Utah Division of Water Quality
Addendum to Statement of Basis
Wasteload Analysis and Antidegradation Level I Review
PRELIMINARY – Discharge to C-7 Ditch

Date: **January 30, 2017**

Facility: **Magna Wastewater Treatment Plant**
UPDES No. UT0021440

Receiving water: **C-7 Ditch**

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.

Purpose
The purpose of this wasteload allocation is to determine WQBELs for planning a new outfall to C-7 Ditch. The limits should be considered preliminary that are subject to change based on collection of site-specific physiographic, flow and water quality data during the permit cycle.

Discharge
Outfall 001: C-7 Ditch → Lee Creek → Great Salt Lake
The maximum design flow for the discharge is 4.0 MGD average monthly and 8.0 MGD maximum daily, as provided by the treatment plant.

This wasteload allocation is for the proposed effluent pipeline alignment as shown in Figure 1. The 42-inch diameter reinforced concrete pipe is 4,000 feet long at 0.0005 foot/foot slope (Epic Engineering 2016).

Receiving Water
The receiving water for Outfall 001is the C-7 Ditch, which does not have designated beneficial uses. The C-7 Ditch was determined to be a drainage ditch that does not have downstream agricultural users of the water. Therefore, per UAC R317-2-13.10, the presumptive beneficial uses for all drainage canals and ditches statewide 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.*

The C-7 Ditch is tributary to Lee Creek, which does not have designated beneficial uses. Per UAC R317-2-13.13, the presumptive beneficial uses for all waters not specifically classified 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.*

The critical flow for the wasteload analysis is typically considered the lowest stream flow for seven consecutive days with a recurrence interval of once every ten years (7Q10). Flow records from USGS stream gage #10172640 Lee Creek Near Magna, UT, for the period 1971 – 1982 and 2006 – 2008 was obtained. The 7Q10 was estimated as the lowest seven day average from 5/24/2006 to 4/10/2008. This more recent period of record of the gage was considered more representative of the current higher flow regime in the creek; however, it is insufficient to statistically calculate the 7Q10 flow.

The discharge at the gage includes flows from C-7 Ditch, Kersey Creek, Magna WWTP, Lee Creek and groundwater (Table 1). The average discharge from Magna WWTP was calculated from DWQ monitoring records from 1999 – 2008. Critical low flow from Kersey Creek and groundwater was assumed to be zero. No flow records were available for C-7 Ditch and Lee Creek above the confluence with C-7 Ditch; the critical low flow was assumed to be 67% from C-7 Ditch and 33% from Lee Creek above C-7 Ditch.

Table 1: Annual Critical Low Flow

Source	Critical Low Flow (cfs)
C-7 Ditch	9.5
Kersey Creek above Magna WWTP	0.0
Magna WWTP	3.7
Lee Creek above C-7 Ditch	4.7
Groundwater	0.0
Lee Creek at USGS Gage	*17.9*

Receiving water quality data was obtained from sampling stations 4991430 Lee Creek at I-80 Crossing, 4991560 C-7 Ditch at 8000 West, and 4991590 C-7 Ditch above Confluence with Kersey Creek. The seasonal annual value was calculated for each constituent with available data in the receiving water.

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*. For this discharge, numeric aquatic life use criteria do not apply to the immediate receiving water (C-7 Ditch), but do apply to downstream receiving waters (Lee Creek). Therefore, Lee Creek is considered the limiting condition in this wasteload allocation to ensure protection of aquatic life uses.

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.

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 annual critical low flow.

Parameters of Concern

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

TMDL

The receiving waters are not listed as impaired for any parameters according to the 303(d) list in the *2012/2014 Utah Integrated Report*.

Water Quality Modeling

A QUAL2Kw model of the receiving water was populated based on physiographic information from Google Earth and site data collected by DWQ staff. The model extends from C-7 Ditch through Lee Creek to the outlet to Gilbert Bay (Figure 1). The QUAL2Kw model was used for determining WQBELs related to eutrophication of the receiving waters, including BOD_5, phosphorus, nitrogen and dissolved oxygen.

