



Great Salt Lake Lithium Feasibility Project – Final Report

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Great Salt Lake Lithium Pilot Project





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Acronyms and Abbreviations

CAPEX	capital expenditure
DLE	direct lithium extraction
DOGM	State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining
DWQ	State of Utah, Department of Environmental Quality, Division of Water Quality
FFSL	State of Utah, Department of Natural Resources, Division of Forestry, Fire and State Lands
gpm	gallons per minute
GSL	Great Salt Lake
IX	ion exchange
kg	kilogram
KPI	key performance indicator
Lilac	Lilac Solutions, Incorporated
NaOH	Sodium Hydroxide
mg/L	milligrams per liter
OPEX	operating expenditure
RO	reverse osmosis
TSS	total suspended solids
UAC	Utah Administrative Code
UPDES	Utah Pollutant Discharge Elimination System
Waterleaf	Waterleaf Resources, a Utah Limited Liability Company



1 Introduction

On October 21, 2024, Waterleaf Resources, LLC (“Waterleaf”) submitted a Feasibility Application to the State of Utah, Department of Natural Resources, Division of Forestry, Fire and State Lands (“FFSL” or “the Division”), requesting authorization to proceed with operation of a Feasibility Assessment project pursuant to the Utah Administrative Code (“UAC”) R652-21, Great Salt Lake Mineral Extraction for a lithium extraction facility (hereinafter generally referred to as “the Pilot Project,” “the Pilot Plant,” or simply, “the Pilot”) located in Box Elder County, Utah, on Gunnison Bay on the eastern shore of the North Arm of the Great Salt Lake (“GSL”). The Pilot Project was intended to demonstrate the technical and commercial viability of Waterleaf parent company Lilac Solutions, Inc.’s (“Lilac”) proprietary non-evaporative ion exchange (“IX”) direct lithium extraction (“DLE”) process in extracting lithium from North Arm brines. Following the Pilot Project’s successful demonstration of this technology and the Division’s acknowledgement that Waterleaf has met the criteria under UAC R652-21 for completion of a Feasibility Assessment, Waterleaf intends to pursue an Operations Royalty Agreement with the Division to produce lithium from the GSL using Lilac’s DLE technology.

This final report summarizes the requirements and deliverables set forth in Sections 4 and 5 of Waterleaf’s Feasibility Application.

2 Pilot Project Development

Lilac has developed a high-performance IX technology platform designed to work across a wide variety of brine resources, from high-grade salar brines to ultra-low lithium grade sources without evaporation. The technology exhibits high selectivity for lithium and maintains consistent performance across varying lithium concentrations and impurity profiles, making it adaptable to diverse brine chemistries without significant modification.

Recognizing the opportunity for lithium extraction from the GSL, in July 2022 Lilac commenced extensive laboratory and mini-pilot testing at its Oakland facility using GSL brine samples. Lilac has now completed over 15,000 IX cycles and accumulated more than 80,000 hours of operational data. This development work has been a success, demonstrating the technical and economic feasibility of lithium extraction from GSL, and provided the foundation for commercial plant design.

Based on these successful results in Oakland, Lilac made the strategic decision to construct an on-site pilot plant at GSL. The pilot plant was designed to operate with an IX reactor of the same design as the commercial-scale reactor, using GSL brine directly from the lake. This pilot plant would allow validation of Lilac’s technology under real operating conditions while generating comprehensive data required to support commercial plant development.



Site selection for the Pilot Plant began in early 2023, as the Waterleaf team evaluated multiple locations and properties around the GSL's North Arm. Waterleaf focused on the North Arm rather than the South Arm, as lithium concentrations were known to be relatively higher in Gunnison Bay (Bunce et al 2022).¹ Waterleaf engaged in discussions with multiple private landowners holding property adjacent to the North Arm, eventually agreeing to a long-term land lease with Mango-Spiral Jetty LLC. The leased property and selected site were deemed suitable for Pilot Plant construction and operation, as well as for potential future construction and operation of a commercial facility utilizing the same IX DLE technology.

Following site design and engineering, biological and cultural clearance surveys, and other federal, state and local permitting, construction of the Pilot Plant commenced in early May 2024. Waterleaf acknowledged certain schedule and cost risk at that time, as both FFSL and the State of Utah, Department of Environmental Quality, Division of Water Quality ("DWQ") were undertaking rulemaking processes to establish the regulatory framework for new GSL mineral production activities. Between May and October 2024, Waterleaf completed the following Pilot Plant construction activities: Figure 1 Pilot Plant Site.

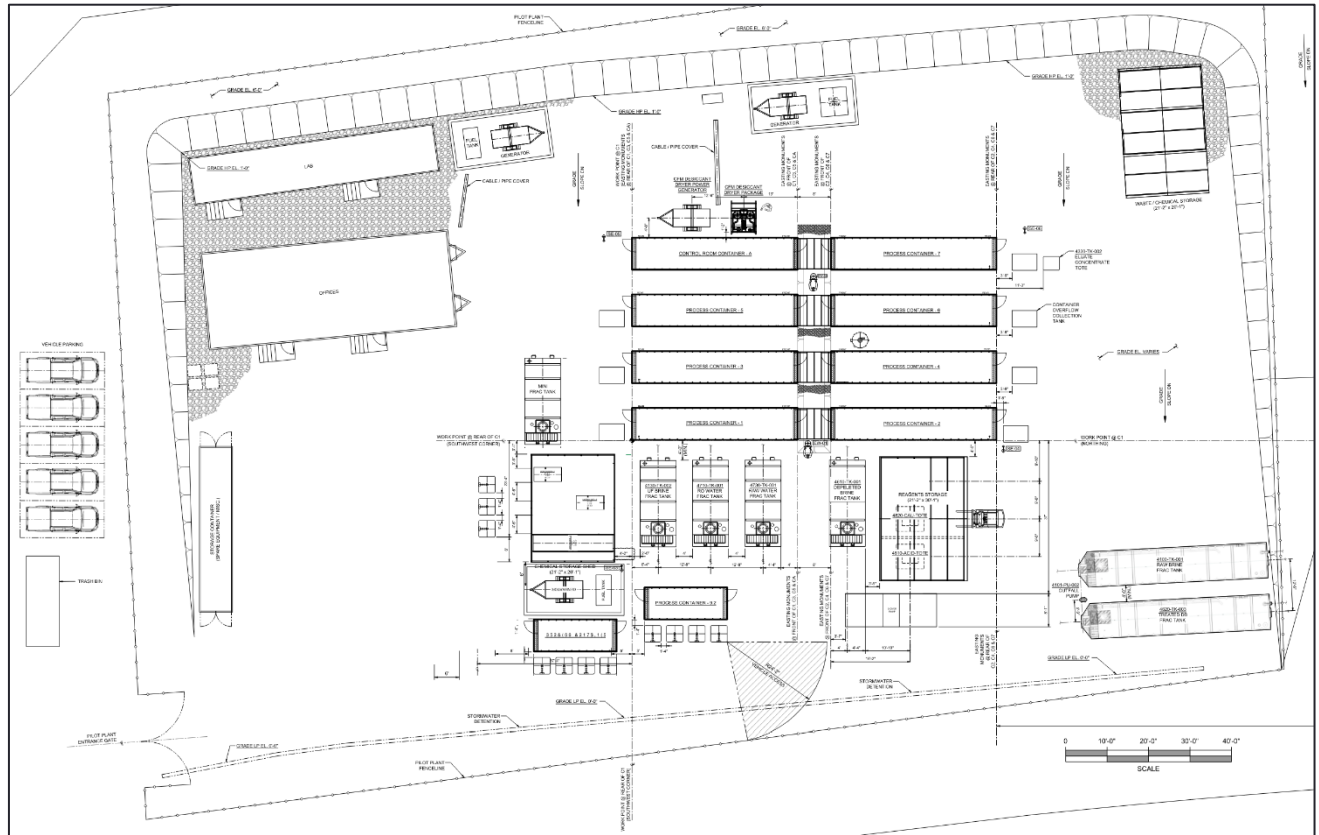
- Access road improvements, including approximately 2.5 miles of grading, drainage and stabilization of an existing two-track road across private land, from Rozel Flats Road to the Pilot Plant site;
- Grading and stabilization of the 1.25-acre Pilot Plant site;
- Mobilization and erection of eight (8) pre-fabricated container units with various unit operations of the lithium extraction process, as well as one (1) temporary office trailer and one (1) mobile laboratory;
- Interconnecting piping; and
- Various ancillary facilities (e.g. temporary storage tanks, generators, garages, lighting, security fencing, etc.).

Upon receiving authorization to proceed with the Pilot Project from FFSL on December 20, 2024, Waterleaf installed the temporary intake pump and piping system to withdraw brine from the North Arm and deliver to the Pilot Plant, as well as the discharge/outfall piping system to return lithium-depleted brine to the North Arm.

Pilot Plant "cold commissioning" – meaning, pressure- and leak-testing, instrumentation calibration, etc. with fresh water in closed-system operation – began in early January 2025; and "hot commissioning" – meaning, full testing and systems operation with pumped and discharged North Arm brine – began in early February 2025, following final issuance of Utah Pollutant Discharge Elimination System ("UPDES") Permit Number UT0026280 by DWQ.

¹ Bunce, L. Lowenstein, T. and Jagniecki, E. 2022. Spring, river, and lake water analyses from the Great Salt Lake basin, northern Utah: Utah Geological Survey Open-File Report 745, 4 p., <https://doi.org/10.34191/OFR-745>

Figure 1 Pilot Plant Site



3 Key Performance Indicators

As described in Waterleaf's Feasibility Assessment application, several key performance indicators ("KPIs") were identified by Waterleaf, in order to aid in evaluating the performance of the Pilot Project and its applicability to a future Operations Royalty Agreement request. The following subsections describe performance against each of the established KPIs. Those KPIs included the following:

- 1) Completion of a Performance Run which, following commissioning, will consist of continuous, stable operation of the Pilot Plant for a minimum of fourteen (14) consecutive days at a plant throughput of at least eleven (11) gallons per minute (gpm) of native/raw brine, maintaining an average on-stream factor of 90%;
- 2) No net loss of water from the GSL in the Lilac IX DLE process, as demonstrated by the following monitoring points:
 - a) Metered volume of native/raw brine through the intake system during the Performance Run; and



- b) Metered volume of lithium-depleted brine through outfall system, which is discharged back to the lake, during the Performance Run;
- 3) Lithium concentration of native/raw brine of at least 55 ppm, as observed in at least eight (8) individual grab samples collected during the Performance Run;
- 4) Product yield of at least one hundred (100) kilograms (“kg”) of lithium chloride and/or lithium sulfate eluate during the Performance Run;
- 5) Brine pretreatment performance achieving a total suspended solids of concentration of <10 milligrams per liter (“mg/L”) during the Performance Run;
- 6) Eluate cationic purity of 70% (lithium molar concentration/total cationic molar concentration);
- 7) Final pilot eluate lithium concentration of greater than 3,000 mg/L; and
- 8) A lithium recovery efficiency of at least 80%.

The sections below provide additional detail, metrics and relevant references for each of the KPIs. A more thorough description of the test work and operations conducted at the Pilot Plant, from construction and commissioning through the Performance Run, is provided in Section 4.

3.1 Performance Run Completion

The Performance Run officially commenced at 1:57 pm Mountain Daylight Time (MDT) on May 20, 2025 and concluded at 2:32 pm MDT on June 10, 2025, for a total Performance Run period of 30,275 minutes. The Pilot Plant remained online (meaning, processing brine through prefiltration, IX, and eluate washing) for a total of 27,974 minutes during the total operating period, resulting in an average onstream factor of 92.4%. During the Performance Run onstream operating period, the Pilot Plant processed a total of 131,553 gallons of brine.

The Performance Run KPIs of sustained, continuous operation – a minimum of 14 (fourteen) consecutive days with at least 90% onstream – and the Pilot exceeded this minimum performance run criterion. Indeed, Waterleaf extended the Performance Run duration by an additional seven (7) days, demonstrating the stable and robust nature of Lilac’s technology and its ability to extract lithium from GSL North Arm brine.

The target Pilot Plant throughput KPI during the Performance Run was eleven (11) gpm; the actual calculated value was 4.7 gpm. However, this flow rate is calculated across the full process, from intake system, through prefiltration/IX DLE/eluate washing, and finishing with discharge of lithium-depleted brine back to GSL. The process “bottleneck” in terms of flow rate was actually the prefiltration step rather than Lilac’s proprietary IX DLE technology (identified during the commissioning phase; see Section 4.1 for additional detail). When taking into account the various surge/buffer tanks and intraprocess flow monitoring points, the actual performance peaked at a maximum flow rate of approximately 9 gpm. As



such, technology provider Lilac has deemed these values to meet the intent of the Performance Run process rate/throughput KPI.

As such, these metrics result in successful demonstration of the Performance Run.

3.2 Water Usage

Perhaps the most critical showing of the Pilot Project is validation of no-net-loss of GSL water from Lilac's IX DLE technology. Although this KPI was specific to the Performance Run, Waterleaf monitored and is reporting flows for the entirety of Pilot Plant operations, including commissioning and decommissioning. The following sections summarize intake flows for raw brine, added process/makeup fresh water, and mitigation water.

Intake and Discharge flow meters were calibrated from the factory prior to installation of Pilot operations.

3.2.1 Raw Brine Intake

Raw brine originated from the North Arm of GSL, pumped via an intake system from open water to the Pilot Plant. Raw brine intake by month and operating period – commissioning (i.e., prior to commencement of the Performance Run), Performance Run, and decommissioning (i.e., following completion of the Performance Run) – is provided in

Table 1 below.

Table 1. Raw Brine Intake, by Month

	Commissioning Intake (gal)	Performance Run Intake (gal)	Decommissioning Intake (gal)	Combined (gal)
January 2025	26,930	0	0	26,930
February 2025	72,650	0	0	72,650
March 2025	65,510	0	0	65,510
April 2025	215,770	0	0	215,770
May 2025	68,640	70,560	0	139,200
June 2025	0	60,990	148,790	209,780
July 2025	0	0	237,940	237,940
August 2025	0	0	125,460	125,460
TOTAL	449,500	131,550	512,190	1,093,240

3.2.2 Process/Makeup Fresh Water

As described in Section 3.2 of Waterleaf's Feasibility Assessment application, the Pilot Plant required certain process/makeup water for operations. Purchased groundwater from an adjacent landowner was trucked to the Pilot Plant site and pumped into a holding tank, where flows from the holding tank to various



unit operations were metered. Total process/makeup freshwater usage by month and operating period is provided in

Table 2 below.

Table 2. Process/Makeup Fresh Water Addition, by Month

	Commissioning (gal)	Performance Run (gal)	Decommissioning (gal)	Combined (gal)
January 2025	7,380	0	0	7,380
February 2025	7,860	0	0	7,860
March 2025	5,960	0	0	5,960
April 2025	13,280	0	0	13,280
May 2025	11,890	1,710	0	13,600
June 2025	0	1,570	5,090	6,660
July 2025	0	0	28,490	28,490
August 2025	0	0	3,070	3,070
TOTAL	46,370	3,280	35,650	86,300

3.2.3 Discharge

Pilot Plant total discharges by month and operating period are provided in Table 3 below. The discharge amounts represent the total volume of water, including both depleted brine and process/makeup water, returned to GSL.

Table 3. Pilot Plant Discharge, by Month.

	Commissioning (gal)	Performance Run (gal)	Decommissioning (gal)	Combined (gal)
January 2025	0	0	0	0
February 2025	77,560	0	0	77,560
March 2025	77,130	0	0	77,130
April 2025	226,160	0	0	226,160
May 2025	60,900	79,560	0	140,460
June 2025	0	63,140	141,200	204,340
July 2025	0	0	254,400	254,400
August 2025	0	0	153,080	153,080
TOTAL	441,750	142,700	548,680	1,133,130

3.2.4 Mitigation Water

No mitigation water was purchased and/or discharged to GSL as part of the Pilot Project. The approved water right utilized for the Pilot Project was consumptive but not utilized as such, as all brine water was returned to GSL.



3.2.5 Summary

Table 4 provides the **Performance Run** period total volume processed through Pilot Plant, demonstrating that the Pilot Project meets the no-net-loss KPI as defined in UAC R652-21. It is important to note that the +5.5% difference is specific to the Pilot Plant configuration and operations and should not be construed as a fixed and firm value for any future commercial project. A commercial project utilizing Lilac's technology will achieve no-net-loss of water from GSL, although the exact ratio may be slightly different. Expected water usage for a commercial project will be addressed in Waterleaf's Operations Royalty Agreement application materials.

Table 4. Performance Run Pilot Plant Throughput, Returned approximately 11,000 gallons more water to the lake than withdrawn.

	Raw Brine, Total	Process/Makeup Water, Total	Discharge, Total	Difference
Volume (gal)	131,553	3,475	142,706	+5.5%

3.3 Native Brine Lithium Concentration

GSL North Arm brine lithium concentrations were monitored regularly over the course of Pilot Plant operations, at a sample port on the intake system immediately upstream of the intake surge/buffer tank. Samples were collected weekly as part of the UPDES discharge permit monitoring and analyzed by Chemtech Ford, a National Environmental Laboratory Accreditation Program-certified independent outside laboratory located in Salt Lake City, Utah, as well as more frequently by Lilac's on-site laboratory staff.

During the course of all Pilot Plant operations (including commissioning, Performance Run, and post-Performance Run), native brine lithium concentrations averaged 68 mg/L in the samples analyzed by Chemtech Ford (N=25) and 66 mg/L in the samples analyzed by Lilac's on-site laboratory (N=283).

During the Performance Run, native brine lithium concentrations averaged 67.4 mg/L in the samples analyzed by Chemtech Ford (N=3) and 68 mg/L in the samples analyzed by Lilac's on-site laboratory (N=18). The 67.7 mg/L measured concentration across 21 samples meets this KPI.

3.4 Product Yield

As further discussed below in Section 4.1, two different washing reagents were tested at the Pilot Plant during the commissioning period. Following plant commissioning and test work, sulfuric acid was the selected reagent for the Performance Run, resulting in lithium sulfate eluate as the target product. As described in Section 3.1.3 of Waterleaf's Feasibility Assessment application, lithium product as eluate was shipped from the Pilot Plant site to Lilac's headquarters and laboratory in Oakland, California for drying, concentrating, and quality analysis.



During the Performance Run, a total of 3,435 kg of liquid lithium sulfate was produced, or approximately 163.4 kg per day. The product yield during the Performance Run meets the target KPI.

3.5 Prefiltration Performance

As further discussed below in Section 4.1, prefiltration is a key aspect of overall performance of Lilac's proprietary DLE technology, and several configurations were tested during Pilot Plant operation. The initial flow sheet involved a primary filtration step using a filter press with the addition of filtration aid and polishing step with a polymeric ultrafiltration module. Using the same equipment, the arrangement was modified to, in one case, bypass the polishing ultrafiltration module, in another case, bypass the primary filter press, and in another case, cease the use of filtration aid. The prefiltration equipment was then modified to flow raw brine directly to a cross-flow ceramic ultrafiltration unit. The final configuration, selected for the Performance Run, included direct filtration of the raw brine using a multimedia filter. Total suspended solids ("TSS") concentration was monitored at two sample ports for this KPI – immediately upstream of the intake surge/buffer tank (referred to herein as *TSS-1*; same location as for the raw brine lithium concentration KPI) and immediately downstream of the prefiltration process block (referred to herein as *TSS-2*). *TSS-1* (N=7) and *TSS-2* (N=7) samples were processed in Lilac's on-site laboratory during the Performance Run. *TSS-1* averaged <60 mg/L and *TSS-2* averaged <60 mg/L during the Performance Run, resulting in a TSS sample testing results below the detection limit.

As *TSS-2* averaged <60 mg/L during the Performance Run, this KPI is deemed to have been met.

