

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

**Date:** March 13, 2014

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Water Quality Management Section

**Facility:** PacifiCorp Carbon Power Plant  
Helper, UT  
UPDES No. UT-0000094

**Outfalls:** 001, 003

**Receiving water:** Price River and Willow Creek

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: Willow Creek → Price River  
The maximum design flow is 1.0 MGD (1.54 cfs).

Outfall 003: Price River  
The maximum design flow is 1.0 MGD (1.54 cfs).

Receiving Water

The receiving water for Outfall 001 is Willow Creek, which is tributary to the Price River. The designated beneficial uses for Willow Creek are 2B, 3A and 4.

The receiving water for Outfall 003 is the Price River. The designated beneficial uses for the Price River at the discharge are 2B, 3A and 4.

- *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.*

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- *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.*

The critical flow for the wasteload analysis was considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10).

For Willow Creek, the 7Q10 flow for summer was assumed to be 0. For the Price River, flow records from USGS stream gage # 09313000 PRICE RIVER NEAR HEINER, UT, for the active period 1934 – 1969 and 1990 – 2003 was obtained. The 7Q10 was calculated using the EPA computer software DFLOW V3.1b. The stream gage is located downstream of the power plant discharge. An average annual flow of 0.3 MGD from the power plant was subtracted from the stream gage to obtain the background flow.

**Table 1: Critical low flow in receiving waters.**

Season	7Q10 Flow (cfs)		Ave Annual Flow (cfs)	Low Flow (cfs)
	Willow Creek	Price River Downstream of Plant	PacifiCorp-Carbon Discharge	Price River Upstream of Plant
Summer	0	8.4	0.5	7.9
Fall		4.8	0.5	4.3
Winter		4.8	0.5	4.3
Spring		24.6	0.5	24.1
Annual		4.0	0.5	3.5

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 discharge to the Price River was verified to be fully mixed within the allowable mixing zone due to the relatively steep gradient of the Price River downstream of the discharge (approximately 2% slope).

The discharge to Willow Creek is considered instantaneously fully mixed due to the lack of flow during critical conditions; therefore, water quality standards need to be met at the discharge point for Outfall 001.

Parameters of Concern

The potential parameters of concern for the discharge/receiving water identified were temperature, total residual chlorine (TRC), total dissolved solids (TDS), total suspended solids (TSS), and pH, as determined in consultation with the UPDES Permit Writer and based on the previous permit limits.

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Ambient Conditions

Ambient conditions were estimated using monitoring data from 1999-2009 from DWQ #4932810 PRICE RIVER ABOVE WILLOW CREEK. The average and maximum of observed data was calculated, with one-half the reporting limit assumed for non-detects. No ambient data was available for TRC.

**Table 2: Ambient condition and water quality standards for temperature for #4932810 PRICE RIVER ABOVE WILLOW CREEK (1999-2009).**

Season	Temperature (deg C)	
	Ambient Average	Standard <sup>1</sup>
Winter	2.5	4.5
Spring	10.0	12.0
Summer	16.3	18.3
Fall	4.3	6.3

1: Standard for 3A is the lower of 20 deg C or max. change of 2 deg C.

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<sub>50</sub> (lethal concentration, 50%) percent effluent for acute toxicity and the IC<sub>25</sub> (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<sub>50</sub> is typically 100% effluent and does not need to be determined by the WLA.

**Table 3: WET Limits for IC<sub>25</sub>**

Season	Percent Effluent	Dilution Factor
Summer	16%	6.1:1
Fall	26%	3.8:1
Winter	26%	3.8:1
Spring	6%	16.6:1

Water Quality Based Effluent Limits

A mass balance mixing analysis was conducted for conservative constituents, assuming mix with 100% of river width for chronic conditions and 50% of river width for acute conditions. The input and results of the mass balance mixing analysis are presented in Appendix A.

The limits for total residual chlorine were determined assuming a decay rate of 20 /day (at 20 C°) and a travel time of 15 minutes in the Price River. The input and results of the analysis for TRC are presented in Appendix B.

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 C.

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Water quality based effluent limits for Outfall 001 and Outfall 003 are presented in Table 4 and 5, respectively.

**Table 4: WQBELs for Outfall 001 to Willow Creek.**

Season	TRC (mg/L)		TDS (mg/L)	Temperature (deg C)	DO (mg/L)
	Acute	Chronic			
Summer				20.0	
Fall				11.9	
Winter				10.1	
Spring				20.0	
Annual	0.019	0.011	1,200		5.0

**Table 5: WQBELs for Outfall 003 to Price River.**

Season	TRC (mg/L)		TDS (mg/L)	Temperature (deg C)	DO (mg/L)
	Acute	Chronic			
Summer	0.08	0.08		28.5	
Fall	0.05	0.05		11.9	
Winter	0.05	0.05		10.1	
Spring	0.19	0.21		43.2	
Annual			3,200		5.0

For parameters without a WQBEL, permit limits should be set according to rules found in R317-1-3 and categorical UPDES discharge requirements.

