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

**Date:** **April 29, 2019** NvS

**Facility:** **Garland Wastewater Treatment Facility**
**Garland, UT**
**UPDES No. UT0026034**

**Receiving water:** **Malad River (2B, 3C)**

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: Malad River → Bear River

The maximum daily design discharge is 0.90 MGD and the maximum monthly design discharge is 0.45 MGD.

Receiving Water
The receiving water for Outfall 001 is the Malad River, which is tributary to Bear River, which drains to Bear River Bay of the Great Salt Lake.

Per UAC R317-2-13, the designated beneficial uses for Malad River and tributaries, from confluence with Bear River to state line are 2B and 3C.

- *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 3C - Protected for nongame fish and other aquatic life, 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 the Malad River in Garland, the 20th percentile of flow measurements from monitoring site 4902720 Malad River above Tremonton WWTP was calculated to estimate seasonal critical flow in the receiving water (Table 1).

**Table 1: Malad River critical low flow**

| Season | Flow (cfs) |
|---|---|
| Summer | 22.0 |
| Fall | 20.6 |
| Winter | 34.0 |
| Spring | 42.8 |

Total Maximum Daily Load (TMDL)

The immediate receiving water for Garland City's proposed discharge is the Malad River. Due to insufficient data, the Malad River was not assessed in the *Utah's 2016 Integrated Report* (DWQ).

The downstream receiving water, Bear River from Great Salt Lake to Malad River, was listed as impaired on the 2016 303(d) list for dissolved oxygen, total dissolved solids, and benthic macroinvertebrates. Refer to the Watershed Protection Section for the status of the Lower Bear River TMDL for dissolved oxygen.

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 mixing zone was not delineated as part of this WLA, but was assumed to remain within the maximum allowable mixing zone specified in the rule.

Parameters of Concern

The potential parameters of concern identified for the discharge and receiving waters were total suspended solids (TSS), dissolved oxygen (DO), $BOD_5$, total phosphorus (TP), total nitrogen (TN), total ammonia (TAM), and pH as determined in consultation with the UPDES Permit Writer.

Water Quality Modeling

A QUAL2Kw model of the Malad River downstream of the Tremonton WWTP was built and calibrated to synoptic survey data collected in August of 2011 by DWQ staff. The methods and results of the model calibration are summarized in the *QUAL2Kw Calibration Report for the Malad River* (DWQ 2019).

The calibrated model was extended approximately 5.5 kilometers upstream from the Tremonton WWTP to the Garland WWTP and continues downstream approximately 4.8 kilometers from the

Tremonton WWTP to the crossing at West 8800 North.

Receiving water quality data was obtained from monitoring site 4902720 Malad River above Tremonton WWTP. The average seasonal value was calculated for each constituent with available data in the receiving water.

The QUAL2Kw model was used for determining WQBELs related to eutrophication and low dissolved oxygen, including oxygen consumption associated with the nitrification of ammonia. Effluent concentrations were adjusted so that water quality standards were not exceeded in the receiving water.

The QUAL2Kw model was also used to determine the limits for ammonia. 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. QUAL2Kw rates, input and output are summarized in Appendix A.

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

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.

Whole Effluent Toxicity (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 |
|---|---|
| Summer | 3% |
| Fall | 3% |
| Winter | 2% |
| Spring | 2% |

Effluent Limits

Eutrophication and dissolved oxygen in the receiving water were evaluated using the QUAL2Kw model. Significant algal growth was predicted downstream of the WWTP during critical conditions; however, the DO was not predicted to go below the criteria for 3C waters with limits as specified in Table 3 for DO and Utah Secondary Treatment Standards for $BOD_5$.