3.6 Eluate Purity and Concentration

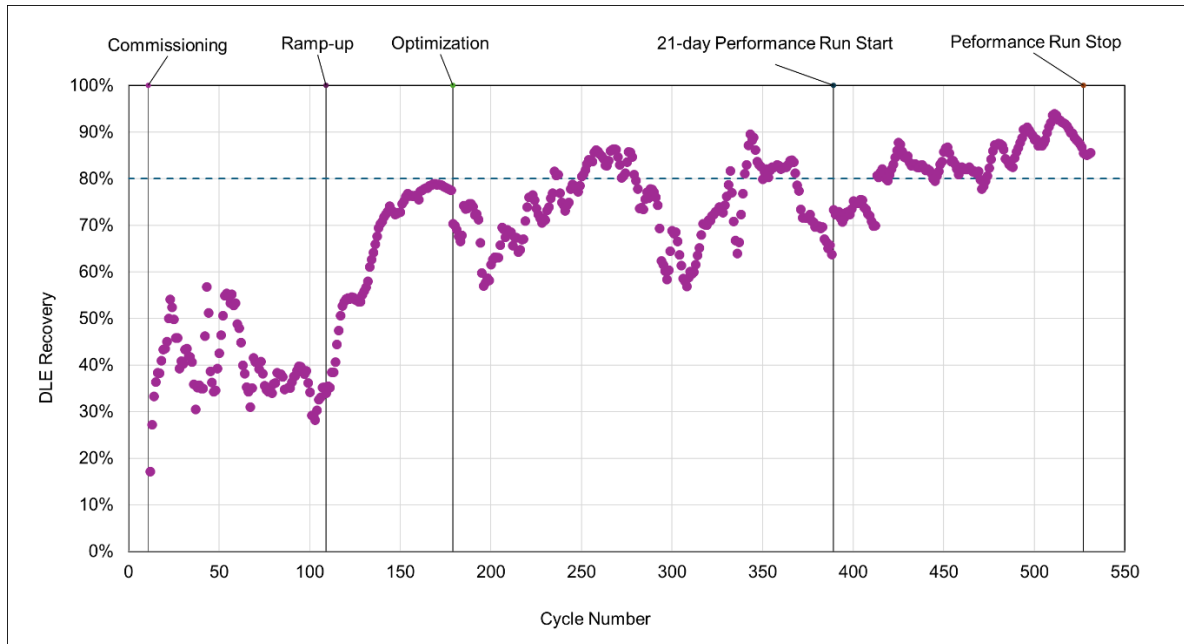
Eluate was shipped in one-cubic-meter totes from the Pilot Plant site to Lilac's headquarters in Oakland, California for product quality analysis. During the Performance Run, lithium sulfate eluate was produced, with a total of 3 totes shipped from the site to Oakland during this period.

Product quality analysis at Lilac's laboratory showed an average eluate cationic purity of 86% percent and average eluate lithium concentration of 8,707 mg/L across the Performance Run totes, thus meeting the sixth and seventh KPIs.

3.7 Recovery Efficiency

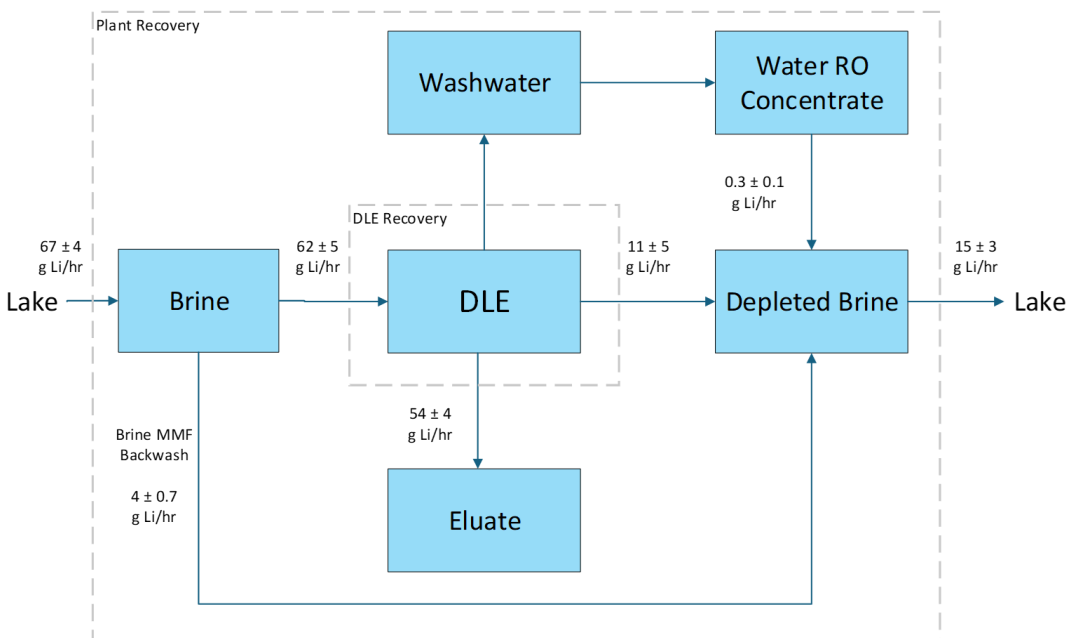
One of the most critical factors in demonstrating commercial viability of Lilac's IX DLE technology is recovery efficiency, meaning how much lithium is captured as product vs. being returned to the lake in the discharge stream. During Pilot Plant commissioning, recovery efficiencies varied widely as different combinations of prefiltration equipment, reagents, IX media loading, operating parameters, etc. were tested by the Pilot Plant operations team. The preferred combination of components were selected for the Performance Run, at which time recovery efficiency was measured as a comparison of the lithium concentration in the intake brine vs. the lithium concentration in the discharge stream.

Figure 2. DLE Recovery during plant operations.



Two recoveries can be calculated across the Pilot Plant: plant recovery and DLE recovery. The total plant lithium recovery is a function of the DLE unit as well as lithium losses in unit operations, such as the brine filter backwash. The DLE recovery represents the recovery of only Lilac's DLE technology.

Figure 3. Performance Run Lithium Mass Balance.





A total of 18 plant intake samples and 12 plant discharge samples were analyzed in Lilac's on-site laboratory during the Performance Run. The average intake concentration (also described in Section 3.3 above) was 68 mg/L, and the average discharge concentration was 14 mg/L, resulting in a calculated plant recovery of 77% percent.

A total of 21 raw brine samples and 139 depleted brine samples were analyzed entering and exiting the DLE unit. The average concentration of brine in was 67 mg/L and the average depleted brine concentration leaving the DLE unit was 12 mg/L. This yields a DLE recovery of 82%, thus this KPI was met.

Further discussion on recovery efficiency, and how it factors into commercial viability, is provided in Section 4.3.

4 Test Work and Operations

This section describes the various unit operations of the Pilot Plant, including equipment configurations, reagents, operating parameters, and combinations thereof, both during commissioning and general test work, as well as during the Performance Run. This section also identifies important lessons learned from the Pilot Plant, which will be applied at the commercial level.

4.1 Process Technology Evaluation

Lilac has been developing its proprietary non-evaporative IX DLE process for nearly a decade, having evaluated lithium-rich brines from around the world – including the GSL North Arm² – in its small-scale test facility and laboratory in Oakland, California. Lilac has also deployed similar pilot units at projects in South America, including Chile and Argentina.

The GSL Pilot Plant was designed to demonstrate Lilac's IX technology under real-world operating conditions while generating comprehensive data for commercial plant development. The pilot represents the critical validation step between Oakland mini-pilot testing and commercial deployment, operating at a scale sufficient to provide performance data while maintaining operational flexibility.

The GSL Pilot Plant utilizes the same packed bed IX reactor design as planned for the commercial facility, maintaining identical bed thickness. Maintaining constant bed thickness ensures that both superficial velocity and brine contact time with the IXM are preserved between pilot and commercial scales when operating at the same residence time, allowing direct translation of lithium extraction performance. This approach ensures direct applicability of pilot performance data to commercial operations while maintaining manageable pilot operational requirements. The reactor configuration and ion exchange media are representative of the commercial design, incorporating the latest technology advancements.

² See Appendix A. Final Brine Sampling Report, March 2024

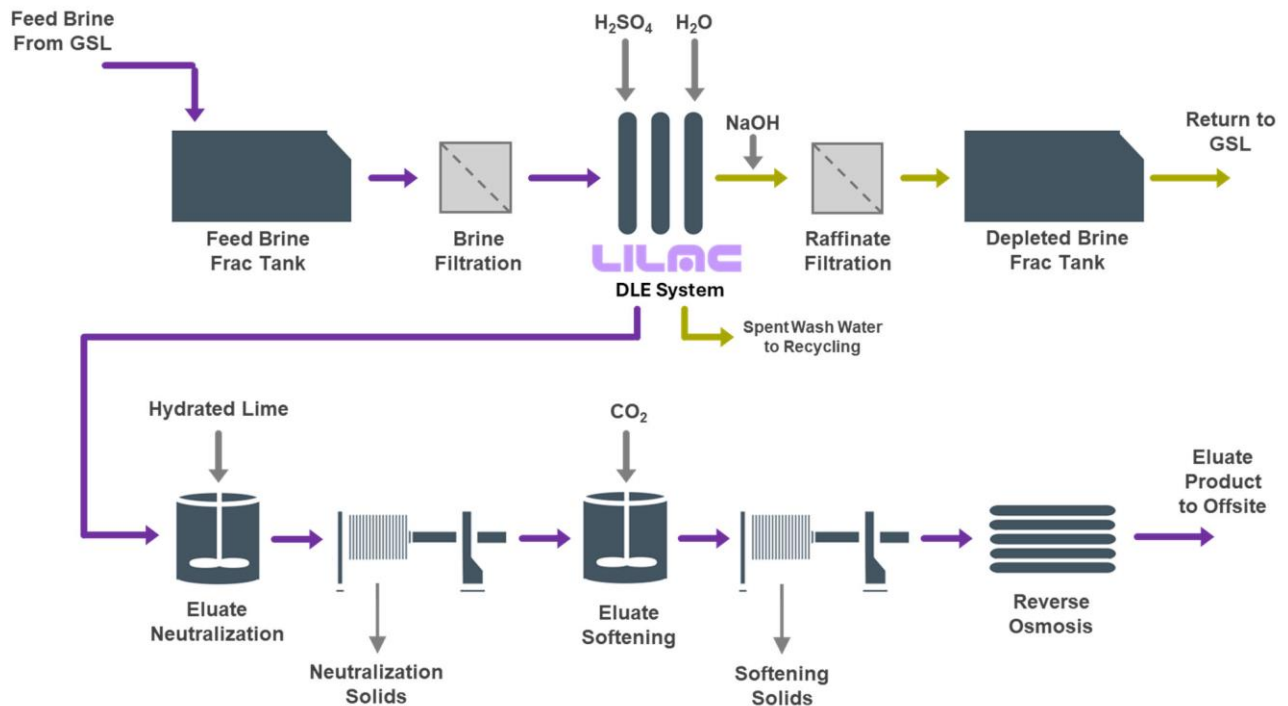


During the majority of the operational period, the pilot plant operated with 3 parallel IX vessels at a baseline brine flowrate of around 18 liters per minute at standard IX operating setpoints. The pilot program also included testing with 8 parallel vessels configuration at a baseline brine flowrate of 47 liters per minute, serving as a system stress test and validating scale-up performance with increased vessel count. The plant utilized raw brine pumped directly from Great Salt Lake at ambient temperature, demonstrating the technology's capability to process natural brine without energy-intensive heating or cooling of the brine. The final product from the pilot plant, a concentrated lithium sulfate eluate, was packaged and shipped to Lilac's Oakland facility and third-party partners for conversion to battery-grade lithium carbonate, allowing the pilot to focus on core DLE technology demonstration.

The GSL Pilot Plant process consisted of four main process areas: (Figure 3)

- Brine Intake and Filtration
- Lilac Ion Exchange
- Eluate Processing
- Depleted Brine Treatment and Return

Figure 3. Lilac Solutions, Inc. IX DLE Process



Although not a specific KPI, another critical component of the Pilot Project was to demonstrate Waterleaf's ability to comply with discharge permit thresholds, during both commissioning and



Performance Run operations. DWQ issued UPDES Permit No. UT0026280 to Waterleaf on February 4, 2025. Compliance and reporting requirements pursuant to UPDES Permit No. UT0026280 have been separately coordinated with and submitted to DWQ, and those reports are incorporated herein by reference. The reported results can be found here: [NPDES Monitoring Data Download | ECHO | US EPA](#).

4.1.1 Intake and Prefiltration

Raw, or lithium-rich, brine was pumped from Gunnison Bay via an air operated double diaphragm pump system and high-density polyethylene pipe to convey raw brine from open water to the Pilot Plant. Raw brine pumping rates varied across the course of operations but averaged approximately eleven (11) gpm. Raw brine was pumped to an upstream (meaning, prior to any prefiltration, pH adjustment, or any other treatment) 21,000-gallon holding tank. This holding, or surge, tank was used to buffer flows from the open water intake system to the various process units, allowing for test work and maintenance activities to occur on either side of the tank. Intake flows were monitored at a flow meter immediately upstream of this tank and are summarized in Section 3.2.

Over the course of the Pilot Project, multiple prefiltration flowsheets were explored, trialed, and evaluated to determine economic feasibility and process compatibility.

In The Filter Press/Polymeric Ultrafiltration option:

Raw brine was piped from the surge tank to a primary filtration filter press unit with the addition of filtration aid before moving to a polymeric ultrafiltration module for final polishing. The primary filter press had a nominal mesh size of five (5) microns (operable one [1] micron, with filtration aid), while the final polishing ultrafilter had mesh size of 0.02 micron. Intermittently, the ultrafilter was mechanically cleaned by performing a backwash, where filtered permeate was flowed in reverse to remove accumulated solids on the surface of the membrane. The solids removed during the backwash were fed to the filter press for separation and removal. Additionally, on a less frequent basis when the ultrafiltration performance was low, the membrane was chemically cleaned with a dilute acid or base reagent. The "Clean-in-Place" (CIP) waste was neutralized and transferred to a holding tank. The waste was removed from the facility for processing by Clean Earth.

At the primary filter press, the accumulated brine solids and filtration aid were intermittently dewatered, dried, discharged, and collected. The solids were finally transferred to a Box Elder County landfill located near Tremonton, Utah.

In the Ceramic Ultrafiltration option:

Raw brine was fed directly to a cross-flow ceramic ultrafiltration unit with a particle cut-off of 0.06 micron. The filtered permeate was then transferred to the downstream IX processes, while the solids concentrated retentate stream was combined with the depleted brine outfall and returned to the lake. The ceramic ultrafiltration unit was mechanically cleaned through a backwash and the stream was returned to the feed. Intermittently, the unit was chemically cleaned using dilute acid or base reagents and then



waste was neutralized and transferred to a holding tank. The waste was removed from the facility for processing by Clean Earth.

In the multimedia filter (MMF) option:

MMF emerged as the optimal solution by taking advantage of the bimodal particle distribution characteristics observed in GSL brine. Figure 4 illustrates the particle size distribution for raw GSL brine (green), MMF-filtered brine (yellow), and brine exiting the Lilac IX system (red), measured by dynamic light scattering (DLS) instrument with results presented as normalized percentage distribution. The data clearly demonstrates MMF's selective filtration performance, with an absolute cutoff around 4-5 μm that effectively removes the larger particle population while allowing the majority of smaller particles to pass through.

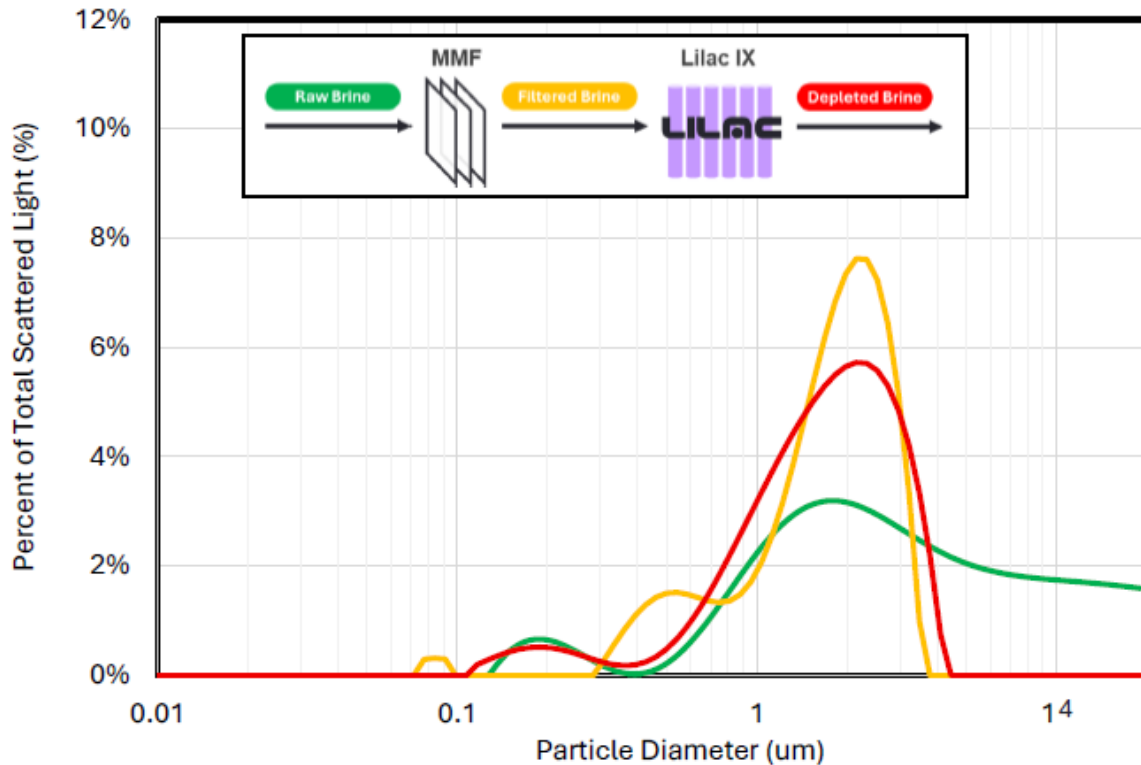
The selective removal approach proves ideal because fine particles ($<4\ \mu\text{m}$) that pass through the MMF do not adversely affect the performance of Lilac's IXM, which demonstrates improved solids tolerance compared to previous generations. The red curve confirms that these smaller particles transit through the IX system without causing operational issues or performance degradation.

The MMF system demonstrated exceptional operational reliability throughout the pilot campaign. The brine filtration MMF used at the GSL Pilot consisted of three layers: gravel at the bottom as a support media, activated glass filter media at the middle as the primary filtration layer, and anthracite at the top as a guard filter media. The system required minimal oversight beyond a scheduled daily backwash regimen, with no fouling or MMF pressure buildup observed during plant operations.

A significant operational advantage of the MMF system is its zero brine solids waste generation. As MMF is a pure physical filtration process with no foreign chemicals added to the brine, the captured solids remain in their natural state and are environmentally acceptable for return to the lake. The MMF backwash process utilizes brine rather than freshwater, producing a backwash stream containing these naturally occurring solids in transit, which is combined with the general depleted brine return stream and discharged back to the lake. This approach eliminates brine solids waste disposal requirements while maintaining low fresh water consumption in the overall process.

By targeting only problematic larger particles while avoiding unnecessary removal of benign fine particles, MMF provides the most cost-effective filtration solution with proven operational reliability. All IX performance runs presented in this report were conducted using MMF-filtered brine.

