Kennecott Utah Copper, LLC

Large Bingham Reservoir System

GROUND WATER DISCHARGE PERMIT UGW350006 Renewal

Comment Response Summary

Division of Water Quality

April 2021

195 North 1950 West • Salt Lake City, UT
Mailing Address: PO Box 144870 • Salt Lake City, UT 84114-4870
Telephone (801) 536-4300 • FAX (801) 536-4301 • TDD (801) 536-4414
www.deq.utah.gov

I. INTRODUCTION

A. Kennecott Utah Copper, LLC Large Bingham Reservoir System

The Kennecott Utah Copper, LLC (Kennecott) Large Bingham Reservoir System (Facility) is utilized for containment of a variety of waters generated and managed during mining operations including: storm water runoff from the mine and waste rock dumps, water pumped from alluvium in Bingham Canyon up-gradient from the reservoir system, flows associated with ground water remediation activities, and other managed mine flows. The water is generally characterized by low pH (3.0-4.0) and elevated total dissolved solids (TDS > 20,000 mg/L).

The Facility is regulated under Ground Water Discharge Permit UGW350006 which was originally issued in 1999 and subsequently renewed in 2005, 2010 and 2015. This renewal of the permit does not authorize new construction or enlargement of the Facility's footprint. The renewal draft permit and Statement of Basis (SOB) were public noticed from January 24, 2021 through February 24, 2021, during which time one commentor, Mr. Ivan Weber of Weber Sustainability Consulting, submitted comments. After reviewing Mr. Weber's comments, the Division of Water Quality (DWQ) maintains that the permit order is properly protective based on negligible risk to ground water and its present and future beneficial uses.

B. Organization and Nature of Response to Comments

Part I of this document presents the primary considerations in permit drafting which include: 1) Legal and regulatory requirements; 2) Site-specific determinations for permit renewal; and 3) Natural site hydrogeologic conditions. Part II addresses specific comments submitted by Mr. Weber.

C. Legal and Regulatory Requirements

1. The Division of Water Quality (DWQ) under the authority of the Utah Ground Water Quality Protection Rules[1] (Ground Water Rules) issues ground water discharge permits to facilities which have a potential to discharge contaminants to ground water[2]. As defined by the Ground Water Rules, such facilities include mining operations.[3] The Ground Water Rules are based on an anti-degradation strategy for ground water protection as opposed to non-degradation; therefore, discharge of contaminants to ground water may be allowed provided that current and future beneficial uses of the ground water are not impaired and the other requirements of Rule 317-6-6.4A are met.[4] Following this strategy, ground water is divided into classes based on its quality[5]; and higher-quality ground water is given

[1] Utah Admin. Code Rule 317-6
[2] https://deq.utah.gov/ProgramsServices/programs/water/groundwater/docs/2008/08Aug/GWQP_PermitInfo.pdf
[3] Utah Admin Code Rule 317-6-6.1A

[4]Preamble to the Ground Water Quality Protection Regulations of the State of Utah, sec. 2.1, August, 1989
[5] Utah Admin. Code Rule 317-6-3
[6] Utah Admin. Code Rule 317-6-4

greater protection[6] due to the greater potential for beneficial uses. DWQ has developed permit conditions consistent with R317-6 and appropriate to the nature of the mined materials, facility operations, maintenance, best available technology[7] (BAT) and the hydrogeologic and climatic conditions of the site, to ensure that the operation would not contaminate ground water.

2. Under Rule 317-6-6.4A, The Director may issue a ground water discharge permit if the Director determines :

    1) The applicant demonstrates that the applicable class TDS limits, ground water quality standards protection levels and permit limits established under R317-6-6.4E will be met;
    2) The monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements;
    3) The applicant is using best available technology to minimize the discharge of any pollutant; and
    4) There is no impairment of present and future beneficial uses of ground water.

3. Under Rule 317-6-1. :

    "Best Available Technology" means the application of design, equipment, work practice, operation standard or combination thereof at a facility to effect the maximum reduction of a pollutant achievable by available processes and methods taking into account energy, public health, environmental and economic impacts and other costs.