The QUAL2Kw model was also used to determine the limits for ammonia toxicity. The water quality criterion for chronic ammonia toxicity is dependent on temperature and pH, and the water quality criterion for acute ammonia toxicity is dependent on pH. Effluent concentrations were adjusted so that water quality standards were not exceeded in the receiving water. QUAL2Kw rates, input and output are summarized in Appendix A.

Insufficient observed data was available for model calibration. The rate parameters used in the model were the same as those used for the Box Elder Creek/Brigham City WWTP QUAL2Kw, which was calibrated under contract by Utah State University (Neilson et al. 2012). C-7 Ditch and Lee Creek were considered to have similar stream characteristics to Box Elder Creek. Synoptic data needs to be collected in the future in order to calibrate the model.

A mass balance mixing analysis was calculated for conservative constituents such as dissolved metals. The WQBELs determined using the mass balance mixing analysis are summarized in Appendix B.

The limits for total residual chlorine were determined assuming a decay rate of 37 /day (at 20 ºC), based on a chlorine decay assessment (Carollo 2016). The chlorine decay in C-7 Ditch should be verified once the effluent pipeline is constructed and discharging. A total travel time of 240 minutes was estimated [35 minutes in the effluent pipe (4,000 lineal feet at 1.9 feet per second velocity) and 205 minutes in C-7 Ditch prior to confluence with Lee Creek (7,350 lineal feet at 0.6 feet per second velocity)]. The analysis for TRC is summarized in Appendix C.

Where WQBELs exceeded secondary standards or categorical limits, the concentration in the model was set at the secondary standard or categorical limit.

Models and supporting documentation are available for review upon request.

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**
Annual	30%

Ammonia

The QUAL2Kw model was utilized to determine annual limits for ammonia based on summer season conditions. 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 that meet both in-stream DO criteria and in-stream toxicity criteria. Annual average pH and seasonal average temperature was 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 were calculated to meet the new criteria assuming presence of the most sensitive species (Table 3).

Table 3: Ammonia Limits to Meet EPA 2013 Ammonia Criteria with Mussels Present

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Ammonia (mg/l) [Toxicity]	Varies	12.0	1 hour	Varies	2.0	30 days

Effluent Limits

The effect of the effluent on the DO in the receiving water was evaluated using the QUAL2Kw model. A DO sag in C-7 Ditch downstream from the plant discharge was predicted by the model; however, the DO concentration recovered by the confluence with Lee Creek and secondary standards for BOD_5 are sufficient to meet DO criteria.

Table 4: Water Quality Based Effluent Limits Summary

<table>
<tr><th rowspan="2">Effluent Constituent</th><th colspan="3">Acute</th><th colspan="3">Chronic</th></tr>
<tr><th>Standard</th><th>Limit</th><th>Averaging Period</th><th>Standard</th><th>Limit</th><th>Averaging Period</th></tr>
<tr><td>Flow (MGD)</td><td></td><td>8.0</td><td>1 day</td><td></td><td>4.0</td><td>30 days</td></tr>
<tr><td>Ammonia (mg/L)</td><td>Varies</td><td>30.0</td><td>1 hour</td><td>Varies</td><td>7.0</td><td>30 days</td></tr>
<tr><td>Min. Dissolved Oxygen (mg/L)[2]</td><td>3.0</td><td>5.0</td><td>Instantaneous</td><td>5.0</td><td>5.0</td><td>30 days</td></tr>
<tr><td>BOD_5 (mg/L)</td><td>NA</td><td>35</td><td>7 days</td><td>NA</td><td>25</td><td>30 days</td></tr>
<tr><td>Total Residual Chlorine (mg/L)</td><td rowspan="5">0.019</td><td></td><td rowspan="5">1 hour</td><td rowspan="5">0.011</td><td></td><td rowspan="5">4 days</td></tr>
<tr><td>Summer</td><td>17.3</td><td>17.7</td></tr>
<tr><td>Fall</td><td>2.6</td><td>2.7</td></tr>
<tr><td>Winter</td><td>1.3</td><td>1.3</td></tr>
<tr><td>Spring</td><td>2.6</td><td>2.7</td></tr>
</table>

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 required for this discharge, as this wasteload is for a new outfall to a different receiving water.