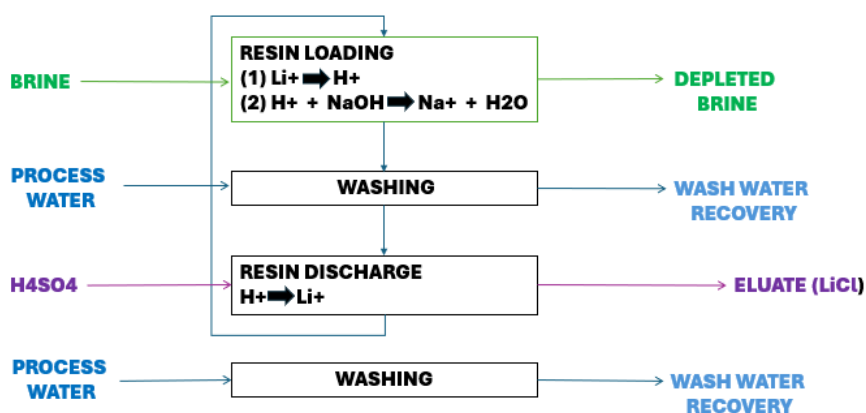
Figure 4 Particle Size Distribution of Raw, Filtered, and Depleted GSL Brine



4.1.2 IX DLE

After prefiltration, filtered raw brine was pumped to the proprietary IX DLE media, where selective extraction of lithium occurs. The net effect of lithium extraction via Lilac's process is the replacement of lithium ions in the brine with sodium ions. To extract lithium, Lilac processes brine in a four-stage IX cycle, as shown in Figure 5 below. The Pilot Project was initially conceived to test two different acid reagents – hydrochloric acid (HCl) and sulfuric acid (H₂SO₄) – in the third stage, as highlighted in Figure 5. Both reagents have been successfully tested by Lilac at the bench scale in Oakland, although sulfuric acid has consistently resulted in higher product yields at this small scale.

Figure 5. Lilac IX process flow.



During the course of Pilot Plant construction, it was ultimately decided by Waterleaf and Lilac to only operate using the sulfuric acid reagent, including both during commissioning and the Performance Run, in order to best understand IX media performance and durability, recovery rates, and product quality for the higher-yielding acid. As described in Section 3.4, a total of 3,435 kg of liquid lithium sulfate eluate was produced during the Performance Run. Sulfuric acid has similarly been selected as the preferred reagent for the commercial scale, with hydrochloric acid no longer being tested or considered by IX DLE technology provider Lilac for the GSL brine.

The pilot plant operates a single Lilac IX module comprising multiple vessels containing proprietary ion exchange media. The IX process operates in a four-step cycle:

- **Brine Loading:** Lithium-bearing brine is passed through the IXM, selectively loading lithium onto the Lilac IXM.
- **Water Washing:** Process water is used to wash the IXM, removing residual brine from the bed.
- **Acid Elution:** Dilute sulfuric acid solution is passed through the IX media, producing a lithium sulfate eluate.
- **Water Washing:** Process water removes residual acid from the bed, before going back to Step 1.

The purpose of the water washing steps is to ensure that no brine is mixed with the eluate, and vice versa. IX process inputs include filtered brine, process water, and sulfuric acid. Process outputs include lithium-depleted brine, spent wash water, and lithium sulfate eluate solution.

Caustic soda (NaOH) was used to neutralize acid (H^+) added in the IX media regeneration step, resulting in a net neutralization of the acid and base used in the IX process. Thus, the acid and base utilized in the IX process exited the process as additional water in the lithium-depleted brine. Approximately 1,570 kg of NaOH were consumed across the course of Pilot Plant operations, including 260 kg during the Performance Run.



4.1.3 Eluate Post-Processing

Upon leaving the DLE IX process, the acidic lithium sulfate was neutralized with base, and the precipitated solids removed in a filter press. Soda ash was used to further soften the eluate, in order to reduce residual calcium and magnesium, and these solids were removed in a secondary filter press unit. During the course of Pilot Plant operations, a total of 2,435 kg of precipitated solids were removed and disposed of offsite, which includes 478 kg during the Performance Run.

The purified eluate was further concentrated using a seawater reverse osmosis (“RO”) unit. This seawater RO unit concentrated the eluate to the retentate stream for further downstream processing, with water recovered to the permeate stream and recycling back into the process. As mentioned in Sections 3.4 and 3.6, the final concentrated eluate product was shipped to Lilac headquarters in Oakland for further crystallization into lithium carbonate (Li_2CO_3) solids.

It is important to note that residual process water from the concentrated eluate was not recovered, as this was deemed to be beyond the scope of the Pilot Project. Returning residual process water from Oakland back to the Pilot Plant for reinjection into the discharge stream was neither necessary nor practical and would not have improved the overall technology demonstration. However, this residual process water will be recovered and reused on-site at the commercial scale during downstream lithium crystallization.

4.2 Successes, Limitations, and Lessons Learned

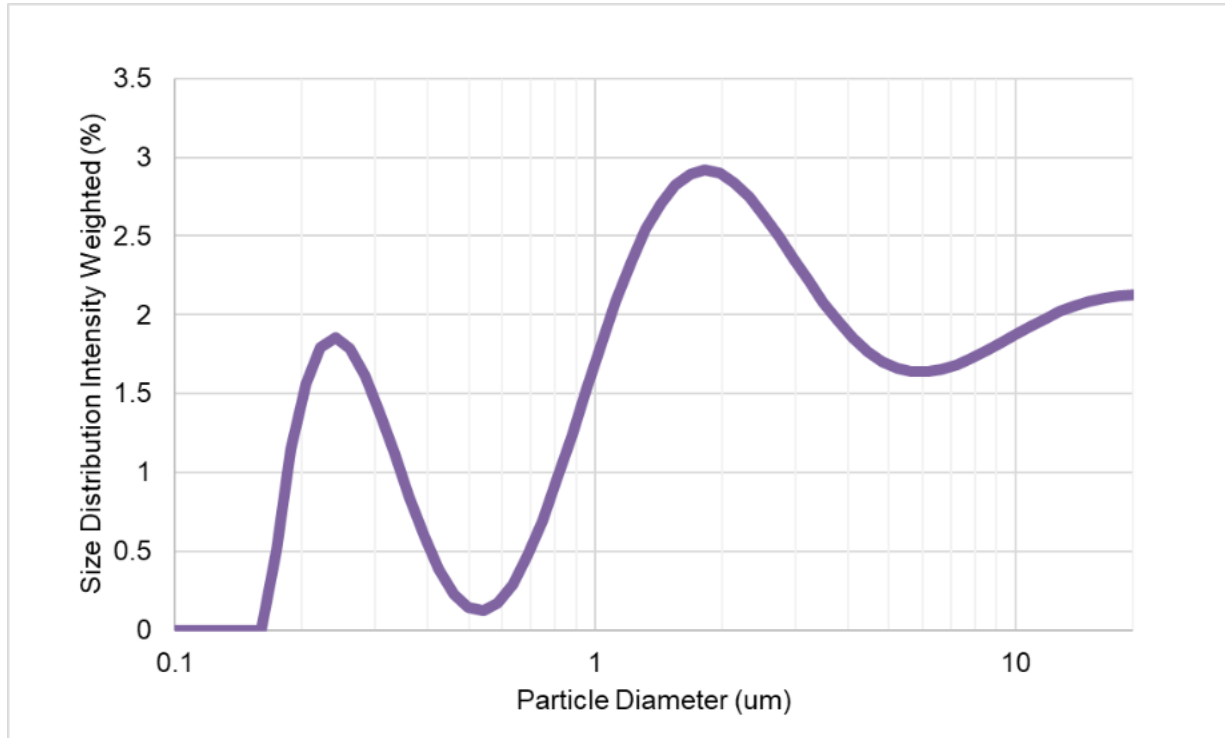
Outside of demonstrating the performance of Lilac’s IX DLE technology on GSL North Arm brine through quantitative KPIs, the Pilot Project was expected to generate certain learnings that could be applied to a future commercial facility. This section discusses various non-quantitative successes, limitations, and other lessons learned over the course of Pilot Plant operations.

These operational insights will directly inform system design presented in Waterleaf’s forthcoming Operations Royalty Agreement application.

4.2.1 Prefiltration

Selection of prefiltration technology presented a unique challenge in trying to balance throughput, quality, and expected commercial cost. As described in Section 4.1, multiple equipment and technology arrangements were implemented as the primary prefiltration process in the field pilot. More still were trialed at the bench scale and offsite mini-pilot scale to exhaust all possibilities for finding the most appropriate selection.

Chart 4.2.1. Great Salt Lake Particle Size Distribution



The brine of GSL's North Arm has physical properties which make any filtration process challenging. The particle size distribution of the native solids in the raw brine stream contains two distinct ranges – one between 0.1-0.5 micron and the other between 1-5 micron. See chart 4.2.1, The smaller size range of particles proved to be more challenging to remove with a cost-effective solution; however, at the start of operations, it was deemed necessary to remove this smaller range in order to achieve acceptable levels of performance out of the downstream IX module. Another property of GSL brine which presents a filtration challenge is the high total dissolved solids, particularly of Mg^{2+} . This contributes to its high viscosity, further exacerbated during the colder winter months. Viscous brine flows more slowly and resists movement through filter media, increasing the pressure needed to maintain a given flow rate. This higher resistance can reduce filtration efficiency and demand more energy to operate. Operating during the winter months provided important learnings on both the equipment design margin required to operate year-round, as well as the technology selected for the commercial design.

In optimizing both the filtration and downstream IX equipment, the strain size required by the prefiltration equipment was relaxed, allowing for the consideration of additional pretreatment technologies. Also, testing showed that membrane filtration would be extremely difficult and require substantial filtration surface area due to the physical properties of the brine. Over the course of Pilot Project operations, it was determined that direct filtration using a Multi-Media Filter provided an optimized mix of effluent quality,



expected throughput per unit of filtration area, and capital investment. It was selected as the prefiltration equipment for the Performance Run period and as the basis for future commercial estimates.

4.2.2 Commercial Scaling

As described in Section 3.3 of Waterleaf's Feasibility Assessment application, the scale up from pilot to commercial scale is anticipated to occur in two ways:

- 1) Increase in the physical dimensions of the pumping, prefiltration and IX steps, and
- 2) Deployment of multiple trains of the sized-up process equipment to achieve target industrial throughput and production volumes.

Based on observations during Pilot Plant operations, the flow path and residence times in the Lilac IX vessel are not anticipated to change between the pilot and commercial scales, retaining the technical validity of the bench/pilot/commercial scale-up process. As commercial design is ongoing, special attention is being paid to the prefiltration unit operation to accommodate increased brine flow rates. Multiple prefiltration trains, as well as additional on-site spares and equipment, will add redundancy to the commercial facility that was not present during pilot operations. Capital investment for multiple trains and on-sites spares is not practical at the pilot phase, and this risk was recognized on multiple occasions during Pilot Plant commissioning, where unscheduled plant down time was the result of waiting for spare and replacement parts to be delivered.

As mentioned in Section 4.1, both hydrochloric and sulfuric acids were originally considered for testing at the Pilot Plant; however, only sulfuric acid was utilized during operations due to its elevated technical performance in the IX DLE block (as tested by Lilac at the bench scale). While both are effective on GSL brine, certain operational considerations such as storage and material handling render use of two different agents impractical at the commercial scale. As both are readily available from the market in commercial quantities, and sulfuric acid has a decided technical performance advantage over hydrochloric acid, supply and storage logistics (e.g. reliable, consistent material delivery to the site, required storage space, etc.) and commercial considerations (e.g. purchase price, contract term, etc.) will focus on sulfuric acid as Waterleaf moves into commercial development.

4.2.3 Commercial Viability

The Pilot Project has provided critical data informing future commercial design optimization.

Three KPIs are expected to have a direct influence on the viability of a future commercial project:

- **Pretreatment Performance**, meaning the final concentration of suspended solids in the brine before the IX media loading vessel (as discussed in Section 4.2.1 above);
- **Lithium recovery efficiency**, meaning how much lithium can be extracted per unit volume of prefiltered brine; and



- **Onstream factor**, meaning the process equipment “up time”, or how many hours per day/week/month/year the plant and process equipment can operate at its target efficiency.

There are several commercial capital and operating expenses (“CAPEX” and “OPEX” respectively) associated with each of these KPIs which inform commercial viability. To date, Waterleaf has made certain assumptions based on industry experience and vendor quotations regarding a commercial project, and the Pilot Project served to validate, invalidate, and/or modify those assumptions.

Pretreatment performance, and the CAPEX and OPEX associated with this unit operation, was perhaps the most important finding of the Pilot Project. Although TSS was known to occur in GSL North Arm brine from earlier small-scale test work, the continuous throughput of brine during Pilot Plant operations proved challenging. As mentioned previously, the Pilot Plant was not configured with oversized and/or on-site spare prefiltration equipment, resulting in significant unscheduled “down time”. This will be addressed in the commercial design, primarily using the selected prefiltration scheme that was deployed during the Performance Run. However, prefiltration with a higher duty specification (meaning, more effective and efficient removal of TSS) results in both increased CAPEX (although still off the shelf, the equipment is simply more expensive) and increased OPEX (due to more frequent cleaning cycles, increased mass for offsite transport and disposal, etc.). A primary task in the commercial design process engineering is to balance CAPEX and OPEX against recovery efficiency and onstream factor, to find the most cost-effective combination.

Recovery efficiency was as expected. Lilac’s IX media is the company’s core competency and highest-value intellectual property, and there was little uncertainty surrounding the IX unit operation performance leading into the Pilot Project. The main lesson learned regarding recovery efficiency as it applies to commercial viability was the number of cycles the IX media could sustain with each of the acid washing reagents. Lilac manufactures the IX media in Fernly, Nevada, to be shipped to the project site during the commercial phase. The Pilot Project allowed for refining financial assumptions surrounding IX media production lead time, shipping intervals, on-site stockpiling, and other OPEX values.

Another commercial viability consideration relating to on-stream factor was the ambient operating conditions. The GSL North Arm, particularly during winter, is a harsh operating environment. During pressure and leak testing of the interconnecting piping, and during early commissioning runs, freezing and salt build-up proved to be constant challenges. Waterleaf retrofitted much of the Pilot Plant to accommodate the ambient temperatures, with conditions improving significantly by the time of the Performance Run period. However, special consideration is being given to the commercial plant design to mitigate freezing issues, such as heat-traced and insulated piping, additional steam generation and usage, preventive maintenance program, and enclosed and protected workspaces. Each of these may result in slightly higher CAPEX and OPEX values, with the trade-off of an improved on-stream factor.

The Pilot Project provided essential insight into the technical and economic levers governing commercial viability. While lithium recovery efficiency is already strong, pretreatment reliability and climate resilience



are the two areas requiring design evolution. With targeted upgrades in these areas, the transition to a scalable, high uptime commercial operation will be implemented.

Waterleaf Key Commercial requirements

Key Requirement / Activity	Achievement
Select optimal brine pretreatment solution	Confirmed no brine pH adjustment or chemical addition required. Multimedia filtration (MMF) selected for brine solids removal – lowest CAPEX & OPEX option while leveraging IX enhanced solids tolerance.
Validate FEL-3 design performance targets	On average during steady state operations: Lithium Recovery: 87% (vs 84% target) Impurity Rejection Rate: 99.97% (meets target)
Optimize Operating Parameters	Performance Run completed a systematic evaluation of IX setpoints, identifying optimal configuration that balances lithium recovery, throughput, and reagent consumption.
Demonstrate Process Scalability	Performance Run validated process scale up - increasing parallel IX vessel count from 3 to 8 had no observable performance degradation.
Confirm Production Throughput	With baseline IX setpoints, confirmed two commercial IX modules will achieve 5,000 tLCE/year production throughput, consistent with FEL-3 design target.
Validate Complete Value Chain	Battery-grade lithium carbonate produced from GSL brine, confirming end-to- end process viability.

5 Environmental Considerations

FFSL’s final rule R652-21-200 (30) defines a Negative Impact as, “a substantive and material adverse impact or disturbance in the singular or cumulative instance, caused or created by one or more Operator, to the Biota or Chemistry of Great Salt Lake, as determined by the division” (other capitalized terms as



defined elsewhere in R652-21-200). As part of Waterleaf's Feasibility Assessment application submitted to FFSL on October 21, 2024, Waterleaf self-certified that that Pilot Project would have no Negative Impact on the Biota and Chemistry of GSL, and Waterleaf maintains that position following Pilot Plant operations based on the data provided herein.

The Pilot Project interacted with the Biota and Chemistry of Great Salt Lake in two ways – physically, through the installation and removal of the intake and outfall system, and chemically, through the permitted discharge of depleted brine. Physical impacts to the Biota and Chemistry of GSL were avoided and minimized through the use of an air-operated double diaphragm intake pump, which contained sealed lubricant chambers and no use of petroleum products (e.g. diesel, gasoline, etc.) on or adjacent to GSL, as well as light use, rubber tired, off-highway vehicles to access, install and maintain the intake system across the lakebed during operation. Reclamation of physical impacts to GSL are further discussed in Section 6. Shorebirds were regularly observed by operations staff in the vicinity of the intake and outfall system, with no signs of distress, morbidity, or other Negative Impact.

Chemical interaction with GSL during Pilot Plant operations occurred in the form of depleted brine discharge to the lake, as permitted by DWQ under UPDES Permit No. UT0026280. Compliance reporting for Permit No. UT0026280 is provided in "Final Monitoring Report," under separate cover and is thus not repeated herein.

All activities were conducted in compliance with applicable permits and state environmental standards, with no observed negative impacts to GSL biota or chemistry.

6 Reclamation Activities

Reclamation of the Pilot Project is governed by Waterleaf's mineral exploration permit No. E0030272, issued by the Department of Natural Resources' Division of Oil, Gas and Mining ("DOGM"). This section describes the decommission and reclamation activities completed as of the date of this report, as well as those pending and/or scheduled. Note that reclamation activities under mineral exploration permit No. E0030272 are secured with a surety bond in amount \$103,000, which DOGM has determined to be sufficient for the Pilot Project. It is anticipated that, upon completion of Pilot Project reclamation activities, the surety bond amount will be transferred to a new reclamation bond covering Waterleaf's planned commercial development.

6.1 Completed to Date

Department of Air Quality: (Air Permit)

- Completed Preapplication meeting
 - Drafting Dispersion Model
 - Application ETA 11.07.25



Army Corp of Engineers:

- Completed Pre Application meeting, Submitted 8.28.25
- Responded to received comments 10.10.25

Division of Oil and Gas, Mining:

- Completed Pre Application meeting (Large Mining Operation)
 - ETA Application submittal 10.31.2025

Fire Forestry State Lands:

- Pilot report, Submittal by 6.25.25
- Cooperative Agreement, Returned Draft to AG office
- Royalty Agreement, Pre application meeting 9.05.25
- Easement, Pre-application meeting redrafting application

Division of Water Quality:

- Operator's certification, Submittal ETA 10.27.25

State Engineer: (Water Rights)

- Updating Brine water rights request, submittal 9.28.25

Box Elder County:

- Site Application submitted 7.05.25
- County Council Meeting 11.20.25

6.2 Pending/Scheduled Permitting

Jurisdiction	Permit	Target Date
Federal	Nationwide Permit Sec 58 - USACE	November 15, 2025
State	Sovereign Land Easement – FFSL	December 24, 2025
State	Small Mining Operations (SMO) – DOGM	December 22, 2025
State	CWA Section 402 (UPDES)	January 22, 2026
State	Commercial Royalty Agreement – FFSL	January 24, 2026
State	CAA Air Emissions Permits – DAQ	January 24, 2026
State	Water Right Allocation – DWRI	December 10, 2025



State	Storm Water Permit – DEQ	December 24, 2025
County	Site Plan – Box Elder County	December 24, 2025
County	Construction Related Permits – Box Elder	December 16, 2025

Overall Project Milestones (Anticipated)

Milestones	Dates
Pilot Operations Completion (2 Weeks Performance Run)	Jun 10, 2025
Joint Pre-Application Meeting (FFSL, DWQ, DOGM)	Sept. 05, 2025
FEL - 3 Study Completion	Jul 04, 2025
Engineering Start	Jul 30, 2025
Final Investment Decision	Nov 24, 2025
Start of Long Lead Procurement	Nov 24, 2025
Construction Start	Mar 06, 2026
Commissioning Start	Feb 26, 2027
Mechanical Completion	Mar 31, 2027



Appendix A. Final Brine Sampling Report, March 2024

March 25, 2024

Mr. Ben Stireman, Deputy Director
Division of Forestry, Fire and State Lands
Utah Department of Natural Resources
1594 W. North Temple, Suite #3520
Salt Lake City, Utah 84116

Re: Royalty Agreement for Brine Sampling
Final Report

Dear Mr. Stireman,

This information constitutes “business confidential” information and/or “trade secrets” of the submitter, Waterleaf Resources LLC (“Waterleaf”, including Waterleaf’s parent company Lilac Solutions Inc. [“Lilac”]). It is provided to the State of Utah on the condition that the information be classified and maintained as “protected” under Section 305 of the Utah Government Records Access Management Act (“GRAMA”). The information pertains to confidential analysis of brine samples and the application of Lilac’s proprietary direct lithium extraction (“DLE”) technology, prepared by the submitter at significant expense. The market for DLE technology and application is highly competitive, and the release of the submitted information to the public would cause competitive injury to the submitter by allowing potential competitors to obtain its proprietary analysis at no cost. Were such public disclosure to be authorized, Waterleaf and Lilac would be less likely to provide similar proprietary information to the State in the future. This constitutes the concise statement of the reasons for confidentiality required by Section 309 of GRAMA.

