State of Utah

Subject: Kennecott Utah Copper 2021 Permit Renewal Fact Sheet Statement of Basis, Level I and II antidegradation reviews for Outfalls 004, 008, and 012.

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Summary: The primary purposes of this evaluation is to protect the uses of the receiving water and to determine if the permit must include water quality-based effluent limits for Outfalls 004, 008, and 012. Based on the information provided by Kennecott Utah Copper (KUC) regarding pollutant concentrations in the effluents in the application, the uses designated in R317-2-12 and existing and designated uses of the receiving waters (Class 5E Transitional Waters→Class 5A Gilbert Bay, Great Salt Lake) will be protected.

Receiving Waters and Designated Uses (UAC R317-2-6):

C-7 Ditch

Class 3E severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic life.

Transitional Waters

Class 5E protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain

Gilbert Bay, Great Salt Lake

Class 5A protected for frequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain

Introduction

KUC has several outfalls. Great Salt Lake is the ultimate or immediate receiving water for three of these outfalls: 004, 008, and 012. The Level I anti-degradation reviews (protection of existing uses) for these outfalls were conducted in accordance with the Utah Division of Water Quality (DWQ) *Interim Methods for Evaluating Use Support for Great Salt Lake Utah Pollution Discharge Elimination System (UPDES) Permits* (v. 1.0 January 4, 2016). These methods apply to discharges that are not required to meet Class 3 freshwater numeric aquatic life use criteria prior to discharging to Great Salt Lake. The Level II anti-degradation review is based on the requirements of UAC R317-2-3. The whole effluent toxicity (WET) requirements are based on the *Utah Pollutant Discharge Elimination System Permit and Enforcement Guidance Document for Whole Effluent Toxicity* (DWQ, February, 2018).

Outfall 004. Outfall 004 discharges to the Class 5E Transitional Waters and thence to Great Salt Lake via a culvert beneath I-80.

Class 5E Transitional Waters→Class 5A Gilbert Bay, Great Salt Lake

Outfall 008. Outfall 008 discharges to the C-7 Ditch to the Class 5E Transitional Waters thence to Great Salt Lake. Outfall 008 did not discharge during the last permit cycle.

Class 3E C-7 Ditch→Class 5E Transitional Waters→Class 5A Gilbert Bay, Great Salt Lake

Outfall 012. Outfall 012 discharges to the Class 5E Transitional Waters and thence to Great Salt Lake via a culvert beneath I-80.

Class 5E Transitional Waters→Class 5A Gilbert Bay, Great Salt Lake

The Transitional Waters are mudflats where the discharges create a channel to Gilbert Bay. For Outfall 012, the channel appears to discharge some groundwater as well based on the presence of flow when outfall discharges were absent. The Transitional Waters only exist when GSL is below an elevation of 4208 feet and Lake elevations are currently less than 4192 feet. The Outfall 012 delta in the Transitional Waters currently exceeds one mile.

Outfall 001 from the Jordan Valley Water Conservancy District Southwest Groundwater Treatment Plant (Jordan Valley, UT0025836) discharges next to KUC outfall 012. The effluents from the two outfalls comingle in the Transitional Waters when both are discharging. In general, the Jordan Valley outfall is a continuous discharge whereas the RTKC discharge is intermittent and seasonal.

Level I Antidegradation Review and Use Support Evaluation

KUC provided supplemental information in support of the previous permit renewal application dated April 29, 2014 [DWQ-2014-006141] and October 31, 2014 [DWQ-2014-014376]. The information was used to determine if water quality-based effluent limits were required. Water quality-based effluent limits are required when the effluent has "reasonable potential" to cause or contribute to a violation of a water quality standard. The standard may be a numeric criterion or the Narrative Standards (UAC R317-2-7.2). Final permit limits are the lower of water quality-based effluent limits or technology-based effluent limits such as secondary treatment standards or categorical limits.

For this renewal, the effluent concentrations measured over the current permit cycle were evaluated. Outfall 008 did not discharge during the previous permit cycle.

The effluent concentrations for Outfalls 004 and 012 were initially compared to Class 3D numeric criteria using DWQ's reasonable potential process and then compared to the effluent concentrations previously evaluated. The reasonable potential process calculates a maximum expected effluent concentration which is screened against Class 3D criteria. Table 1 summarizes the comparisons of effluent concentrations to the previous permit. As shown in Table 1, effluent concentrations remain similar to the previously evaluated concentrations. New toxicity information for brine shrimp for arsenic, copper, lead, and zinc was added to evaluations. In short term toxicity tests, brine shrimp were demonstrated to be more sensitive to these metals than brine flies. Therefore, if brine shrimp are protected, brine flies will be protected. The data collected for the Class 5E Joint Discharge Area Transitional Waters Monitoring Program are also evaluated.

Table 1. Comparisons of effluent concentrations evaluated for 2017 Permit and 2021 Renewals

Pollutant	**2017 Permit**		**Outfall 012 2021**		**Outfall 004 2021**	
	Maximum	**Average**	**Maximum**	**Maximum 30-day average**	**Maximum**	**Maximum 30-day average**
Arsenic	0.056	0.030	0.079	0.022	0.2	0.2
Cadmium	0.007	0.005	0.004	0.003	0.001	0.001
Copper	0.055	0.032	0.096	0.059	0.03	0.03
Lead	<0.005	<0.005	0.006	<0.005	0.005	0.005
Mercury	<0.0002	<0.0002	0.000025	0.0000035[1]	<0.001	<0.001
Zinc	0.030	0.017	0.069	0.023	0.025	0.025
Selenium			0.018		0.007	0.007
All units mg/l [1]The 2021 averages were calculated using the analytical reporting limit for concentrations less than the reporting limit (nondetect)						

Arsenic

Outfall 004 does not have reasonable potential for arsenic. Arsenic effluent concentrations initially indicate reasonable potential because the concentrations exceed the Class 3D comparison value of 0.15 mg/l and ambient concentrations in Gilbert Bay. The maximum 30-day average effluent concentration was 0.073 mg/l. The no-effects concentration of 8 mg/l reported by Brix et al. (2003) for arsenic is substantially higher than the effluent concentrations and arsenic is concluded to not have reasonable potential. These findings are further supported by recent chronic toxicity testing conducted by TRE Environmental Solutions (TRE). TRE (2020a) reports an IC20 (inhibitory concentration for 20 percent of the tested organisms) for growth was 19.4 mg/l.

Outfall 012 does not have reasonable potential for arsenic. The maximum expected effluent concentration is less than the Class 3D comparison value of 0.15 mg/l and ambient concentrations in Gilbert Bay.