Prepared by:
Nicholas von Stackelberg, P.E.
Standards and Technical Services Section

Documents

WLA Document: *magna_potw_c7ditch_wla_2017-01-30.docx*
QUAL2Kw Wasteload Model: *magna_potw_c7ditch_wla_2017.xlsm*

References:

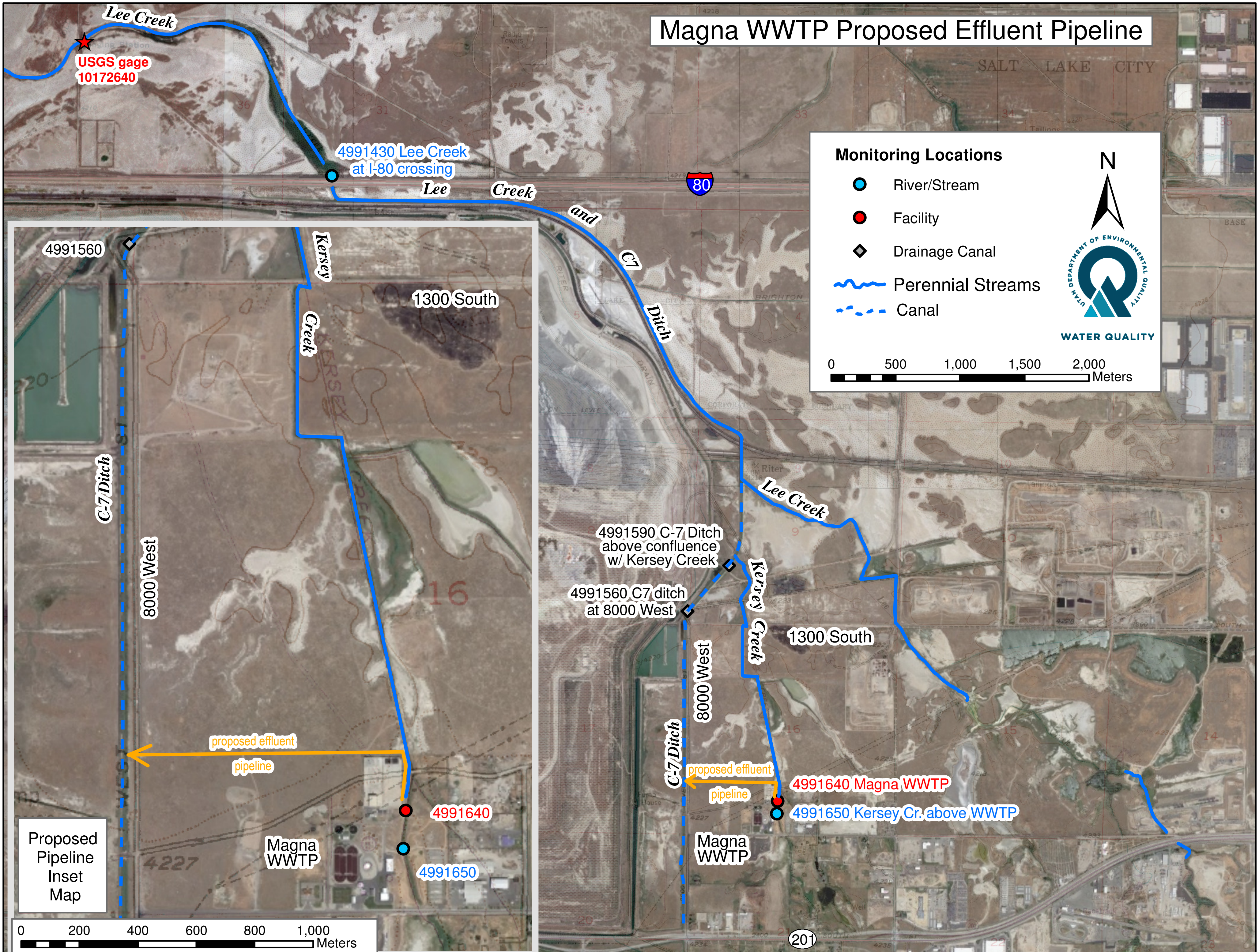
Carollo. 2016. *Chlorine Decay Assessment*. Magna Water District.