Waterleaf is pleased to provide this brine sampling report pursuant to item 6 in the Royalty Agreement for Brine Sampling (“the Agreement”), signed by and between Waterleaf and the Division of Forestry, Fire and State Lands (“the Division”) September 28, 2023. The terms used herein are as defined in the Agreement, unless otherwise specified. Item 6 required, “...a report of all elements or minerals identified, processed, or produced from the extracted water or brine...” as well as “...information regarding the chemical and physical composition of the water or brine after mineral extraction or processing.” Said information was to be provided “ within three (3) months of the termination of [the] Agreement”, with Term of the Agreement being September 28, 2023 (“the Effective Date”) through December 28, 2023; therefore, on or before March 28, 2024.

Please feel free to contact Steve Morrey (801.694.2245) directly with any questions regarding this report. Thank you.



FINAL BRINE SAMPLING REPORT

Brine Extraction

Following a series of unanticipated delays associated with granting of water rights for the brine after signing of the Agreement, brine was extracted from the Great Salt Lake’s Gunnison Bay on January 31, 2024. Two (2) lined, 5,000-gallon open-top steel holding tanks were staged on private land adjacent to Rozel Flats Road, at location 41.4712, -112.6616. A commercially operated Kaman K-1200 K-Max helicopter utilizing a 565-gallon dip bucket collected Gunnison Bay brine from location 41.4465, -112.7019 over a period of approximately six (6) hours, with several brief flight interruptions to repair and/or reconfigure equipment. Upon filling of the lined tanks, the helicopter departed the site, also on January 31, 2024.

Over the course of the next month, each of twenty-seven (27) 330-gallon plastic totes were filled from the lined tanks via pump and lay-flat hose and transported via flatbed trailer from the Rozel Flats Road site to Waterleaf’s technology provider and parent company Lilac’s headquarters in Oakland, California. These 27 filled totes represent a total Sampling Volume of approximately 8,910 gallons. Due to the weight of the individual totes, each shipment contained six (6) or seven (7) totes, with the first set of totes departing from the Rozel Flats Road site on February 5, 2024 and the last set of totes arriving in Oakland on March 1, 2024. Following the brine extraction and shipping, all steel containers, pumps, hose and other transfer equipment was removed from the Rozel Flats Road site on March 19, 2024.

Sampling and Analysis – Native Brine

Lilac owns, operates and maintains industry-standard laboratory analytical equipment and its expert laboratory staff have analyzed brine samples from around the world. For safety reasons, *in situ* sampling of the brine as it was collected from Gunnison Bay was deemed impractical. However, as totes began arriving in Oakland, Lilac collected 1-2 liter grab samples from each of the 27 individual totes¹, in order to provide a representative sample array from the total Sampling Volume (N=27). *Ex situ* analysis of the samples is further described herein.

The elements and minerals identified by Lilac’s laboratory analysis, as well as the associated analytical protocol, are provided in Table 1. Raw Brine Summary below. Results have been averaged across each of the 27 grab samples.

Table 1. Raw Brine Summary

¹ To achieve a homogenous sample from the large volume tote containers, totes were agitated with a tote mixer for five (5) minutes, and a transfer pump was utilized to collect the individual samples.



Parameter	Analytical Method	Result	Units
pH	EPA 150.1	7.7	SU
Density	ASTM D 1475	1.2	g/mL
Total Suspended Solids	EPA 160.2	80	mg/L
Turbidity	EPA 180.1	39	NTU
Viscosity	ASTM D 445	2.3	cSt
Dissolved Oxygen	EPA 360.1	1.7	mg/L
Conductivity	EPA 120.1	55	mS/cm
Lithium	EPA 200.7	72	mg/L
Sodium	EPA 200.7	81400	mg/L
Magnesium	EPA 200.7	14000	mg/L
Calcium	EPA 200.7	300	mg/L
Potassium	EPA 200.7	9100	mg/L
Boron	EPA 200.7	56	mg/L
Strontium	EPA 200.7	4.7	mg/L
Iron	EPA 200.7	3.5	mg/L
Manganese	EPA 200.7	0.12	mg/L
Sulfur	EPA 200.7	6840	mg/L
Barium	EPA 200.7	0.2	mg/L
Arsenic	EPA 200.7	<2	mg/L

Sampling and Analysis – Post-Processed Brine

In addition to laboratory equipment for analysis of native brine, Lilac also owns and operates a laboratory and bench-scale ion exchange (“IX”) technology test equipment for Lilac’s proprietary IX process. To date, Lilac has processed approximately 330 gallons of the Sampling Volume in the test equipment and conducted similar analyses of the post-processed (i.e. “spent”) brine. Results of the laboratory analysis of the spent brine are provided in Table 1 below. The composition of the spent brine from the bench scale tests will be slightly different with the composition of the spent brine from the pilot and commercial scale plant, since those plants will incorporate various recycle streams into the extraction process.

Table 1. Spent Brine Summary

Parameter	Analytical Method	Result	Units
pH	EPA 150.1	7.7	SU
Density	ASTM D 1475	1.2	g/mL
Total Suspended Solids	EPA 160.2	<5	mg/L
Turbidity	EPA 180.1	1	NTU
Viscosity	ASTM D 445	1.9	cSt
Dissolved Oxygen	EPA 360.1	2.3	mg/L
Conductivity	EPA 120.1	46	mS/cm



Lithium	EPA 200.7	18	mg/L
Sodium	EPA 200.7	84700	mg/L
Magnesium	EPA 200.7	14000	mg/L
Calcium	EPA 200.7	405	mg/L
Potassium	EPA 200.7	8830	mg/L
Boron	EPA 200.7	60	mg/L
Strontium	EPA 200.7	5	mg/L
Iron	EPA 200.7	<0.15	mg/L
Manganese	EPA 200.7	<0.035	mg/L
Sulfur	EPA 200.7	7150	mg/L
Barium	EPA 200.7	0.1	mg/L
Arsenic	EPA 200.7	<2	mg/L

Accuracy and Precision of Analytical Results

Cation concentrations in samples were quantified utilizing EPA Method 200.7 coupled with Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). This method is renowned for its high accuracy in detecting and quantifying trace metals in various environmental samples. However, the samples analyzed contained high concentrations of Sodium, Magnesium, Potassium, and Sulfur, and had to be further diluted to fall within the quantitative range of the analytical method. Diluting samples to fit within the quantitative range of analysis can impact accuracy and precision by potentially introducing errors associated with dilution factors, leading to increased variability in measurements.





Appendix B. Final Monitoring Report



Final Monitoring Report

Waterleaf Resources Great Salt Lake
Lithium Extraction Demonstration
Plant

Prepared for
Waterleaf Resources

Prepared by
HDR, Inc.
2825 E. Cottonwood Parkway, Suite 200
Salt Lake City, UT 84121

October 25, 2025

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Appendices

- A. UPDES Permit
- B. Laboratory Data Results
- C. Biota Monitoring Report

Abbreviations

°C	degrees Celsius
af	acre-feet
Demonstration Plant	Great Salt Lake Lithium Extraction Demonstration Plant
DLE	direct lithium extraction
DMR	discharge monitoring report
DNA	deoxyribonucleic acid
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
g/cm ³	grams per cubic centimeter
g/L	grams per liter
g/mL	grams per milliliter
g/mol	grams per mole
GSL	Great Salt Lake
IQR	interquartile range
ITS	internal transcribed spacer
IX	ion exchange
lb	pounds
maf	million acre-feet
MDL	minimum detection limit
mg/L	milligrams per liter
mL	milliliter
NA	not applicable
NetDMR	Network Discharge Monitoring Report
NVGD 1929	National Geodetic Vertical Datum of 1929
No.	number
rRNA	ribosomal ribonucleic acid
Si	silicon
SiO ₂	silica (silicon dioxide)
UAC	Utah Administrative Code
UDFFSL	Utah Division of Forestry, Fire and State Lands
UDWQ	Utah Division of Water Quality
UGS	Utah Geological Survey
UPDES	Utah Pollutant Discharge Elimination System
USGS	U.S. Geological Survey
Waterleaf	Waterleaf Resources
WSE	water surface elevation

1 Introduction

Waterleaf Resources (Waterleaf) prepared this final monitoring report to present data and data analysis related to chemistry, flow, and biota data obtained during the operation of the Great Salt Lake (GSL) Lithium Extraction Demonstration Plant (Demonstration Plant).

The chemistry and flow data were collected, analyzed, and reported pursuant to Utah Pollutant Discharge Elimination System (UPDES) Permit No. UT0026280, which was issued to Waterleaf by the Utah Division of Water Quality (UDWQ) on February 4, 2025 (UDWQ 2025a). The Demonstration Plant's discharge of effluent to the GSL was authorized by the UPDES permit, which is provided in Appendix A, *UPDES Permit*. The UPDES permit also authorized the operation of the GSL lithium extraction facility, by certification by rule, under Utah Administrative Code (UAC) R317-16.

Summaries of the laboratory chemistry results and continuous flow monitoring data are provided in Appendix B, *Laboratory Test Results*.

The microbial diversity (biota) report (Baxter 2025; Appendix C, *Biota Monitoring Report*) is summarized in this final monitoring report. The biota report provides additional data that characterize the biota in the North Arm of the GSL and in the discharge flow of the Demonstration Plant. The UPDES permit did not require an assessment of the North Arm biota data.

1.1 Purpose

This report is being provided to support the applications for authorizations required to operate Waterleaf's GSL Phase 1 Lithium Extraction Commercial Plant. These applications are the UDWQ UPDES Permit UT0026280 modification, the UDWQ GSL Mineral Extraction Facility Operator Certification (Operator Certification) (UAC R317-16-5(4)), and Utah Division of Forestry, Fire and State Lands (UDFFSL) agreements.

The information in this report and appendices includes summaries of UPDES compliance monitoring data, continuous flow data, North Arm habitat identification, and additional data collected to characterize North Arm biota.

Demonstration Plant discharges are evaluated to determine that there would be no negative impacts to the GSL, as defined by UDWQ R317-16-16 and as supported by chemical monitoring results review and analysis, flow monitoring results, North Arm habitat inventory, and a North Arm biota monitoring study.

1.2 Background

The Waterleaf Resources Demonstration Plant operated from February 2025 through August 2025. The Demonstration Plant, a temporary facility, was operated to validate Waterleaf's proprietary ion-exchange (IX) direct lithium extraction (DLE) process. This proprietary technology is a nonconsumptive and nonevaporative process to extract lithium from GSL North Arm brine. GSL North Arm brine was conveyed to the plant, processed through the IX DLE equipment, and discharged back into the GSL with no brine depletion. Intake and outfall (influent and discharge) infrastructure was located in the open water of the North Arm of the GSL, and the Demonstration Plant's equipment and offices were located on the western slope of the Promontory Mountains in Box Elder County, Utah.

The North Arm (Gunnison Bay) of the GSL is classified as a Class 5B water of the state. It is protected by UDWQ for infrequent primary and secondary contact recreation, waterfowl, and shorebirds and other water-oriented wildlife including their necessary food chain (UAC R317-2-6.5). Numeric water quality standards for the North Arm are not established but narrative standards apply.

Influent brine and discharge water chemistry data, flow data, and biota data were collected during operation of the Demonstration Plant. Operation activities spanned 28 weeks during the winter, spring, and summer. The data collected reflect seasonal changes in GSL North Arm water surface levels, brine temperature, brine chemistry, salinity, and biota growth.

The influent and discharge chemistry weekly monitoring events summarized in this report were conducted and reported in accordance with the UPDES permit and UAC R317-16. The UPDES compliance monitoring data results, which were submitted electronically, can be accessed through the U.S. Environmental Protection Agency's (EPA) ECHO website for facility UT0026280.¹

¹ U.S. Environmental Protection Agency, Enforcement and Compliance History Online (ECHO) website, National Pollutant Discharge Elimination System (NPDES) Monitoring Data Download page, <https://echo.epa.gov/trends/loading-tool/get-data/monitoring-data-download>.

2 Summary of Monitoring Means and Methods

This section summarizes the monitoring methods and means that were used to collect data during the Demonstration Plant's operation.

- **Water quality monitoring.** HDR conducted weekly composite water quality sampling and analysis on influent and discharge flows on behalf of Waterleaf.
- **Flow monitoring.** Waterleaf conducted continuous flow monitoring at the intake and outfall systems.
- **Biota monitoring.** Dr. Bonnie Baxter of Westminster University conducted biota monitoring on behalf of Waterleaf. Three biota monitoring events were conducted in 2025.

2.1 Water Quality Monitoring

HDR conducted the required water quality monitoring on behalf of Waterleaf. Required water quality monitoring occurred during the Demonstration Plant's operation in accordance with the UPDES permit (UDWQ 2025a). The data results were reported electronically via EPA's Network Discharge Monitoring Report (NetDMR) system. This section summarizes the means and methods that were used to collect water quality samples and perform the laboratory analyses.

2.1.1 Field and Laboratory Parameters and Methods

HDR collected weekly water quality samples, which were composited for laboratory analysis. Discrete samples were collected every 2 hours over a 6-hour duration. Instantaneous flow rates were measured and used to prepare the flow-weighted composites for chemical analysis by a state-certified analytical laboratory. Chemtech-Ford Laboratory in Salt Lake City, Utah, conducted all water chemistry laboratory analyses.

Silicon (Si) concentrations were calculated by using the UDWQ equation (UDWQ 2025b), using silica concentrations and a molar mass conversion equation:

$$\begin{aligned}
 [\text{Si}] &= [\text{SiO}_2] \times (\text{Si molar mass} / \text{SiO}_2 \text{ molar mass}) \\
 [\text{Si}] &= [\text{SiO}_2] \times (28.09 \text{ g/mol} / 60.08 \text{ g/mol}) \\
 [\text{Si}] &= [\text{SiO}_2] / 2.139
 \end{aligned}$$

Where: Si = Silicon concentration, mg/L
SiO₂ = Silica concentration, mg/L

In addition to the laboratory chemical analyses, field measurements were taken and reported for pH, dissolved oxygen, and temperature using a Horiba U-53-2 handheld multimeter. Field measurements for density were made using an Anton-Paar density meter. Table 1 lists the constituents and methods that were used for the water quality analysis.

Table 1. Water Quality Monitoring Laboratory Methods

Analysis Method	Constituents
Metals (Total)	
EPA 200.7, Metals in Water by ICP-AES	Boron, calcium, lithium, potassium, silica ¹ , sodium
EPA 200.8, Metals in Water by ICP/MS	Aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, molybdenum, nickel, selenium, silver, zinc
EPA 1631, Mercury in Water by CVAFS	Mercury
Inorganic Nonmetals	
EPA 300.0, Determination of Inorganic Anions by Ion Chromatography	Bromide, chloride, nitrate, sulfate
EPA 335.4, Determination of Total Cyanide by Semi-automated Colorimetry	Cyanide
SM 2320 B, Alkalinity by Titration	Alkalinity, bicarbonate, carbonate, hardness, hydroxide
SM 4500 NO ₂ B, Nitrite by Colorimetry	Nitrite
SM 5210 B, 5-Day BOD Test	Biochemical oxygen demand (BOD)
Hach 8000, EPA Reactor Digestion Method	Chemical oxygen demand (COD)
APHA Standard Method 2540 C, Total Dissolved Solids Dried at 180°C	Total dissolved solids (TDS)
APHA Standard Method 2540 D, Total Suspended Solids Dried at 103–105°C	Total suspended solids (TSS)
Other Methods	
Field Measurement – Instantaneous	Dissolved oxygen, pH, water temperature, density, flow
Visual Observations	Unnatural deposits, floating debris, oil, scum, or other nuisances such as color or odor
Grab Sample	Oil and grease
Continuous Monitoring	Influent and discharge flows

Definitions: °C = degrees Celsius; AES = atomic emission spectroscopy; APHA = American Public Health Association; BOD = biochemical oxygen demand; CVAFS = cold vapor atomic fluorescence spectroscopy; EPA = U.S. Environmental Protection Agency; ICP = inductively coupled plasma; MS = mass spectrometry; NO₂ = nitrogen dioxide; SM = Standard Method

1. Silica data have been used to calculate silicon values.

2.1.2 Quality Assurance

Water quality data were analyzed in accordance with the UPDES permit requirements; these requirements include constituents analyzed, frequency, and laboratory minimum detection limits (MDLs). Additional UDWQ Director's requirements were included in the UPDES permit, including providing laboratory Level IV data quality packages. Level IV data quality packages were submitted electronically with the discharge monitoring reports (DMRs).

As a result of this process, Waterleaf observed the following:

- **Precision**
 - Field duplicate samples were collected by UDWQ staff during February and March 2025 as required by UPDES permit UT0026280 and were analyzed to validate Waterleaf's sample results.
 - The precision of the water quality results is documented in the Level IV data quality packages, which include equipment calibration and validation.
- **Accuracy and Bias**
 - Field instrument calibration met manufacturers' requirements.
 - Laboratory quality assurance/quality control (QA/QC) met each laboratory's internal method requirements.
 - Trace-level mercury was not detected in field blank samples when analyzed during the May 1, 2025, monitoring event.
- **Representativeness**
 - All field measurements and samples were collected from locations and on a frequency as required by UPDES permit UT0026280.
 - Weekly compliance monitoring events were conducted when the Demonstration Plant discharged to the GSL (February through August 2025). During the Demonstration Plant's operation, discharges to the GSL were suspended for three 1-week periods, so compliance monitoring was not conducted during those three 1-week periods.
- **Completeness**
 - Field and laboratory completeness requirements were met.
- **Comparability**
 - Field conditions were within the range of the selected in-situ meter and probe capabilities.
 - Laboratory method detection limits were sufficient to meet UPDES requirements and data quality objectives (Waterleaf 2025a).

Detailed Level IV laboratory quality control and quality assurance documentation was submitted electronically via EPA's NetDMR system. This documentation can be accessed through EPA's ECHO website, as discussed in Section 1.2, *Background*.

2.2 Flow Monitoring

Waterleaf conducted continuous and instantaneous flow monitoring on influent and discharge flows during the Demonstration Plant's operation.

Continuous flow monitoring was conducted using Krohne Optiflux 4300 and Rosemount Magnetic flow meters installed in the Demonstration Plant's intake and outfall infrastructure, respectively. Influent flow monitoring occurred before GSL brine entered the intake holding tank; discharge flow monitoring occurred after brine was discharged from the outfall holding tank. Inline flow meters were installed to continuously monitor the influent flows from the GSL and discharges to the GSL.

