[e]		
Total Nitrogen (kg)							
Summer Load: April – Sept.					20,782		Echo Reservoir TMDL
Annual Load					48,585		
Total Phosphorus (mg/L)					1.0 [e,f]	30 days	TBPEL, Append A
Total Phosphorus (kg)							
Summer Load: April – Sept.					2,078		Echo Reservoir TMDL
Annual Load					4,849		
Total Dissolved Solids (mg/L)	1,900[g]	1,900	Max				Appendix A
Metals, Total Recoverable (µg/l)							
Aluminum	750	750	1 hr	N/A	N/A	N/A	
Antimony	5.6[b]	5.6	Max				
Arsenic	10[b]	10	Max	150	150	4 day	
Barium	1,000[b]	1,000	Max				
Cadmium	8.7	8.7	1 hr	0.8	0.8[a]	4 day	
Chromium (Total)	50[b]	50	Max				
Chromium (III)	5,612	5,612	1 hr	268	268	4 day	
Chromium (VI)	16	16	1 hr	11	11	4 day	
Copper	52	52	1 hr	30	30	4 day	Appendix B
Cyanide	22	22	1 hr	5.2	5.2	4 day	
Iron	1,000	1,000	Max				
Lead	25.5[b]	25.5	Max	19	19	4 day	
Mercury	2.4[b]	2.4	Max	0.012	0.012	4 day	
Nickel	100[b]	100	1 hr	168.5	168.5	4 day	
Selenium	18	18	1 hr	4.6	4.6	4 day	
Silver	41	41	1 hr				
Zinc	388	388	1 hr	388	300	4 day	
Zinc Annual Load (kg)					321.1[a]		Silver Creek TMDL

a: Effluent limit per *Silver Creek Total Maximum Daily Load for Dissolved Zinc and Cadmium* (Michael Baker Jr. Inc. and Psomas, 2004). Load limit is for combined current and future allocation.
b: Standard based on human health criterion.
c: Based on previous permit limit.
d: Based on meeting in-stream ammonia toxicity criteria in Silver Creek.
e: Based on meeting in-stream DO criteria in Silver Creek.
f: Based on Technology Based Effluent Limit, meets WQBEL.
g: Site specific standard for TDS for Silver Creek from Tollgate Canyon to headwaters.
h: Effluent limit per *Rockport Reservoir and Echo Reservoir Total Maximum Daily Loads* (SWCA Inc. 2014). Load limit is for combined current and future allocation.

Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remains below the WQBELs presented in this wasteload.

The pollutant concentration and load from the facility is being increased under the proposed treatment plant upgrade; therefore, a Level II Antidegradation Review (ADR) is required for this discharge.

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Watershed Protection Section

Documents:

WLA Document: *silver_creek_potw_wla_2020-03-11.docx*
QUAL2Kw Calibration Model: *silver_q2k_cal_2012_v4.xlsm*
QUAL2Kw Wasteload Model: *silver_potw_q2kw_wla_2019_v4_altseason.xlsm*

References:

Field Data Collection for QUAL2Kw Model Build and Calibration Standard Operating Procedures Version 1.0. 2012. Utah Division of Water Quality.

QUAL2Kw Model Calibration Report for Silver Creek. 2019. Utah Division of Water Quality.

Rockport Reservoir and Echo Reservoir Total Maximum Daily Loads Final Report. 2014. SWCA Environmental Consultants, Inc.

Silver Creek Total Maximum Daily Load for Dissolved Zinc and Cadmium. 2004. Michael Baker Jr. Inc. and Psomas.

Silver Creek Water Quality Study Final Technical Report. 2013. SWCA Environmental Consultants, Inc.

Utah's 2016 Integrated Report. 2016. Utah Division of Water Quality.

Using QUAL2K Modeling to Support Nutrient Criteria Development and Wasteload Analyses in Utah. 2012. Neilson, B.T., A.J. Hobson, N. von Stackelberg, M. Shupryt, and J.D. Ostermiller.

Utah Wasteload Analysis Procedures Version 1.0. 2012. Utah Division of Water Quality.