**Table 3: Water Quality Based Effluent Limits Summary**

| Effluent Constituent | Acute | | | Chronic | | |
|---|---|---|---|---|---|---|
| | Standard | Limit | Averaging Period | Standard | Limit | Averaging Period |
| Flow (MGD) | | 0.90 | 1 day | | 0.45 | 30 days |
| Ammonia (mg/L)[1] | | | | | | |
| Summer | | 12 | | | 1.0 | |
| Fall | Varies | 17 | 1 hour | Varies | 2.5 | 30 days |
| Winter | | 25 | | | 15 | |
| Spring | | 30 | | | 15 | |
| Min. Dissolved Oxygen (mg/L)[2] | 3.0 | 5.0 | Instantaneous | 5.0 | 5.0 | 30 days |
| $BOD_5$ (mg/L)[2] | None | 35 | 7 days | None | 25 | 30 days |

1: Limits due to toxicity criteria.
2: Limits based on Utah Secondary Treatment Standards (*UAC R317-1-3.2*).

## 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.

Since Garland WWTP is a new discharge and the pollutant concentration and load are increasing to the receiving water, a Level II Antidegradation Review (ADR) is required.

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Watershed Protection Section

## Documents:

WLA Document: *garland_potw_wla_2019-04-29.docx*
QUAL2Kw Wasteload Model: *garland_potw_wla_2016.xlsm*

## References:

*Lower Bear River Watershed Restoration Action Strategy*. 2002. Utah Division of Water Quality

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

*Field Data Collection for QUAL2Kw Model Build and Calibration Standard Operating Procedures Version 1.0*. 2012. Utah Division of Water Quality.

*Using QUAL2K Modeling to Support Nutrient Criteria Development and Wasteload Analyses in Utah*. 2013. Neilson, B.T., A.J. Hobson, N. von Stackelberg, M. Shupryt, and J.D. Ostermiller.

*Utah's 2016 Final Integrated Report*. 2016. Utah Division of Water Quality.

*QUAL2Kw Calibration Report for the Malad River*. 2019. Utah Division of Water Quality.

**WASTELOAD ANALYSIS [WLA]** Date: 7/12/2016
**Appendix A: QUAL2Kw Analysis Results**

| | | | |
|---|---|---|---|
| Discharging Facility: | Garland WWTP | | |
| UPDES No: | New | | |
| Permit Flow [MGD]: | 0.90 | Max. Daily | |
| | 0.45 | Max. Monthly Average | |
| Receiving Water: | Malad River | | |
| Stream Classification: | 2B, 3C | | |
| Stream Flows [cfs]: | 22.00 | Summer (July-Sept) | Critical Low Flow |
| | 20.60 | Fall (Oct-Dec) | |
| | 34.04 | Winter (Jan-Mar) | |
| | 42.80 | Spring (Apr-June) | |
| Instantaneously Fully Mixed: | No | | |
| Acute River Width: | 50% | | |
| Chronic River Width: | 100% | | |

**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/Upstream Information | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 22.0 | 20.6 | 34.0 | 42.8 |
| Temperature (deg C) | 21.2 | 9.9 | 2.7 | 14.2 |
| Specific Conductance (µmhos) | 4,664 | 4,360 | 3,695 | 4,207 |
| Inorganic Suspended Solids (mg/L) | 80.5 | 43.6 | 31.2 | 85.6 |
| Dissolved Oxygen (mg/L) | 8.1 | 11.1 | 11.4 | 9.2 |
| Dissolved Oxygen Diel Range (mg/L) | 3.3 | 2.0 | 2.0 | 2.0 |
| $CBOD_5$ (mg/L) | 3.8 | 2.3 | 1.8 | 4.0 |
| Organic Nitrogen (mg/L) | 1.867 | 1.867 | 1.867 | 1.867 |
| NH4-Nitrogen (mg/L) | 0.052 | 0.055 | 0.049 | 0.098 |
| NO3-Nitrogen (mg/L) | 2.392 | 1.342 | 1.153 | 1.730 |
| Organic Phosphorus (mg/L) | 0.076 | 0.030 | 0.059 | 0.109 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.017 | 0.021 | 0.038 | 0.028 |
| Phytoplankton (µg/L) | 35.0 | 35.0 | 35.0 | 35.0 |
| Detritus [POM] (mg/L) | 16.6 | 7.4 | 4.3 | 17.9 |
| Alkalinity (mg/L) | 363 | 363 | 363 | 363 |
| pH | 8.2 | 8.2 | 8.2 | 8.2 |

