

**Utah Division of Water Quality
Salt Lake City, Utah**

WASTELOAD ANALYSIS [WLA] [REDACTED] = not included in the WLA
Addendum: Statement of Basis

19-Dec-22
4:00 PM

Facilities: Centerfield Regional Culinary Water Treatment Plant
Discharging to: Twelve Mile Creek

UPDES No: UT-0025704

I. Introduction

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 [R317-2-8, UAC]. Projected concentrations are compared to numeric water quality standards to determine acceptability. The anti-degradation policy and procedures are also considered. The primary in-stream parameters of concern may include metals (as a function of hardness), total dissolved solids (TDS), total residual chlorine (TRC), un-ionized ammonia (as a function of pH and temperature, measured and evaluated in terms of total ammonia), and dissolved oxygen.

Mathematical water quality modeling is employed to determine stream quality response to point source discharges. Models aid in the effort of anticipating stream quality at future effluent flows at critical environmental conditions (e.g., low stream flow, high temperature, high pH, etc).

The numeric criteria in this wasteload analysis may always be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

II. Receiving Water and Stream Classification

Twelve Mile Creek:	2B,3C,3D,4
Antidegradation Review:	Level I review completed. Level II review is not required.

III. Numeric Stream Standards for Protection of Aquatic Wildlife

Total Ammonia (TNH3)	Varies as a function of Temperature and pH Rebound. See Water Quality Standards	
Chronic Total Residual Chlorine (TRC)	0.011 mg/l (4 Day Average)	0.019 mg/l (1 Hour Average)
Chronic Dissolved Oxygen (DO)	N/A	5.0 mg/l (30 Day Average) mg/l (7Day Average) 3.0 mg/l (1 Day Average)
Maximum Total Dissolved Solids	1200.0 mg/l	

Acute and Chronic Heavy Metals (Dissolved)

Parameter	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard		
	Concentration	Load*	Concentration		Load*
Aluminum	87.00 ug/l**	0.261 lbs/day	750.00	ug/l	2.253 lbs/day
Arsenic	150.00 ug/l	0.451 lbs/day	340.00	ug/l	1.022 lbs/day
Cadmium	1.48 ug/l	0.004 lbs/day	4.10	ug/l	0.012 lbs/day
Chromium III	164.04 ug/l	0.493 lbs/day	3432.04	ug/l	10.312 lbs/day
ChromiumVI	11.00 ug/l	0.033 lbs/day	16.00	ug/l	0.048 lbs/day
Copper	18.26 ug/l	0.055 lbs/day	29.36	ug/l	0.088 lbs/day
Iron			1000.00	ug/l	3.005 lbs/day
Lead	8.65 ug/l	0.026 lbs/day	222.04	ug/l	0.667 lbs/day
Mercury	0.0120 ug/l	0.000 lbs/day	2.40	ug/l	0.007 lbs/day
Nickel	101.42 ug/l	0.305 lbs/day	912.21	ug/l	2.741 lbs/day
Selenium	4.60 ug/l	0.014 lbs/day	20.00	ug/l	0.060 lbs/day
Silver	N/A ug/l	N/A lbs/day	14.62	ug/l	0.044 lbs/day
Zinc	233.20 ug/l	0.701 lbs/day	233.20	ug/l	0.701 lbs/day

* Allowed below discharge

**Chronic Aluminum standard applies only to waters with a pH < 7.0 and a Hardness < 50 mg/l as CaCO3

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Metals Standards Based upon a Hardness of 219.45 mg/l as CaCO₃

IV. Numeric Stream Standards for Protection of Agriculture

	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
	Concentration	Load*	Concentration	Load*
Arsenic			100.0 ug/l	lbs/day
Boron			750.0 ug/l	lbs/day
Cadmium			10.0 ug/l	0.02 lbs/day
Chromium			100.0 ug/l	lbs/day
Copper			200.0 ug/l	lbs/day
Lead			100.0 ug/l	lbs/day
Selenium			50.0 ug/l	lbs/day
TDS, Summer			1200.0 mg/l	1.80 tons/day

V. Numeric Stream Standards for Protection of Human Health (Class 1C Waters)

Metals	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
	Concentration	Load*	Concentration	Load*
Arsenic			ug/l	lbs/day
Barium			ug/l	lbs/day
Cadmium			ug/l	lbs/day
Chromium			ug/l	lbs/day
Lead			ug/l	lbs/day
Mercury			ug/l	lbs/day
Selenium			ug/l	lbs/day
Silver			ug/l	lbs/day
Fluoride (3)			ug/l	lbs/day
to			ug/l	lbs/day
Nitrates as N			ug/l	lbs/day