WASTELOAD ANALYSIS [WLA] Date: 3/11/2020

Appendix A: QUAL2Kw Analysis for Eutrophication

Discharging Facility:	Silver Creek WRF	
UPDES No:	UT-0021911	
Permit Flow [MGD]:	4.00	Maximum Monthly Flow
	8.00	Maximum Daily Flow
Receiving Water:	Silver Creek	
Stream Classification:	1C, 2B, 3A, 4	
Stream Flows [cfs]:	0.0	Summer (July-Aug) Critical Low Flow
	0.0	Fall (Sep-Nov)
	0.0	Winter (Dec-Mar)
	0.0	Spring (Apr-June)
Fully Mixed:	YES	
Acute River Width:	100%	
Chronic River Width:	100%	

Modeling Information

A QUAL2Kw model was used to determine these effluent limits.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis.
Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Headwater/Upstream Information	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)		No Flow		

Discharge Information - Silver Creek WRF

Chronic	**Summer**	**Fall**	**Winter**	**Spring**
Flow (MGD)	4.0	4.0	4.0	4.0
Temperature (deg C)	17.2	13.0	9.7	12.2
Specific Conductance (μmhos)	1800	1800	1800	1800
Inorganic Suspended Solids (mg/L)	6.0	6.0	6.0	6.0
Dissolved Oxygen (mg/L)	6.5	6.5	6.5	6.5
$CBOD_5$ (mg/L)	10.0	10.0	10.0	10.0
Organic Nitrogen (mg/L)	1.00	1.00	1.00	1.00
NH4-Nitrogen (mg/L)	1.00	2.50	3.00	2.50
NO3-Nitrogen (mg/L)	8.00	7.00	7.00	7.00
Organic Phosphorus (mg/L)	0.50	0.50	0.50	0.50
Inorganic Ortho-Phosphorus (mg/L)	0.50	0.50	0.50	0.50
Phytoplankton (μg/L)	0.00	0.00	0.00	0.00
Detritus [POM] (mg/L)	0.0	0.0	0.0	0.0
Alkalinity (mg/L)	200	200	200	200
pH	7.2	7.2	7.1	7.1

Acute	Summer	Fall	Winter	Spring
Flow (MGD)	8.0	8.0	8.0	8.0
Temperature (deg C)	18.4	17.3	11.6	16.3
Specific Conductance (μmhos)	1800	1800	1800	1800
Inorganic Suspended Solids (mg/L)	6.0	6.0	6.0	6.0
Dissolved Oxygen (mg/L)	5.0	5.0	5.0	5.0
$CBOD_5$ (mg/L)	10.0	10.0	10.0	10.0
Organic Nitrogen (mg/L)	1.00	1.00	1.00	1.00
NH4-Nitrogen (mg/L)	13.00	15.00	8.00	11.00
NO3-Nitrogen (mg/L)	8.00	8.00	8.00	8.00
Organic Phosphorus (mg/L)	0.50	0.50	0.50	0.50
Inorganic Ortho-Phosphorus (mg/L)	0.50	0.50	0.50	0.50
Phytoplankton (μg/L)	0.00	0.00	0.00	0.00
Detritus [POM] (mg/L)	0.0	0.0	0.0	0.0
Alkalinity (mg/L)	200	200	200	200
pH	7.4	7.3	7.7	7.5

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitations based upon Water Quality Standards for DO

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent limitation as follows:

Constituent	Standard	Summer	Fall	Winter	Spring
Flow (MGD)	N/A	4.0	4.0	4.0	4.0
$CBOD_5$ (mg/L)	N/A	10.0	10.0	10.0	10.0
Dissolved Oxygen [30-day Ave] (mg/L)	6.5	6.5	6.5	6.5	6.5
Dissolved Oxygen [7-day Ave] (mg/L)	5.0	5.0	5.0	5.0	5.0
Dissolved Oxygen [Minimum] (mg/L)	4.0	4.0	4.0	4.0	4.0
NH4-Nitrogen (mg/L)	Varies	1.0	2.5	3.0	2.5
Total Nitrogen (mg/L)	N/A	10.0	10.5	11.0	10.5
Total Phosphorus (mg/L)	N/A	1.0	1.0	1.0	1.0

Effluent Limitations based upon Water Quality Standards for Ammonia

In-stream criteria of downstream segments for Ammonia will be met with an effluent limitation as follows:

NH4-Nitrogen (mg/L)	Standard	Summer	Fall	Winter	Spring
Acute [1-hour average]	Varies	13.0	15.0	8.0	11.0
Chronic [30-day average]	Varies	3.7	4.6	5.0	5.0