Instantaneous flow monitoring was conducted by HDR during water chemistry monitoring events. For each discrete water quality sample, an instantaneous flow measurement was recorded. These instantaneous flow measurements were used to prepare the flow-weighted composite sample for laboratory analysis. Instantaneous flows were recorded from the Waterleaf continuous flow meters.

2.3 Biota Monitoring

Waterleaf contracted with Dr. Bonnie Baxter of Westminster University to study the microbial biomass and community (bacteria, archaea, algae, and fungi) in the influent to and discharge from the Demonstration Plant, which was located on the eastern shore of the North Arm of the GSL (Baxter 2025). The goals of the study were to characterize the biota community in the influent flow and evaluate whether the discharge from the Demonstration Plant affected the biota community of the North Arm.

The following data collection and analysis were conducted to evaluate the influent and discharge characteristics during the Demonstration Plant's operation:

- Identify the biota cells present to estimate cell density and measure biomass.
- Extract and sequence DNA associated with bacteria, archaea, algae, and fungi to determine their abundance and presence.
- Inoculate samples to determine cell growth rate for three conditions: influent, discharge, and a mix (50:50) of influent and discharge.

To identify the presence or absence of biota cells, Dr. Baxter collected water samples from the raw brine intake tank and the Demonstration Plant's discharge tank and pumped the samples through a sterile polyvinylidene fluoride (PVDF) membrane pressure filter unit with a pore size of 0.22 micrometer (μm) to analyze the accumulated biomass. The filter media were frozen on site with liquid nitrogen to preserve the samples and were transported to the lab frozen on dry ice. In the lab, the samples were run through a centrifuge and dried to create a pellet of the cells, and the dry weight of the cell pellet was measured. Using a hemacytometer (which provides a grid and special cover glass to control the distributed volume), the cell density in each of the samples was estimated. The presence of cells in the influent and discharge flows was then verified and further analyzed through biosignatures (DNA sequencing).

To identify microbial diversity, the filter samples were sent to an external laboratory to conduct the DNA sequencing, which establishes the species of life present. The lab

extracted the biota DNA from filters and then amplified the specific genes associated with bacteria, archaea, algae, and fungi. Evaluations were conducted on the DNA sequencing results to determine the presence and relative abundance of microbial taxa present in the influent and discharge water samples. The genetic data were examined and assembled by relative abundance, meaning that the abundance of species can be compared within a specific sample but not to other sample results.

Water samples were inoculated by Dr. Baxter, and biota and observations were logged over 24 days to document growth rates. Four water samples were inoculated: sterile, influent (raw brine), discharge brine, and a 50:50 mix of influent and discharge. The 50:50 mix represents North Arm brine mixed with discharge brine to determine whether the biota would grow that environment.

3 Water Quality Results

The results of each water quality compliance monitoring event were submitted electronically to EPA's NetDMR website in accordance with the UPDES permit requirements. Analytical laboratory data quality Level IV packages were submitted electronically. Laboratory results are provided in Appendix B, *Laboratory Data Results*. A summary of those results is provided below.

Influent and discharge samples were collected and analyzed weekly during the Demonstration Plant's operation. Table 2 lists the dates of the water quality compliance monitoring events annotated with a description of Demonstration Plant operation phases.

Table 2. Dates of Water Quality Compliance Monitoring Events

Week	Sampling Date	Influent Sampling	Discharge Sampling	Notes
1	2/6/25	✓	✓	Start-up operations
2	2/13/25	✓	✓	Start-up operations
3	2/20/25	—	—	No discharge
4	2/26/25	✓	✓	Start-up operations
5	3/4/25	✓	✓	Start-up operations
6	3/13/25	✓	✓	Equipment validation
7	3/18/25	✓	✓	Equipment validation
8	3/25/25	✓	✓	Equipment validation
9	4/2/25	✓	✓	Equipment validation
10	4/8/25	✓	✓	Equipment validation
11	4/15/25	✓	✓	Equipment validation
12	4/22/25	✓	✓	Equipment validation
13	5/1/25	✓	✓	Equipment validation
14	5/6/25	✓	✓	Equipment validation
15	5/12/25	—	—	No discharge
16	5/20/25	✓	✓	Performance run
17	5/29/25	✓	✓	Performance run
18	6/03/25	✓	✓	Performance run
19	6/12/25	✓	✓	Equipment validation
20	6/17/25	✓	✓	Equipment validation
21	6/24/25	✓	✓	Equipment validation
22	7/1/25	✓	✓	Equipment validation
23	7/10/25	✓	✓	Equipment validation
24	7/15/25	✓	✓	Equipment validation
25	7/22/25	—	—	No discharge
26	7/29/25	✓	✓	Equipment validation
27	8/7/25	✓	✓	Equipment validation
28	8/12/25	✓	✓	Equipment validation

3.1 Visual Observation Results

Observations of water quality covered by state narrative water quality standards were made and documented during compliance monitoring. These observations targeted unnatural deposits, floating debris, oil, scum, or other nuisances such as color or odor, that are specifically identified in the narrative standards. No floating debris, oil, scum, or odor were observed in the influent and discharge samples that were evaluated.

The color of the influent and discharge varied throughout the Demonstration Plant's operation; no color was observed early in the plant's operation (February and March), and color was increasingly observed in the influent for the remainder of the plant's operation (April through August). The color of the influent increasingly became pinker as the North Arm's brine temperatures rose and the presence of biota increased. This observation is normal and is supported by the biota monitoring that was conducted (see Appendix C, *Biota Monitoring Report*).

During the first several weeks of the Demonstration Plant's operation, steel rust flakes were observed in the discharge samples. The source of the rust flakes was determined to be corrosion from the intake and outfall steel holding tanks and other carbon steel equipment throughout the Demonstration Plant. Waterleaf observed that the steel holding tanks were corroding and that rust was flaking off the tank interiors as the brine levels fluctuated in the holding tanks and the exposed steel discolored and began to disintegrate.

After the observations were made, Waterleaf modified operation of the Demonstration Plant to minimize the change in water level in the tanks, thereby reducing the exposure of the steel tanks' interiors. The rust flakes were observed and recorded during the February biota monitoring event along with the presence of biota. The biota monitoring report concluded that the corrosion of the holding tanks was not adversely affecting the microorganisms in the discharge (Appendix C, *Biota Monitoring Report*). Rust flakes were not observed after week 5 of the Demonstration Plant's operation.

3.2 Chemistry Monitoring Results

The influent and discharge flows were sampled and analyzed in compliance with the UPDES permit and the Operator Certification. In all, 25 monitoring events were conducted at the Demonstration Plant during its 28-week operation (there was no discharge during 3 of the 28 weeks). A summary of all laboratory analytical results and laboratory MDLs is provided in Table 3 for each constituent in alphabetical order. Field measurements (density, dissolved oxygen, pH, and temperature) are discussed in Section 3.4, *Field Chemistry Results* including a discussion on salinity characteristics of the influent and discharge.

Additionally, as required by UDFFSL rules, a performance run period occurred during weeks 16 through 18 of operation (May 20 through June 10, 2025). During the performance run of the Demonstration Plant, equipment operations were optimized and maintained to measure certain performance metrics (Waterleaf 2025b). Table 4 summarizes average influent and discharge concentrations for this period.

In this section, Waterleaf examines the influent and discharge chemical data in context with laboratory MDLs and uncertainty or error. Also, the chemical data were evaluated for outliers based on interquartile range (IQR) outlier analysis.

During the 28-week operation of the Demonstration Plant, the plant operated in three phases: start-up operations, equipment validation, and performance run (see Table 2 for the duration of each phase). During start-up operations, spikes in some metal constituents and rust flakes were observed, as discussed above in Section 3.1. Data results during start-up are discussed in Section 3.3.3 and summarized in Table 6 for the specific metal constituents that had data spikes during start-up.

To assess whether Demonstration Plant mass loads changed North Arm background mass, loads for metals, salt, and manganese are compared in Table 7, Table 8, and Table 9.

Lithium concentrations and mass loading are provided in Table 10.

In addition to the chemical laboratory analyzes reported in this section, UPDES required the reporting of silicon. Waterleaf used the UDWQ molar mass equation, using silica laboratory results, including the MDL value for nondetect values. Using the UDWQ molar mass equation and the silica data results, the silicon data are:

- Influent characteristics:
 - Average concentration: 2.5 mg/L
 - Minimum concentration: 2.0 mg/L
 - Maximum concentration: 3.6 mg/L
- Discharge characteristics:
 - Average concentration: 2.7 mg/L
 - Minimum concentration: 2.0 mg/L
 - Maximum concentration: 4.3 mg/L

Table 3. Summary of All Laboratory Analytical Results (Weeks 1–28)

Constituent	Influent Average (min/max)	Discharge Average (min/max)	Minimum Detection Limit (mg/L)	UPDES Specified Minimum Detection Limit (mg/L)
Alkalinity	569 (526/599)	360 (119/504)	0.2	NA
Aluminum, total	1.7 (ND/5.2)	1.6 (ND/5.1)	1.2	NA
Arsenic, total	0.477 (0.361/0.620)	0.322 (0.054/0.483)	0.0044	0.180 ¹
Barium, total	0.190 (ND/0.342)	0.169 (ND/0.322)	0.057	NA
Bicarbonate	569 (526/599)	360 (119/504)	0.2	NA
Biological oxygen demand	7.4 (ND/16)	6.7 (ND/13)	2.0	NA
Boron, total	60.3 (50.6/65.5)	56.7 (46.7/62.8)	0.61 ²	NA
Bromide	174 (140/201)	160 (132/186)	0.5 ³	NA
Cadmium, total	ND	ND	0.0012 ⁴	0.0052
Calcium, dissolved	302 (277/327)	288 (258/318)	0.7 ⁵	NA
Carbonate	ND	ND	0.2	NA
Chemical oxygen demand (COD)	2,420 (ND/7,020)	1,617 (ND/4,300)	617.0 ⁶	NA
Chloride	181,400 (159,000/194,00)	168,360 (144,000/181,000)	180.0	NA
Chromium, total	0.072 (0.014/0.250)	0.069 (ND/0.236)	0.0062 ⁷	0.0166
Copper, total	0.0391 (0.0182/0.0759)	0.0470 (0.0052/0.1360)	0.0182 ⁸	0.067
Cyanide, total	ND	ND	0.022 ⁹	0.0093
Hardness	59,692 (55,400/67,100)	56,256 (48,600/62,700)	11.7 ¹⁰	NA
Hydroxide	ND	ND	0.2	NA
Iron, total	0.58 (ND/0.80)	1.57 (ND/16.4)	0.57	NA
Lead, total	ND	ND ¹¹	0.0087 ¹¹	0.0465
Lithium, total	67.7 (55.1/81.6)	30.8 (9.33/54.8)	0.403 ¹²	NA
Magnesium, total	14,312 (13,300/16,100)	13,480 (11,600/15,000)	2.4 ¹³	NA
Manganese, total	0.0411 (0.0264/0.0794)	0.2385 (0.0554/0.91)	0.0159 ¹⁴	NA
Mercury, total	33.2 ng/L (ND/211 ng/L)	39.9 ng/L (ND/109 ng/L)	9 ng/L ¹⁵	0.000022
Molybdenum, total	0.136 (0.111/0.218)	0.111 (0.0169/0.312)	0.038 ¹⁶	NA
Nickel, total	0.049 (0.011/0.29)	0.052 (0.009/0.279)	0.0112 ¹⁷	0.376
Nitrate	ND	ND	6.64 ¹⁸	NA
Nitrite	ND	ND	0.01	NA
Oil and grease	ND	ND	5	NA
Potassium, total	8,662 (8,050/9,650)	8,138 (6,860/9,000)	8.6 ¹⁹	NA
Selenium, total	0.308 (0.074/0.908)	0.301 (0.012/0.933)	0.0141 ²⁰	0.0079

Table 3. Summary of All Laboratory Analytical Results (Weeks 1–28)

Constituent	Influent Average (min/max)	Discharge Average (min/max)	Minimum Detection Limit (mg/L)	UPDES Specified Minimum Detection Limit (mg/L)
Silica, total	5.3 (ND/7.7)	5.7 (ND/9.2)	4.2	NA
Silver, total	ND	ND	0.008 ²¹	0.0899
Sodium, dissolved	92,920 (79,000/112,000)	86,568 (61,400/110,000)	343 ²²	NA
Sulfate, dissolved	24,220 (10,200/28,100)	22,400 (12,600/28,200)	49.4 ²³	NA
Total dissolved solids (TDS)	340,040 (311,000/363,000)	312,640 (259,000/362,000)	1,000 ²⁴	NA
Total suspended solids (TSS)	111 (ND/530)	106 (6/454)	3 ²⁵	NA
Zinc, total	ND	ND	0.05 ²⁶	0.675

Definitions: max = maximum; MDL = minimum detection limit; mg/L = milligrams per liter; min = minimum; NA = not applicable; ND=nondetect (not detected above MDL); ng/L = nanograms per liter

- MDL for arsenic was reported as 0.0088 mg/L for week 1 and 0.022 mg/L for week 24.
- MDL for boron was reported as 12.1 mg/L for week 9.
- MDL for bromide varied between 0.5 and 4.7 mg/L.
- MDL for cadmium was reported as 0.0061 mg/L for week 24.
- MDL for calcium was reported as 14.6 mg/L for week 24.
- MDL for COD was reported as 154 mg/L for weeks 1 through 11, 308 mg/L for week 12, and 617 mg/L for weeks 13 through 28.
- MDL for chromium varied between 0.0062 and 0.0618 mg/L.
- MDL for copper was reported as 0.0364 mg/L for week 1 and 0.0036 mg/L for week 5.
- MDL for cyanide varied between 0.004 and 0.132 mg/L.
- MDL for hardness varied between 11.7 and 234 mg/L.
- MDL for lead was reported as 0.0174 mg/L for week 1 and 0.0435 mg/L for week 24; discharge value was reported at 0.015 mg/L for week 20.
- MDL for lithium was reported as 8.07 mg/L for week 8.
- MDL for magnesium was reported as 48 mg/L for weeks 8, 14, 15, 18, and 24, and 4.8 mg/L for week 4.
- MDL for manganese was reported as 0.0318 mg/L for week 1.
- MDL for mercury was reported as 44.9 ng/L for week 1 and 70 ng/L for week 27.
- MDL for molybdenum was reported as 0.0075 mg/L for week 1 and 0.0188 mg/L for week 24.
- MDL for nickel was reported as 0.0223 mg/L for week 1 and 0.112 mg/L for week 17.
- MDL for nitrate was reported as 33.2 mg/L for week 10.
- MDL for potassium was reported as 171 mg/L for weeks 8, 16, 18, and 24.
- MDL for selenium was reported as 0.0283 mg/L for week 1 and 0.0707 mg/L for week 24.
- MDL for silver was reported as 0.017 mg/L for week 1 and 0.042 mg/L for week 24.
- MDL for sodium was reported as 172 mg/L for week 6.
- MDL for sulfate was reported as 247 mg/L for weeks 1, 7, 9, 10, 12, 17–20, 23, and 26–28.
- MDL for TDS was reported as 20 mg/L for week 4.
- MDL for TSS varied between 0.8 and 8 mg/L.
- MDL for zinc was reported as 0.09 mg/L for week 1.

Table 4. Summary of Performance Run Laboratory Analytical Results (Weeks 16–18)

Constituent	Influent Average (Min/Max) (mg/L)	Discharge Average (Min/Max) (mg/L)
Alkalinity	560 (552/569)	373 (312/414)
Aluminum, total	2.7 (1.2/5.2)	2.5 (1.2/5.1)
Arsenic, total	0.43 (0.39/0.48)	0.31 (0.31/0.32)
Barium, total	0.19 (0.18/0.20)	0.16 (0.15/0.18)
Bicarbonate	560 (552/569)	373 (312/414)
Biological oxygen demand	10 (9/11)	9 (7/10)
Boron, total	60.2 (59.3/61.0)	58.0 (57.4/58.6)
Bromide	173 (140/201)	156 (139/170)
Cadmium, total	ND (ND/ND)	ND (ND/ND)
Calcium, dissolved	291 (277/300)	284 (270/293)
Calculated silicon ¹	2.5 (2.3/2.7)	3.1 (2.9/3.4)
Carbonate	ND (ND/ND)	ND (ND/ND)
Chemical oxygen demand (COD)	1,006 (617/1200)	845 (617/1,300)
Chloride	182,333 (177,000/187,000)	173,333 (166,000/181,000)
Chromium, total	0.048 (0.021/0.062)	0.051 (0.030/0.062)
Copper, total	0.039 (0.030/0.052)	0.040 (0.032/0.054)
Cyanide, total	ND (ND/ND)	ND (ND/ND)
Hardness	58,800 (58,100/59,600)	56,833 (55,500/57,900)
Hydroxide	ND (ND/ND)	ND (ND/ND)
Iron, total	ND (ND/ND)	1.72 (1.30/2.40)
Lead, total	ND (ND/ND)	ND (ND/ND)
Lithium, total	67.4 (66.1/69.6)	16.0 (14.4/18.8)
Magnesium, total	14,100 (13,900/14,300)	13,633 (13,300/13,900)
Manganese, total	0.038 (0.030/0.043)	0.163 (0.141/0.182)
Mercury, total	25.3 (23.3/27.2)	28.6 (24.9/31.4)
Molybdenum, total	0.126 (0.122/0.132)	0.081 (0.055/0.122)
Nickel, total	0.052 (0.015/ND)	.0512 (ND/ND)
Nitrate	ND (ND/ND)	ND (ND/ND)
Nitrite	ND (ND/ND)	ND (ND/ND)
Oil and grease	ND (ND/ND)	ND (ND/ND)
Potassium, total	8,423 (8,280/8,600)	8,137 (7,880/8,480)
Selenium, total	0.185 (0.101/0.238)	0.242 (0.121/0.342)
Silica, total	5.4 (5.0/5.8)	6.7 (6.3/7.3)
Silver, total	ND (ND/ND)	ND (ND/ND)
Sodium, dissolved	95,100 (94,200/96,700)	92,500 (90,300/93,600)
Sulfate, dissolved	25,400 (24,300/26,700)	25,167 (25,000/25,300)
Total dissolved solids (TDS)	341,667 (335,000/349,000)	328,667 (326,000/332,000)
Total suspended solids (TSS)	127 (62/228)	112 (64/175)
Zinc, total	ND (ND/ND)	ND (ND/ND)

Definitions: max = maximum; MDL = minimum detection limit; mg/L = milligrams per liter; min = minimum; NA = not applicable; ND=nondetect (not detected above MDL); ng/L = nanograms per liter

1. This is a calculated value based on silica data.

3.3 Chemistry Monitoring Results Discussion and Graphs

This section reviews the results Demonstration Plant weekly laboratory analyses and summarizes the monitoring results for metals, salts, manganese, and lithium. The metal constituents reviewed are aluminum, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, mercury, molybdenum, nickel, selenium, silver, and zinc, and the salts constituents reviewed are calcium, chloride, magnesium, potassium, sodium, and sulfate. Metals and salts, as well as other constituents (manganese and lithium), are required to be analyzed and reported by the UPDES permit and GSL Mineral Extraction Facility Operator Certification rules.

Data results for all constituents are summarized in Table 3 above, and laboratory results spreadsheets are attached in Appendix B, *Laboratory Data Results*.

To evaluate whether changes in metals, salts, and minerals (manganese and lithium) discharge concentrations (as compared to intake concentrations) result in a change in chemistry in the North Arm of the GSL. Waterleaf uses various lines of evidence, which consist of the following,

- MDLs and uncertainty of data
- Lack of comparable historic North Arm chemistry data and numeric water quality standards
- Relative increase or decrease in average concentrations (Table 3 above) as compared to MDLs and uncertainty
- Relative increase or decrease in average concentrations during the performance run (Table 4 above)
- Outlier analysis (Table 5 below)
- Relative increase or decrease in normal operations average concentrations (removing the first 5 weeks of start-up operations; see Table 6 below)
- Total change in mass loadings (discharge load subtracted from influent load) based on average concentrations, as compared to North Arm mass, at current water surface elevations (WSE) (Table 7, Table 8, and Table 9 below)
- Biota study results

3.3.1 Minimum Detection Limits and Uncertainty

Chemical analyses on the GSL brine samples and specifically North Arm brine samples are difficult to perform because of the high density, high salinity, and other unique characteristics of GSL brine. These characteristics interfere with laboratory means and methods. Due to these interferences, data results can often have various MDLs, various dilution rates, and large spike recovery ranges, all of which create a level of error and uncertainty. Although this error and uncertainty exists, the individual laboratory test results met data quality criteria and equipment precision ranges.

