

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

Date: February 9, 2015

Facility: Plain City Wastewater Treatment Facility
UPDES No. UT0021326

Receiving water: Dix Creek (2B, 3D)

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: Drainage Ditch → Dix Creek → First Salt Creek → Harold S. Crane Waterfowl Management Area and Willard Spur of Great Salt Lake

The maximum daily design discharge is 0.9 MGD and the maximum monthly design discharge is 0.6 MGD for the facility.

Receiving Water

The receiving water for Outfall 001 is an unnamed drainage ditch, which is tributary to Dix Creek, which drains to First Salt Creek, Harold S. Crane Waterfowl Management Area, and Willard Spur of the Great Salt Lake. None of the receiving waters downstream of the lagoons appear to be used for agricultural purposes.

Per UAC R317-2-13.10, the presumptive designated beneficial uses for the drainage ditch are 2B and 3E.

- *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 3E - Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.*

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Per UAC R317-2-13.13, the presumptive designated beneficial uses for Dix Creek are 2B and 3D.

- *Class 3D - Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*

Typically, the critical flow for the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Due to a lack of flow records for Dix Creek, a flow measurement was taken on December 20, 2013 to estimate annual critical flow in the receiving water (Table 1). No flow records were found for the drainage ditch and it was assumed the ditch has no flow during critical conditions.

Table 1: Annual critical low flow

Season	Flow (cfs)	
	Drainage Ditch above WWTP	Dix Creek above confluence with Drainage Ditch
Annual	0.0	2.5

Dix Creek water quality was characterized based on one sampling event conducted on December 20, 2013.

TMDL

The receiving water and downstream waterbodies are not listed as impaired for any parameters according to the 2010 303(d) list.

Mixing Zone

The maximum allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and 2,500 feet for chronic conditions, per UAC R317-2-5. Water quality standards must be met at the end of the mixing zone.

The actual length of the mixing zone was not determined; however, it was presumed to remain within the maximum allowable mixing zone dimensions. Acute limits were calculated using 50% of the seasonal critical low flow.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), BOD₅, total phosphorus (TP), total nitrogen (TN), total ammonia (TAN), E. coli, pH, and total residual chlorine (TRC) as determined in consultation with the UPDES Permit Writer.

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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 LC₅₀ (lethal concentration, 50%) percent effluent for acute toxicity and the IC₂₅ (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 LC₅₀ is typically 100% effluent and does not need to be determined by the WLA.

Table 2: WET Limits for IC₂₅

Season	Percent Effluent
Annual	27%

Effluent Limits

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

The water quality standard for chronic ammonia toxicity is dependent on temperature and pH, and the water quality standard for acute ammonia toxicity is dependent on pH. The water quality standards for ammonia are summarized in Appendix B.

The limits for total residual chlorine were determined assuming a decay rate of 20 /day (at 20 °C) and a travel time in the unnamed ditch of 260 minutes (3,900 linear feet at 0.25 foot per second velocity) prior to discharge to Dix Creek. The analysis for TRC is summarized in Appendix C.

Due to lack of monitoring data, it was not possible to assess the effects of TP, TN, DO and BOD₅ in the effluent on the DO in the downstream receiving waters; it is presumed that previous permit limits for these constituents, if applicable, would be sufficiently protective of the receiving water.

Table 3: Water Quality Based Effluent Limits Summary

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Flow (MGD)		0.9	1 day		0.6	30 days
BOD ₅ (mg/L)	N/A	65	7 days	N/A	45	30 days
DO Minimum (mg/L)	3.0	5.0	Instantaneous	5.0	5.0	30 days
Ammonia (mg/L) ¹	Varies		1 hour	Varies		30 days
Summer (Jul-Sep)		15.6			5.1	
Fall (Oct-Dec)		15.6			9.4	
Winter (Jan-Mar)		15.6			12.5	
Spring (Apr-Jun)		15.6			9.4	
Total Residual Chlorine (mg/L)	0.019		1 hour	0.011		4 days
Summer (Jul-Sep)		1.5			1.3	
Fall (Oct-Dec)		0.5			0.4	
Winter (Jan-Mar)		0.3			0.3	
Spring (Apr-Jun)		0.5			0.4	

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Models and supporting documentation are available for review upon request.