Epic Engineering. 2016. *WWTP Outfall Bypass Pipeline – Alternative Comparison Summary Memo*. Prepared for Magna Water District.

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

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

Utah Division of Water Quality. *2012/2014 Utah Integrated Report.*



Magna WWTP Proposed Effluent Pipeline
Lee Creek
USGS gage 10172640
4991430 Lee Creek at I-80 crossing
80
Lee Creek and C7 Ditch
Lee Creek
4991590 C-7 Ditch above confluence w/ Kersey Creek
4991560 C7 ditch at 8000 West
Kersey Creek
1300 South
8000 West
C-7 Ditch
proposed effluent pipeline
4991640 Magna WWTP
4991650 Kersey Cr. above WWTP
Magna WWTP
201
SALT LAKE CITY
Monitoring Locations
River/Stream
Facility
Drainage Canal
Perennial Streams
Canal
N
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY
0 500 1,000 1,500 2,000 Meters
4991560
Kersey Creek
1300 South
C-7 Ditch
8000 West
proposed effluent pipeline
4991640
Magna WWTP
4991650
Proposed Pipeline Inset Map
0 200 400 600 800 1,000 Meters

WASTELOAD ANALYSIS [WLA] Date: 1/30/2017
Appendix A: QUAL2Kw Analysis for Eutrophication

Discharging Facility:	Magna WWTP		
UPDES No:	UT-0021440		
Permit Flow [MGD]:	4.00	Maximum Monthly Flow	
	8.00	Maximum Daily Flow	
Receiving Water:	C-7 Ditch/Lee Creek		
Stream Classification:	2B, 3D		
Stream Flows [cfs]:	9.50	Summer (July-Sept)	Critical Low Flow
	9.50	Fall (Oct-Dec)	
	9.50	Winter (Jan-Mar)	
	9.50	Spring (Apr-June)	
Acute River Width:	50.0%		
Chronic River Width:	100.0%		

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 Inputs - C-7 Ditch	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	9.5	9.5	9.5	9.5
Temperature (deg C)	22.4	7.8	6.2	16.9
Specific Conductance (μmhos)	2,497	3,123	4,157	2,611
Inorganic Suspended Solids (mg/L)	73.3	29.1	18.5	114.5
Dissolved Oxygen (mg/L)	8.7	10.2	12.7	8.9
$CBOD_5$ (mg/L)	2.5	2.3	2.5	4.6
Organic Nitrogen (mg/L)	2.342	2.342	2.342	2.342
NH4-Nitrogen (mg/L)	0.061	0.157	0.134	0.533
NO3-Nitrogen (mg/L)	0.476	2.075	2.152	1.025
Organic Phosphorus (mg/L)	0.162	0.022	0.000	0.171
Inorganic Ortho-Phosphorus (mg/L)	0.092	0.139	0.226	0.128
Phytoplankton (μg/L)	10.0	10.0	10.0	10.0
Detritus [POM] (mg/L)	8.1	3.2	2.1	12.7
Alkalinity (mg/L)	250	250	250	250
pH	8.1	8.1	8.3	8.2

Discharge Inputs - Chronic	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	4.0	4.0	4.0	4.0
Temperature (deg C)	21.9	16.5	12.5	17.1
Specific Conductance (μmhos)	2,492	2,273	2,644	2,750
Inorganic Suspended Solids (mg/L)	2.4	2.1	3.2	2.2
Dissolved Oxygen (mg/L)	5.0	5.0	5.0	5.0
$CBOD_5$ (mg/L)	25.0	25.0	25.0	25.0
Organic Nitrogen (mg/L)	5.0	5.0	5.0	5.0
NO3-Nitrogen (mg/L)	12.3	14.7	12.3	13.0
Organic Phosphorus (mg/L)	0.0	0.0	0.0	0.0
Inorganic Ortho-Phosphorus (mg/L)	5.0	5.0	5.0	5.0
Phytoplankton (μg/L)	0.0	0.0	0.0	0.0
Detritus [POM] (mg/L)	0.0	0.0	0.0	0.0
Alkalinity (mg/L)	400	400	400	400
pH	7.6	7.6	7.6	7.7