Overall, the MDLs for the analyzed constituents were consistent and met UPDES requirements. The laboratory data quality packages reported a few cases in which the MDL for selenium was not met. Level IV laboratory data quality results also documented dilution rates and spike recovery rates to meet quality control and assurance requirements.

Waterleaf also uses context when reviewing the data. Some constituents were analyzed at MDLs that were less than designated by the UPDES, as shown in Table 3 above. For example, copper was analyzed with an MDL of 0.0182 mg/L, which is below the UPDES stated MDL of 0.067 mg/L. So, when the influent and discharge average values are calculated at 0.0391 mg/L and 0.0470mg/L, respectively, they are below the UPDES stated MDL and might be considered comparable. Very low MDLs can bias the review of the data by detecting increases and decreases in concentration that are insignificant compared to other data sets.

Error and uncertainty (lab interference) need to be considered when reviewing the data. The heavy brine requires that samples are diluted to effectively be analyzed by equipment that is normally processing fresh water samples. The dilution rates for analyses ranged from undiluted (rate of 1) to 6, 20, and 50 up to a high of 100. Also, all samples were analyzed independently, so the intake and discharge samples for the same day might be diluted differently. Laboratory method accuracy is measured by percent recovery, and these percent recoveries vary for the different methods used for this project. For example, salts generally have a $\pm 20\%$ recovery, while metals have a $\pm 15\%$ recovery. The Utah Geological Survey has estimated that, for most GSL data, a minimum error of about 10% could be attributed to the challenges of processing the brine, based on conversations with the analytical laboratory (UGS 2025).

Waterleaf did report all data to UDWQ consistent with UPDES compliance monitoring requirements. That being said, the laboratory chemical analyses and results provided are adequate to meet the data quality objectives of the monitoring, which are to characterize the chemistry of the North Arm raw brine that is used as influent water to the lithium extraction process and to characterize the discharge of the lithium-depleted brine back to the North Arm.

3.3.2 Outlier Analyses

As with any data set, results often include concentrations that are unusually high or low—or in other words, outside the normal or expected range. To evaluate the impact of outliers on the Demonstration Plant data set, an outlier analysis was performed to identify whether outliers occurred extensively throughout the data set. Waterleaf determined that they did not. Therefore, Waterleaf included all data in the calculation of average, minimum, and maximum. Below is a summary of the outlier analyses and the results.

An IQR outlier analysis was conducted on the laboratory data results for each constituent's influent and discharge data. This analysis requires calculating the upper-quartile boundaries and then comparing the data to this threshold. Data points above this threshold are considered outliers.

In all, of the 1,900 data points analyzed for 38 constituents, 18 constituents were determined to have 59 data exceedances; that is, 59 data points were above the upper-quartile boundary. Of these 59 data points, 34 were influent outlier points and 25 were discharge outlier points. The results of the outlier analyses for those constituents with data exceedances are shown in Table 5 below.

Of note, outlier analyses were not conducted on the 10 constituents with nondetected concentrations. Also, the lower-quartile boundary analyses were not completed due to the presence of nondetection concentrations.

This analysis provides further evidence that the significant variations in data results are limited—using the IQR analytical methodology, about 3.1% of the data reported are considered outliers (outside the upper-quartile boundary).

Based on the IQR outlier analyses for all constituents analyzed, Waterleaf determined that the outliers did not occur extensively. Therefore, all data are included in the calculation of average, minimum, and maximum concentrations.

Table 5. Summary of Outlier Analyses

Constituent	Influent Outliers			Discharge Outliers		
	Influent Average (mg/L)	Upper Boundary (mg/L)	Number of Exceedances	Discharge Average (mg/L)	Upper Boundary (mg/L)	Number of Exceedances
Aluminum, total	1.7	3.0	1	1.6	2.5	2
Barium, total	0.190	0.238	3	0.169	0.248	2
Bromide	0.173	200.5	1	160.1	192.5	0
COD	2,420	4,450	4	1,1617	4,650	0
Chromium, total	0.072	0.196	2	0.069	0.176	2
Copper, total	0.0391	0.0661	2	0.0470	0.0753	2
Hardness	59,692	64,100	2	56,256	65,200	0
Iron, total	0.58	0.57	1	1.57	2.4	2
Lead, total	0.0104	0.0087	0	0.0107	0.0087	1
Lithium, total	67.7	73.0	2	30.6	91.7	0
Magnesium, total	14,312	15,400	2	13,480	15,600	0
Manganese, total	0.0411	0.0550	2	0.239	0.511	1
Mercury, total	33.2	33.7	2	39.9	52.8	3
Molybdenum, total	0.136	0.163	1	0.111	0.178	4
Nickel, total	0.049	0.091	4	0.052	0.087	3
Potassium, total	8,662.4	9,535	1	8,138	9,455	0
Sodium, dissolved	92,920	108,100	1	86,568	114,300	0
TSS	110.9	278.5	3	105.6	264.0	3

Definitions: COD = chemical oxygen demand; mg/L = milligrams per liter; TSS = total suspended solids

3.3.3 Metals Discussion

In this section, Waterleaf reviews the laboratory data results for metal constituents. Metals are often the focus of review due to their potential toxicity and their regulation by the Clean Water Act. Metal MDLs and loads were specific components of the UPDES permit. As stated in Section 1.2, *Background*, the North Arm is protected for recreation and wildlife use; however, numeric water quality standards have not been established.

The metal constituents discussed below are aluminum, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, mercury, molybdenum, nickel, selenium, silver, and zinc.

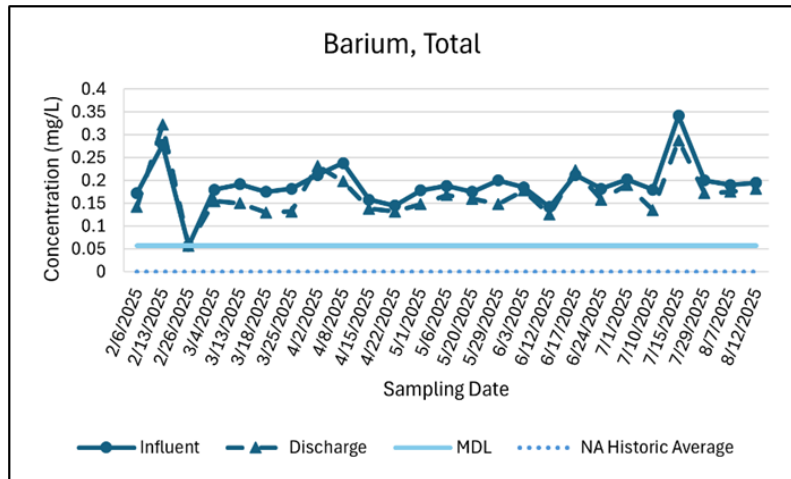
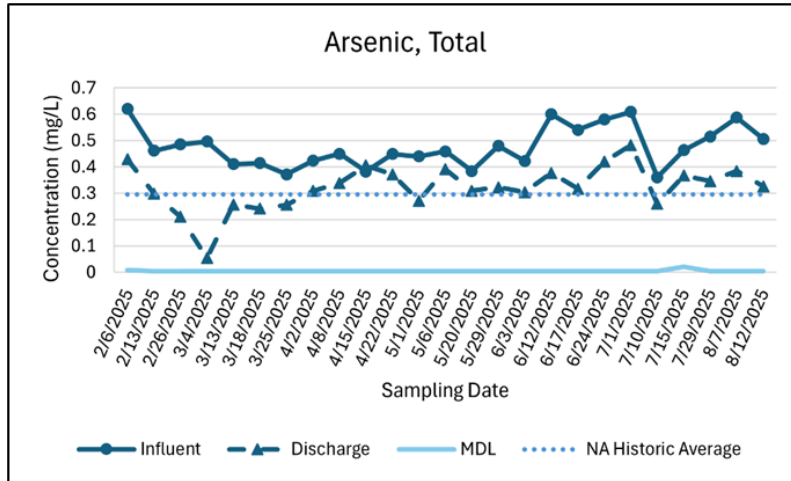
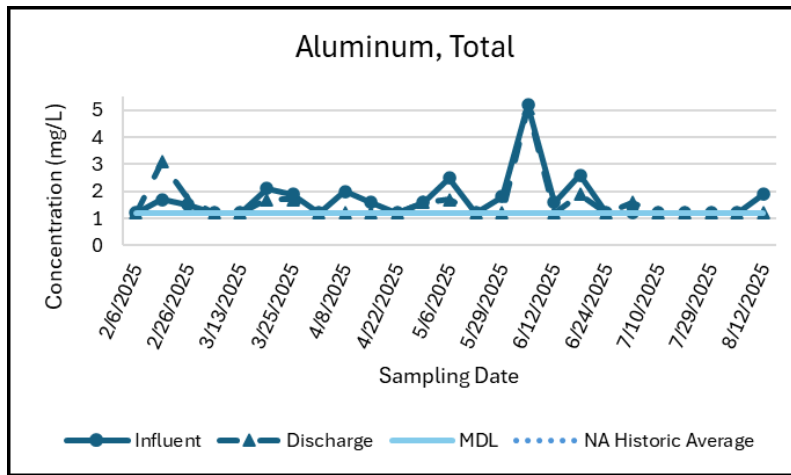
Metals That Were Not Detected. The data results reported four metal constituents (cadmium, lead, silver, and zinc) as nondetected for both influent and discharge concentrations for the entire 28-week operation of the Demonstration Plant, including the start-up and performance run periods (Table 3 above).

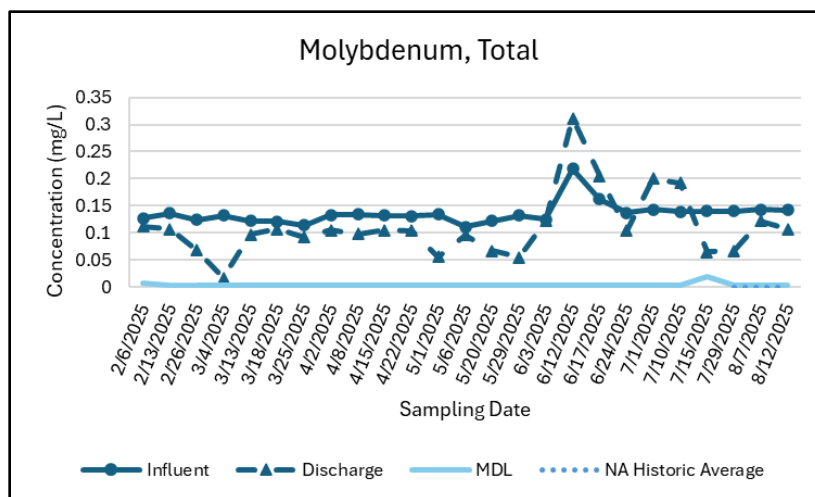
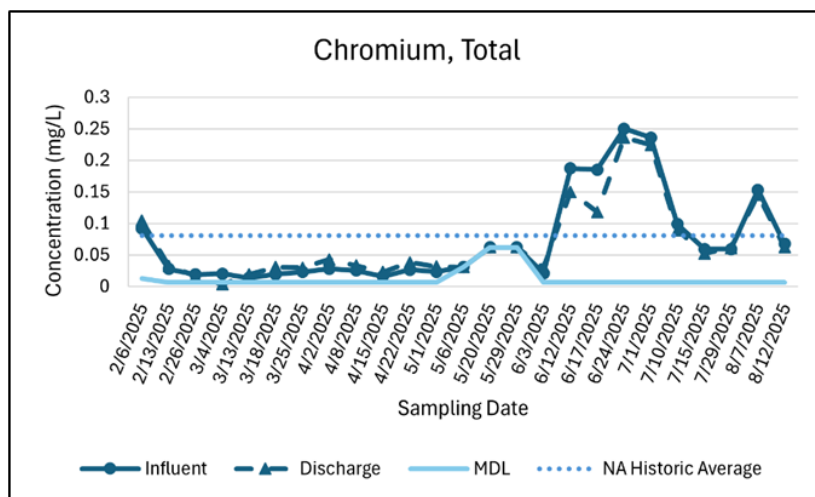
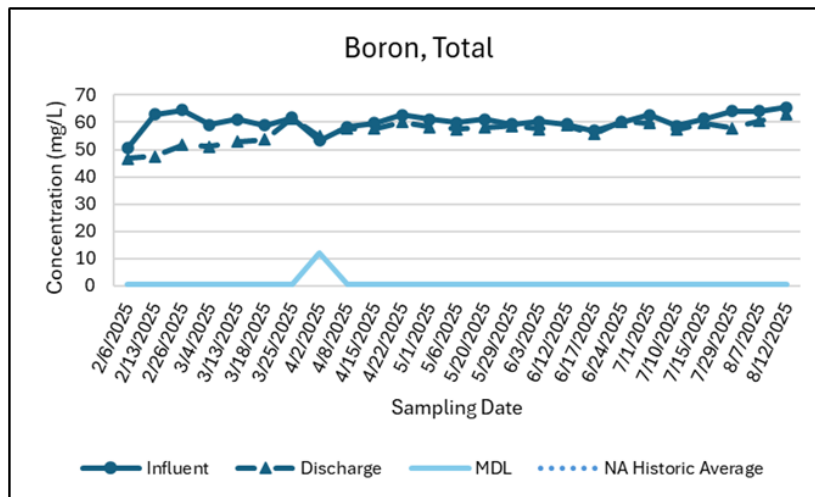
Metals with Lower Discharge Concentrations. Seven metal constituents (aluminum, arsenic, barium, boron, chromium, molybdenum, and selenium) were reported with lower average discharge concentrations than average influent concentrations during the Demonstration Plant's operation. Weekly laboratory data for influent and discharge concentrations are graphically shown below in Figure 1 for these seven constituents along with laboratory MDLs and North Arm historical averages. North Arm historical averages were determined by analyzing the UDWQ water quality database, North Arm monitoring locations, and reported values (HDR 2023). For some constituents, historical data were not available.

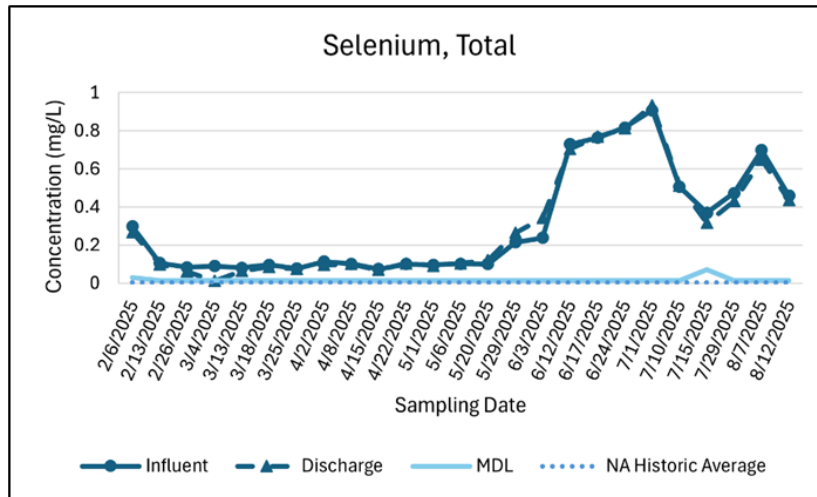
The data for the entire 28-week operation indicate the following decreases in average discharge concentrations compared to average influent concentrations: aluminum (decrease of 7%), arsenic (decrease of 32%), barium (decrease of 11%), boron (decrease of 6%), chromium (decrease of 4%), molybdenum (decrease of 18%), and selenium (decrease of 2%).

These constituents also showed average decreased concentrations compared to intake concentrations during the performance run (weeks 16–18) (Table 4 above), with the exception of chromium and selenium, for which average discharge concentrations increased above average intake concentrations. If the uncertainty estimate of 10% is taken into perspective, the decreases for aluminum, boron, chromium, and selenium are within this error range.

Figure 1. Graphs of Metal Constituents with Lower Average Discharge Concentrations



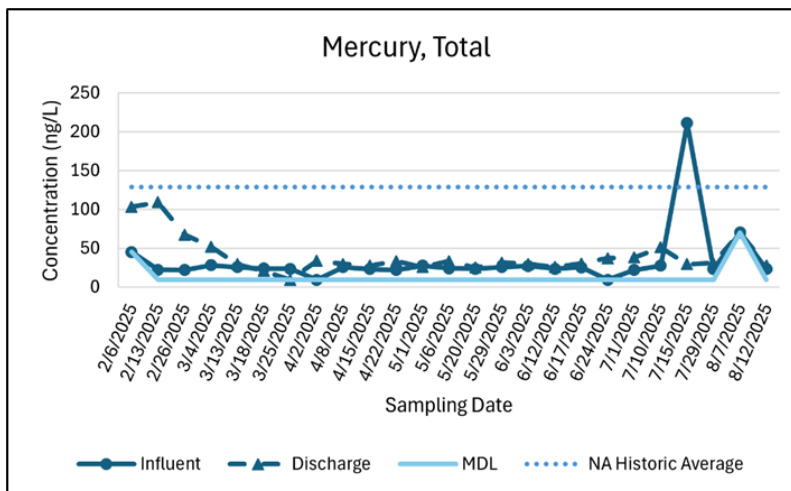
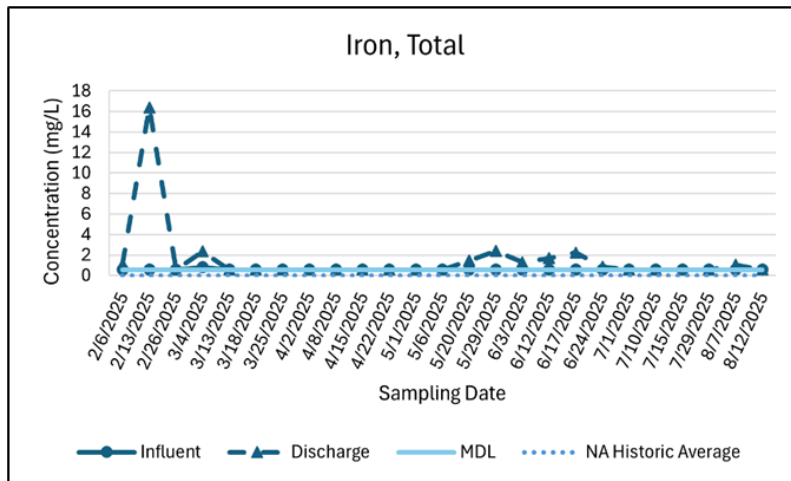
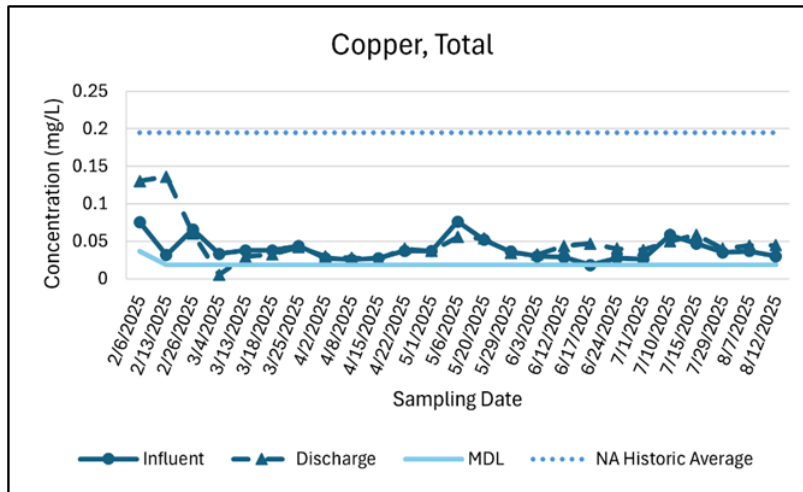


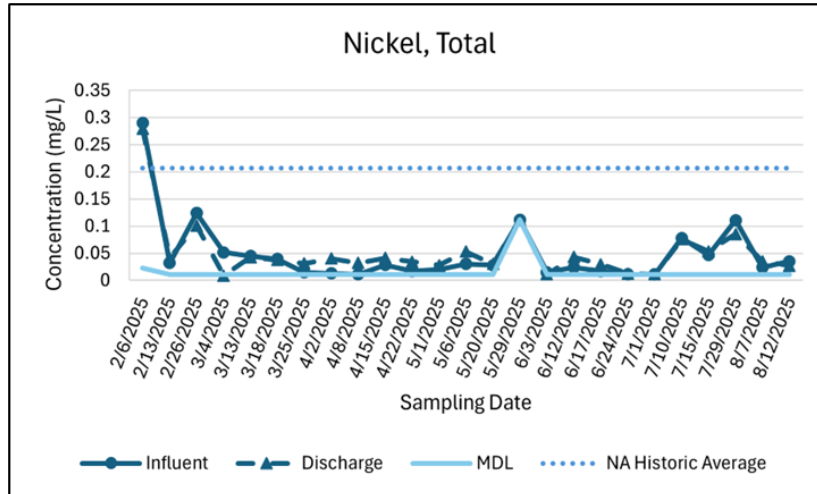


Metals with Higher Discharge Concentrations. Four metal constituents (copper, iron, mercury, and nickel) were reported with higher average discharge concentrations than average influent concentrations during the Demonstration Plant's operation. Weekly laboratory data for influent and discharge concentrations are graphically shown below in Figure 2 for these four constituents along with laboratory MDLs and North Arm historical averages. North Arm historical averages were determined by analyzing the UDWQ water quality database, North Arm monitoring locations, and reported values (HDR 2023).