Summary Comments

The mathematical modeling and best professional judgement indicate that violations of receiving water beneficial uses with their associated water quality standards, including important down-stream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

Coefficients and Other Model Information

Parameter	*Value*	*Units*
Stoichiometry:		
Carbon	40	gC
Nitrogen	7.2	gN
Phosphorus	1	gP
Dry weight	100	gD
Chlorophyll	1	gA
Inorganic suspended solids:		
Settling velocity	2	m/d
Oxygen:		
Reaeration model	Tsivoglou-Neal	
Temp correction	1.024	
Reaeration wind effect	None	
O2 for carbon oxidation	2.69	gO2/gC
O2 for NH4 nitrification	4.57	gO2/gN
Oxygen inhib model CBOD oxidation	Exponential	
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2
Oxygen inhib model nitrification	Exponential	
Oxygen inhib parameter nitrification	0.60	L/mgO2
Oxygen enhance model denitrification	Exponential	
Oxygen enhance parameter denitrification	0.60	L/mgO2
Oxygen inhib model phyto resp	Exponential	
Oxygen inhib parameter phyto resp	0.60	L/mgO2
Oxygen enhance model bot alg resp	Exponential	
Oxygen enhance parameter bot alg resp	0.60	L/mgO2
Slow CBOD:		
Hydrolysis rate	0	/d
Temp correction	1.047	
Oxidation rate	0.103	/d
Temp correction	1.047	
Fast CBOD:		
Oxidation rate	10	/d
Temp correction	1.047	
Organic N:		
Hydrolysis	0.0557	/d
Temp correction	1.07	
Settling velocity	0.19837	m/d
Ammonium:		
Nitrification	3	/d
Temp correction	1.07	
Nitrate:		
Denitrification	0.7560365	/d
Temp correction	1.07	
Sed denitrification transfer coeff	0.3346	m/d
Temp correction	1.07	
Organic P:		
Hydrolysis	0.148895	/d
Temp correction	1.07	
Settling velocity	0.150074	m/d
Inorganic P:		
Settling velocity	0.2742	m/d
Sed P oxygen attenuation half sat constant	0.51586	mgO2/L

Phytoplankton:		
Max Growth rate	2.60985	/d
Temp correction	1.07	
Respiration rate	0.206492	/d
Temp correction	1.07	
Death rate	0.36118	/d
Temp correction	1	
Nitrogen half sat constant	15	ugN/L
Phosphorus half sat constant	2	ugP/L
Inorganic carbon half sat constant	1.30E-05	moles/L
Phytoplankton use HCO3- as substrate	Yes	
Light model	Smith	
Light constant	57.6	langleys/d
Ammonia preference	27.53835	ugN/L
Settling velocity	0.4930385	m/d
Bottom Plants:		
Growth model	Zero-order	
Max Growth rate	8.3462	gD/m2/d or /d
Temp correction	1.07	
First-order model carrying capacity	100	gD/m2
Basal respiration rate	0.0291854	/d
Photo-respiration rate parameter	0.01	unitless
Temp correction	1.07	
Excretion rate	0.42997	/d
Temp correction	1.07	
Death rate	4.14	/d
Temp correction	1.07	
External nitrogen half sat constant	455.924	ugN/L
External phosphorus half sat constant	62.8735	ugP/L
Inorganic carbon half sat constant	9.78E-05	moles/L
Bottom algae use HCO3- as substrate	Yes	
Light model	Smith	
Light constant	96.0028	mgO^2/L
Ammonia preference	25.4271	ugN/L
Subsistence quota for nitrogen	0.4378356	mgN/gD
Subsistence quota for phosphorus	0.0509885	mgP/gD
Maximum uptake rate for nitrogen	408.673	mgN/gD/d
Maximum uptake rate for phosphorus	62.4695	mgP/gD/d
Internal nitrogen half sat ratio	3.26674	
Internal phosphorus half sat ratio	1.730743	
Nitrogen uptake water column fraction	1	
Phosphorus uptake water column fraction	1	
Detritus (POM):		
Dissolution rate	4.396892	/d
Temp correction	1.07	
Settling velocity	0.4995725	m/d
pH:		
Partial pressure of carbon dioxide	370	ppm
TRC:		
Decay rate	0.8	/d