4. The ground water application provisions in Rule 317-6-6.3 provide discretion to the Director in determining the particular information that must be submitted in an application as evidenced by the introductory sentence that provides: "*Unless otherwise determined by the Director*, the application for a permit to discharge wastes or pollutants to ground water shall include the following complete information . . ." (emphasis added). Rule 317-6 applies to a wide variety of facilities with varying degrees of potential to discharge contaminants to ground water. Operational and natural site characteristics are relevant to a Rule 317-6 inquiry. Rule 317-6-6.3 lists all informational categories that *may* be used within the universe of permitted facilities to provide substantial evidence in the administrative record to support a finding that Rule 317-6-6.4A has been satisfied. In other words, Rule 317-6-6.3 gives the Director discretion to determine what is required to be submitted to meet the requirement of Rule 317-6-6.4A on a case by case basis. To be clear, the Director's discretion is not without limitation, rather the discretion is exercised based upon appropriate review of the *relevant* scientific, technical, engineering or other facts related to the permit, its processes and site characteristics.

D. Site-Specific Determinations for UGW350006 Renewal

[7] Utah Admin. Code Rule 317-6-1(1.3)

1. Subsection 1 of Rule 317-6-6.4A (protection levels) is satisfied for the renewal because ground water in the vicinity of the reservoirs has been classified as Class IV – Saline due to prior contamination. As a result, TDS limits are not applicable under this permit.

2. Subsection 2 of Rule 317-6-6.4A (monitoring) is satisfied for the renewal because the applicant is required to conduct periodic compliance monitoring and reporting to the Director under requirements specified in the permit.

3. Subsection 3 of Rule 317-6-6.4A (BAT) is satisfied because the reservoirs were constructed using best available technology design elements including double HDPE liners with leak detection to minimize discharge of pollutants.

4. Subpart 4 of Rule 317-6-6.4A (impairment) is satisfied for the renewal because the ground water has been classified as Class IV – Saline due to contamination present prior to construction of the reservoir system. Potential infiltration of contaminants from the Facility will not result in impairment of present and future beneficial uses of ground water. Class IV water is managed to protect human health and the environment and is not fit for consumptive human use.

Therefore, as summarized above, further discussed in the SOB and based upon the ground water discharge permit application[1] and other documents referenced or provided in conjunction with the application or referenced herein, and relied upon by the DWQ, the DWQ has concluded that the proposed facility meets the required conditions for permit renewal.

E. Site Conditions

The Ground Water Rules take into account hydrogeologic conditions related to the potential for ground water contamination as well as varying natural ground water quality. In developing permit conditions the Ground Water Rules allow these factors to be taken into account so as not to impose unnecessary conditions on permittees.

Hydrogeology and Background Water Quality Beneath the Large Bingham Reservoir System

Tertiary volcanic bedrock is the primary stratigraphic unit that underlies the majority of the area. The Tertiary volcanics are covered by Plio-Pleistocene alluvial deposits that thicken to the east to form the principal aquifer in the Southwest Salt Lake Valley[2].

The central portion of Salt Lake Valley is generally characterized as having a shallow unconfined and a principal confined aquifer system. Confining layers are generally not present or discontinuous near the base of the mountains and are more pronounced towards the center of the valley[3].

Ground water beneath the reservoir system has been classified as Class IV – Saline due to contamination caused by historic mining activities[4]. A ground water plume with high sulfide, low pH and elevated metals extends directly down gradient of the reservoirs and is being monitored and remediated under an EPA Record of Decision and is not regulated under this permit.

II. DWQ Response to Comments

The text of the document submitted by Mr. Weber during the public comment period is presented below. It has been restated verbatim in italics. The document was not formatted as a series of numbered comments, rather comments were presented throughout the narrative. For purposes of the DWQ's response, the document has been separated into subparts to address comments as encountered within the text.

Dear Dr. Gaddis:

The following comments are submitted regarding the continued operation of the Large Bingham Reservoir system east of, and below, the Rio Tinto/Kennecott waste rock dumps on the downhill flank of the open-pit Bingham Canyon Mine, generally encompassing what is known as the Eastside Collection System for the interception of acid mine drainage, and the system's hydrological relationship with both the Jordan River and Great Salt Lake's ecosystems, and with the rapidly-growing human community in South Jordan, Daybreak and Salt Lake County.