Cadmium

Outfall 004 does not have reasonable potential for cadmium. Cadmium concentrations initially indicate reasonable potential because the maximum expected effluent concentration could exceed the Class 3D comparison. However, effluent cadmium concentrations were lower than previously evaluated and lower than the EC_{50} concentrations for brine shrimp reported by Brix et al. (2006). The EC_{50} is higher than a no-effects concentration but there are over 4 orders of magnitude between the effluent concentrations and the EC_{50} of 11.7 mg/l. Effluent cadmium concentrations were below detectable concentrations in most of the effluent samples collected during the last permit cycle.

Outfall 012 does not have reasonable potential for cadmium. The maximum expected effluent concentration did not indicate reasonable potential and concentrations were lower than previously concluded to not have reasonable potential based on comparisons of effluent concentrations to the results of toxicity tests (Brix et al. 2006). The EC_{50} concentration of 11.7 mg/l reported by Brix et al. (2006) is orders of magnitude higher than the effluent concentrations.

Copper

Outfall 004 does not have reasonable potential for copper. Copper concentrations initially indicate reasonable potential because the effluent concentrations exceed the Class 3D comparison value of 0.030 mg/l. Copper concentrations were similar to the concentrations concluded to not have reasonable potential for the previous permit. No reasonable potential is concluded because effluent concentrations are lower than the effects levels for brine shrimp reproduction toxicity tests conducted by Brix et al. (2006).

Outfall 012 does not have reasonable potential for copper. Copper concentrations initially indicate reasonable potential because the effluent concentrations exceed the Class 3D comparison value of 0.030 mg/l and were higher than observed for the previous permit. The maximum 30-day concentration was 0.059 mg/l (Table 1). As documented in April 29, 2014 KUC submittal (DWQ-2014-006141), Brix et al. (2006) reported that the median effective concentration[1] (EC_{50}) for effects on brine shrimp reproduction was 0.068 mg/l (dissolved)[2]. To protect against chronic effects on reproduction, an estimate of the no-observed-effects concentration or EC_{20} as opposed to an EC_{50} was derived by KUC.. KUC obtained the raw data from Brix and calculated an EC_{20} of 0.059 mg/l (dissolved).

Applying the default conversion factor from dissolved to total copper specified in UAC R317-2-14, the no-effects concentration for total recoverable copper concentration is 0.061 mg/l. This conversion factor appears to be conservative based on the data reported in Adams et al. (2015). Adams et al. (2015) reported a median Cu translator of 0.79, based on dissolved and total recoverable Cu concentrations in Great Salt Lake water samples. The median is assumed to be a reasonable estimate of the geometric mean recommended for translators by EPA. Applying the translator of 0.79 results in a total recoverable copper concentration of 0.079 mg/l before mixing.

Brine shrimp are not expected to inhabit the Class 5E Transitional Waters, so a dilution of 1.5 was calculated based on discharging to Class 5A Gilbert Bay in accordance with the mixing zone requirements of UAC R317-2-5 (May 5, 2015 Mixing Analysis Outfall Ditch to Great Salt Lake DWQ-2015-016387). Applying the dilution to the 0.079 mg/l results in a maximum allowable average effluent concentration of 0.118 mg/l (total recoverable). The maximum 30-day average copper concentration was 0.059 mg/l and copper concentrations are concluded to not have reasonable potential. These findings are further supported by recent chronic testing conducted by TRE on brine shrimp. TRE (2020b) report that the IC_{20} for growth was 0.74 mg/l total recoverable copper.

[1] Concentration at which 50% of the test population was affected

[2] RTKC reports the copper EC_{50} as 69 µg/l in the April 29, 2014 RTKC Submittal but Brix et al. (2006) reports 68 µg/l.

Mercury

Outfall 004 does not have reasonable potential for mercury. Mercury was not detected in the effluent.

Outfall 012 does not have reasonable potential for mercury. Mercury concentrations in the effluent were measured using a more sensitive analytical method during this permit cycle. The maximum expected concentration was less than the Class 3D screening criteria. With one exception, mercury concentrations were less than the comparison value of 0.000012 mg/l (UAC R317-2-14) used to screen for reasonable potential.

Selenium and mercury are potentially bioaccumulative pollutants in RTKC's effluent and are also expected to be in the effluent from Jordan Valley. The two outfalls comingle in a common drainage in the Class 5E Transitional Waters when both are discharging. The potential impacts of the combined effluents were considered for these two potentially bioaccumulative pollutants.

An organic form of mercury, methylmercury (MeHg), is present in Gilbert Bay's water and biota. MeHg has the greater potential for impairing the uses compared to other forms of Hg found in the environment because of greater toxicity and biotransfer potential. The reader is cautioned to discern between MeHg and mercury in the following discussions.

Translators are necessary to determine reasonable potential for bioaccumulative compounds. Translators are simple mathematical models of complex processes. Translators are used to estimate the concentration of a pollutant in one media, for instance, brine shrimp, from the concentration in a different media, for instance, water. When mercury is released to the receiving waters, a portion of the mercury is expected to be methylated by indigenous bacteria (mercury to MeHg translator). A portion of this MeHg is taken up by the lower life forms such as invertebrates and a portion of this MeHg is transferred higher in the food web to other biota (MeHg in water to the lower and higher food web receptors).

Beginning in 2011, monitoring of invertebrates, bird eggs, water and sediment in the transitional and open waters. The results of this monitoring are available in the annual Joint Discharge Area Transitional Monitoring Program reports required by the permit. The organism concentrations reported remain relatively low and based on these data, mercury is concluded to not have reasonable potential.

Selenium

Outfall 004 does not have reasonable potential for selenium in the Transitional Waters. Effluent concentrations of 0.007 mg/l exceed the comparison value of 0.046 mg/l. The higher effluent concentrations evaluated by the Transitional Waters Monitoring Program for Outfall 012 collected prior to Jordan Valley discharging in 2017 (only KUC discharged) support that the concentrations and frequency of discharges from Outfall 004 are unlikely to adversely affect the aquatic life. To ensure continued protection for Gilbert Bay, the contributions of selenium from Outfall 004 are included in the annual loading limit of 900 kg/yr currently applicable to Outfall 012 only.

Outfall 008 does not have reasonable potential for selenium in the Transitional Waters because the maximum expected concentration was less than the Class 3D screening criteria. To ensure continued protection for Gilbert Bay, the contributions of selenium from Outfall 008 are included in the annual loading limit of 900 kg/yr currently applicable to Outfall 012 only.