Atmospheric Inputs:	Summer	Fall	Winter	Spring
Min. Air Temperature, F	43.2	25.3	9.4	33.5
Max. Air Temperature, F	79.8	57.0	33.4	62.4
Dew Point, Temp., F	55.7	30.9	22.4	46.2
Wind, ft./sec. @ 21 ft.	5.2	3.5	3.2	5.6
Cloud Cover, %	10%	10%	10%	10%

Other Inputs:	
Bottom Algae Coverage	N/A
Bottom SOD Coverage	N/A
Prescribed SOD, $gO_2/m^2/day$	N/A

WASTELOAD ANALYSIS [WLA] Date: 3/11/2020

Appendix B: Mass Balance Mixing Analysis for Conservative Constituents

Discharger:	Silver Creek WRF		
Receiving Stream:	Silver Creek		
Stream Classification:	1C, 2B, 3A, 4		
Aquatic Life Class 3:	3A		
Agriculture Class 4:	Yes		
Direct Drinking Water Source:	Yes		
Important Fishery for Human Consumption:	Yes		
Season:	Annual		
Stream Flow:	0.00	cfs	
Stream Flow [Acute]:	0.00	cfs	
Stream Flow [Chronic]:	0.00	cfs	
Stream Hardness:	400	mg/l as CaCO3	
Effluent Flow:	4.00	MGD	
	6.19	cfs	
Effluent Hardness:	400	mg/l as CaCO3	
Mixed Flow:	6.19	cfs	Dilution Fact. 0.00
Mixed Flow [Acute]	6.19	cfs	
Mixed Flow [Chronic]	6.19	cfs	
Mixed Hardness:	400	mg/l as CaCO3	

Human Health Criteria (Class 1C Waters) - Maximum

	Units	Standard	Upstream Concentration	Effluent Limit
Dissolved Metals				
Arsenic	µg/L	10.0	N/A	10.0
Barium	µg/L	1000.0	N/A	1000.0
Beryllium	µg/L	4.0	N/A	4.0
Cadmium	µg/L	10.0	N/A	10.0
Chromium	µg/L	50.0	N/A	50.0
Lead	µg/L	15.0	N/A	15.0
Mercury	µg/L	2.0	N/A	2.0
Selenium	µg/L	50.0	N/A	50.0
Silver	µg/L	50.0	N/A	50.0
Inorganics				
Bromate	µg/L	10.0	N/A	10.0
Chlorite	mg/l	1000.0	N/A	1000.0
Fluoride Min. (varies with air temperature)	mg/l	1.4	N/A	1.4
Fluoride Max. (varies with air temperature)	mg/l	2.4	N/A	2.4
Nitrates as N	mg/l	10.0	N/A	10.0
Organics				
Chlorophenoxy Herbicides				
2,4-D	µg/L	70.0	N/A	70.0
2,4,5-TP	µg/L	10.0	N/A	10.0
Methoxychlor	µg/L	40.0	N/A	40.0

Aquatic Wildlife Criteria (Class 3 Waters)

Chronic Metals, µg/L	Total Recoverable Standard	Conversion Factor	Dissolved Standard	Upstream Concentration	Dissolved Effluent Limit	Total Recoverable Effluent Limit
Aluminum*	N/A	1.000	N/A	N/A	N/A	N/A
Arsenic	150.0	1.000	150.0	N/A	150.0	150.0
Cadmium	0.76	0.851	0.64	N/A	0.64	0.76
Chromium III	268.2	0.860	230.7	N/A	230.7	268.2
ChromiumVI	11.0	1.000	11.0	N/A	11.0	11.0
Copper	30.5	0.960	29.3	N/A	29.3	30.5
Cyanide	5.2	1.000	5.2	N/A	5.2	5.2
Iron						
Lead	18.6	0.589	10.9	N/A	10.9	18.6
Mercury	0.012	1.000	0.012	N/A	0.012	0.012
Nickel	168.5	0.997	168.0	N/A	168.0	168.5
Selenium	4.6	1.000	4.6	N/A	4.6	4.6
Silver						
Tributylin	0.072	1.000	0.072	N/A	0.072	0.072
Zinc	387.8	0.986	382.4	N/A	382.4	387.8

* Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 ug/1 chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 ug/1 acute aluminum criterion (expressed as total recoverable).