VI. Numeric Stream Standards the Protection of Human Health from Water & Fish Consumption [Toxics]

Metals	Maximum Conc., ug/l - Acute Standards			
	Class 1C		Class 3A, 3B	
Antimony	ug/l	lbs/day		
Arsenic	ug/l	lbs/day	4300.00 ug/l	103.46 lbs/day
Asbestos	ug/l	lbs/day		
Beryllium				
Cadmium				
Chromium (III)				
Chromium (VI)				
Copper				
Cyanide	ug/l	lbs/day	2.2E+05 ug/l	5293.53 lbs/day
Lead	ug/l	lbs/day		
Mercury			0.15 ug/l	0.00 lbs/day
Nickel			4600.00 ug/l	110.68 lbs/day
Selenium	ug/l	lbs/day		
Silver	ug/l	lbs/day		
Thallium			6.30 ug/l	0.15 lbs/day
Zinc				

There are additional standards that apply to this receiving water, but were not considered in this modeling/waste load allocation analysis.

VII. Mathematical Modeling of Stream Quality

Model configuration was accomplished utilizing standard modeling procedures. Data points were plotted and coefficients adjusted as required to match observed data as closely as possible.

The modeling approach used in this analysis included one or a combination of the following models.

(1) The Utah River Model, Utah Division of Water Quality, 1992. Based upon STREAMDO IV (Region VIII) and Supplemental Ammonia Toxicity Models; EPA Region VIII, Sept. 1990 and

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QUAL2E (EPA, Athens, GA).

(2) Utah Ammonia/Chlorine Model, Utah Division of Water Quality, 1992.

(3) AMMTOX Model, University of Colorado, Center of Limnology, and EPA Region 8

(4) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al.
Harper Collins Publisher, Inc. 1987, pp. 644.

Coefficients used in the model were based, in part, upon the following references:

(1) Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens Georgia. EPA/600/3-85/040 June 1985.

(2) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al.
Harper Collins Publisher, Inc. 1987, pp. 644.

VIII. Modeling Information

The required information for the model may include the following information for both the upstream conditions at low flow and the effluent conditions:

Flow, Q, (cfs or MGD)	D.O. mg/l
Temperature, Deg. C.	Total Residual Chlorine (TRC), mg/l
pH	Total NH3-N, mg/l
BOD5, mg/l	Total Dissolved Solids (TDS), mg/l
Metals, ug/l	Toxic Organics of Concern, ug/l

Other Conditions

In addition to the upstream and effluent conditions, the models require a variety of physical and biological coefficients and other technical information. In the process of actually establishing the permit limits for an effluent, values are used based upon the available data, model calibration, literature values, site visits and best professional judgement.

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 Upstream Information

		Stream							
		Critical Low							
		Flow	Temp.	pH	T-NH3	BOD5	DO	TRC	TDS
		cfs	Deg. C		mg/l as N	mg/l	mg/l	mg/l	mg/l
Summer (Irrig. Season)		4.0	18.7	8.6	0.06	1.00	6.82	0.00	292.0
	Fall	4.4	4.5	8.5	0.04	1.00	---	0.00	258.2
	Winter	2.0	3.8	8.5	0.03	2.00	---	0.00	258.2
	Spring	6.4	10.7	8.6	0.03	1.00	---	0.00	258.2
Dissolved Metals	Al	As	Cd	CrIII	CrVI	Copper	Fe	Pb	
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
All Seasons	15.00	1.24	0.50	2.50	1.00	6.00	10.0	1.50	
Dissolved Metals	Hg	Ni	Se	Ag	Zn	Boron			
	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l			
All Seasons	0.0000	4.00	0.50	1.00	15.00	10.0			* 1/2 MDL

Projected Discharge Information

Season	Flow, MGD	Temp.	TDS mg/l	TDS tons/day
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Summer	0.30000	NA	3274.00	4.09495
Fall	0.30000	NA		
Winter	0.30000	NA		
Spring	0.30000	NA		

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

IX. 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 coincide with the environmental conditions expected at low stream flows.

Effluent Limitation for Flow based upon Water Quality Standards

In-stream criteria of downstream segments will be met with an effluent flow maximum value as follows:

Season	Daily Average	
Summer	0.300 MGD	0.464 cfs
Fall	0.300 MGD	0.464 cfs
Winter	0.300 MGD	0.464 cfs
Spring	0.300 MGD	0.464 cfs

Flow Requirement or Loading Requirement

The calculations in this wasteload analysis utilize the maximum effluent discharge flow of 0.3 MGD. If the discharger is allowed to have a flow greater than 0.3 MGD during 7Q10 conditions, and effluent limit concentrations as indicated, then water quality standards will be violated. In order to prevent this from occurring, the permit writers must include the discharge flow limitation as indicated above; or, include loading effluent limits in the permit.