I. Large Bingham Reservoir and Eastside Collection System

Built in 1993 and following years, the "Large Bingham Reservoir" is shorthand for several system elements required to intercept acid mine drainage, some subject to the same principles of materials aging that you'd expect of roofing, pond liners, or membranes used to separate flows in industrial or natural processes. Most, if not all, were mandated by the "South Facilities Water Remedial Action Design" in compliance with CERCLA Natural Resource Damage Claim rulings, reflecting the scientific findings that formed the basis of agreements determining strategies for limiting the effects of ground water contamination, along with subsequent operational changes to the system.

*The geography and delineation of **"the site"** is very much subject to --- or SHOULD BE subject to --- seldom-recognized variables in acid mine leaching/drainage processes, particularly selenium. The analytical table printed on the following page, from KUCC's Engineering Services recording geochemistry from a monitoring well a short distance below the dam of the Large Bingham Reservoir from approximately 1997, serves as an illustration of what is scientifically advisable, from an environmental management point of view, and what should be legally required:*

Kennecott
Engineering Services

EPA Method		ECG1146 7/30/97	ECG1146 8/21/97	ECG1146 8/22/97	ECG1146 8/25/97	ECG1146 9/9/97	ECG1146 9/12/97			
SW-846	Analyte	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	avg	std. dev.	rel
EPA 7020	Al	2,432	2,049	2,303	2,228		2,366	2,276	147.48	6.5%
EPA 7140	Ca	487	459	476	471		483	475	11.13	2.3%
EPA 7130	Cd	0.83					0.91			
EPA 7200	Co	19.8					16.4			
EPA 7190	Cr	0.71					0.54			
EPA 7210	Cu	158	148	150	149	142	142	149	5.66	3.8%
EPA 7380	Fe	785	686	727	719		682	720	41.35	5.7%
EPA 7610	K	10.7	11.0	11.4	11.4		13.0	11	0.87	7.5%
EPA 7450	Mg	4,480	4,400	4,574	4,479		4,303	4,447	101.47	2.3%
EPA 7460	Mn	367	383	400	401		400	390	14.94	3.8%
EPA 7770	Na	45.4	48.7	51.8	53.5		55.2	51	3.90	7.7%
EPA 7420	Pb	0.61					0.83			
EPA 7950	Zn	141	132	139	138		135	137	3.74	2.7%
	chloride	~~44.2~~								
EPA 375.3	sulfate	33,759		33,327	32,632	32,105	32,360	33,020	639.65	1.9%
	pH			3.4	3.4	3.4	3.7			
	Ec			21,800	21,300	21,300	21,900			
	Eh						287			
Sampler				Lucy	Files	Files	Files			

AWW

ACIDWELL analyses 1990s

*The parameters listed in this Acid Well analysis table surely represent the most severe of the analytes addressed in acid solutions that are encountered in waste rock leaching --- <u>but **Selenium is not among the analytes listed**</u>. Were selenium to be considered, it would determine a very different geography of "the site" and of "affected environments" in a profound way. We urge the consideration of Selenium as a requirement in the Permit in question.*

DWQ Response 1:

The DWQ currently administers seven Ground Water Quality Discharge permits and one Utah Pollutant Discharge Elimination System (UPDES) permit for Kennecott facilities and operations (see Table 1 below). Due to the size and variability of Kennecott operations, the DWQ does not regulate Kennecott as a single "site". Rather, operations are addressed under specific permits intended to enforce requirements applicable to a given activity or location.

Table 1: DWQ Permits Issued for Kennecott Operations

Permit Type	Permit Number	Permit Name
Ground Water Discharge	UGW350001	Barneys Canyon
Ground Water Discharge	UGW350006	Large Bingham Reservoir System
Ground Water Discharge	UGW350008	Smelter
Ground Water Discharge	UGW350010	Bingham Mine Leach Collection System
Ground Water Discharge	UGW350011	Tailings Impoundment
Ground Water Discharge	UGW350015	Magna Reservoirs
Ground Water Discharge	UGW350017	Copperton Concentrator
UPDES	UT0000051	Surface Water & Storm Water Discharge Outfalls

Ground water quality discharge permit UGW350006 is the subject of this document as the permit currently under renewal. Selenium is a required analyte of the semi-annual samples required to be collected from reservoir water under UGW350006 Part I.C.2 and Appendix A, Section 6.0.