Discharge Inputs - Acute	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	8.0	8.0	8.0	8.0
Temperature (deg C)	21.9	16.5	12.5	17.1
Specific Conductance (μmhos)	2,492	2,273	2,644	2,750
Inorganic Suspended Solids (mg/L)	2.4	2.1	3.2	2.2
Dissolved Oxygen (mg/L)	5.0	5.0	5.0	5.0
$CBOD_5$ (mg/L)	35.0	35.0	35.0	35.0
Organic Nitrogen (mg/L)	5.0	5.0	5.0	5.0
NO3-Nitrogen (mg/L)	12.3	14.7	12.3	13.0
Organic Phosphorus (mg/L)	0.0	0.0	0.0	0.0
Inorganic Ortho-Phosphorus (mg/L)	5.0	5.0	5.0	5.0
Phytoplankton (μg/L)	0.0	0.0	0.0	0.0
Detritus [POM] (mg/L)	0.0	0.0	0.0	0.0
Alkalinity (mg/L)	400	400	400	400
pH	7.8	7.8	8.0	8.0

Tributary Inputs - Lee Creek	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	4.7	4.7	4.7	4.7
Temperature (deg C)	22.4	7.8	6.2	16.9
Specific Conductance (μmhos)	2,497	3,123	4,157	2,611
Inorganic Suspended Solids (mg/L)	73.3	29.1	18.5	114.5
Dissolved Oxygen (mg/L)	8.7	10.2	12.7	8.9
$CBOD_5$ (mg/L)	2.5	2.3	2.5	4.6
Organic Nitrogen (mg/L)	2.342	2.342	2.342	2.342
NH4-Nitrogen (mg/L)	0.061	0.157	0.134	0.533
NO3-Nitrogen (mg/L)	0.476	2.075	2.152	1.025
Organic Phosphorus (mg/L)	0.162	0.022	0.000	0.171
Inorganic Ortho-Phosphorus (mg/L)	0.092	0.139	0.226	0.128
Phytoplankton (μg/L)	10.0	10.0	10.0	10.0
Detritus [POM] (mg/L)	8.1	3.2	2.1	12.7
Alkalinity (mg/L)	250	250	250	250
pH	8.1	8.1	8.3	8.2

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 and Ammonia Toxicity

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

Chronic	Standard	Summer	Fall	Winter	Spring
Flow (MGD)	N/A	4.0	4.0	4.0	4.0
NH4-Nitrogen (mg/L)	Varies	7.0	12.0	10.0	9.0
BOD_5 (mg/L)	N/A	25.0	25.0	25.0	25.0
Dissolved Oxygen [30-day Ave] (mg/L)	5.0	5.0	5.0	5.0	5.0

Acute	Standard	Summer	Fall	Winter	Spring
Flow (cfs)	N/A	8.0	8.0	8.0	8.0
NH4-Nitrogen (mg/L)	Varies	30.0			
$CBOD_5$ (mg/L)	N/A	35.0	35.0	35.0	35.0
Dissolved Oxygen [Minimum] (mg/L)	3.0	5.0	5.0	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 downstream 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	0.242802	/d
Temp correction	1.047	
Fast CBOD:		
Oxidation rate	10	/d
Temp correction	1.047	
Organic N:		
Hydrolysis	0.2625675	/d
Temp correction	1.07	
Settling velocity	0.087906	m/d
Ammonium:		
Nitrification	2.817054	/d
Temp correction	1.07	
Nitrate:		
Denitrification	1.756367	/d
Temp correction	1.07	
Sed denitrification transfer coeff	0.24334	m/d
Temp correction	1.07	
Organic P:		
Hydrolysis	0.227735	/d
Temp correction	1.07	
Settling velocity	0.103774	m/d
Inorganic P:		
Settling velocity	0.06798	m/d
Sed P oxygen attenuation half sat constant	0.99342	mgO2/L