Outfall 012 does have reasonable potential for the Gilbert Bay and the Transitional Waters and the water quality-based effluent is 0.054 mg/l and an annual loading limit of 900 kg/yr. Selenium concentrations in the effluent exceed the Class 3D comparison value of 0.046 mg/l. The water quality standard for Gilbert Bay for selenium standard is 12.5 mg/kg dw in bird eggs. However, no translator is available to reliably predict the water concentrations that correspond to a bird egg concentration of 12.5 mg/kg dw. Hence the continued reliance on monitoring and other comparison values. Ackerman et al. (2015) reported the selenium and mercury concentrations for over 1,000 eggs collected from Great Salt Lake. These results in addition to the annual egg samples collected by DWQ support that the selenium standard continues to be met in the open waters of Gilbert Bay. Figure 1 shows the selenium concentrations by DWQ for eggs collected from Gilbert Bay. DWQ's data show that egg concentrations and water concentrations (data not shown, <0.001mg/l) remain stable.

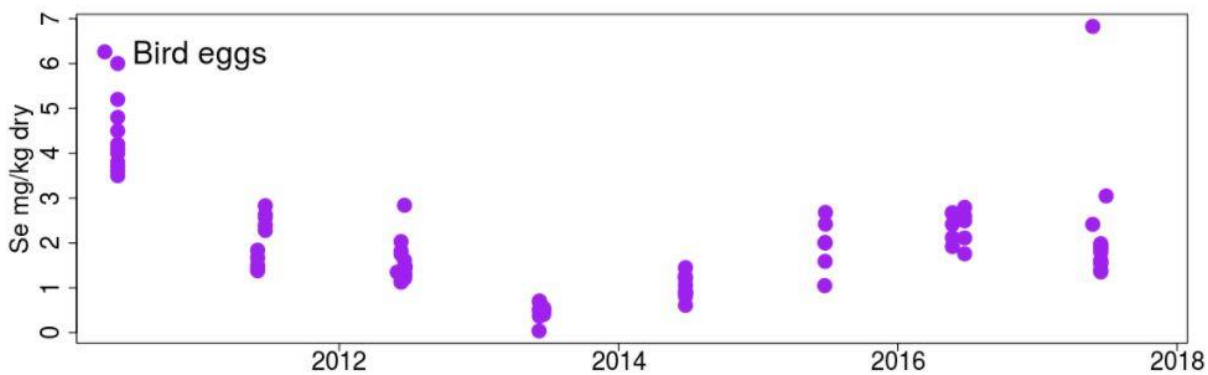

Figure 1. Gilbert Bay egg concentrations of selenium measured by DWQ

As required by the Transitional Waters Monitoring Program in the permit, KUC collected and analyzed samples of bird eggs, invertebrates, fish, and water from the outfall delta and Great Salt Lake. Monitoring data are available for every year since 2011. The results are annually submitted to DWQ.

The permit includes required actions (triggers) based on the geometric mean selenium concentration of selenium from at least 5 eggs. Requirements for calculating the geometric mean of egg concentrations from at least 5 eggs were clarified for this permit. As shown on Figure 2, the 5-egg minimum was met only in 2017. One to 4 eggs were collected in 2015, 2016, 2019, and 2020 and no eggs in other years.

Birds were observed in the delta every year. Figure 3 shows the number of birds observed each year and the days of discharge. Bird use appears to be correlated with the availability of water from effluent discharges in the delta. Jordan Valley is typically a continuous discharge and commenced discharging to the delta in 2017. KUC discharged continuously during the 2015 monitoring period and intermittently or not at all for the other years. Although birds were present every year, nesting was not always observed. Eggs could not be collected the years that no nesting was observed. Other factors preventing eggs from being collected include predation and seiche events resulting in flooding.

In 2019 and 2020, individual eggs exceeded 9.8 mg/kg dw. The permit requires that any results that exceed 9.8 mg/kg be reported to DWQ immediately. In 2020 and 2021, Jordan Valley voluntarily implemented operational changes to reduce bird exposures to selenium in the Delta. Preliminary reports by Jordan Valley for 2021 were that no eggs were available.

Figure 4 shows the geomean concentrations for invertebrates, fish and eggs for each year when more than one egg could be collected. The observed correlations between selenium concentrations in bird forage (e.g., invertebrates) and bird eggs are expected if sampled food items are representative of the bird diets. The other measurements of biota, water, and sediment are intended to help interpret the egg observations. Figure 5 shows the geometric mean concentrations of selenium measured in invertebrates. As the relationships between selenium concentrations and eggs are developed, the invertebrate concentrations may be useful for inferring egg concentrations for years when eggs could not be collected.