Acute Metals,µg/L	Total Recoverable Standard	Conversion Factor	Dissolved Standard	Upstream Concentration	Dissolved Effluent Limit	Total Recoverable Effluent Limit
Aluminum	750.0	1.000	750.0	N/A	750.0	750.0
Arsenic	340.0	1.000	340.0	N/A	340.0	340.0
Cadmium	8.7	0.886	7.7	N/A	7.7	8.7
Chromium III	5611.7	0.316	1773.3	N/A	1773.3	5611.7
ChromiumVI	16.0	1.000	16.0	N/A	16.0	16.0
Copper	51.7	0.960	49.6	N/A	49.6	51.7
Cyanide	22.0	1.000	22.0	N/A	22.0	22.0
Iron	1000.0	1.000	1000.0	N/A	1000.0	1000.0
Lead	476.8	0.589	280.8	N/A	280.8	476.8
Mercury	2.4	1.000	2.4	N/A	2.4	2.4
Nickel	1515.9	0.998	1512.9	N/A	1512.9	1515.9
Selenium	18.4	1.000	18.4	N/A	18.4	18.4
Silver	41.1	0.850	34.9	N/A	34.9	41.1
Tributylin	0.46	1.000	0.46	N/A	0.46	0.46
Zinc	387.8	0.978	379.3	N/A	379.3	387.8

Physical	Standard	Upstream Concentration	Effluent Limit
Temperature (deg C) [Maximum]	20.0	N/A	20.0
pH [Minimum]	6.5	N/A	6.5
pH [Maximum]	9.0	N/A	9.0
Inorganics, µg/L			
Hydrogen Sulfide (un-disassociated)	2.0	N/A	2.0
Phenol (Maximum)	0.10	N/A	0.10
Radiological pCi/l			
Gross Alpha	15.00	N/A	15.0

Organics (µg/L)	Chronic Standard	Acute Standard	Upstream Concentration	Chronic Effluent Limit	Acute Effluent Limit
Acrolein	3.0	3.0	N/A	3.0	3.0
Aldrin		1.5	N/A		1.5
Chlordane	0.0043	1.2	N/A	0.0043	1.2
Chlorpyrifos	0.041	0.083	N/A		0.083
DDT, DDE	0.0010	0.55	N/A	0.0010	0.55
Diazinon	0.17	0.17	N/A		0.17
Dieldrin	0.056	0.24	N/A	0.056	0.24
Alpha-Endosulfan	0.056	0.11	N/A	0.056	0.11
Beta-Endosulfan	0.056	0.11	N/A	0.056	0.11
Endrin	0.036	0.086	N/A	0.036	0.086
Heptachlor	0.0038	0.26	N/A	0.0038	0.26
Heptachlor epoxide	0.0038	0.26	N/A	0.0038	0.26
Lindane	0.08	1.0	N/A	0.08	1.0
Methoxychlor		0.03	N/A		0.03
Mirex		0.001	N/A		0.001
Nonylphenol	6.6	28.0	N/A		28.0
Parathion	0.013	0.066	N/A		0.066
PCB's	0.014		N/A	0.014	
Pentachlorophenol (varies with pH)	15.0	19.0	N/A	15.0	19.0
Toxaphene	0.0002	0.73	N/A	0.0002	0.73

Agricultural Criteria (Class 4 Waters) - Maximum

	Units	Standard	Upstream Concentration	Effluent Limit
Total Dissolved Solids	mg/l	1900.0	N/A	1900.0
Arsenic	µg/L	100.0	N/A	100.0
Boron	µg/L	750.0	N/A	750.0
Cadmium	µg/L	10.0	N/A	10.0
Chromium	µg/L	100.0	N/A	100.0
Copper	µg/L	200.0	N/A	200.0
Lead	µg/L	100.0	N/A	100.0
Selenium	µg/L	50.0	N/A	50.0

Numeric Criteria for the Protection of Human Health from Consumption of Water and Fish