Well ECG1146 (with historical results from 1997 shown in the table included in the above comment) is sampled annually and now does include selenium as an analyte, however it is not a monitoring point under permit UGW350006.

Permit Action: None.

As you know, selenium is the nearly inseparable companion of sulfur in acidic leachates, especially from copper and several other metal ores (nickel, silver, zinc, especially). Selenium is notable, however, for its solubility and for its toxicity to invertebrates, fish, crustaceans, and particularly to bird reproduction. Within the area defined as "the site" for this permit, few of the organisms typically threatened are of serious concern. Aside from a few ponds in the Daybreak development, and the migratory birds attracted to water wherever it occurs, there are not many life forms that selenium would jeopardize. Collectively, we must not neglect the Jordan River, a short distance downgradient from this extended collection, retention and conveyance system, as it traverses the foot of the Oquirrh Mountain Range.

These acid waters are either "treated" or not, and are piped to points of disposal around Kennecott's Tailings Impoundment near Magna, 10 or 12 miles to the north, and to the Great Salt Lake's south shore. Since "the site" of this ground water discharge permit must be recognized as one that extends to the points of leakage and of discharge of these treatment waters all the way to

the Jordan River, Jordan River marshes, and to the Great Salt Lake, itself, then the geography of consequent exposure to selenium must encompass those areas, as well!

We must assume that the catalog of scientific literature of eco-toxic effects of selenium is widely available, at least as available as it was to Kennecott's decision makers in the late 1990s, when literally millions of dollars of funding was spent in the building of the "biosulfide plant", pictured below in its early months, one primary purpose of which was to reduce selenium selectively for removal of selenium contamination from acidic leach waters gathered from the eastside collection system and aquifers, upgradient and downgradient, of the Large Bingham Reservoir vicinity:

This pioneering Biosulfide plant worked, and worked wonderfully, according to the process engineers-operators and their reports. It was possible to extract selenium --- as well as a catalog of other metals --- by selective chemical reduction. Where does that process stand in the intentions of the present ground water discharge permit? One way or the other, Kennecott/Rio Tinto have long since admitted that selenium is a constituent of acidic leach waters, both from the north Refinery area and from the leaching of the vast Waste Rock Dumps and Concentrator area. The academic work of Dr. Wayne Wurtzbaugh and colleagues at Utah State University have categorically identified the critical, negative effects of Selenium on the Great Salt Lake.

The review of the Permit in question is also the time to remember that copper is not the only metal that has been mined in this facility. Silver, gold, and even uranium have been extracted here, over the years.

DWQ Response 2:

The objective of the Large Bingham Reservoir System Ground Water Discharge Permit UGW350006 is to monitor the reservoir system for leaks. As described in Part I.B.1 of the permit, BAT discharge control design elements of the reservoir liner include (bottom to top) a 1-ft thick

clay layer with hydraulic conductivity no greater than 1 x 10^{-6}, a layer of geotextile material, a secondary (lower) 60-mil HDPE liner, another layer of geotextile material, and a primary (upper) 80-mil HDPE liner. The area between the primary and secondary HDPE liners is divided into 10 individual sumps that act as a leak collection system and narrow the area of maintenance and repair if a leak is detected. As such, monitoring and inspection requirements under this permit are limited to the performance and integrity of the liners. Ground water treatment or monitoring activities do not fall under the scope of UGW350006.