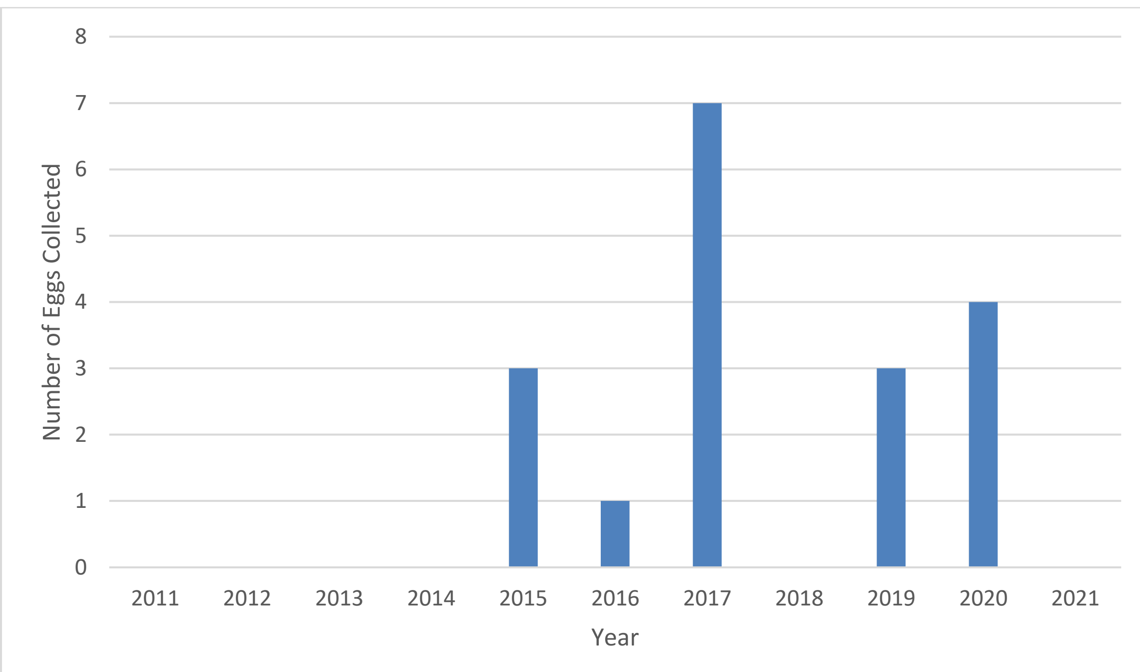

Figure 2. Number of eggs collected each year from the Outfall 012 delta

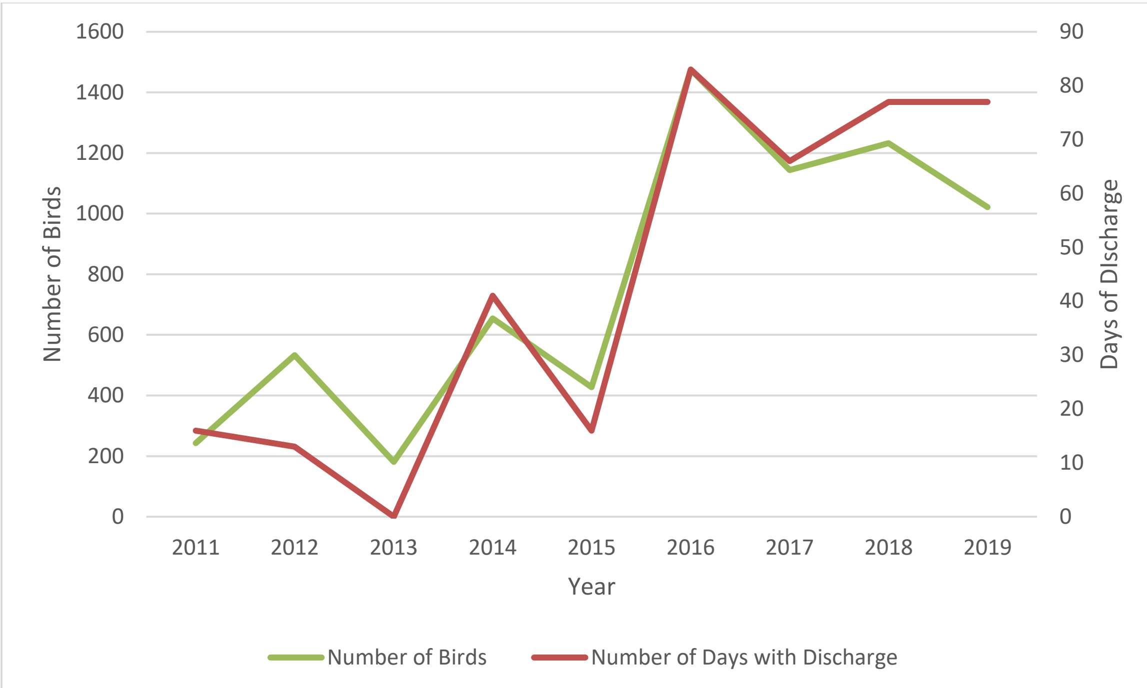

Figure 3. Number of birds observed in the Outfall 012 delta and days of discharge by either KUC or Jordan Valley

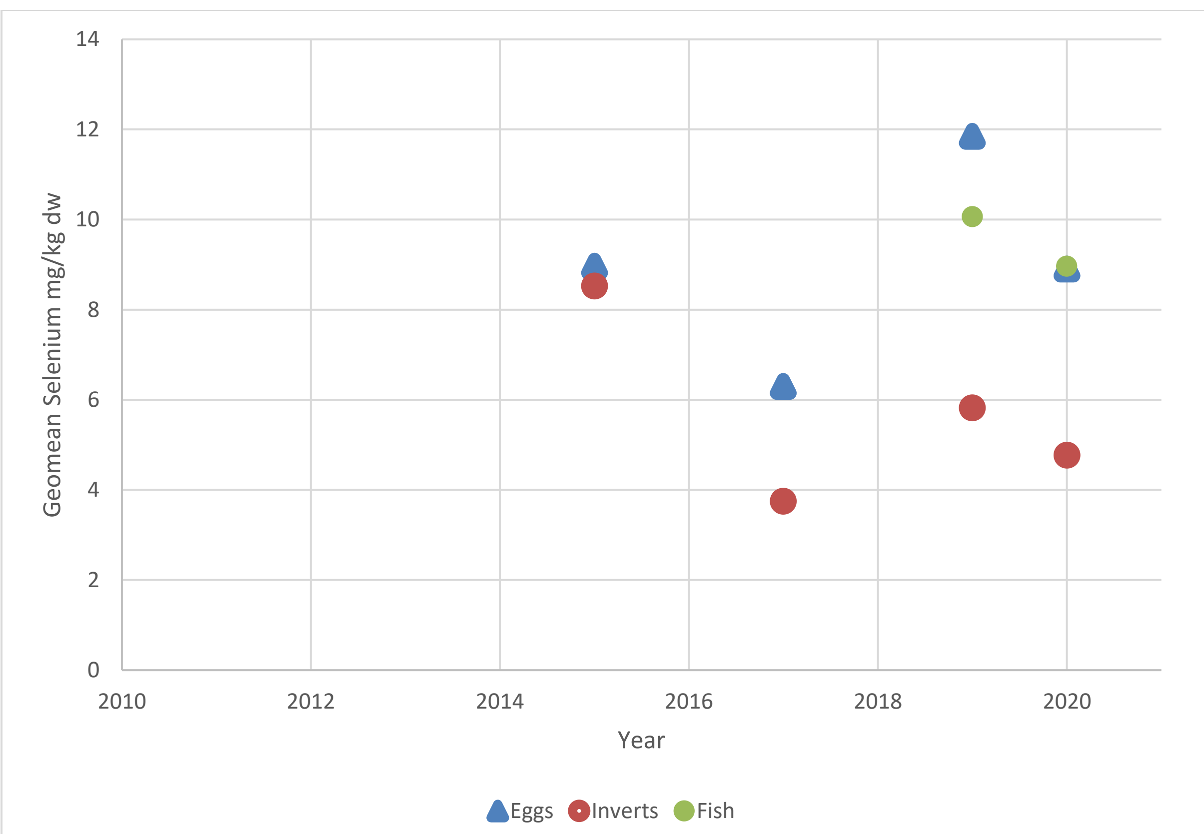

Figure 4. Geometric mean concentrations of selenium measured in bird eggs, invertebrates, and fish from the outfalls delta when more than one egg was collected.