Parameter Maximum Conc., µg/l	Class 1C (Water and Organism)			Class 3 (Organism Only)		
Toxic Organics	**Standard**	**Upstream Concentration**	**Effluent Limitation**	**Standard**	**Effluent Limitation**	**Most Stringent Limitation**
Antimony	5.6	N/A	5.6	640	640	5.6
Copper	1300	N/A	1300			1300
Nickel	610	N/A	610	4600	4600	610
Selenium	170	N/A	170	4200	4200	170
Thallium	0.24	N/A	0.24	0.47	0.47	0.24
Zinc	7400	N/A	7400	26000	26000	7400
Cyanide	4	N/A	4	400	400	4
Asbestos (million fibers/L)	7	N/A	7			7
2,3,7,8-TCDD Dioxin	5.00E-09	N/A	5.00E-09	5.1E-09	5.1E-09	5.00E-09
Acrolein	3	N/A	3	400	400	3
Acrylonitrile	0.061	N/A	0.061	7	7	0.061
Benzene	2.1	N/A	2.1	51	51	2.1
Bromoform	7	N/A	7	120	120	7
Carbon Tetrachloride	0.4	N/A	0.4	5	5	0.4
Chlorobenzene	100	N/A	100	800	800	100
Chlorodibromomethane	0.8	N/A	0.8	21	21	0.8
Chloroform	60	N/A	60	2000	2000	60
Dichlorobromomethane	0.95	N/A	0.95	27	27	0.95
1,2-Dichloroethane	9.9	N/A	9.9	2000	2000	9.9
1,1-Dichloroethylene	300	N/A	300	20000	20000	300
1,2-Dichloropropane	0.9	N/A	0.9	31	31	0.9
1,3-Dichloropropene	0.27	N/A	0.27	12	12	0.27
Ethylbenzene	68	N/A	68	130	130	68
Methyl Bromide	100	N/A	100	10000	10000	100
Methylene Chloride	20	N/A	20	1000	1000	20
1,1,2,2-Tetrachloroethane	0.2	N/A	0.2	3	3	0.2
Tetrachloroethylene	10	N/A	10	29	29	10
Toluene	57	N/A	57	520	520	57
1,2 -Trans-Dichloroethyle	100	N/A	100	4000	4000	100
1,1,1-Trichloroethane	10000	N/A	10000	200000	200000	10000
1,1,2-Trichloroethane	0.55	N/A	0.55	8.9	8.9	0.55
Trichloroethylene	0.6	N/A	0.6	7	7	0.6
Vinyl Chloride	0.022	N/A	0.022	1.6	1.6	0.022
2-Chlorophenol	30	N/A	30	800	800	30
2,4-Dichlorophenol	10	N/A	10	60	60	10
2,4-Dimethylphenol	100	N/A	100	3000	3000	100
2-Methyl-4,6-Dinitrophenol	2	N/A	2	30	30	2
2,4-Dinitrophenol	10	N/A	10	300	300	10
3-Methyl-4-Chlorophenol	500	N/A	500	2000	2000	500
Penetachlorophenol	0.03	N/A	0.03	0.04	0.04	0.03
Phenol	4000	N/A	4000	300000	300000	4000
2,4,5-Trichlorophenol	300	N/A	300	600	600	300
2,4,6-Trichlorophenol	1.5	N/A	1.5	2.8	2.8	1.5