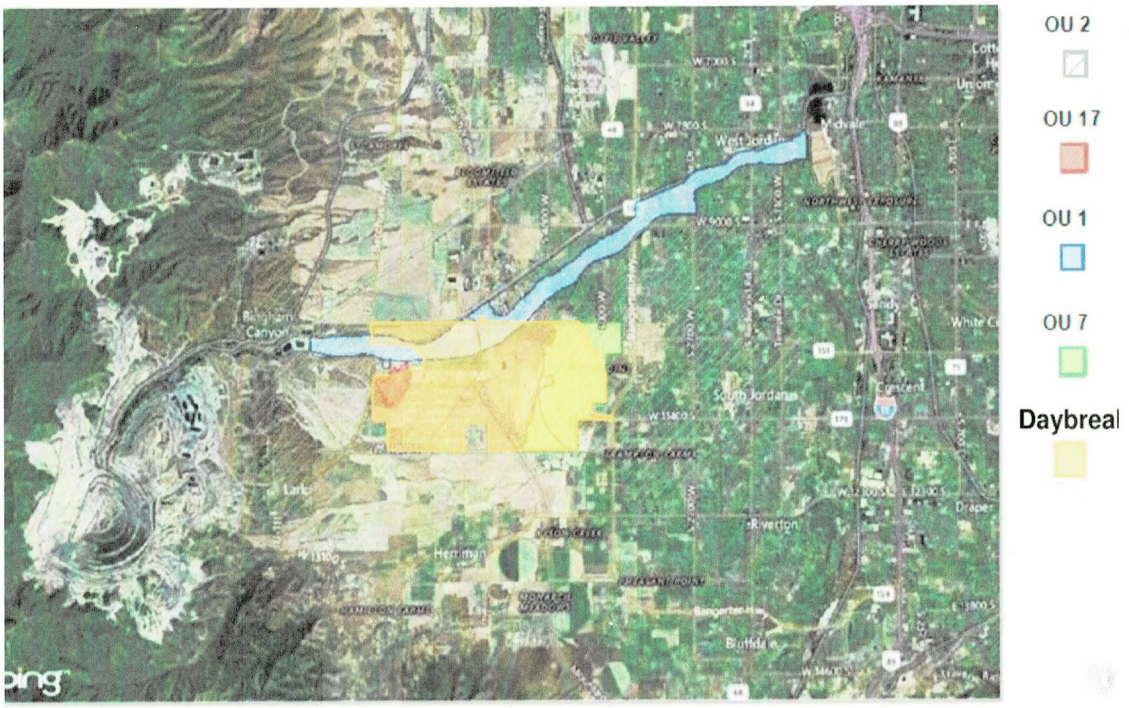
Permit Action: None.

II. Daybreak

And then there's Daybreak, growing at a terrific rate immediately below Highway 111 --- and above, very near the Bingham Mine waste rock dumps, where acid rock drainage is generated --- and planned even to engulf the Large Bingham reservoir on its north and south flanks, near the historic mining town of Lark. Soil and ground water assume a similar geochemical identity, as ground water emerges to or near the surface. Considering that the soil cover standards for Daybreak call for a minimum of 18", it becomes obvious that there's not a great deal of earth separating residents from soils and waters that have been cleaned or diluted to some relatively uncertain degree.