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 remain below the WQBELs presented in this wasteload.

A Level II Antidegradation Review (ADR) is required for this discharge, as the allowable pollutant load is being increased under this permit renewal due to an increase in flow from 0.3MGD to 1.0MGD in the wasteload.

Documents:

WLA Document: *pacificorp\_carbon\_wla\_2014\_final.docx*

Analysis: *pacificorp\_carbon\_wla\_2014.xlsx*

References:

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

**WASTELOAD ANALYSIS [WLA]**

Date: 3/12/2014

**Appendix A: Simple Mixing Analysis for Conservative Constituents**

Discharging Facility:	PacifiCorp Carbon Power Plant		
UPDES No:	UT-0000094		
Outfall:	003		
Permit Flow [MGD]:	1.00	Maximum Monthly Flow	
	1.00	Maximum Daily Flow	
Receiving Water:	Price River		
Stream Classification:	2B, 3A, 4		
Stream Flows [cfs]:	7.90	Summer (July-Sept)	Critical Low Flow
	4.30	Fall (Oct-Dec)	
	4.30	Winter (Jan-Mar)	
	24.10	Spring (Apr-June)	
	3.50	Annual	
Fully Mixed:	NO		
Acute River Width:	50%		
Chronic River Width:	100%		

**Modeling Information**

A simple mixing analysis 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**

	<b>Price River</b>
	cfs
Summer	7.9
Fall	4.3
Winter	4.3
Spring	24.1

**Discharge Information**

	<b>Flow</b>
	MGD
Maximum Daily	1.0
Maximum Monthly	1.0

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.

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Effluent Limitations for Protection of Recreation (Class 2B Waters)

Physical		Maximum Concentration
Parameter		
	pH Minimum	6.5
	pH Maximum	9.0
<b>Bacteriological</b>		
	E. coli (30 Day Geometric Mean)	206 (#/100 mL)
	E. coli (Maximum)	668 (#/100 mL)

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

Physical Parameter	Standard	Background	Limit
Temperature (deg C)			
Maximum Temperature	20		
Temperature Change	2		
Summer	18.3	16.3	28.5
Fall	6.3	4.3	11.9
Winter	4.5	2.5	10.1
Spring	12.0	10.0	43.2
<b>Dissolved Oxygen (mg/L)</b>			
30-day Average	6.5		
7-day Average	5.0		
Instantaneous	4.0		

Inorganics	Parameter	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
		Standard	Background	Limit	Standard	Background	Limit
	Phenol (mg/L)						
	Hydrogen Sulfide (Undissociated) [mg/L]				0.010		
	Ammonia (mg/L)						
	Summer	0.9	0.1	5.3	2.3	0.1	7.7
	Fall	2.0	0.1	7.4	2.5	0.1	5.8
	Winter	2.4	0.1	8.6	3.0	0.1	7.0
	Spring	1.4	0.1	22.3	2.2	0.1	18.5

Total Recoverable Metals	Parameter	Chronic Standard (4 Day Average) <sup>1</sup>			Acute Standard (1 Hour Average) <sup>1</sup>		
		Standard	Background <sup>2</sup>	Limit	Standard	Background <sup>2</sup>	Limit
	Aluminum (µg/L)	87	31.5	213	750	31.5	1563
	Arsenic (µg/L)	150	1.4	486	340	1.4	723
	Cadmium (µg/L)	0.5	0.3	0.9	5.1	0.3	10.5
	Chromium VI (µg/L)	11.0	4.4	25.9	16.0	4.4	29.1
	Chromium III (µg/L)	175	4.4	560	3655	4.4	7785
	Copper (µg/L)	19.5	5.3	51.6	31.6	5.3	61.3
	Cyanide (µg/L)	5.2	3.5	9.1	22.0	3.5	42.9
	Iron (µg/L)				1000	31.3	2096
	Lead (µg/L)	10	0.3	30	245	0.3	522
	Mercury (µg/L)	0.012	0.008	0.021	2.4	0.0	5.1
	Nickel (µg/L)	108	0.5	352	974	0.5	2074
	Selenium (µg/L)	4.6	1.9	10.7	18.4	1.9	37.1
	Silver (µg/L)				16.7	11.2	22.9
	Tributyltin (µg/L)	0.07	0.048	0.13	0.46	0.05	0.93
	Zinc (µg/L)	249	14.7	779	249	14.7	514

1: Based upon a Hardness of 237 mg/l as CaCO<sub>3</sub>

2: Background concentration average of monitoring data, if available, or assumed 67% of chronic standard.