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.

A Level II Antidegradation Review (ADR) is not required for this discharge since the pollutant concentration and load is not increasing under this permit renewal.

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Documents:

WLA Document: *plain_city_potw_wla_2015_final.docx*
Wasteload Analysis: *plain_city_potw_wla_2015.xlsm*

References:

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

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WASTELOAD ANALYSIS [WLA]

Date: 2/9/2015

Appendix A: Simple Mixing Analysis for Conservative Constituents

Discharging Facility: Plain City Lagoons
 UPDES No: UT-0021326
 Permit Flow [MGD]: 0.90 Annual Max. Daily
 0.60 Annual Max. Monthly

Receiving Water: Dix Creek
 Stream Classification: 2B, 3D
 Stream Flows [cfs]: 2.5 All Seasons Critical Low Flow

Fully Mixed: NO
 Acute River Width: 50%
 Chronic River Width: 100%

Modeling Information

A simple mixing analysis was used to determine the effluent limits.

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 for Protection of Recreation (Class 2B Waters)

No dilution in unnamed irrigation ditch.

Physical

Parameter	Standard
pH Minimum	6.5
pH Maximum	9.0
Turbidity Increase (NTU)	10.0

Dissolved Oxygen

Minimum (mg/L)	3.0
30-day Average (mg/L)	5.0

Bacteriological

E. coli (30 Day Geometric Mean)	206 (#/100 mL)
E. coli (Maximum)	668 (#/100 mL)

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Effluent Limitations for Protection of Aquatic Wildlife (Class 3D Waters)

Inorganics	Chronic Standard (4 Day Average)		Acute Standard (1 Hour Average)
	Parameter	Standard	Standard
	Phenol (mg/L)		0.010
	Hydrogen Sulfide (Undissociated) [mg/L]		0.002

Ammonia-Total (mg/L)

Season	Chronic (30-day ave)			Acute (1-hour ave)		
	Standard	Background	Limit	Standard	Background	Limit
Summer	1.7	0.5	5.1	8.4	0.5	15.6
Fall	2.9	0.5	9.4	8.4	0.5	15.6
Winter	3.7	0.5	12.5	8.4	0.5	15.6
Spring	2.9	0.5	9.4	8.4	0.5	15.6

Metals-Total Recoverable

Parameter	Chronic (4-day ave)			Acute (1-hour ave)		
	Standard ¹	Background	Limit	Standard ¹	Background	Limit
Aluminum (µg/L)	87.0	15.2	280.4	750.0	15.2	1409.7
Arsenic (µg/L)	150.0	3.0	545.9	340.0	3.0	642.6
Cadmium (µg/L)	0.4	0.10	1.4	4.5	0.10	8.5
Chromium VI (µg/L)	11.0	2.0	35.2	16.0	2.0	28.6
Chromium III (µg/L)	146.6	2.0	536.1	1127.1	2.0	2137.1
Copper (µg/L)	18.2	2.0	62.0	29.5	2.0	54.1
Cyanide (µg/L) ²	5.2	3.5	9.8	22.0	3.5	38.6
Iron (µg/L)				1000.0	139.0	1773.0
Lead (µg/L)	6.2	0.1	22.3	157.9	0.1	299.4
Mercury (µg/L) ²	0.012	0.008	0.023	2.4	0.008	4.5
Nickel (µg/L)	105.2	5.0	375.1	947.3	5.0	1793.3
Selenium (µg/L)	4.6	1.0	14.3	18.4	1.0	34.0
Silver (µg/L)				13.5	0.5	25.1
Tributyltin (µg/L) ²	0.072	0.048	0.136	0.46	0.048	0.83
Zinc (µg/L)	239.3	13.2	848.2	237.3	13.2	438.5