| Tremonton WWTP Information | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 1.8 | 1.2 | 1.4 | 1.7 |
| Temperature (deg C) | 19.9 | 15.5 | 10.7 | 14.6 |
| Specific Conductance (µmhos) | 1,476 | 1,532 | 1,486 | 1,444 |
| Inorganic Suspended Solids (mg/L) | 4.5 | 4.5 | 11.2 | 5.1 |
| Dissolved Oxygen (mg/L) | 6.7 | 7.4 | 7.8 | 7.2 |
| $CBOD_5$ (mg/L) | 8.1 | 6.3 | 16.2 | 5.1 |
| Organic Nitrogen (mg/L) | 3.170 | 3.170 | 3.170 | 3.170 |
| NH4-Nitrogen (mg/L) | 1.755 | 5.378 | 5.117 | 5.153 |
| NO3-Nitrogen (mg/L) | 2.007 | 2.020 | 2.635 | 4.147 |
| Organic Phosphorus (mg/L) | 1.436 | 1.523 | 1.565 | 1.495 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.479 | 0.508 | 0.522 | 0.498 |
| Phytoplankton (µg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Detritus [POM] (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Alkalinity (mg/L) | 383 | 383 | 383 | 383 |
| pH | 7.8 | 7.7 | 7.6 | 7.7 |

| Discharge Information<br>Acute | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 0.9 | 0.9 | 0.9 | 0.9 |
| Temperature (deg C) | 19.9 | 15.5 | 10.7 | 14.6 |
| Specific Conductance (µmhos) | 1,476 | 1,532 | 1,486 | 1,444 |
| Inorganic Suspended Solids (mg/L) | 15.0 | 15.0 | 15.0 | 15.0 |
| 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) | 2.200 | 2.200 | 2.200 | 2.200 |
| NH4-Nitrogen (mg/L) | 12.000 | 17.000 | 25.000 | 30.000 |
| NO3-Nitrogen (mg/L) | 5.000 | 5.000 | 5.000 | 5.000 |
| Organic Phosphorus (mg/L) | 0.750 | 0.750 | 0.750 | 0.750 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.250 | 0.250 | 0.250 | 0.250 |
| Phytoplankton (µg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Detritus [POM] (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Alkalinity (mg/L) | 383 | 383 | 383 | 383 |
| pH | 8.1 | 8.1 | 8.1 | 8.1 |

| Chronic | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 0.45 | 0.45 | 0.45 | 0.45 |
| Temperature (deg C) | 19.9 | 15.5 | 10.7 | 14.6 |
| Specific Conductance (µmhos) | 1,476 | 1,532 | 1,486 | 1,444 |
| Inorganic Suspended Solids (mg/L) | 15.0 | 15.0 | 15.0 | 15.0 |
| 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) | 2.200 | 2.200 | 2.200 | 2.200 |
| NH4-Nitrogen (mg/L) | 1.000 | 2.500 | 15.000 | 15.000 |
| NO3-Nitrogen (mg/L) | 5.000 | 5.000 | 5.000 | 5.000 |
| Organic Phosphorus (mg/L) | 0.750 | 0.750 | 0.750 | 0.750 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.250 | 0.250 | 0.250 | 0.250 |
| Phytoplankton (µg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Detritus [POM] (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Alkalinity (mg/L) | 383 | 383 | 383 | 383 |
| pH | 7.6 | 7.6 | 7.6 | 7.6 |

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 Secondary Standards**

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD5 limitation as follows:

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

**Effluent Limitation for Dissolved Oxygen (DO) based upon Secondary 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 | 5.0 | 5.0 | mg/L |
| Winter | 5.0 | 5.0 | mg/L |
| Spring | 5.0 | 5.0 | 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:

| | Total Ammonia | | |
|---|---|---|---|
| **Season** | **Chronic** | **Acute** | |
| Summer | 1.0 | 12.0 | mg/L as N |
| Fall | 2.5 | 17.0 | mg/L as N |
| Winter | 15.0 | 25.0 | mg/L as N |
| Spring | 15.0 | 30.0 | 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 | Churchill | |
| 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 | 0.103 | /d |
| Temp correction | 1.047 | |
| *Fast CBOD:* | | |
| Oxidation rate | 10 | /d |
| Temp correction | 1.047 | |
| *Organic N:* | | |
| Hydrolysis | 0.2903475 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.242158 | m/d |
| *Ammonium:* | | |
| Nitrification | 0.2693435 | /d |
| Temp correction | 1.07 | |
| *Nitrate:* | | |
| Denitrification | 1.6900865 | /d |
| Temp correction | 1.07 | |
| Sed denitrification transfer coeff | 0.21487 | m/d |
| Temp correction | 1.07 | |
| *Organic P:* | | |
| Hydrolysis | 0.228215 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.05548 | m/d |
| *Inorganic P:* | | |
| Settling velocity | 0.85204 | m/d |
| Sed P oxygen attenuation half sat constant | 1.98778 | mgO2/L |

| | | |
|---|---|---|
| *Phytoplankton:* | | |
| Max Growth rate | 2.8944 | /d |
| Temp correction | 1.07 | |
| Respiration rate | 0.480803 | /d |
| Temp correction | 1.07 | |
| Death rate | 0.86518 | /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 | 25.4151 | ugN/L |
| Settling velocity | 0.05 | m/d |
| *Bottom Plants:* | | |
| Growth model | Zero-order | |
| Max Growth rate | 72.858765 | gD/m2/d or /d |
| Temp correction | 1.07 | |
| First-order model carrying capacity | 100 | gD/m2 |
| Basal respiration rate | 0.1996688 | /d |
| Photo-respiration rate parameter | 0.01 | unitless |
| Temp correction | 1.07 | |
| Excretion rate | 0.225035 | /d |
| Temp correction | 1.07 | |
| Death rate | 1.1864 | /d |
| Temp correction | 1.07 | |
| External nitrogen half sat constant | 424.656 | ugN/L |
| External phosphorus half sat constant | 63.89725 | ugP/L |
| Inorganic carbon half sat constant | 3.89E-05 | moles/L |
| Bottom algae use HCO3- as substrate | Yes | |
| Light model | Smith | |
| Light constant | 93.4186 | mgO^2/L |
| Ammonia preference | 19.602 | ugN/L |
| Subsistence quota for nitrogen | 0.3791592 | mgN/gD |
| Subsistence quota for phosphorus | 0.1186205 | mgP/gD |
| Maximum uptake rate for nitrogen | 1474.3665 | mgN/gD/d |
| Maximum uptake rate for phosphorus | 111.866 | mgP/gD/d |
| Internal nitrogen half sat ratio | 3.167674 | |
| Internal phosphorus half sat ratio | 2.9784295 | |
| Nitrogen uptake water column fraction | 1 | |
| Phosphorus uptake water column fraction | 1 | |
| *Detritus (POM):* | | |
| Dissolution rate | 0.168998 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.206573 | m/d |
| *pH:* | | |
| Partial pressure of carbon dioxide | 370 | ppm |

| Atmospheric Inputs: | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Max. Air Temperature, F | 89.1 | 47.7 | 38.8 | 70.4 |
| Min. Air Temperature, F | 58.6 | 26.6 | 20.7 | 44.2 |
| Dew Point, Temp., F | 57.2 | 34.0 | 28.6 | 47.3 |
| Wind, ft./sec. @ 21 ft. | 7.7 | 6.1 | 6.2 | 7.8 |
| Cloud Cover, % | 0.1 | 0.1 | 0.1 | 0.1 |

| Other Inputs: | | |
|---|---|---|
| Bottom Algae Coverage | 10.0% | |
| Bottom SOD Coverage | 100.0% | |
| Prescribed SOD | 0.0 | gO2/m2/d |