The increases in average discharge concentrations compared to the average influent concentrations are: copper (increase of 20%), iron (increase of 272%), mercury (increase of 20%), and nickel (increase of 6%). Based on a review of the graphs and the data, it is apparent that, during the Demonstration Plant's start-up period, discharge concentrations for these metals were higher than during the following weeks. Waterleaf conducted further review of the data and operations during this start-up period to determine the cause of the data spikes. Waterleaf determined that, during start-up operations (weeks 1–5), processes and equipment were the cause of the data spikes for certain metal constituents, because these four constituents are not a component of the DLE process.

Figure 2. Graphs of Metal Constituents with Higher Average Discharge Concentrations





The increases in discharge concentrations (compared to influent concentrations) for copper, iron, mercury, and nickel during the start-up period can be partially attributed to the Demonstration Plant's equipment being made from carbon steel, stainless steel, and other corrodible materials. Equipment becomes corroded from exposure to the high-saline North Arm brine and exposure to oxygen. Evidence of corrosion consisted of higher concentrations of four metals (copper and iron, plus mercury and nickel) during the first 5 weeks, which was the Demonstration Plant's start-up period of operation, as well as visual observations of rust flakes in the discharge. During investigations to identify the source of the rust flakes in the discharge, observations were made confirming that the carbon steel frac tanks being used to store raw brine and depleted brine were in fact showing signs of corrosion.

After the initial start-up period of 5 weeks, rust flakes were not observed, and the discharge concentrations became more consistent. Table 6 compares the average influent and discharge results for the start-up period (weeks 1–5) and regular operations (weeks 6–28). As the data indicate, average discharge concentrations drastically reduced after the initial plant start-up process. After start-up, mercury and nickel average discharge concentrations decreased compared to average influent concentrations. Copper and iron results reported an increase in average discharge concentrations compared to average influent concentrations.

Table 6. Metal Concentration Data Comparison of Start-up and Regular Operations

Constituent	Start-up (Weeks 1–5)		Operation (Weeks 6–28)	
	Influent Average (mg/L)	Discharge Average (mg/L)	Influent Average (mg/L)	Discharge Average (mg/L)
Copper, total	0.0513	0.0829	0.0368	0.0401
Iron, total	0.628	5.10	ND (<0.57)	0.902
Mercury, total	29.2 ng/L	82.8 ng/L	34.0 ng/L	31.7 ng/L
Nickel, total	0.124	0.108	0.0348	0.0412

Definitions: mg/L = milligrams per liter; ND = nondetect; ng/L = nanograms per liter

These four constituents, along with chromium and selenium, had increased discharge concentrations compared to influent concentrations during the performance run period.

Waterleaf noticed that iron discharge concentrations increased during a 6-week period during regular operations and conducted further analyses. Most of the iron intake and discharge concentration results were reported nondetect, except during start-up operations and during a 6-week period (weeks 16–22). The increased discharge concentrations during start-up were discussed above. The increased discharge concentrations for weeks 16–22 followed a period of no discharge (week 15). During week 15, the plant experienced equipment failures and did not operate. When the plant was brought back online with replacement equipment operating, increases in iron discharges occurred until the process recovered (week 22). Iron discharge concentrations were reported nondetect during the remainder of operation (weeks 22–28).

Metal Load Analyses. To help determine impacts to North Arm chemistry due to operation of the Demonstration Plant, mass loads for the metal constituents were reviewed. Demonstration Plant mass loads were determined using all the laboratory data during operations (28 weeks), including outliers, compared to North Arm mass. Demonstration Plant loads were calculated by subtracting average influent concentration and influent volume from average discharge concentrations and discharge volume. North Arm mass was calculated using the average influent concentration and the North Arm volume at a WSE of 4,192 feet. The resulting mass load due to Demonstration Plant operation is shown in Table 7.

Table 7. Metals Load Comparison of Demonstration Plant Operations and North Arm

Constituent	Influent Average (mg/L)	Influent Load ¹ (lb)	Discharge Average (mg/L)	Discharge Load ² (lb)	Load to North Arm (lb)	North Arm Mass ³ (lb)
Aluminum, total	1.7	15.49	1.6	15.13	–0.36	14,978,200
Arsenic, total	0.477	4.35	0.322	3.04	–1.3	4,202,700
Barium, total	0.190	1.73	0.169	1.60	–0.13	1,674,000
Boron, total	60.3	549.3	56.7	536.1	–13.2	531,286,700
Chromium, total	0.072	0.66	0.069	0.65	–0.01	634,400
Copper, total	0.0391	0.36	0.0470	0.44	0.09	344,500
Iron, total	0.58	5.28	1.57	14.84	9.56	5,110,200
Mercury, total	0.0000332	1.65	0.0000399	2.0	0.35	290
Molybdenum, total	0.136	1.24	0.111	1.05	–0.19	1,198,300
Nickel, total	0.049	0.45	0.052	0.49	0.04	431,700
Selenium, total	0.308	2.81	0.301	2.85	0.04	2,713,700

Definitions: af = acre-feet; lb = pounds; mg/L = milligrams per liter; WSE = water surface elevation

1. Based on a Demonstration Plant total intake volume of 3.35 af
2. Based on a Demonstration Plant total discharge volume of 3.47 af
3. North Arm Mass based on WSE of 4,192 feet and volume of 3,240,000 af and average influent concentrations

In considering the mass decreases in the North Arm for aluminum, arsenic, barium, boron, chromium, and molybdenum discharges (Table 7 above), mass decreases due to

Demonstration Plant operations are in the range of 0.000002% to 0.00003% compared to North Arm total mass and are considered by Waterleaf to be *de minimis*.

In considering the mass load increases to the North Arm from the Demonstration Plant (Table 7 above), increases for copper (0.00002%), nickel (0.000009%) and selenium (0.0000015%) are considered by Waterleaf to be *de minimis*. The mass increase of iron to the North Arm is estimated at 9.6 pounds (lb), compared to 5.11 million pounds, or an increase of 0.0002%, which is also considered by Waterleaf to be *de minimis*.

The mercury data indicate that the mass load to the North Arm resulted in a 0.35-lb increase, compared to a North Arm mass of 290 lb, or an increase of 0.12%, which is considered by Waterleaf to be not significant. The bulk of this mass load occurred during the start-up period (Figure 2 and Table 6 above). Although mercury concentrations in the discharge during start-up operations were higher than in the influent, subsequently, during the remainder of the Demonstration Plant's operation, average discharge concentrations were less than average influent concentrations.

A review of the start-up comparison (Table 6 above) and investigation into the source of the corrosion revealed conditions specific to the Demonstration Plant's equipment. Comparing the data collected during remainder of the operations and performance run data run (Table 4 above), the temporary discharge of mercury mass load to the North Arm, due to start-up operations, is considered by Waterleaf to be not significant.

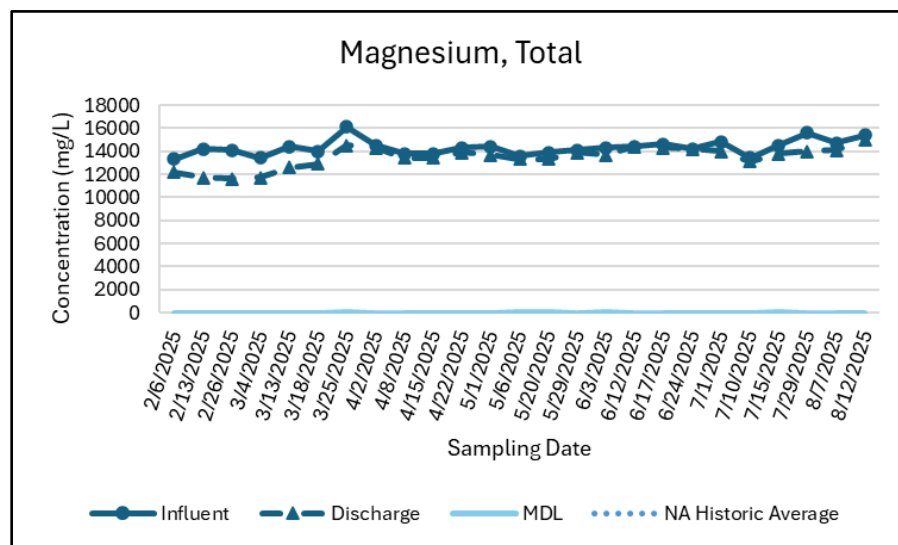
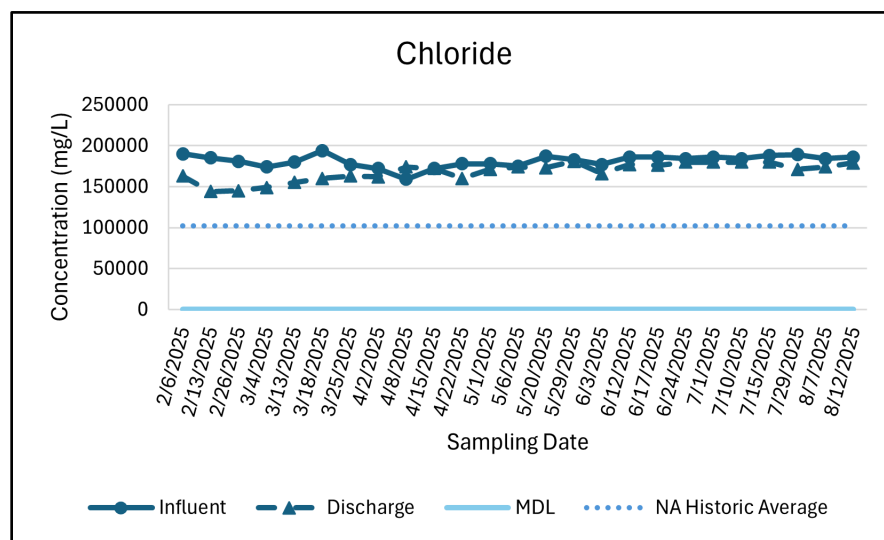
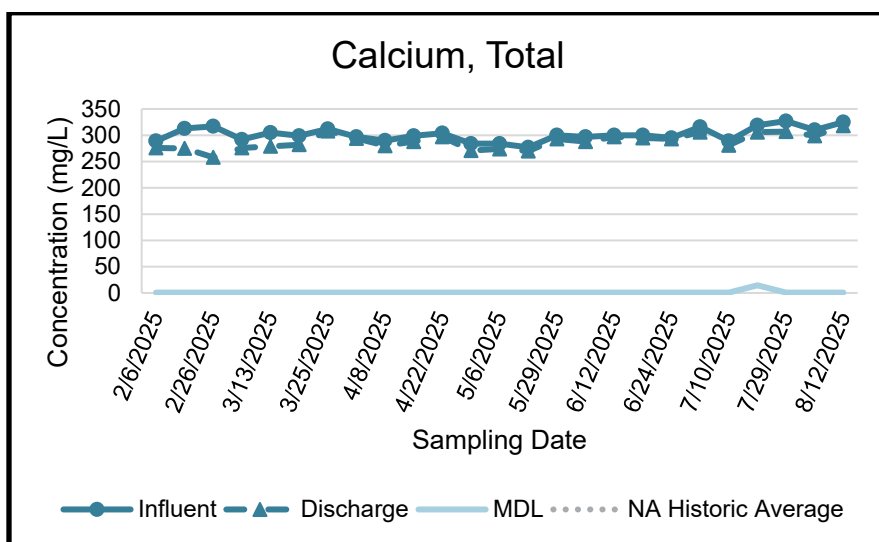
3.3.4 Salts Discussion

In this section, Waterleaf reviews the laboratory data results for salt constituents. GSL salts are important because they support the mineral extraction industry.

All salt cations and anions were reported with lower discharge concentrations than influent concentrations. These salt constituents are calcium, chloride, magnesium, potassium, sodium, and sulfate. The monitoring data for these constituents are graphed in Figure 3 below. Salt constituents' average discharge concentrations decreased in the range of 4.6% to 7.5% compared to average influent concentrations. This range is comparable to the average discharge concentration decrease in TDS of 8% compared to the average influent concentration.

To help determine impacts to North Arm chemistry due to operation of the Demonstration Plant, mass loads for the salt constituents were reviewed. Demonstration Plant mass loads were determined using all the laboratory data during operations (28 weeks). Demonstration Plant mass loads were calculated by subtracting average influent concentration and influent volume from average discharge concentrations and discharge volume. North Arm mass was calculated using the average influent concentration and the North Arm volume at a WSE of 4,192 feet. The result indicates that the Demonstration Plant reduced the salt constituents mass in the North Arm. The mass load comparison is shown in Table 8 below.

Figure 3. Graphs of Salt Constituents



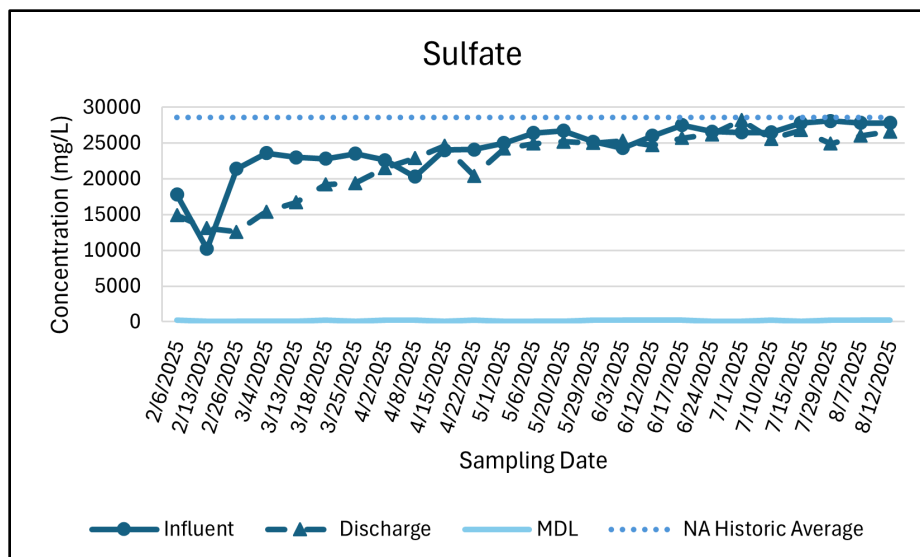
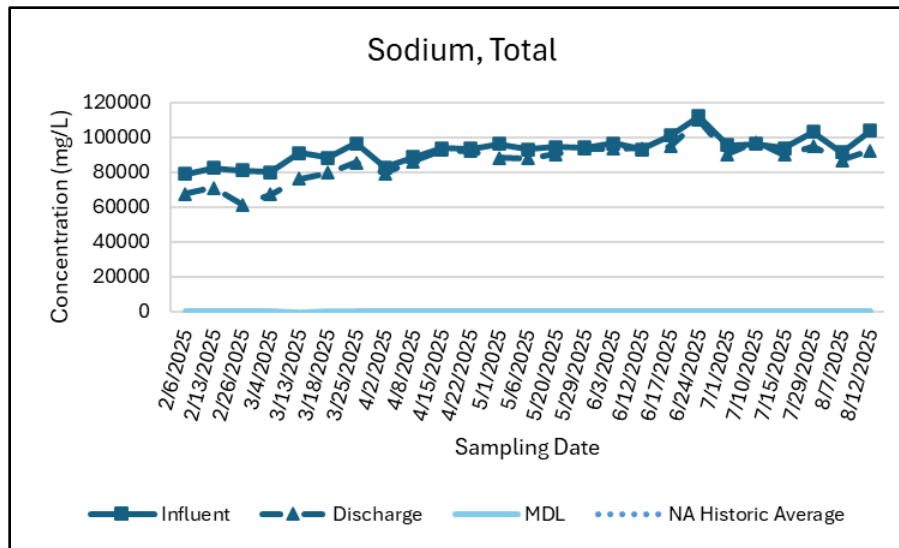
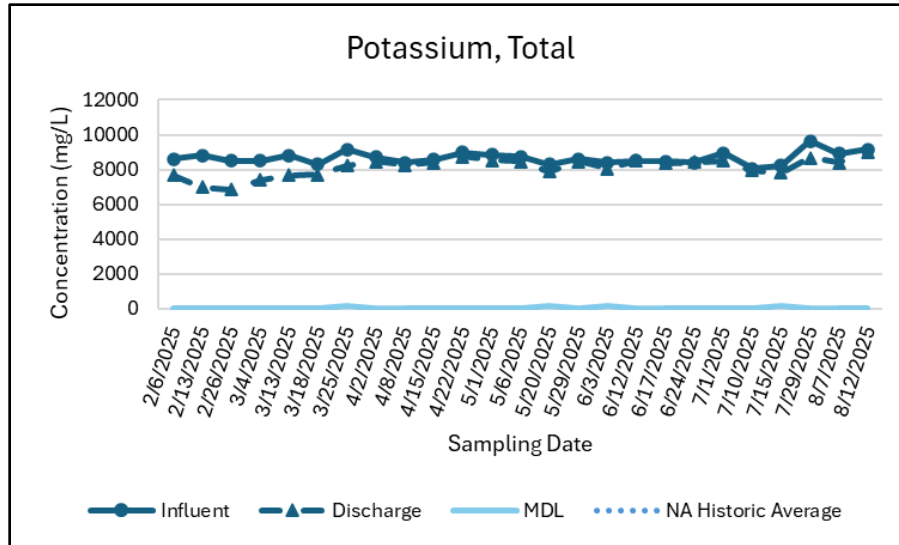


Table 8. Salt Load Comparison of Demonstration Plant Operations and North Arm

Constituent	Influent Average (mg/L)	Influent Load ¹ (lb)	Discharge Average (mg/L)	Discharge Load ² (lb)	Load to North Arm (lb)	North Arm Mass ³ (lb)
Calcium	302	2,750	288	2,720	-30	2,657,315,000
Chloride	181,400	1,652,500	168,400	1,591,900	-60,600	1,598,265,596,000
Magnesium	14,312	130,400	13,480	127,500	-2,900	126,099,103,000
Potassium	8,662	78,900	8,138	76,900	-2,000	76,322,028,000
Sodium	92,920	846,500	86,568	818,500	-28,000	818,692,609,000
Sulfate	24,220	220,600	22,400	211,800	-8,800	213,395,770,000

Definitions: af = acre-feet; lb = pounds; mg/L = milligrams per liter; WSE = water surface elevation

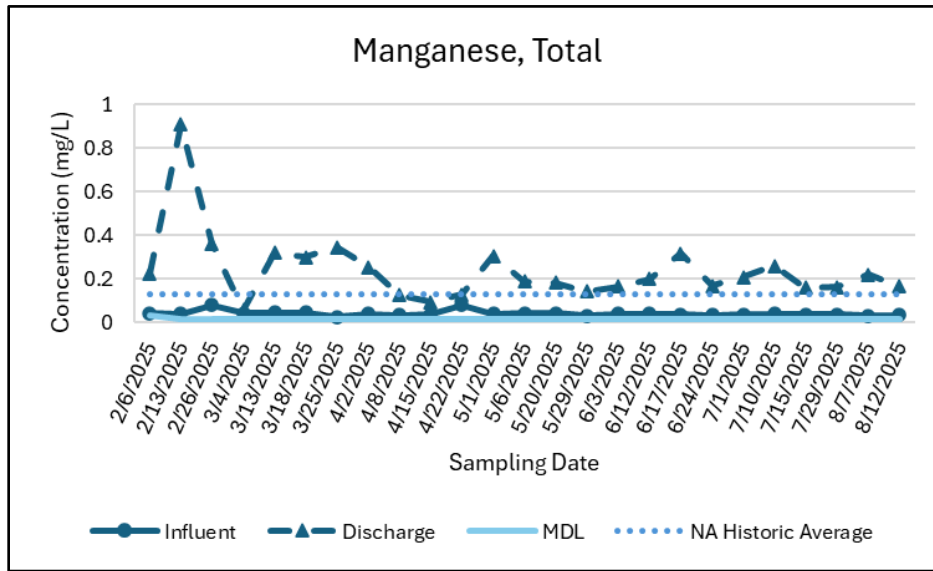
1. Based on a Demonstration Plant total intake volume of 3.35 af
2. Based on a Demonstration Plant total discharge volume of 3.47 af
3. North Arm Mass based on WSE of 4,192 feet and volume of 3,240,000 af with average influent concentrations

In assessing the mass decreases in the North Arm for salt constituents due to the Demonstration Plant's operation, mass decreases are considered by Waterleaf to be *de minimis*.