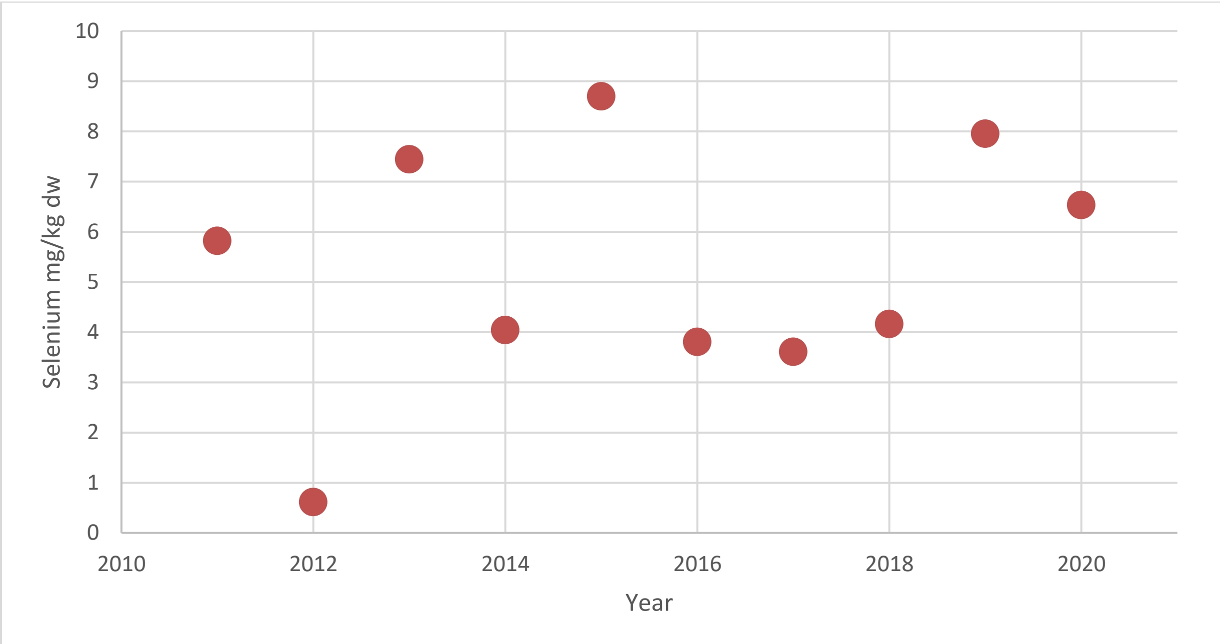

Figure 5. Geometric mean concentrations of selenium measured in invertebrates from the outfalls delta exclusive of brine shrimp and brine flies.

The requirements of the Transitional Waters Monitoring Program are unchanged from the previous permit. The permit continues to allow changes to Sampling and Analysis Plan during the permit cycle with Director approval. This flexibility is intended to allow modifications to the monitoring based if warranted based on changes observed.

The annual reports submitted document an increase in vegetation cover since Jordan Valley began continuously discharging to the Transitional Waters approximately 3 years ago. These changes to the habitat are expected to affect bird use in this area and could also affect nesting success by reducing predation by increasing vegetation cover. These habitat changes may also affect selenium exposures by affecting bird access to the water or causing shifts in the macroinvertbrate community. An increase in phragmites may also cause the habitat to be less desirable for shorebirds.

The 5 to 8 egg requirement is unchanged. Selenium concentrations in eggs collected often exhibit a high degree of variability as do the eggs from the outfall delta. This is one of the reasons that geometric mean, which is less sensitive to variability than the e.g., an arithmetic mean, is used to characterize egg concentrations. When variability is high, a larger number of samples are needed to achieve a similar level of certainty compared to when variability is low. However, the maximum number of eggs is limited to 8 avoid adversely impacting bird populations. Similar to the selenium standard for Gilbert Bay, a minimum of 5 eggs are required. Requiring a minimum of 5 eggs balances having sufficient confidence in the results to take actions and having a performance standard that can be implemented.

Level II Antidegradation Review
In accordance with UAC R317-2-3.5.b.1.(b), a Level II antidegradation review is not required because there are no changes to effluent concentrations or loading compared to the previous permit.

WET (Whole Effluent Toxicity) Testing
The requirements for acute WET and chronic WET monitoring are consistent with the Utah 2018 WET Guidance and are unchanged from the previous permit. The permit provision that allows for a reduction from a frequency of quarterly was removed because quarterly is the minimum frequency for major industrial dischargers.

Recommended Changes to Permit
Selenium discharges from Outfall 004 and 008 are added to the annual limit of 900 kg/yr previously applicable to Outfall 012 only. Selenium and flow monitoring frequency for Outfalls 004 and 008 were increased to support the annual load estimates.

The requirement that the geometric mean of selenium in eggs is based on 5 to 8 eggs was clarified.

In accordance with 2018 DWQ WET policy, the provision that allows for a reduction in the frequency of WET testing to less than quarterly was deleted. Quarterly monitoring is the minimum for major industrial permits.

REFERENCES

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TRE Environmental Solutions (TRE), 2020b. Results of Analytical Data for Experiment #18. DWQ-2020-015753

Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review – PRELIMINARY
Discharge to Matheson Wetlands Preserve

Date:	**January 20, 2022**
Prepared by:	**Christopher L. Shope** **Standards and Technical Services**
Facility:	**Rio Tinto Kennecott Copper** **UPDES Permit No. UT-0000051**
Outfalls:	**002, 007, 009, and 104**
Receiving water:	**Lee Creek, Pine Creek, and Great Salt Lake**

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 (DWQ).

<u>Discharge</u>

Outfall 002: C-7 Ditch → Lee Creek → Great Salt Lake
The maximum daily discharge for Outfall 002 is 72.0 MGD (111.4 cfs), as estimated by the permittee.

Outfall 007: C-7 Ditch → Lee Creek → Great Salt Lake
The maximum daily discharge for Outfall 007 is 21.6 MGD (55.0 cfs), as estimated by the permittee.

Outfall 009: Pine Creek → Middle Canyon Creek → Great Salt Lake
The maximum daily discharge for Outfall 009 is 0.03 MGD (0.046 cfs), as estimated by the permittee.

Outfall 104: Internal Outfall → Great Salt Lake
The maximum daily discharge for Outfall 104 is 4.46 MGD (6.9 cfs), as estimated by the permittee.

Receiving Water

The receiving water for Outfall 002 and 007 is 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.

The C-7 Ditch is tributary to Lee Creek, which does not have designated beneficial uses. Therefore, per UAC R317-2-13.13, the presumptive beneficial uses for all waters not specifically classified are 2B and 3D.