Effluent Limitation for Whole Effluent Toxicity (WET) based upon WET Policy

Effluent Toxicity will not occur in downstream segments if the values below are met.

WET Requirements	LC50 > IC25 >	46.5% Effluent 12.2% Effluent	[Acute] [Chronic]				
				Chronic IC25 % Effluent	Acute LC50 % Effluent		
Season	Receiving Water Flow (cfs)	Effluent Flow (MGD)	Effluent Flow (cfs)	Combined Flow (cfs)	Totally Mixed		
Summer	4.00	0.3	0.5	4.5	NO	10.4%	0.6%
Fall	4.40	0.3	0.5	4.9	NO	9.5%	0.6%
Winter	2.00	0.3	0.5	2.5	NO	18.8%	1.1%
Spring	6.40	0.3	0.5	6.9	NO	6.8%	0.4%

Effluent Limitation for Biological Oxygen Demand (BOD) based upon Water Quality Standards or Regulations

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

Season	Concentration	
Summer	25.0 mg/l as BOD5	62.5 lbs/day
Fall	25.0 mg/l as BOD5	62.5 lbs/day
Winter	25.0 mg/l as BOD5	62.5 lbs/day
Spring	25.0 mg/l as BOD5	62.5 lbs/day

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

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

Season	Concentration
Summer	4.00
Fall	4.00
Winter	4.00
Spring	4.00

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:

Season		Concentration	Load
Summer	4 Day Avg. - Chronic	7.5 mg/l as N	18.8 lbs/day
	1 Hour Avg. - Acute	16.8 mg/l as N	42.0 lbs/day
Fall	4 Day Avg. - Chronic	12.7 mg/l as N	31.6 lbs/day
	1 Hour Avg. - Acute	26.0 mg/l as N	65.0 lbs/day
Winter	4 Day Avg. - Chronic	6.1 mg/l as N	15.2 lbs/day
	1 Hour Avg. - Acute	13.7 mg/l as N	34.2 lbs/day
Spring	4 Day Avg. - Chronic	9.8 mg/l as N	24.5 lbs/day
	1 Hour Avg. - Acute	21.2 mg/l as N	53.1 lbs/day

Acute limit calculated with an Acute Zone of Initial Dilution (ZID) to be equal to 50.0%.

Effluent Limitation for Total Residual Chlorine based upon Water Quality Standards

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

Season		Concentration	Load
Summer	4 Day Avg. - Chronic	0.083 mg/l	0.21 lbs/day
	1 Hour Avg. - Acute	0.084 mg/l	0.21 lbs/day
Fall	4 Day Avg. - Chronic	0.090 mg/l	0.22 lbs/day
	1 Hour Avg. - Acute	0.090 mg/l	0.23 lbs/day
Winter	4 Day Avg. - Chronic	0.047 mg/l	0.12 lbs/day
	1 Hour Avg. - Acute	0.051 mg/l	0.13 lbs/day
Spring	4 Day Avg. - Chronic	0.126 mg/l	0.00 lbs/day
	1 Hour Avg. - Acute	0.122 mg/l	0.00 lbs/day

Effluent Limitations for Total Dissolved Solids based upon Water Quality Standards

Season		Concentration	Load
Summer	Maximum, Acute	9025.9 mg/l	11.29 tons/day
Fall	Maximum, Acute	9317.4 mg/l	11.65 tons/day
Winter	Maximum, Acute	9161.9 mg/l	11.46 tons/day
Spring	4 Day Avg. - Chronic	9424.1 mg/l	11.79 tons/day

Colorado Salinity Forum Limits Determined by Permitting Section

Effluent Limitations for Total Recoverable Metals based upon Water Quality Standards

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In-stream criteria of downstream segments for Dissolved Metals will be met with an effluent limitation as follows (based upon a hardness of 219.45 mg/l):