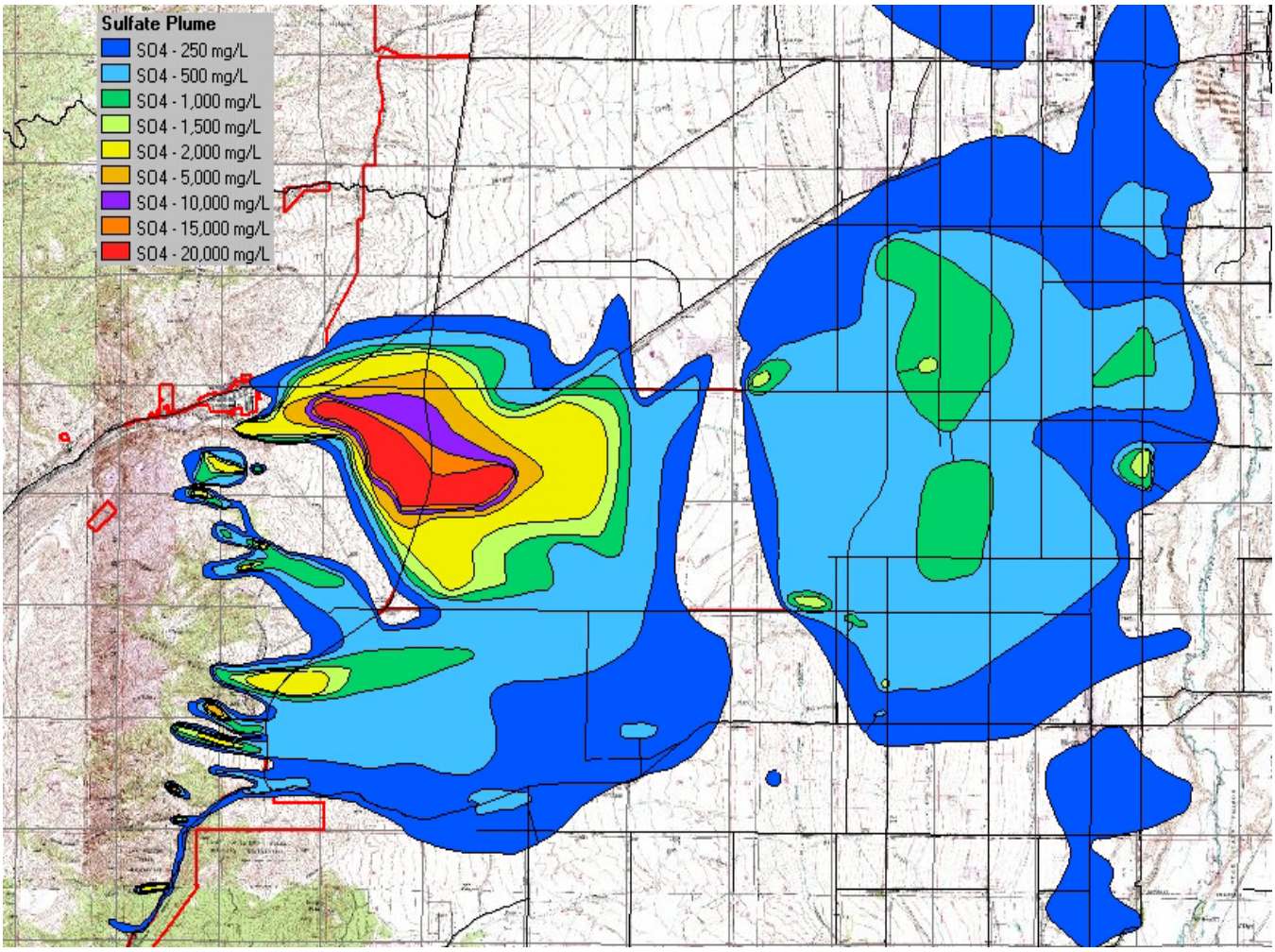
The following series of images approaches an accurate perspective on Daybreak's environmental 'place' relative to historic Kennecott mining operations:

S. Jordan Evaporation Ponds prior to Cleanup / Reclamation (looking westward over the Daybreak site):



(Daybreak Development Rel. to Mine Terrain; Daybreak Site in Yellow)

Sulfide Ground Water Plumes below Large Bingham Reservoir, Eastside Collection System, and Lands to East of Daybreak Site. Bingham Mine is to the left, north toward top:


Sulfate Plume
SO4 - 250 mg/L
SO4 - 500 mg/L
SO4 - 1,000 mg/L
SO4 - 1,500 mg/L
SO4 - 2,000 mg/L
SO4 - 5,000 mg/L
SO4 - 10,000 mg/L
SO4 - 15,000 mg/L
SO4 - 20,000 mg/L