**WASTELOAD ANALYSIS [WLA]** Date: 7/12/2016

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

| | | | |
|---|---|---|---|
| Discharging Facility: | Garland WWTP | | |
| UPDES No: | New | | |
| Permit Flow [MGD]: | 0.45 | Maximum Monthly Flow | |
| | 0.90 | Maximum Daily Flow | |
| Receiving Water: | Malad River | | |
| Stream Classification: | 2B, 3C | | |
| Stream Flows [cfs]: | 22.0 | Summer (July-Sept) | Critical Low Flow |
| | 20.6 | Fall (Oct-Dec) | |
| | 34.0 | Winter (Jan-Mar) | |
| | 42.8 | Spring (Apr-June) | |
| Instantaneously 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**

| | Malad River |
|---|---|
| | cfs |
| Chronic | 20.6 |
| Acute | 10.3 |

**Effluent Information**

| | Flow |
|---|---|
| | MGD |
| Maximum Monthly | 0.45 |
| Maximum Daily | 0.90 |

**Mixed Information**

| | Flow |
|---|---|
| | cfs |
| Chronic | 21.3 |
| Acute | 11.7 |

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)

| Physical Parameter | Maximum Concentration |
|---|---|
| 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 3C Waters)

| Physical Parameter | Maximum Concentration |
|---|---|
| Temperature (deg C) | 27 |
| Temperature Change (deg C) | 4 |

| Inorganics Parameter | Maximum Concentration Standard |
|---|---|
| Phenol (mg/L) | 0.010 |
| Hydrogen Sulfide (Undissociated) [m | 0.002 |

| Metals (µg/L) | Dissolved | | | Total Recoverable | |
|---|---|---|---|---|---|
| Chronic Standard (4 Day Average)[1] | Standard | Background | Limit | Conversion Factor | Limit |
| Aluminum | N/A | 15.0 | N/A | 1.000 | N/A |
| Arsenic | 150.0 | 22.0 | 6,092 | 1.000 | 6,092 |
| Cadmium | 0.6 | 0.5 | 7.6 | 0.851 | 8.9 |
| Chromium VI | 11.0 | 5.6 | 264 | 1.000 | 264 |
| Chromium III | 230.7 | 5.6 | 10,660 | 0.860 | 12,395 |
| Copper | 29.3 | 6.0 | 1,111 | 0.960 | 1,157 |
| Cyanide[2] | 5.2 | 3.5 | 87 | 1.000 | 87 |
| Lead | 10.9 | 1.5 | 449 | 0.589 | 763 |
| Mercury[2] | 0.012 | 0.008 | 0.200 | 1.000 | 0.200 |
| Nickel | 168.0 | 5.0 | 7,723 | 0.997 | 7,747 |
| Selenium | 4.6 | 3.3 | 66.6 | 1.000 | 66.6 |
| Tributylin[2] | 0.072 | 0.048 | 1.199 | 1.000 | 1.199 |
| Zinc | 382.4 | 19.3 | 17,214 | 0.986 | 17,458 |

1: Based upon a Hardness of 400 mg/l as CaCO3

2: Background concentration assumed 67% of chronic standard

3: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as $CaC0_3$ in the receiving water after mixing, the 87 ug/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 ug/L acute aluminum criterion (expressed as total recoverable).