Parameter Maximum Conc., µg/l	Class 1C (Water and Organism)			Class 3 (Organism Only)		
Toxic Organics	**Standard**	**Upstream Concentration**	**Effluent Limitation**	**Standard**	**Effluent Limitation**	**Most Stringent Limitation**
Acenaphthene	70	N/A	70	90	90	70
Anthracene	300	N/A	300	400	400	300
Benzidine	0.00014	N/A	0.00014	0.011	0.011	0.00014
BenzoaAnthracene	0.0012	N/A	0.0012	0.0013	0.0013	0.0012
BenzoaPyrene	0.00012	N/A	0.00012	0.00013	0.00013	0.00012
BenzobFluoranthene	0.0012	N/A	0.0012	0.0013	0.0013	0.0012
Bis2-Chloro1methylether	0.00015	N/A	0.00015	0.017	0.017	
Bis2-Chloro1methylethylether	200	N/A	200	4000	4000	
Bis2-ChloroethylEther	0.03	N/A	0.03	2.2	2.2	
Bis2-Chloroisopropy1Ether	1400	N/A	1400	65000	65000	
Bis2-EthylhexylPhthalate	0.32	N/A	0.32	0.37	0.37	
Butylbenzyl Phthalate	0.1	N/A	0.1	0.1	0.1	0.1
2-Chloronaphthalene	800	N/A	800	1000	1000	
Chrysene	0.12	N/A	0.12	0.13	0.13	0.12
Dibenzoa, (h)Anthracene	0.00012	N/A	0.00012	0.00013	0.00013	0.00012
1,2-Dichlorobenzene	1000	N/A	1000	3000	3000	1000
1,3-Dichlorobenzene	7	N/A	7	10	10	7
1,4-Dichlorobenzene	300	N/A	300	900	900	300
3,3-Dichlorobenzidine	0.049	N/A	0.049	0.15	0.15	0.049
Diethyl Phthalate	600	N/A	600	600	600	600
Dimethyl Phthalate	2000	N/A	2000	2000	2000	2000
Di-n-Butyl Phthalate	20	N/A	20	30	30	20
2,4-Dinitrotoluene	0.049	N/A	0.049	1.7	1.7	0.049
Dinitrophenols	10	N/A	10	1000	1000	10
1,2-Diphenylhydrazine	0.03	N/A	0.03	0.2	0.2	0.03
Fluoranthene	20	N/A	20	20	20	20
Fluorene	50	N/A	50	70	70	50
Hexachlorobenzene	0.000079	N/A	0.000079	0.000079	0.000079	0.000079
Hexachlorobutedine	0.01	N/A	0.01	0.01	0.01	0.01
Hexachloroethane	0.1	N/A	0.1	0.1	0.1	0.1
Hexachlorocyclopentadiene	4	N/A	4	4	4	4
Ideno 1,2,3-cdPyrene	0.0012	N/A	0.0012	0.0013	0.0013	0.0012
Isophorone	34	N/A	34	1800	1800	34
Nitrobenzene	10	N/A	10	600	600	10
N-Nitrosodiethylamine	0.0008	N/A	0.0008	1.24	1.24	0.0008
N-Nitrosodimethylamine	0.00069	N/A	0.00069	3	3	0.00069
N-Nitrosodi-n-Propylamine	0.005	N/A	0.005	0.51	0.51	0.005
N-Nitrosodiphenylamine	3.3	N/A	3.3	6	6	3.3
Pentachlorobenzene	0.1	N/A	0.1	0.1	0.1	0.1
Pyrene	20	N/A	20	30	30	20
1,2,4-Trichlorobenzene	0.071	N/A	0.071	0.076	0.076	0.071
Aldrin	0.00000077	N/A	0.00000077	0.00000077	0.00000077	0.00000077
alpha-BHC	0.00036	N/A	0.00036	0.00039	0.00039	0.00036
beta-BHC	0.008	N/A	0.008	0.014	0.014	0.008
gamma-BHC (Lindane)	4.2	N/A	4.2	4.4	4.4	4.2
Hexachlorocyclohexane (HCH)	0.0066	N/A	0.0066	0.01	0.01	0.0066
Chlordane	0.00031	N/A	0.00031	0.00032	0.00032	0.00031
4,4-DDT	0.00003	N/A	0.00003	0.00003	0.00003	0.00003
4,4-DDE	0.000018	N/A	0.000018	0.000018	0.000018	0.000018
4,4-DDD	0.00012	N/A	0.00012	0.00012	0.00012	0.00012
Dieldrin	0.0000012	N/A	0.0000012	0.0000012	0.0000012	0.0000012
alpha-Endosulfan	20	N/A	20	30	30	20
beta-Endosulfan	20	N/A	20	40	40	20
Endosulfan Sulfate	20	N/A	20	40	40	20
Endrin	0.03	N/A	0.03	0.03	0.03	0.03
Endrin Aldehyde	1	N/A	1	1	1	1
Heptachlor	0.0000059	N/A	0.0000059	0.0000059	0.0000059	0.0000059
Heptachlor Epoxide	0.000032	N/A	0.000032	0.000032	0.000032	0.000032
Methoxychlor	0.02	N/A	0.02	0.02	0.02	0.02
Polychlorinated Biphenyls (PCB)	0.000064	N/A	0.000064	0.000064	0.000064	0.000064
Toxaphene	0.0007	N/A	0.0007	0.00071	0.00071	0.0007

Summary - Dissolved Metals (µg/l)

