Utah Division of Water Quality
ADDENDUM
Statement of Basis
Wasteload Analysis

Date: **November 21, 2011**

Facility: **Oakley POTW**
Oakley, UT
UPDES No. UT020061

Receiving water: **Weber River (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 002: Weber River

The design flow for the discharge is 0.25 MGD, per the previous permit.

Receiving Water
The receiving water for outfall 002 is the Weber River. The designated uses for the Weber River are 1C, 2B, 3A, and 4.

The receiving water does not have an approved TMDL for any parameters. Rockport Reservoir downstream is listed as impaired for dissolved oxygen and temperature, and Echo Reservoir further downstream is listed as impaired for dissolved oxygen, temperature and total phosphorus (2010 Utah Integrated Report).

The critical flow for the wasteload analysis was considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Flow records from USGS stream gage #10128500 WEBER RIVER NEAR OAKLEY, UT for the period 1904 – 2010 was obtained. The 7Q10 was calculated using the EPA computer software DFLOW V3.1b.

7Q10 Flow (Annual) = 35.2 cfs

For chronic conditions, the 7Q10 flow was simulated; for acute conditions, 50% of the 7Q10 flow was simulated.

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Mixing Zone

The 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.

Parameters of Concern

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

Due to lack of heavy industry in Oakley, metals were not considered parameters of concern for the purposes of this wasteload.

Water Quality Modeling

A QUAL2Kw model of the receiving water was built and calibrated under contract by Utah State University (USU). The model was calibrated to synoptic survey data collected in the summer of 2010 by USU and DWQ.

Receiving water quality data was obtained from the synoptic survey conducted for the model calibration from 8/23 to 8/26/2010. The average value was calculated for each constituent in the receiving water. The sampling site was on the Weber River immediately above the plant discharge.

The calibrated model was used for determining WQBELs. Effluent concentrations were adjusted so that water quality standards were not exceeded at the end of the mixing zone.

The calibration model and the wasteload model are available for review by request.

Effluent Limits

The DO in the Weber River is not significantly impacted by the discharge from the Oakley POTW. Therefore, secondary treatment requirements (R317-1-3) are sufficient to meet water quality standards in the receiving water.

QUAL2Kw rates, input and output for DO related constituents are summarized in Appendix A.

WLA Document: *oakley_potw_wla_2011.doc*
QUAL2Kw Wasteload Model: *oakley_potw_wla_2011.xls*
QUAL2Kw Calibration Model: *qual2kw Oakley City Calibration V1.2b.xls*

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WASTELOAD ANALYSIS [WLA] Date: 11/21/2011
Appendix A: Dissolved Oxygen and Nutrients

Discharging Facility: Oakley WWTP
UPDES No: UT-0020061
Permit Flow [MGD]: 0.25

Receiving Water: Weber River
Stream Classification: 1C, 2B, 3A, 4
Stream Flows [cfs]: 35.20 Summer (July-Sept) Critical Low Flow
- Fall (Oct-Dec)
- Winter (Jan-Mar)
- Spring (Apr-June)

Acute River Width: 50.0%
Chronic River Width: 100.0%

Modeling Information

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.

Current Headwater/Upstream Information

	7Q10 Flow	Temp.	pH	Alkalinity	Spec. Cond.	ISS
	cfs	Deg. C		mg/L	umhos	mg/L
Summer	35.2	0.0	0.0	111	0	0.5
Fall	-	-	-	-	-	-
Winter	-	-	-	-	-	-
Spring	-	-	-	-	-	-

	T-NH4	Org. N	NO3	Org. P	Inorg. P
	mg/L as N	mg/L as N	mg/L as N	mg/L as P	mg/L as P
Summer	0.013	0.000	0.079	0.003	0.004
Fall	-	-	-	-	-
Winter	-	-	-	-	-
Spring	-	-	-	-	-

	Max. DO	Min. DO	CBOD	Detritus	Phytoplank
	mg/L	mg/L	mg/L	mg/L	ug/L
Summer	0.00	0.00	2.23	0.0	2.0
Fall	-	-	-	-	-
Winter	-	-	-	-	-
Spring	-	-	-	-	-

Projected Discharge Information

	Flow	Temp.	pH	Alkalinity	ISS
	MGD	Deg. C		mg/L	mg/L
Summer	0.25	18.30	7.85	400	2.0
Fall	-	-	-	-	-
Winter	-	-	-	-	-
Spring	-	-	-	-	-

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 Limitation for Biological Oxygen Demand (BOD_5) based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD_5 limitation as follows:

	Concentration		
Season	**Chronic**	**Acute**	
Summer	25.0	35.0	mg/L as CBOD5
Fall	-	-	mg/L as CBOD5
Winter	-	-	mg/L as CBOD5
Spring	-	-	mg/L as CBOD5

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards

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

	Concentration		
Season	**Chronic**	**Acute**	
Summer	5.0	5.0	mg/L
Fall	-	-	mg/L
Winter	-	-	mg/L
Spring	-	-	mg/L

Effluent Limitation for Total Nitrogen (TN) and Total Phosphorus based upon Water Quality Standards

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

	Total Nitrogen		Total Phosphorus		
Season	**Chronic**	**Acute**	**Chronic**	**Acute**	
Summer	10.850	13.800	1.300	2.670	mg/L
Fall	-	-	-	-	mg/L
Winter	-	-	-	-	mg/L
Spring	-	-	-	-	mg/L

Effluent Limitation for Total Ammonia based upon Water Quality Standards

In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

	Organic Nitrogen		Total Ammonia		
Season	**Chronic**	**Acute**	**Chronic**	**Acute**	
Summer	5.700	6.100	1.450	3.400	mg/L as N
Fall	-	-	-	-	mg/L as N
Winter	-	-	-	-	mg/L as N
Spring	Max	-	Max	-	mg/L as N

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	0.001	m/d
Oxygen:		
Reaeration model	Internal	
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	0.22265	/d
Temp correction	1.047	
Fast CBOD:		
Oxidation rate	10	/d
Temp correction	1.047	
Organic N:		
Hydrolysis	0.0810275	/d
Temp correction	1.07	
Settling velocity	0.155642	m/d
Ammonium:		
Nitrification	3.483972	/d
Temp correction	1.07	
Nitrate:		
Denitrification	0.902462	/d
Temp correction	1.07	
Sed denitrification transfer coeff	0.2395	m/d
Temp correction	1.07	
Organic P:		
Hydrolysis	0.199205	/d
Temp correction	1.07	
Settling velocity	0.165438	m/d
Inorganic P:		
Settling velocity	1.6467	m/d
Sed P oxygen attenuation half sat constant	0.8846	mgO2/L

Phytoplankton:		
Max Growth rate	2.427675	/d
Temp correction	1.07	
Respiration rate	0.1954895	/d
Temp correction	1.07	
Death rate	0.57862	/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	15	ugN/L
Settling velocity	0.4811	m/d
Bottom Plants:		
Growth model	Zero-order	
Max Growth rate	30.371825	gD/m2/d or /d
Temp correction	1.07	
First-order model carrying capacity	100	gD/m2
Basal respiration rate	0.1285202	/d
Photo-respiration rate parameter	0.39	unitless
Temp correction	1.07	
Excretion rate	0.193645	/d
Temp correction	1.07	
Death rate	0.017	/d
Temp correction	1.07	
External nitrogen half sat constant	143.544	ugN/L
External phosphorus half sat constant	89.5825	ugP/L
Inorganic carbon half sat constant	2.92E-06	moles/L
Bottom algae use HCO3- as substrate	Yes	
Light model	Half saturation	
Light constant	67.0276	langleys/d
Ammonia preference	20.3871	ugN/L
Subsistence quota for nitrogen	1.2329748	mgN/gD
Subsistence quota for phosphorus	0.1469345	mgP/gD
Maximum uptake rate for nitrogen	1359.3435	mgN/gD/d
Maximum uptake rate for phosphorus	155.915	mgP/gD/d
Internal nitrogen half sat ratio	4.637943	
Internal phosphorus half sat ratio	3.090491	
Nitrogen uptake water column fraction	1	
Phosphorus uptake water column fraction	1	
Detritus (POM):		
Dissolution rate	1.319081	/d
Temp correction	1.07	
Settling velocity	0.3537095	m/d
pH:		
Partial pressure of carbon dioxide	370	ppm

Atmospheric Inputs:	Summer	Fall	Winter	Spring
Max. Air Temperature, F	83.5	-	-	-
Min. Air Temperature, F	46.6	-	-	-
Dew Point, Temp., F	55.7	-	-	-
Wind, ft./sec. @ 21 ft.	5.7	-	-	-
Cloud Cover, %	0.1	-	-	-
Shade, %	0.0	-	-	-

Other Inputs:

Bottom Algae Coverage	100.0%	
Bottom SOD Coverage	100.0%	
Prescribed SOD	0.0	gO2/m2/d

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File Name: oakley_potw_wla_2011.xls