Per UAC R317-2-13.7.a, Middle Canyon Creek and tributaries in Tooele County is composed of beneficial uses 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.*

- *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 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.*

- *Class 3E: Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.*

- *Class 4: Protected for agricultural uses including irrigation of crops and stock watering.*

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.

Receiving Water Critical Flow

Typically, the critical flow for the wasteload analysis is considered as the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10).

For Outfalls 002 and 007, sporadic flow records are available at several monitoring locations; however, robust flow records from USGS stream gage # 10172640 LEE CREEK NEAR MAGNA, UT, for the period 1971 – 1982 and 2006 – 2008 were 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 is more representative of the expected current flow regime in the creek. Since no discharge occurred from Outfalls 002 and 007 during this period, the gage represents the flow available for dilution.

For Outfall 009, there were no upstream monitoring locations and downstream gage USGS 403258112123201 (C- 3- 3)20bad-S1 BIG SPRING (PINE CYN),NR TOOELE was used with monitoring data from 4/21/06 through 10/7/16. The 20th percentile of flow was calculated to represent flow under critical conditions.

Finally, Outfall 104 is an internal outfall without measure flow or background water quality conditions. Therefore, background flow was assumed to be non-existent and water quality parameters were calculated from beneficial use criterion as end of pipe limits.

Outfalls 002 and 007: 7Q10 Flow (Annual) = 17.9 cfs
Outfall 009: Critical Flow (Annual) = 0.4 cfs
Outfall 104: Critical Flow (Annual) = 0.0 cfs (end of pipe criteria)

Total Maximum Daily Load (TMDL)

According to the Utah Combined 2018/2020 303(d) Water Quality Assessment Report, the receiving water for the Outfall 002 and 007 discharge, Lee Creek from Great Salt Lake to headwaters near 2100 South (UT16020204-036_00), was listed as fully supporting.

Pine Creek in the Middle Canyon assessment unit Middle Canyon Creek and tributaries, Tooele County (UT16020304-007_00) is described as Insufficient Data.

Mixing Zone

The maximum allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and for chronic conditions is 2500 ft, 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.

Dilution Factor

The dilution factors were calculated assuming full mix with the receiving water at the end of the mixing zone (Table 1).

Table 1: Summary of dilution factor at end of mixing zone.

Outfall	Criteria	Flow (cfs)			Dilution Factor	Dilution Ratio
		Background	Effluent	Mixed		
002	Chronic	17.9	77.4	95.3	0.81	0.23:1
	Acute	9.0	77.4	86.3	0.90	0.12:1
007	Chronic	17.9	23.2	41.1	0.56	0.77:1
	Acute	9.0	23.2	32.2	0.72	0.39:1
009	Chronic	0.4	0.133	0.533	0.25	3.01:1
	Acute	0.2	0.133	0.333	0.40	1.50:1
104	Chronic	0.0	6.9	6.9	1.00	0.00:1
	Acute	0.0	6.9	6.9	1.00	0.00:1

Parameters of Concern

The potential parameters of concern for the discharge/receiving water identified were dissolved metals, total suspended solids, and pH, as determined in consultation with the UPDES Permit Writer. WQBELs were determined for metals.

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}

Outfall	Percent Effluent
002	81%
007	56%
009	25%
104	100%

Wasteload Allocation Methods

Receiving Water Quality and Standards

The water quality standards for dissolved metals are dependent on hardness (total as $CaCO_3$). Based on DWQ monitoring data from C-7 Ditch and Lee Creek, the average hardness for receiving waters at Outfalls 002 and 007 exceeds 400 mg/L. Per Utah R317-2-14, a maximum hardness of 400 mg/L was used for determining the dissolved metals criteria. Ambient conditions were estimated using monitoring data from DWQ 4991594 C-7 Ditch at 2100 S and from DWQ 4991430 LEE CREEK AT I80 CROSSING. The average of observed data was calculated, with one-half the reporting limit assumed for non-detects.

The monitoring data from downstream location USGS 403258112123201 (C- 3- 3)20bad-S1 BIG SPRING (PINE CYN),NR TOOELE was used for Outfall 009, where hardness was 44 mg/L. The average of observed data was calculated, with one-half the reporting limit assumed for non-detects.

Table 3: Water quality standards for Outfalls 002 and 007

	Outfall 002[c]				Outfall 007[c]		
Dissolved Metal	**Ambient Dissolved (µg/L)**	**Acute Standard (µg/L)**	**Chronic Standard (µg/L)**		**Ambient Dissolved (µg/L)**	**Acute Standard (µg/L)**	**Chronic Standard (µg/L)**
Aluminum	5.0	750	N/A[b]		5.0	750	N/A[b]
Arsenic	12.9	340	150		15.3	340	150
Cadmium	0.05	6.5	2.03		0.07	6.5	2.03
Chromium VI	7.3[a]	16.0	11.0		7.3[a]	16.0	11.0
Chromium III	154[a]	1,773	231		154[a]	1,773	231
Copper	1.8	49.6	29.3		1.8	49.6	29.3
Cyanide	3.5[a]	22.0	5.2		3.5[a]	22.0	5.2
Iron	15.0	1,000	NONE		15.0	1,000	NONE
Lead	0.2	281	10.9		0.2	281	10.9
Mercury	0.008[a]	2.4	0.012		0.100	2.4	0.012
Nickel	2.5	1,513	168		2.5	1,513	168
Selenium	0.4	18.4	4.6		0.4	18.4	4.6
Silver	0.25	34.9	NONE		0.25	34.9	NONE
Zinc	5.1	379	382		6.0	379	382

a Ambient concentration assumed 2/3 of water quality criteria.
b The criterion for aluminum is implemented as follows:
Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 µg/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 µg/L acute aluminum criterion (expressed as total recoverable).
c Per R317-2.14.2(7), for hardness > 400 mg/l as CaCO3, calculations will assume a hardness of 400 mg/l as CaC03.

Table 4: Water quality standards for Outfalls 009 and 104

	Outfall 009				Outfall 104		
Dissolved Metal	**Ambient Dissolved (µg/L)**	**Acute Standard (µg/L)**	**Chronic Standard (µg/L)**		**Ambient Dissolved (µg/L)**	**Acute Standard (µg/L)**	**Chronic Standard (µg/L)**
Aluminum	58.0[a]	750	N/A[b]		58.0[a]	750	N/A[b]
Arsenic	2.3	340	150		100[a]	340	150
Cadmium	0.38	0.8	0.39		0.48[a]	1.8	0.72
Chromium VI	7.3[a]	16.0	11.0		7.3[a]	16.0	11.0
Chromium III	25.2[a]	291	38		49[a]	570	74
Copper	3.8	6.2	4.4		6.0[a]	13.4	9.0
Cyanide	3.5[a]	22.0	5.2		3.5[a]	22.0	5.2
Iron	16.7	1,000	NONE		667[a]	1,000	NONE
Lead	2.0	26	1.0		1.7[a]	65	2.5
Mercury	0.075	2.4	0.012		0.008[a]	2.4	0.012
Nickel	0.5	234	26		34.7[a]	468	52
Selenium	3.1[a]	18.4	4.6		3.1[a]	18.4	4.6
Silver	0.5[a]	0.8	NONE		2.1[a]	3.2	NONE
Zinc	3.8[a]	58	59		79[a]	117	118

a Ambient concentration assumed 2/3 of water quality criteria.
b The criterion for aluminum is implemented as follows:
Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 µg/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 µg/L acute aluminum criterion (expressed as total recoverable).