	Class 1C Human Health (Drinking Water Only)	Class 1C Human Health (Drinking Water + Organism)	Class 3 Human Health (Organism Only)	Class 3 Acute Aquatic Wildlife	Class 4 Agricultural	Acute Most Stringent
Aluminum				750		750
Antimony		5.6	640			5.6
Arsenic	10.0			340	100	10.0
Barium	1000					1000
Beryllium	4.0					4.0
Cadmium	10.0			7.7	10.0	7.7
Chromium (Total)	50.0				100	50.0
Chromium (III)				1,773		1773
Chromium (VI)				16.0		16.0
Copper		1,300		49.6	200	49.6
Cyanide		4.0	4.0	22.0		4.0
Iron				1,000		1000
Lead	15.0			281	100	15.0
Mercury	2.0			2.4		2.0
Nickel		610	4,600	1,513		610
Selenium	50.0		4,200	18.4	50.0	18.4
Silver	50.0			34.9		34.9
Thallium		0.24	0.47			0.24
Tributylin				0.5		0.46
Zinc		7,400	26,000	379		379

Summary - Total Recoverable Metals (µg/l)

	Chronic Total Recoverable Limits	Acute Most Stringent Dissolved Limits	Acute Most Stringent Total Recoverable Limits
Aluminum	N/A	750	750
Antimony		5.6	5.6
Arsenic	150	10	10
Barium		1000	1,000
Beryllium		4.0	4.0
Cadmium	0.8	7.7	7.7
Chromium (Total)		50	50
Chromium (III)	268	1773	1,773
Chromium (VI)	11	16	16
Copper	30	50	50
Cyanide	5.2	4	4
Iron		1000	1,000
Lead	19	15	15.0
Mercury	0.012	2.0	2.0
Nickel	168.5	610	610
Selenium	4.6	18	18
Silver		35	35
Thallium		0.24	0.2
Tributyltin	0.07	0.46	0.5
Zinc	388	379	379

Total Recoverable to Dissolved Fraction Conversion Factor [Laboratory Correction Factor] EPA 823-B 96-007 June 1996

	ACUTE FACTOR	CHRONIC FACTOR
Aluminum	1.000	1.000
Antimony		
Arsenic	1.000	1.000
Barium	1.000	1.000
Beryllium		
Cadmium	0.886	0.851
Chromium III	0.316	0.860
Chromium VI	1.000	1.000
Copper	0.960	0.960
Cyanide		
Iron	1.000	1.000
Lead	0.589	0.589
Mercury	0.850	1.000
Nickel	0.998	0.997
Selenium	1.000	1.000
Silver	0.850	1.000
Thallium		
Tributyltin		
Zinc	0.978	0.986

Appendix C

Freshwater total ammonia criteria based on EPA 2013 Ammonia Criteria

INPUT	Summer	Fall	Winter	Spring
Temperature (deg C):				
Maximum:	18.4	17.3	11.6	16.3
Monthly Average:	17.2	13.0	9.7	12.2
pH:				
Maximum:	7.40	7.30	7.70	7.50
Monthly Average:	7.20	7.20	7.10	7.10
Are unionid mussels present?	Present	Present	Present	Present
Are salmonid present? [Beneficial use 3A]	Present	Present	Present	Present
Are fish early life stages present?	Present	Present	Present	Present
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Acute (1-hour):	12.14	15.18	9.64	12.55
Chronic (30-day average):	2.06	2.70	3.51	2.99

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

M E M O R A N D U M

TO: File, Silver Creek WRF UPDES Permit UT0024414

FROM: Nicholas von Stackelberg, P.E.

DATE: March 28, 2013

SUBJECT: Determination for Classification of the Silver Creek Water Reclamation Facility Outlet Channel

The discharge from the Silver Creek Water Reclamation Facility (SCWRF) is to an unnamed open channel, referred to as the "SCWRF outlet channel," that drains to Silver Creek. It is the determination of the Division of Water Quality (DWQ) that the SCWRF outlet channel is a tributary of Silver Creek that should be classified under R317-2-13.4 with beneficial uses 1C, 2B, 3A, and 4. This determination was made based on the following findings:

- Based on an evaluation of aerial photography, the SCWRF outlet channel clearly originates above the treatment plant, flows along the southern and eastern property boundary, and then combines with the treatment plant effluent prior to draining to Silver Creek.
- The source of background flow in the channel appears to be seeps and springs that originate in upslope areas upstream of the plant.
- The SCWRF outlet channel appears to have been realigned during construction of the treatment plant and the access road that continues on to the Promontory area. Evidence of this is the presence of a legacy channel north of the road that drains to Silver Creek and that appears to have been disconnected from the upstream portion of the channel.
- Tributaries to Silver Creek are classified under *Weber River and tributaries, from Stoddard diversion to headwaters: 1C, 2B, 3A, 4.*

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