Phytoplankton:		
Max Growth rate	2.57133	/d
Temp correction	1.07	
Respiration rate	0.1432355	/d
Temp correction	1.07	
Death rate	0.45734	/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	0.0645665	m/d
Bottom Plants:		
Growth model	Zero-order	
Max Growth rate	8.663865	gD/m2/d or /d
Temp correction	1.07	
First-order model carrying capacity	100	gD/m2
Basal respiration rate	0.1046738	/d
Photo-respiration rate parameter	0.39	unitless
Temp correction	1.07	
Excretion rate	0.05015	/d
Temp correction	1.07	
Death rate	0.1437	/d
Temp correction	1.07	
External nitrogen half sat constant	127.576	ugN/L
External phosphorus half sat constant	89.161	ugP/L
Inorganic carbon half sat constant	1.10E-04	moles/L
Bottom algae use HCO3- as substrate	Yes	
Light model	Half saturation	
Light constant	71.6656	langleys/d
Ammonia preference	15.2922	ugN/L
Subsistence quota for nitrogen	0.9375732	mgN/gD
Subsistence quota for phosphorus	0.058037	mgP/gD
Maximum uptake rate for nitrogen	640.4095	mgN/gD/d
Maximum uptake rate for phosphorus	190.7675	mgP/gD/d
Internal nitrogen half sat ratio	1.8677685	
Internal phosphorus half sat ratio	4.4374015	
Nitrogen uptake water column fraction	1	
Phosphorus uptake water column fraction	1	
Detritus (POM):		
Dissolution rate	3.773984	/d
Temp correction	1.07	
Settling velocity	0.097025	m/d
pH:		
Partial pressure of carbon dioxide	370	ppm

Atmospheric Inputs:	Summer	Fall	Winter	Spring
Min. Air Temperature, F	0.0	0.0	0.0	0.0
Max. Air Temperature, F	2496.7	3123.0	4156.6	2611.0
Dew Point, Temp., F	81.5	32.3	20.5	127.2
Wind, ft./sec. @ 21 ft.	73.3	29.1	18.5	114.5
Cloud Cover, %	874%	1021%	1269%	890%

Other Inputs:	
Bottom Algae Coverage	s.u.
Bottom SOD Coverage	ug/L
Prescribed SOD, gO_2/m^2/day	0

WASTELOAD ANALYSIS [WLA] Date: 9/30/2016
Appendix B: Mass Balance Mixing Analysis for Conservative Constituents

Discharging Facility:	Magna WWTP		
UPDES No:	UT-0021440		
Permit Flow [MGD]:	4.0	Maximum Monthly Flow	
	8.0	Maximum Daily Flow	
Receiving Water:	C-7 Ditch/Lee Creek		
Stream Classification:	2B, 3D		
Stream Flows [cfs]:	Chronic	Acute	
C-7 Ditch	9.5	9.5	
Lee Creek	4.7	2.4	
Total	14.2	11.9	
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

	7Q10 Flow cfs
Summer	9.5
Fall	-
Winter	-
Spring	-

Discharge Information

	Flow MGD
Maximum Daily	8.0
Maximum Monthly	4.0

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.

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

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

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

Parameter **Maximum Concentration**

Physical

Inorganics	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
	Standard	Limit		Standard	Limit	
Total Residual Chlorine (TRC)	0.011	0.011	mg/L	0.019	0.019	mg/L
Phenol				0.010	0.010	mg/L
Hydrogen Sulfide (Undissociated)				0.002	0.002	mg/L

Total Recoverable Metals [µg/L]