1: Based upon a Hardness of 230 mg/l as CaCO₃

2: Background concentration assumed 67% of chronic standard

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Organics [Pesticides]

Parameter	Chronic (4-day ave)		Acute (1-hour ave)	
	Standard	Limit	Standard	Limit
Aldrin (µg/L)			1.5	1.5
Chlordane (µg/L)	0.0043	0.0043	1.2	1.2
DDT, DDE (µg/L)	0.001	0.001	0.55	0.55
Diazinon (µg/L)	0.17	0.17	0.17	0.17
Dieldrin (µg/L)	0.0056	0.0056	0.24	0.24
Endosulfan, a & b (µg/L)	0.056	0.056	0.11	0.11
Endrin (µg/L)	0.036	0.036	0.086	0.086
Heptachlor & H. epoxide (µg/L)	0.0038	0.0038	0.26	0.26
Lindane (µg/L)	0.08	0.08	1.0	1.0
Methoxychlor (µg/L)			0.03	0.03
Mirex (µg/L)			0.001	0.001
Nonylphenol (µg/L)	6.6	6.6	28.0	28.0
Parathion (µg/L)	0.0130	0.0130	0.066	0.066
PCB's (µg/L)	0.014	0.014		
Pentachlorophenol (µg/L)	15.0	15.0	19.0	19.0
Toxephene (µg/L)	0.0002	0.0002	0.73	0.73

Radiological

Parameter	Maximum Concentration Standard
Gross Alpha (pCi/L)	15

Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code
Acute

INPUT				
	Summer	Fall	Winter	Spring
pH:	8.00	8.00	8.00	8.00
Beneficial use classification:	3D	3D	3D	3D
OUTPUT				
Total ammonia nitrogen criteria (mg N/L): Acute:	8.408	8.408	8.408	8.408

Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code
Chronic

INPUT				
	Summer	Fall	Winter	Spring
Temperature (deg C):	20.0	12.0	8.0	12.0
pH:	8.00	8.00	8.00	8.00
Are fish early life stages present?	No	No	No	No
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	1.709	2.434	2.434	2.434
Chronic - Fish Early Life Stages Absent:	1.709	2.863	3.705	2.863

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WASTELOAD ANALYSIS [WLA]
Appendix C: Total Residual Chlorine

Discharging Facility: Plain City Lagoons
 UPDES No: UT-0021326

CHRONIC

	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	Decay Rate (/day)		Travel Time (min)	Decay Coefficient	Effluent Limit
								@ 20 deg C	@ T deg C			
Discharge (cfs)	Summer	2.5		0.9	3.4							
	Fall	2.5		0.9	3.4							
	Winter	2.5		0.9	3.4							
	Spring	2.5		0.9	3.4							
TRC (mg/L)	Summer	0.000	0.011			0.041	20.0	20	20.0	260	0.03	1.503
	Fall	0.000	0.011			0.041	12.0	20	13.9	260	0.08	0.495
	Winter	0.000	0.011			0.041	8.0	20	11.5	260	0.12	0.326
	Spring	0.000	0.011			0.041	12.0	20	13.9	260	0.08	0.495

ACUTE

	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	Decay Rate (/day)		Travel Time (min)	Decay Coefficient	Effluent Limit
								@ 20 °C	@ T °C			
Discharge (cfs)	Summer	1.3		1.4	2.6							
	Fall	1.3		1.4	2.6							
	Winter	1.3		1.4	2.6							
	Spring	1.3		1.4	2.6							
TRC (mg/L)	Summer	0.000	0.019			0.036	20.0	20	20.0	260	0.03	1.334
	Fall	0.000	0.019			0.036	12.0	20	13.9	260	0.08	0.440
	Winter	0.000	0.019			0.036	8.0	20	11.5	260	0.12	0.289
	Spring	0.000	0.019			0.036	12.0	20	13.9	260	0.08	0.440