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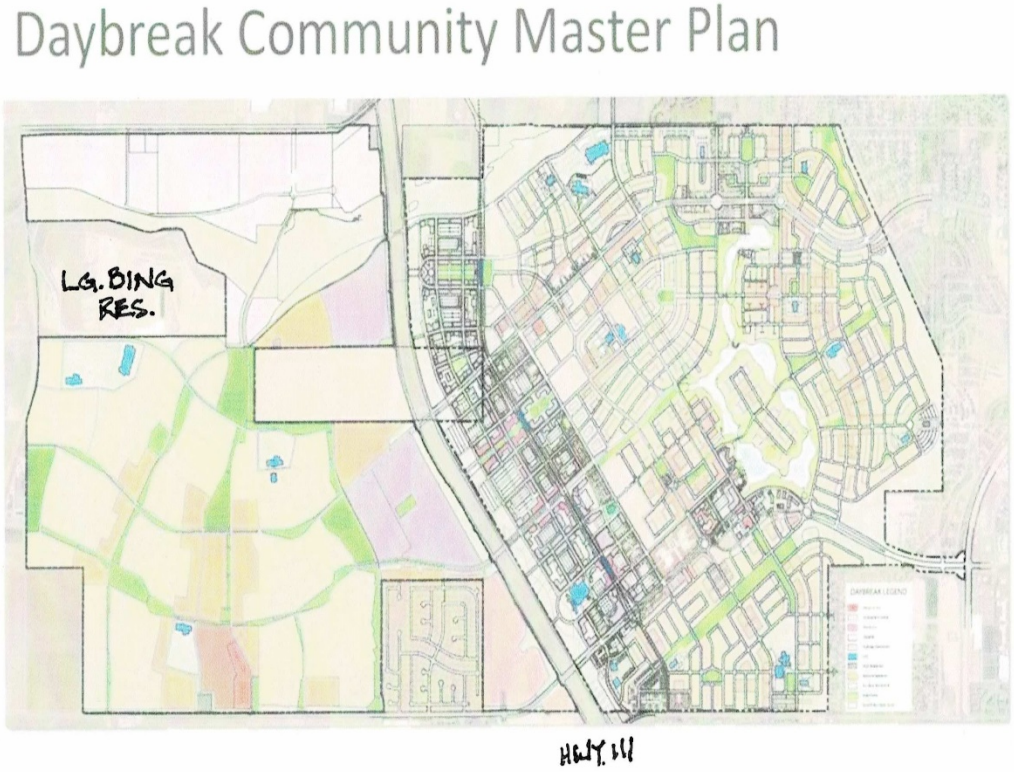

(Large Bingham Reservoir & Eastside Collection System and Daybreak/development)

(Daybreak Development Proximity to Waste Rock Dumps)

In Summeary: "Site" must be understood in its full extent, from the southernmost cutoff/interception wall in Yosemite Drainage (or whereever it is, in this day and age of climate change), through the entire sequence of cutoff walls and piping, through the Desilting Basin and both zones of the Large Bingham Reservoir, and also through the pipeline to the discharge points at the shores of the Great Salt Lake. Delineation of the site to its full extent is fundamental to an ecologically responsible basis for administering Permit 350006 to fully honor community environmental justice principles into the future!

DWQ Response 3:

The concerns captured in the images and narrative above do not fall under UGW350006 (described in comment response 2). As listed in comment response 1, the DWQ regulates Kennecott operations and facilities via multiple permits specific to a given activity or location. Specifically, the cutoff walls are regulated under UGW350010 (Bingham Mine Leach Collection System), the tailings pipeline is regulated under UGW350017 (Copperton Concentrator), the tailings impoundment is regulated under UGW350011 (Tailings Impoundment), and discharge points at the shores of the Great Salt Lake are addressed under UPDES Permit UT0000051 (Surface Water and Storm Water Discharges).

The sulfide plume shown in the above figure is undergoing monitoring and remediation under an EPA Record of Decision and is not managed under DWQ authority. Likewise, soil cleanup

activities within the area now occupied by Daybreak were conducted under Federal (EPA) regulation and do not fall under DWQ permits.

Permit Action: None.

III. Reservoir Liner Life

The liner system within the Large Bingham Reservoir and component parts of the Eastside Collection System and basins within the system is approaching 28 years old. In the industrial universe of synthetic liners --- setting aside the interaction of liners with materials contained within the vessels created --- generally considers a 28-year old liner system to be near the end of its life. This permit, suffice it to say, is heavily dependent on leak-detection and interception attributes. We can only urge UDWQ attention to these attributes, along with that of RTKUC, and for reviews to become increasingly frequent, for the sake of the vast numbers of migratory birds that pass through the Great Salt Lake ecosystem, the burgeoning numbers of residents of South Jordan and other potentially (inevitably?) affected municipalities, and for the future of water quality in the entire watershed. At this point, we will not venture into review of these administrative variables; as a career-long architectural and engineering specifications writer, however, we are committed to doing so as opportunity permits.