	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
Parameter	Standard[1]	Background[2]	Limit	Standard[1]	Background[2]	Limit
Aluminum	87.0	58.0	154	750	58.0	1,413
Arsenic	150	100	265	340	100	570
Cadmium	0.5	0.3	0.8	4.3	0.3	8.2
Chromium VI	11.0	7.3	19.4	16.0	7.3	24.3
Chromium III	152	101	268	3,181	101	6,130
Copper	16.9	11.2	29.8	26.9	11.2	41.9
Cyanide	22.0	14.7	38.8	5.2	14.7	-3.9
Iron				1,000	667	1,319
Lead	7.7	5.1	13.6	197	5.1	381
Mercury	0.012	0.008	0.021	2.4	0.008	4.7
Nickel	93.8	62.5	165	843	62.5	1591
Selenium	4.6	3.1	8.1	18.4	3.1	33.1
Silver				12.5	8.3	16.4
Tributylin	0.072	0.048	0.127	0.46	0.048	0.85
Zinc	216	144	380	216	144	284

1: Based upon a Hardness of 200 mg/l as CaCO3.

2: Background concentration assumed 2/3 of chronic limit.

Organics (Pesticides) [µg/L]

	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
Parameter	**Standard**	**Background[1]**	**Limit**	**Standard**	**Background[1]**	**Limit**
Aldrin				1.5	1.0	2.0
Chlordane	0.0043	0.0029	0.0076	1.2	0.0029	2.3
DDT, DDE	0.001	0.001	0.002	0.55	0.001	1.08
Diazinon	0.17	0.11	0.30	0.17	0.11	0.22
Dieldrin	0.0056	0.0037	0.0099	0.24	0.0037	0.47
Endosulfan, a & b	0.056	0.037	0.099	0.11	0.037	0.18
Endrin	0.036	0.024	0.064	0.086	0.024	0.145
Heptachlor & H. epoxide	0.0038	0.0025	0.0067	0.26	0.0025	0.51
Lindane	0.08	0.05	0.14	1.0	0.05	1.9
Methoxychlor				0.03	0.02	0.04
Mirex				0.001	0.001	0.001
Nonylphenol	6.6	4.4	11.6	28.0	4.4	50.6
Parathion	0.0130	0.0087	0.0229	0.066	0.0087	0.121
PCB's	0.014	0.009	0.025			
Pentachlorophenol	15.0	10.0	26.5	19.0	10.0	27.6
Toxephene	0.0002	0.0001	0.0004	0.73	0.0001	1.43

1: Background concentration assumed 2/3 of chronic limit.

Radiological

Parameter	Maximum Concentration
Gross Alpha	15 pCi/L

WASTELOAD ANALYSIS [WLA]
Appendix C: Total Residual Chlorine

Date: 1/26/2017

Discharging Facility: Magna WWTP
UPDES No: UT-0021440

CHRONIC

	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	Decay Rate (/day) @ 20 deg C	Decay Rate (/day) @ T deg C	Travel Time (min)	Decay Coefficient	Effluent Limit
Discharge (cfs)	Summer	14.2		6.2	20.4							
	Fall	14.2		6.2	20.4							
	Winter	14.2		6.2	20.4							
	Spring	14.2		6.2	20.4							
TRC (mg/L)	Summer	0.000	0.011			0.036	20.0	37	37.0	240	0.00	17.273
	Fall	0.000	0.011			0.036	12.0	37	25.6	240	0.01	2.593
	Winter	0.000	0.011			0.036	8.0	37	21.3	240	0.03	1.266
	Spring	0.000	0.011			0.036	12.0	37	25.6	240	0.01	2.593

ACUTE

	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	Decay Rate (/day) @ 20 °C	Decay Rate (/day) @ T °C	Travel Time (min)	Decay Coefficient	Effluent Limit
Discharge (cfs)	Summer	11.9		12.4	24.2							
	Fall	11.9		12.4	24.2							
	Winter	11.9		12.4	24.2							
	Spring	11.9		12.4	24.2							
TRC (mg/L)	Summer	0.000	0.019			0.037	20.0	37	37.0	240	0.00	17.726
	Fall	0.000	0.019			0.037	12.0	37	25.6	240	0.01	2.661
	Winter	0.000	0.019			0.037	8.0	37	21.3	240	0.03	1.300
	Spring	0.000	0.019			0.037	12.0	37	25.6	240	0.01	2.661