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Organics [Pesticides]	Parameter	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
		Standard	Background <sup>1</sup>	Limit	Standard	Background <sup>1</sup>	Limit
	Aldrin (µg/L)				1.5	1.0	2.1
	Chlordane (µg/L)	0.0043	0.0029	0.0075	1.2	0.0	2.6
	DDT, DDE (µg/L)	0.001	0.001	0.002	0.55	0.00	1.17
	Diazinon (µg/L)	0.17	0.11	0.30	0.17	0.11	0.23
	Dieldrin (µg/L)	0.0056	0.0038	0.0098	0.24	0.00	0.51
	Endosulfan, a & b (µg/L)	0.056	0.038	0.098	0.11	0.04	0.19
	Endrin (µg/L)	0.036	0.024	0.063	0.086	0.024	0.156
	Heptachlor & H. epoxide (µg/L)	0.0038	0.0025	0.0066	0.26	0.00	0.55
	Lindane (µg/L)	0.08	0.05	0.14	1.0	0.1	2.1
	Methoxychlor (µg/L)				0.03	0.02	0.04
	Mirex (µg/L)				0.001	0.001	0.001
	Nonylphenol (µg/L)	6.6	4.4	11.5	28.0	4.4	54.7
	Parathion (µg/L)	0.0130	0.0087	0.0227	0.066	0.009	0.131
	PCB's (µg/L)	0.014	0.009	0.024			
	Pentachlorophenol (µg/L)	15.0	10.1	26.2	19.0	10.1	29.1
	Toxephene (µg/L)	0.0002	0.0001	0.0003	0.73	0.00	1.56

1: Background concentration assumed 67% of chronic standard

Radiological	Parameter	Maximum Concentration		
		Standard	Background <sup>1</sup>	Limit
	Gross Alpha (pCi/L)	15	10.1	20.6

1: Background concentration assumed 67% of chronic standard.

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

Parameter	Maximum Concentration		
	Standard	Background <sup>1</sup>	Limit
Total Dissolved Solids (mg/L)	1200	307	3221
Boron (mg/L)	0.75	0.2	2.1
Arsenic, Dissolved (µg/L)	100	1.4	323
Cadmium, Dissolved (µg/L)	10	0.3	31.8
Chromium, Dissolved (µg/L)	100	4.4	316
Copper, Dissolved (µg/L)	200	5.3	640
Lead, Dissolved (µg/L)	100	0.3	326
Selenium, Dissolved (µg/L)	50	1.9	159
Gross Alpha (pCi/L)	15	10.1	26.2

1: Background concentration average of monitoring data, if available, or assumed 67% of chronic standard.

**WASTELOAD ANALYSIS [WLA]  
Appendix B: Total Residual Chlorine**

Date: 3/12/2014

Discharging Facility: PacifiCorp Carbon Power Plant  
UPDES No: UT-0000094

**CHRONIC**

Discharge (cfs)	Season	Receiving Water	Standard	Effluent Boundary	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	7.9		1.5	9.4								
	Fall	4.3		1.5	5.8								
	Winter	4.3		1.5	5.8								
	Spring	24.1		1.5	25.6								
TRC (mg/L)	Summer	0.000	0.011			0.067	16.3	20	16.9	15	0.84	0.080	
	Fall	0.000	0.011			0.042	4.3	20	9.7	15	0.90	0.046	
	Winter	0.000	0.011			0.042	2.5	20	8.9	15	0.91	0.046	
	Spring	0.000	0.011			0.182	10.0	20	12.6	15	0.88	0.208	

**ACUTE**

Discharge (cfs)	Season	Receiving Water	Standard	Effluent Boundary	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	4.0		1.5	5.5								
	Fall	2.2		1.5	3.7								
	Winter	2.2		1.5	3.7								
	Spring	12.1		1.5	13.6								
TRC (mg/L)	Summer	0.000	0.019			0.068	16.3	20	16.9	15	0.84	0.080	
	Fall	0.000	0.019			0.045	4.3	20	9.7	15	0.90	0.050	
	Winter	0.000	0.019			0.045	2.5	20	8.9	15	0.91	0.050	
	Spring	0.000	0.019			0.167	10.0	20	12.6	15	0.88	0.190	



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

INPUT				
pH:	Summer	Fall	Winter	Spring
	8.47	8.42	8.33	8.49
Beneficial use classification:	3A	3A	3A	3A

  

OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Acute:	2.251	2.490	2.977	2.198

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

INPUT				
Temperature (deg C):	Summer	Fall	Winter	Spring
	17.4	6.8	4.9	10.5
pH:	8.47	8.42	8.33	8.49
Are fish early life stages present?	No	No	No	No
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	0.947	1.245	1.453	1.116
Chronic - Fish Early Life Stages Absent:	0.947	2.021	2.359	1.442