Effluent Limits

Effluent limits for conservative pollutants were determined using a mass balance mixing analysis (UDWQ 2021). The hardness dependent conversion factors (CF) per UAC R317-2-14 Table 2.14.3a and Table 2.14.3b were used to translate the dissolved metals effluent limits to total recoverable metals effluent limits. Effluent limits for total recoverable metals are presented in Table 5.

Table 5: WQBELs for Total Recoverable Metals (µg/L)

Metal	Outfall 002		Outfall 007		Outfall 009		Outfall 104	
	Acute 1-hr Ave	Chronic 4-day Ave	Acute 1-hr Ave	Chronic 4-day Ave	Acute 1-hr Ave	Chronic 4-day Ave	Acute 1-hr Ave	Chronic 4-day Ave
Aluminum	836	N/A	1,038	N/A	1790	174	750	N/A
Arsenic	378	182	465	254	848	594	340	150
Cadmium	8.2	2.9	10.2	4.2	1.55	0.45	1.9	0.79
Chromium VI	17.0	11.8	19.3	13.8	29.0	22.0	16.0	11.0
Chromium III	6,206	289	7,592	337	2184	88	1,803	86.0
Copper	57.5	37.1	70.9	52.6	10.3	6.8	14.0	9.3
Cyanide	24.1	5.6	29.2	6.5	49.9	10.4	22.0	5.2
Iron	1,114	NONE	1381	NONE	2478	NONE	1,000	NONE
Lead	532	22.8	660.9	32.7	68.7	1.1	81.6	3.2
Mercury	2.6	0.013	3.289	0.012	5.895	0.012	2,400	0.012
Nickel	1,691	207	2101	297	586	103	469	52
Selenium	20.5	5.6	25.3	7.8	41.5	9.2	18.4	4.6
Silver	45.8	NONE	56.8	NONE	1.4	NONE	3.8	NONE
Zinc	432	477	535	683	144	228	120	120

All models and supporting documentation are available for review upon request.

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 not required for this facility because the upgraded and expanded facility discharge has previously been permitted.

Documents:

WLA Document*: Kennecott_WLA_2022.docx*
Wasteload Analysis and Addendums: *Kennecott_WLA_2022.xlsx*

References:

Utah Division of Water Quality. 2021. *Utah Wasteload Analysis Procedures Version 2.0.*

Utah Division of Water Quality
ADDENDUM
Statement of Basis
Wasteload Analysis

Date:	**October 18, 2021**
Prepared by:	**Suzan Tahir** **Standards and Technical Services**
Facility:	**Rio Tinto Kennecott Copper** **UPDES No. UT-0000051** **Outfall 010; Butterfield Tunnel**
Receiving water:	**Butterfield Creek (2B, 3D, 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 010: Butterfield Tunnel

The maximum daily discharge for the facility is 0.12 MGD (0.2 cfs) as estimated by the permittee.

Receiving Water

The receiving water for Outfall 010 is Butterfield Creek which is tributary to the Jordan River.

Butterfield Creek's designated beneficial uses, as per UAC R317-2-13.5, uses are 2B, 3D, 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.*

- *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.*

- *Class 4 -- Protected for agricultural uses including irrigation of crops and stock watering.*

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 Butterfield Creek, the 20th percentile of available flow measurements was calculated for the period of record to approximate the 7Q10 low flow condition. The source of flow data was DWQ sampling station #4994450; BUTTERFIELD CANYON CK AB KCC 010 (2000-2020).

The critical low flow condition for Butterfield Creek is 0.50 cfs.

Ambient Butterfield Creek water quality was characterized based on samples collected from DWQ sampling station #4994450; BUTTERFIELD CANYON CK AB KCC 010 (2000-2020)

TMDL

Butterfield Creek (UT16020204-024_02) is listed as impaired for total dissolved solids (TDS), Selenium, and *E.* coli according to Utah's Combined 2018/2020 Integrated Report. A TMDL has not been completed for these constituents and this time. Water quality based effluent limits (WQBELs) for these constituents will be set at the applicable water quality standards with no allowance for mixing.

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 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 parameters of concern identified for the discharge/receiving water were dissolved metals, TDS, and pH as determined in consultation with the UPDES Permit Writer.

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.

IC25 WET limits for Outfall 011 should be based on 27% effluent.

Receiving Water Quality and Standards

The water quality standards for dissolved metals are dependent on hardness (total as CaCO3). Based on DWQ monitoring data from Butterfield Creek an average hardness of 246 mg/L was used for determining the dissolved metals criteria. Ambient conditions were estimated using monitoring data from 4994450; BUTTERFIELD CANYON CK AB KCC 010 (2000-2020). The 80th percentile of observed data was calculated, with one-half the reporting limit assumed for non-detects.

Table 1: Water quality standards for dissolved metals for a hardness of 400 mg/L and ambient conditions for #4994450; BUTTERFIELD CANYON CK AB KCC 010 (2000-2020).

Dissolved Metal	Ambient 80th Percentile (µg/L)	Acute Standard (µg/L)	Chronic Standard (µg/L)
Aluminum	15.0	750	87
Arsenic	2.5	340	150
Boron	38.45	750	None
Cadmium	0.50	4.1	1.4
Chromium VI	2.50	16.00	11.0
Chromium III	2.50	1184	231
Copper	6.00	31.2	29.3
Cyanide	3.47[a]	22.00	5.20
Iron	15.68	1000.00	None
Lead	1.50	168	10.9
Mercury	0.01[a]	2.40	0.012
Nickle	5.00	997	168
Selenium	0.88	18.40	4.60
Silver	1.00	14.9	None
Zinc	15.00	25	382

[a] Ambient concentration assumed 2/3 of water quality criteria.

[b] The criterion for aluminum is implemented as follows:
Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 µg/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 µg/L acute aluminum criterion (expressed as total recoverable).