	4 Day Average		1 Hour Average		Load
	Concentration	Load	Concentration	Load	
Aluminum	N/A	N/A	3,917.4	ug/l	11.8 lbs/day
Arsenic	1,432.17 ug/l	2.3 lbs/day	1,799.9	ug/l	5.4 lbs/day
Cadmium	9.92 ug/l	0.0 lbs/day	19.6	ug/l	0.1 lbs/day
Chromium III	1,556.33 ug/l	2.5 lbs/day	18,211.4	ug/l	54.7 lbs/day
Chromium VI	97.19 ug/l	0.2 lbs/day	80.6	ug/l	0.2 lbs/day
Copper	123.92 ug/l	0.2 lbs/day	130.0	ug/l	0.4 lbs/day
Iron	N/A	N/A	5,266.3	ug/l	15.8 lbs/day
Lead	70.30 ug/l	0.1 lbs/day	1,172.5	ug/l	3.5 lbs/day
Mercury	0.12 ug/l	0.0 lbs/day	12.7	ug/l	0.0 lbs/day
Nickel	941.07 ug/l	1.5 lbs/day	4,826.1	ug/l	14.5 lbs/day
Selenium	39.94 ug/l	0.1 lbs/day	104.0	ug/l	0.3 lbs/day
Silver	N/A	N/A	73.3	ug/l	0.2 lbs/day
Zinc	2,113.80 ug/l	3.4 lbs/day	1,173.5	ug/l	3.5 lbs/day
Cyanide (free)	50.02 ug/l	0.1 lbs/day	116.8	ug/l	0.4 lbs/day

Effluent Limitations for Heat/Temperature based upon Water Quality Standards

Summer	27.9 Deg. C.	82.2 Deg. F
Fall	14.4 Deg. C.	57.9 Deg. F
Winter	9.3 Deg. C.	48.8 Deg. F
Spring	24.2 Deg. C.	75.5 Deg. F

Effluent Targets for Pollution Indicators Based upon Water Quality Standards

In-stream criteria of downstream segments for Pollution Indicators will be met with an effluent limit as follows:

	1 Hour Average	
	Concentration	Loading
Gross Beta (pCi/l)	50.0 pCi/L	
BOD (mg/l)	5.0 mg/l	15.0 lbs/day
Nitrates as N	4.0 mg/l	12.0 lbs/day
Total Phosphorus as P	0.05 mg/l	0.2 lbs/day
Total Suspended Solids	90.0 mg/l	270.4 lbs/day

Note: Pollution indicator targets are for information purposes only.

Effluent Limitations for Protection of Human Health [Toxics Rule] Based upon Water Quality Standards (Most stringent of 1C or 3A & 3B as appropriate.)

In-stream criteria of downstream segments for Protection of Human Health [Toxics] will be met with an effluent limit as follows:

Metals	Maximum Concentration	
	Concentration	Load
Antimony	ug/l	lbs/day
Arsenic	ug/l	lbs/day
Asbestos	ug/l	lbs/day
Beryllium		
Cadmium		
Chromium (III)		
Chromium (VI)		

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Copper	ug/l	lbs/day
Cyanide	ug/l	lbs/day
Lead		
Mercury	ug/l	lbs/day
Nickel	ug/l	lbs/day
Selenium		
Silver		
Thallium	ug/l	lbs/day
Zinc		

**Metals Effluent Limitations for Protection of All Beneficial Uses
Based upon Water Quality Standards and Toxics Rule**

	Class 4 Acute Agricultural ug/l	Class 3 Acute Aquatic Wildlife ug/l	Acute Toxics Drinking Water Source ug/l	Acute Toxics Wildlife ug/l	1C Acute Health Criteria ug/l	Acute Most Stringent ug/l	Class 3 Chronic Aquatic Wildlife ug/l
Aluminum		3917.4				3917.4	N/A
Antimony				41361.0		41361.0	
Arsenic	961.9	1799.9			0.0	961.9	1432.2
Asbestos						0.00E+00	
Barium						0.0	
Beryllium						0.0	
Cadmium	91.9	19.6			0.0	19.6	9.9
Chromium (III)		18211.4			0.0	18211.4	1556.3
Chromium (VI)	940.3	80.6			0.0	80.64	97.19
Copper	1872.1	130.0				130.0	123.9
Cyanide		116.8	2116143.1			116.8	50.0
Iron		5266.3				5266.3	
Lead	949.0	1172.5			0.0	949.0	70.3
Mercury		12.74		1.44	0.0	1.44	0.115
Nickel		4826.1		44246.6		4826.1	941.1
Selenium	476.6	104.0			0.0	104.0	39.9
Silver		73.3			0.0	73.3	
Thallium				60.6		60.6	
Zinc		1173.5				1173.5	2113.8
Boron	6999.7					6999.7	

Summary Effluent Limitations for Metals [Wasteload Allocation, TMDL]

[If Acute is more stringent than Chronic, then the Chronic takes on the Acute value.]