Suffice it to hypothesize that Kennecott's liners will need replacing in the relatively near future, some system constituents sooner than later. Standards by which this is done will present a formidable technological challenge.

DWQ Response 4:

Monitoring the life of the HDPE liner is a requirement under Part I.C.3 of UGW350006. At a frequency of once during each 5-year permit term Kennecott is required to conduct deconstructive testing of the HDPE liner. Based on the testing results, a written report projecting the useful life of the liner must be submitted to the DWQ and a proposed replacement plan and schedule will be required prior to reservoir relining.

Permit Action: None.

IV. Conclusions:

Mining impacts on communities are seldom as compressed either in space or time as is the case here, where historic copper mining has become a seemingly innocent habit, despite the near-world's-largest scale of the Rio Tinto/Kennecott Utah Copper Bingham Canyon Mine --- not to mention the monstrosity presented by the smelting and refining operation at Kennecott's "North End". The proximity of this industrial behemoth to the Great Salt Lake and its millions of migratory waterfowl, of at least 250 species, renders this industrial occurrence surely one of the most threatening to ecosystems and human life and livelihoods in the World. Given the severity of regional threats from air quality impacts from Kennecott's mine and processing facilities, combined with climate change impacts from the vast amounts of fossil carbon energy forms utilized, this particular ground water discharge permit must be recognized for what it is, truthfully:

a means to conceal a predatory international corporation's impacts on one of the most extensive resource extraction facilities on the planet --- wealth extracted notwithstanding.
We will not pretend that UDEQ/UDWQ is in position just to shut down the Large Bingham Reservoir, or any of the other dozen or so permitted dimensions of this legacy copper mine. We not only DO PRETEND, however, but we moreover insist within the powers of a concerned public to do so, that Rio Tinto, Kennecott, Utah Department of Environmental Quality and the Division of Water Quality responsibly and seriously submit for public review a plan for addressing the aging and maintenance of the Large Bingham Reservoir going into the future, and also consummate a Mine Closure Plan by which this entire facility will be closed --- ultimately necessitating a permanent Eastside Collection System and Large Bingham Reservoir complex to intercept and remove contamination from all mine water runoff, in perpetuity. Closure does not mean turning off the lights and leaving town. Here, as in most mines and ALL METAL SULFIDE MINES, it means the creation of a caring, environmentally just, ecologically responsible and competent, fully funded, social entity to execute the imperatives of controlling and optimizing the impacts of what the company has created heretofore.

Respectfully submitted,
Ivan Weber
Weber Sustainability Consulting (retired)
953 East 1st Avenue
Salt Lake City, Utah 84103
ivan@webersustain.com

DWQ Response 5:

A Mine Closure Plan does not fall within the scope of permit UGW350006. This requirement has been captured under Part II.J.3 of permit UGW350010 (Bingham Mine Leach Collection System). One year prior to final mine closure Kennecott is required to submit a Final Closure Plan for Director review and approval.

Permit Action: None.

References

1. Utah Groundwater Discharge Permit Application, Large Bingham Reservoir Zone 2. Kennecott Utah Copper, April 1994.

2. Bingham Canyon Mine East Side Collection Monitoring Network Ground Water Discharge Permit Application. Kennecott Utah Copper, April 1996.

3. Hydrogeology of recharge areas and water quality of the principal aquifers along the Wasatch Front and adjacent areas, Utah. U.S. Geological Survey Water Resources Investigations Report 93-4221. P.B. Anderson, D.D. Susong, S.R. Wold, V.M. Heilweil, and R.L. Baskin, 1994.

4. Ground-Water Quality Classification for the Principal Basin-Fill Aquifer, Salt Lake Valley, Salt Lake County, Utah. Utah Geological Survey. J. Wallace and M. Lowe, 2008.