Effluent Limits

Effluent limits for conservative pollutants were determined using a mass balance mixing analysis (UDWQ 2012). The hardness dependent conversion factors (CF) per UAC R317-2-14 Table 2.14.3a and Table 2.14.3b were used to translate the dissolved metals effluent limits to total recoverable metals effluent limits, assuming a hardness of 244 mg/L. Effluent limits for total recoverable metals are presented in Table 2

Table 2: WQBELs for Total Recoverable Metals (ug/l), Outfall 010

Metal	Acute 1-hr Average	Chronic 4-day Average
Aluminum	1739.8	280.9
Arsenic	794.5	547.3
Cadmium	9.94	4.40
Boron	1708.2	None
Chromium VI	34.2	33.9
Chromium III	8780.72	653.51
Copper	67.78	57.06
Cyanide	47.0[a]	9.9
Iron	2325.6	None
Lead	594	30.5
Mercury	5.6[a]	0.02
Nickel	2336.69	396.56
Selenium	42.0	14.6
Silver	39.67	None
Zinc	578.50	902.02
[a] Receiving water is 303(d) listed for constituent. WQBELs equal the standard.		

The receiving water is 303(d) listed for TDS, therefore, an acute limit of 1200 mg/l applies.
The receiving water is 303(d) listed for *E. coli*, therefore, a 30-day geometric mean of 206 (No.#/100 ML) and a maximum of 668 (No.#/100 ML) apply.

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 not required for this discharge since the pollutant concentration and load is not increasing under this permit renewal.

Documents:

WLA Document*: Kennecott_WLADoc_010_2021.docx*
Wasteload Analysis and Addendum: *Kennecott_WLA_010_2021.xlsm*

References:

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

Utah Division of Water Quality.2021. *Utah's Combined 2018/2020 Integrated Report*.

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

Date:	**October 17, 2021**
Prepared by:	**Suzan Tahir** **Standards and Technical Services**
Facility:	**Rio Tinto Kennecott Copper** **UPDES No. UT-0000051** **Outfall 011**
Receiving water:	**Utah Salt Lake Canal => Ritter Canal => C7 Ditch => Lee Creek (2B, 3D, 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 011: Adamson Spring

The maximum daily discharge for the facility is 3.6 MGD (5.6 cfs) as estimated by the permittee.

Receiving Water

The receiving water for Outfall 011 is the Utah-Salt Lake Canal, thence to the Ritter Canal, thence the C7 ditch, which discharges to Lee Creek.

Lee Creek does not have specific designated beneficial uses; therefore, per UAC R317-2-13.13, the presumptive beneficial uses are 2B and 3D.

- *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 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.*

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). 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 is more representative of the current higher flow regime in the creek; however, it is insufficient to statistically calculate the 7Q10 flow. There were no USGS recordings after 4/10/2008, therefore the same flow value was used in this wasteload analysis.

7Q10 Flow (Annual) = 17.9 cfs

<u>TMDL</u>
Lee Creek (UT16020204-036_00, Lee Creek from Great Salt Lake to headwaters near 2100 South) is fully supporting all parameters according to Utah's 2018/2020 Combined Integrated Report.

<u>Mixing Zone</u>
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 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.

<u>Parameters of Concern</u>
The parameters of concern identified for the discharge/receiving water were dissolved metals, total suspended solids, and pH as determined in consultation with the UPDES Permit Writer.

<u>WET Limits</u>
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.

IC25 WET limits for Outfall 011 should be based on 24% effluent.

Receiving Water Quality and Standards

The water quality standards for dissolved metals are dependent on hardness (total as CaCO3). Based on DWQ monitoring data from C-7 Ditch and Lee Creek, the average hardness exceeds 400 mg/L. Per Utah R317-2-14, a maximum hardness of 400 mg/L was used for determining the dissolved metals criteria. Ambient conditions were estimated using monitoring data from 2000-2020 from DWQ #4991430 LEE CREEK AT I80 CROSSING. The 80th percentile of observed data was calculated, with one-half the reporting limit assumed for non-detects.

Table 1: Water quality standards for dissolved metals for a hardness of 400 mg/L and ambient conditions for #4991430 LEE CREEK AT I80 CROSSING (2000-2020).

Dissolved Metal	Ambient 80th Percentile (µg/L)	Acute Standard (µg/L)	Chronic Standard (µg/L)
Aluminum	17.62	750	NA[b]
Arsenic	15.8	340	150
Boron	493.5	750	None
Cadmium	0.50	6.5	2.03
Chromium VI	4.6	16.0	11.0
Chromium III	154[a]	1773	231
Copper	6.0	49.6	29.3
Cyanide	3.5[a]	22.0	5.20
Iron	19.44	1000	None
Lead	1.5	281	10.9
Mercury	0.008[a]	2.4	0.012
Nickle	4.5	1513	168
Selenium	3.78	18.4	4.6
Silver	1.0	34.9	None
Zinc	15.0	379	382

[a] Ambient concentration assumed 2/3 of water quality criteria.

[b] The criterion for aluminum is implemented as follows:
Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaC03 in the receiving water after mixing, the 87 µg/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 µg/L acute aluminum criterion (expressed as total recoverable).

Effluent Limits

Effluent limits for conservative pollutants were determined using a mass balance mixing analysis (UDWQ 2012). The hardness dependent conversion factors (CF) per UAC R317-2-14 Table 2.14.3a and Table 2.14.3b were used to translate the dissolved metals effluent limits to total recoverable metals effluent limits, assuming a hardness of 400 mg/L. Effluent limits for total recoverable metals are presented in Table 2

Table 2: WQBELs for Total Recoverable Metals (ug/l), Outfall 011

Metal	Acute 1-hr Average	Chronic 4-day Average
Aluminum	1926.97	309.99
Arsenic	861.05	581.43
Cadmium	18.34	8.17
Chromium VI	28	21.9
Chromium III	13847.94[a]	555.58
Copper	124.70	108.44
Cyanide	51.78	10.77
Iron	2575.81	None
Lead	1239.00	70.12
Mercury	6.24[a]	0.02
Nickle	3944.84	695.74
Selenium	41.90	7.24
Silver	105.19	None
Zinc	986.45	1585.46
Boron	1893.5	None
[a] Ambient concentration assumed 2/3 of water quality criteria.		

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 not required for this discharge since the pollutant concentration and load is not increasing under this permit renewal.

Documents:

WLA Document*: Kennecott_WLA011Doc_2021.docx*
Wasteload Analysis and Addendum: *Kennecott_WLA-011_2016.xlsm*

References:

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

Utah Division of Water Quality.2021. *Utah's Combined 2018/2020 Integrated Report*.