| Metals (µg/L) | Dissolved | | | Total Recoverable | |
|---|---|---|---|---|---|
| | Acute Standard (1 Hour Average)[1] | Standard | Background[2] | Limit | Conversion Factor | Limit |
| Aluminum | 750.0 | 15.0 | 19,144 | 1.000 | 19,144 |
| Arsenic | 340.0 | 22.0 | 8,331 | 1.000 | 8,331 |
| Cadmium | 7.7 | 0.5 | 190 | 0.886 | 214 |
| Chromium VI | 7.7 | 5.6 | 72.8 | 1.000 | 72.8 |
| Chromium III | 16.0 | 5.6 | 288 | 0.316 | 910 |
| Copper | 49.6 | 6.0 | 1,152 | 0.960 | 1,200 |
| Cyanide[2] | 22.0 | 3.5 | 492 | 1.000 | 492 |
| Iron | 1000.0 | 47.0 | 24,908 | 1.000 | 24,908 |
| Lead | 280.8 | 1.5 | 7,263 | 0.589 | 12,331 |
| Mercury[2] | 2.400 | 0.0 | 62.2 | 1.000 | 62.2 |
| Nickel | 1512.9 | 5.0 | 39,195 | 0.998 | 39,274 |
| Selenium | 18.4 | 3.3 | 403 | 1.000 | 403 |
| Silver | 34.9 | 1.0 | 884 | 0.850 | 1,040 |
| Tributylin[2] | 0.460 | 0.048 | 10.8 | 1.000 | 10.8 |
| Zinc | 379.3 | 19.3 | 9,414 | 0.978 | 9,625 |

1: Based upon a Hardness of 50 mg/l as CaCO3

2: Background concentration assumed 67% of chronic standard

| Organics [Pesticides] (µg/L) | Chronic Standard (4 Day Average) | | | Acute Standard (1 Hour Average) | | |
|---|---|---|---|---|---|---|
| Parameter | Standard | Background[1] | Limit | Standard | Background[1] | Limit |
| Acrolein | 3.0 | 2.0 | 50.0 | 3.0 | 2.0 | 31.9 |
| Aldrin | | | | 1.5 | 1.0 | 16.0 |
| Chlordane | 0.0043 | 0.0029 | 0.0716 | 1.2 | 0.0 | 31.1 |
| DDT, DDE | 0.001 | 0.001 | 0.017 | 0.55 | 0.00 | 14.3 |
| Diazinon | 0.17 | 0.11 | 2.83 | 0.17 | 0.11 | 1.81 |
| Dieldrin | 0.0056 | 0.0038 | 0.0933 | 0.24 | 0.00 | 6.15 |
| Endosulfan, a & b | 0.056 | 0.038 | 0.933 | 0.11 | 0.04 | 2.00 |
| Endrin | 0.036 | 0.024 | 0.600 | 0.086 | 0.024 | 1.68 |
| Heptachlor & H. epoxide | 0.0038 | 0.0025 | 0.0633 | 0.26 | 0.00 | 6.70 |
| Lindane | 0.08 | 0.05 | 1.33 | 1.0 | 0.1 | 24.8 |
| Methoxychlor (Maximum) | | | | 0.03 | 0.02 | 0.32 |
| Mirex (Maximum) | | | | 0.001 | 0.001 | 0.011 |
| Nonylphenol | 6.6 | 4.4 | 110 | 28.0 | 4.4 | 626 |
| Parathion | 0.0130 | 0.0087 | 0.2165 | 0.066 | 0.009 | 1.52 |
| PCB's | 0.014 | 0.009 | 0.233 | | | |
| Pentachlorophenol | 15.0 | 10.1 | 250 | 19.0 | 10.1 | 264 |
| Toxephene | 0.0002 | 0.0001 | 0.0033 | 0.73 | 0.00 | 19.0 |

1: Background concentration assumed 67% of chronic standard

| Radiological | Maximum Concentration | | |
|---|---|---|---|
| Parameter | Standard | Background[1] | Limit |
| Gross Alpha (pCi/L) | 15 | 10.1 | 159.7 |

1: Background concentration assumed 67% of chronic standard; TDS is based on observed ambient data