	WLA Acute ug/l	WLA Chronic ug/l	
Aluminum	3917.4	N/A	
Antimony	41360.98		
Arsenic	961.9	1432.2	Acute Controls
Asbestos	0.00E+00		
Barium			
Beryllium			
Cadmium	19.6	9.9	
Chromium (III)	18211.4	1556	
Chromium (VI)	80.6	97.2	Acute Controls
Copper	130.0	123.9	
Cyanide	116.8	50.0	
Iron	5266.3		
Lead	949.0	70.3	
Mercury	1.443	0.115	
Nickel	4826.1	941	
Selenium	104.0	39.9	
Silver	73.3	N/A	
Thallium	60.6		
Zinc	1173.5	2113.8	Acute Controls

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Boron 6999.69

Other Effluent Limitations are based upon R317-1.
E. coli 126.0 organisms per 100 ml

X. Antidegradation Considerations

The Utah Antidegradation Policy allows for degradation of existing quality where it is determined that such lowering of water quality is necessary to accommodate important economic or social development in the area in which the waters are protected [R317-2-3]. It has been determined that certain chemical parameters introduced by this discharge will cause an increase of the concentration of said parameters in the receiving waters. Under no conditions will the increase in concentration be allowed to interfere with existing instream water uses.

The antidegradation rules and procedures allow for modification of effluent limits less than those based strictly upon mass balance equations utilizing 100% of the assimilative capacity of the receiving water. Additional factors include considerations for "Blue-ribbon" fisheries, special recreational areas, threatened and endangered species, and drinking water sources.

An Antidegradation Level I Review was conducted on this discharge and its effect on the receiving water. Based upon that review, it has been determined that an Antidegradation Level II Review is not required.

XI. Colorado River Salinity Forum Considerations

Discharges in the Colorado River Basin are required to have their discharge at a TDS loading of less than 1.00 tons/day unless certain exemptions apply. Refer to the Forum's Guidelines for additional information allowing for an exceedence of this value. This doesn't apply to facilities that do not discharge to the Colorado River Basin.

XII. 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.

XIII. Notice of UPDES Requirement

This Addendum to the Statement of Basis does not authorize any entity or party to discharge to the waters of the State of Utah. That authority is granted through a UPDES permit issued by the Utah Division of Water Quality. The numbers presented here may be changed as a function of other factors. Dischargers are strongly urged to contact the Permits Section for further information. Permit writers may utilize other information to adjust these limits and/or to determine other limits based upon best available technology and other considerations provided that the values in this wasteload analysis [TMDL] are not compromised. See special provisions in Utah Water Quality Standards for adjustments in the Total Dissolved Solids values based upon background concentration.

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801-538-6052
File Name: Centerfield_WLA_2022.xlsm

APPENDIX - Coefficients and Other Model Information

CBOD Coeff. (Kd)20 1/day 2.000	CBOD Coeff. FORCED (Kd)/day 0.000	CBOD Coeff. (Ka)T 1/day 1.887	REAER. Coeff. (Ka)20 (Ka)/day 94.213	REAER. Coeff. FORCED 1/day 0.000	REAER. Coeff. (Ka)T 1/day 91.435	NBOD Coeff. (Kn)20 1/day 0.250	NBOD Coeff. (Kn)T 1/day 0.227
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Open Coeff. (K4)20 1/day 0.000	Open Coeff. (K4)T 1/day 0.000	NH3 LOSS (K5)20 1/day 4.000	NH3 (K5)T 1/day 3.775	NO2+NO3 LOSS (K6)20 1/day 0.000	NO2+NO3 (K6)T 1/day 0.000	TRC Decay K(CI)20 1/day 32.000	TRC K(CI)(T) 1/day 29.732
BENTHIC DEMAND (SOD)20 gm/m2/day 1.000	BENTHIC DEMAND (SOD)T gm/m2/day 0.924						
K1 CBOD {theta} 1.0	K2 Reaer. {theta} 1.0	K3 NH3 {theta} 1.1	K4 Open {theta} 1.0	K5 NH3 Loss {theta} 1.0	K6 NO2+3 {theta} 1.0	K(CI) TRC {theta} 1.1	S Benthic {theta} 1.1

Antidegradation Review

An antidegradation review (ADR) was conducted to determine whether the proposed activity complies with the applicable antidegradation requirements for receiving waters that may be affected. The Level I ADR evaluated the criteria of R317-2-3.5(b) and determined that a Level II antidegradation Review is not required.