3.3.5 Manganese

Manganese is identified as a component of the DLE process and is discharged from the Demonstration Plant. This is the only constituent that resulted in higher concentrations in the discharge compared to the influent concentrations because of the DLE process. Figure 4 below shows the results of the weekly influent and discharge compliance sampling for manganese.

Figure 4. Graph of Manganese Influent and Discharge Data



Average discharge concentrations are reported higher than average influent concentrations over the entire duration of the Demonstration Plant's operation, including the start-up and performance run periods.

To help determine impacts to North Arm chemistry due to operation of the Demonstration Plant, the increase of the North Arm manganese mass was reviewed. Demonstration Plant manganese mass load was determined using all the laboratory data during operations (28 weeks). Demonstration Plant mass load was calculated by subtracting average influent concentration and influent volume from average discharge concentrations and discharge volume. North Arm mass was calculated using the average influent concentration and the North Arm volume at a WSE of 4,192 feet. The result indicates that the Demonstration Plant added about 1.88 lb of manganese to the mass in the North Arm, or, in other words, the mass of the North Arm increased by about 0.00052%. This increase in North Arm manganese mass due to the operation of the Demonstration Plant is considered by Waterleaf to be *de minimis*. The mass load comparison for manganese is shown in Table 9.

Table 9. Manganese Load Comparison of Demonstration Plant Operations and North Arm

Constituent	Influent Average (mg/L)	Influent Load ¹ (lb)	Discharge Average (mg/L)	Discharge Load ² (lb)	Load to North Arm (lb)	North Arm Mass ³ (lb)
Manganese	0.0411	0.37	0.2385	2.26	1.88	362,100

Definitions: af = acre-feet; lb = pounds; mg/L = milligrams per liter; WSE = water surface elevation

1. Based on a Demonstration Plant total intake volume of 3.35 af
2. Based on a Demonstration Plant total discharge volume of 3.47 af
3. North Arm Mass based on WSE of 4,192 feet and volume of 3,240,000 af with average influent concentrations

Waterleaf conducted additional data review related to the discharge of manganese. There are no federal or state water quality standards for manganese levels for

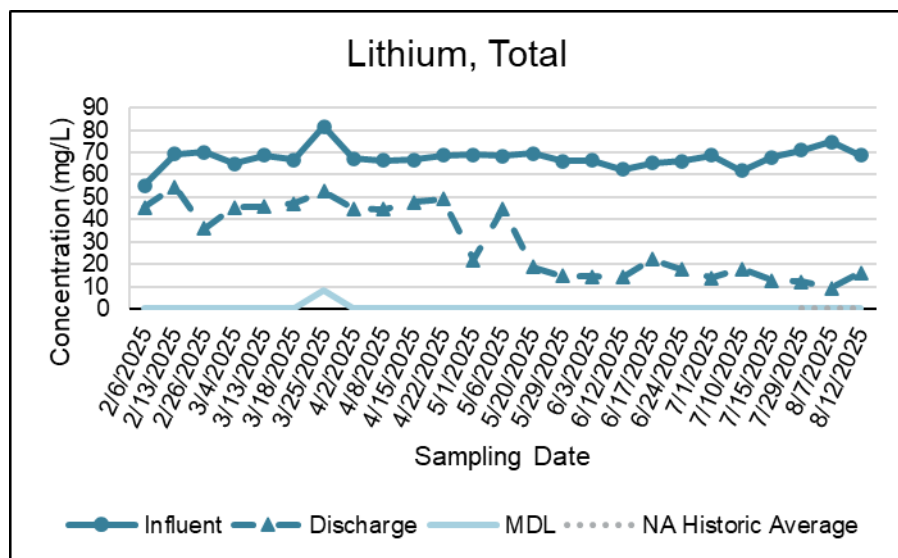
recreational exposures. Manganese is a mineral that exists naturally in the GSL and other freshwater bodies. Federal guidelines are published for dermal exposure to manganese during showering with tap water (drinking water) (HDR 2025). Waterleaf asserts that the manganese in the North Arm and in the depleted brine discharge is in solution and will not precipitate. This review determined that the increase in manganese discharged to the GSL due to the Demonstration Plant was not significant compared to existing standards and guidelines, existing North Arm loads, and protection of existing beneficial uses.

3.3.6 Lithium

Lithium is the targeted mineral for extraction by the Demonstration Plant. As a result, average discharge concentrations are less than average influent concentrations over the entire duration of the Demonstration Plant's operation, including the start-up and performance run periods. The extraction of lithium from the GSL is overseen by UDFSL, and royalties are paid by Waterleaf in accordance with GSL mineral extraction facility rules.

Figure 5 shows the results of the weekly influent and discharge compliance sampling for lithium.

Figure 5. Graph of Lithium Influent and Discharge Data



To help determine impacts to North Arm chemistry due to operation of the Demonstration Plant, the decrease of the North Arm lithium mass was reviewed. Demonstration Plant lithium mass load was determined using all the laboratory data during operations (28 weeks). Demonstration Plant mass load was calculated by subtracting average influent concentration and influent volume from average discharge concentrations and discharge volume. North Arm mass was calculated using the average influent concentration and the North Arm volume at a WSE of 4,192 feet. The result indicates that the Demonstration Plant reduced the North Arm lithium mass by about 326 lb, or, in other words, the mass of the North Arm decreased by about 0.000055%. This decrease in North Arm lithium mass due to the operation of the Demonstration Plant is

considered by Waterleaf to be *de minimis*. The mass load comparison for lithium is shown in Table 10.

Table 10. Lithium Load Comparison of Demonstration Plant Operations and North Arm

Constituent	Influent Average (mg/L)	Influent Load ¹ (lb)	Discharge Average (mg/L)	Discharge Load ² (lb)	Load to North Arm (lb)	North Arm Mass ³ (lb)
Lithium	67.7	617	30.8	291	-326	594,724,000

Definitions: af = acre=feet; lb = pounds; mg/L = milligrams per liter; WSE = water surface elevation

1. Based on a Demonstration Plant total intake volume of 3.35 af
2. Based on a Demonstration Plant total discharge volume of 3.47 af
3. North Arm Mass based on WSE of 4,192 feet and volume of 3,240,000 af with average influent concentrations

3.4 Field Chemistry Results

As identified in Table 1 above, field measurements were taken during the compliance monitoring events for influent and discharge flows. These field measurements are density, dissolved oxygen, pH, and temperature.

Table 11 summarizes the field measurements. Parameter-specific discussions follow the table.

Table 11. Summary of Field Measurements

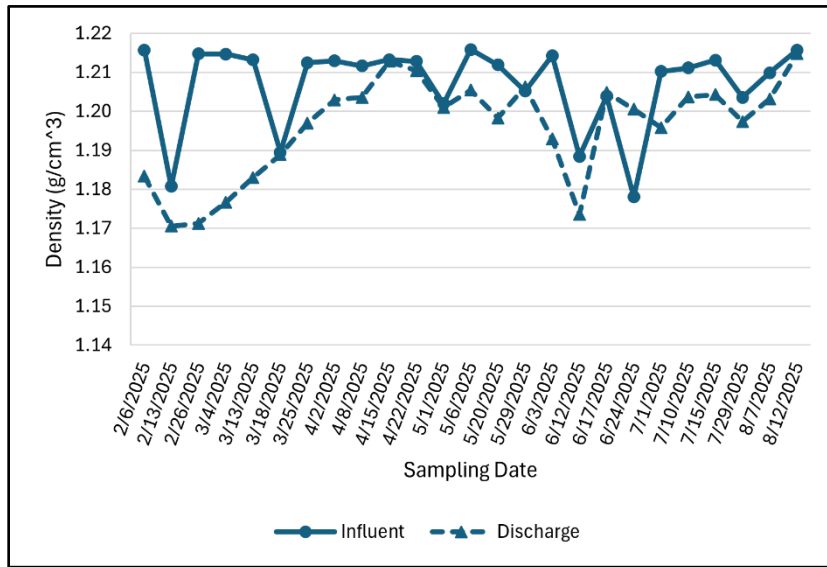
Field Parameter	Influent Average	Discharge Average	UPDES Limit
Density, g/cm ³	1.21	1.20	NA
Dissolved oxygen, mg/L	7.12	6.44	NA
pH	7.52	7.40	6.5–9
Temperature, °C	NA	NA	NA

Definitions: °C = degrees Celsius; g/cm³ = grams per cubic centimeter; mg/L = milligrams per liter; NA = not applicable; UPDES = Utah Pollutant Discharge Elimination System

3.4.1 Density

Influent density was relatively consistent, ranging between 1.21 and 1.22 grams per cubic centimeter (g/cm³). The influent density dipped on several occasions, and these dips were reasoned to be due to environmental conditions, specifically recent rainfall and the shallowness of the intake infrastructure (Figure 6 below).

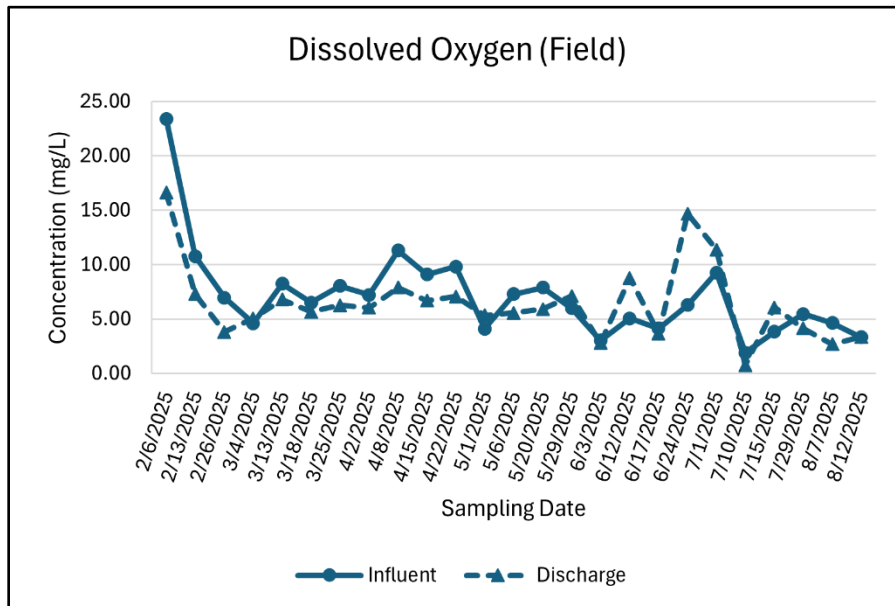
Figure 6. Density Graph



3.4.2 Dissolved Oxygen

Generally, the discharge dissolved oxygen (DO) measurements were less than the influent DO measurements. At the start of the Demonstration Plant's operation, more groundwater than North Arm brine was processed, resulting in higher DO levels (Figure 7).

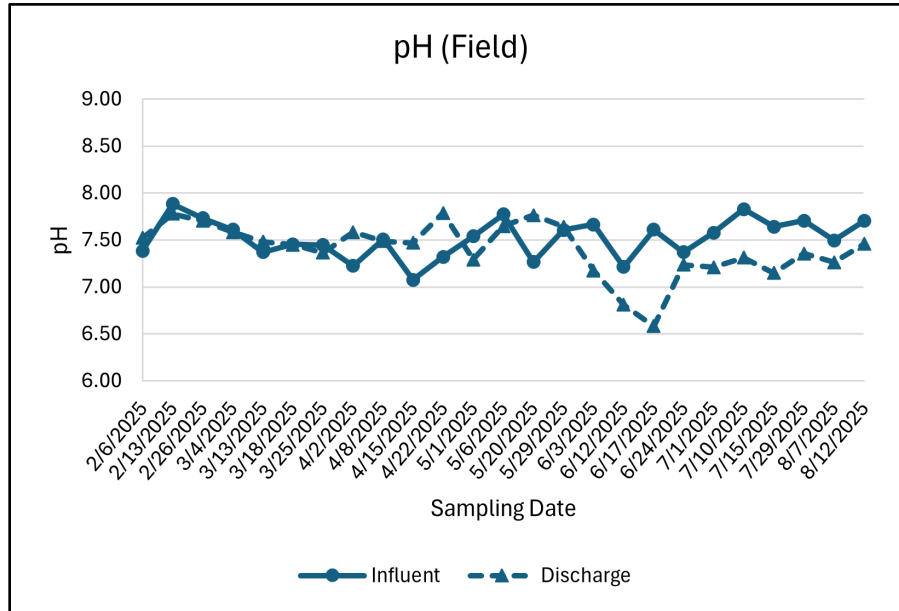
Figure 7. Dissolved Oxygen Graph



3.4.3 pH

Field measurements of pH for both the influent and discharge flows met the UPDES permit limit range of 6.5–9 (Figure 8).

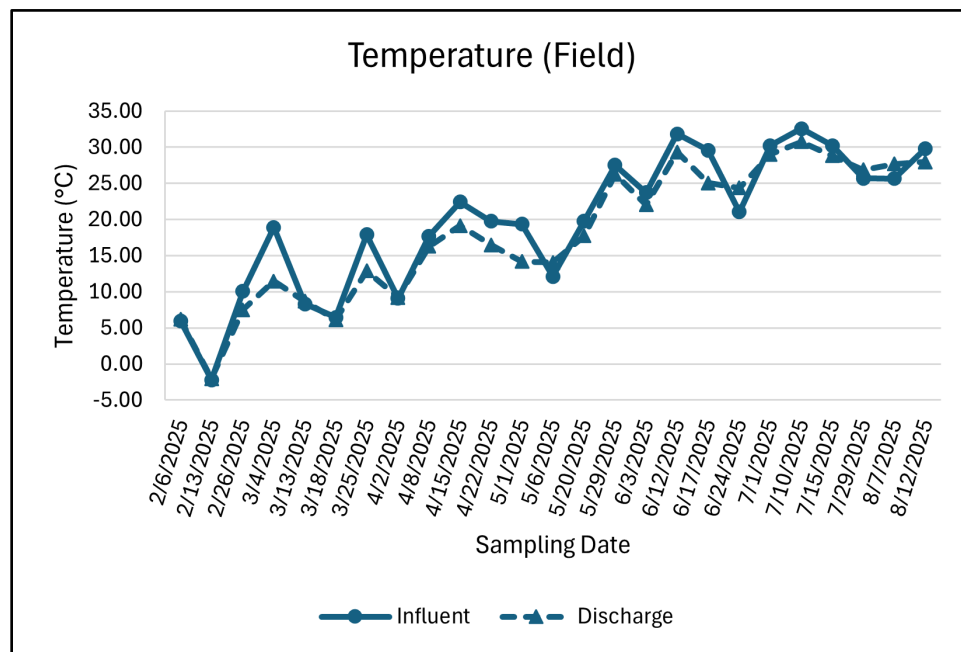
Figure 8. pH Graph



3.4.4 Temperature

Influent and discharge flow temperature measurements rose over the operation of the Demonstration Plant, following the expected seasonal warming of North Arm brine between February and August (Figure 9).

Figure 9. Temperature Graph



3.4.5 Influent and Discharge Water Salinity

HDR collected and reported the density at the intake and outfall locations during the Demonstration Plant's operation. These measurements were taken using an Anton Paar density meter. Per UDWQ rules, the Demonstration Plant cannot negatively alter the salinity of the North Arm of the GSL (UAC R317-16-2(16)(a)).

The GSL's salinity values were calculated using the formula below and documented in Open-File Report 0728, *Standard Operating Procedure – Great Salt Lake Water Density Measurement and Salinity Calculation* (UGS 2020).

$$S = \frac{\left(\sqrt{((1.04708 - (0.00112 * T))^2) - (4 * 0.000314721 * (-(\rho * 1000) + (\rho^0 * 1000) + (0.00199 * T^2) - (1.21061 * T) + 184.01602)))} \right)}{(2 * 0.000314721)}$$

ρ = density of GSL water (g/cm^3) ρ^0 = density of pure water (g/cm^3)
 S = salinity (g/L) T = water temperature ($^\circ\text{K}$)

However, as described in Open-File Report 0728, this salinity calculation is specific to typical South Arm densities, or salinity values up to about 18‰. For salinity values above 18‰, the result “shall be noted as outside the salinity range used to develop the GSL Equation of State” (UGS 2020). In 2023, the U.S. Geological Survey (USGS) published a data release that increased the upper boundary of the GSL salinity equation to 1.214.



Because the North Arm densities exceed this upper boundary, the equation is not validated to calculate North Arm salinity values (USGS 2023). Therefore, the salinity values were not calculated for this report, and Waterleaf compared density values as a surrogate value for salinity. This analysis is provided to support the determination that the Demonstration Project did not negatively alter the salinity (density) of the GSL.

Density profile data are shown in Figure 6 above for the influent and discharge flows for each monitoring event. Table 12 on the following page shows the influent and discharge density values as measured. Waterleaf asserts that the discharge from the Demonstration Plant did not affect the overall density of the North Arm. This is based on (1) the density measurements made and (2) a comparison of the total volume of discharge (3.48 acre-feet [af]) to the total volume of the North Arm of about 3.25 million acre-feet (maf), at an average WSE of 4,192 feet mean sea level during the Demonstration Plant's operation (USGS 2006), as shown in Figure 10 below.

Figure 10. North Arm Volume

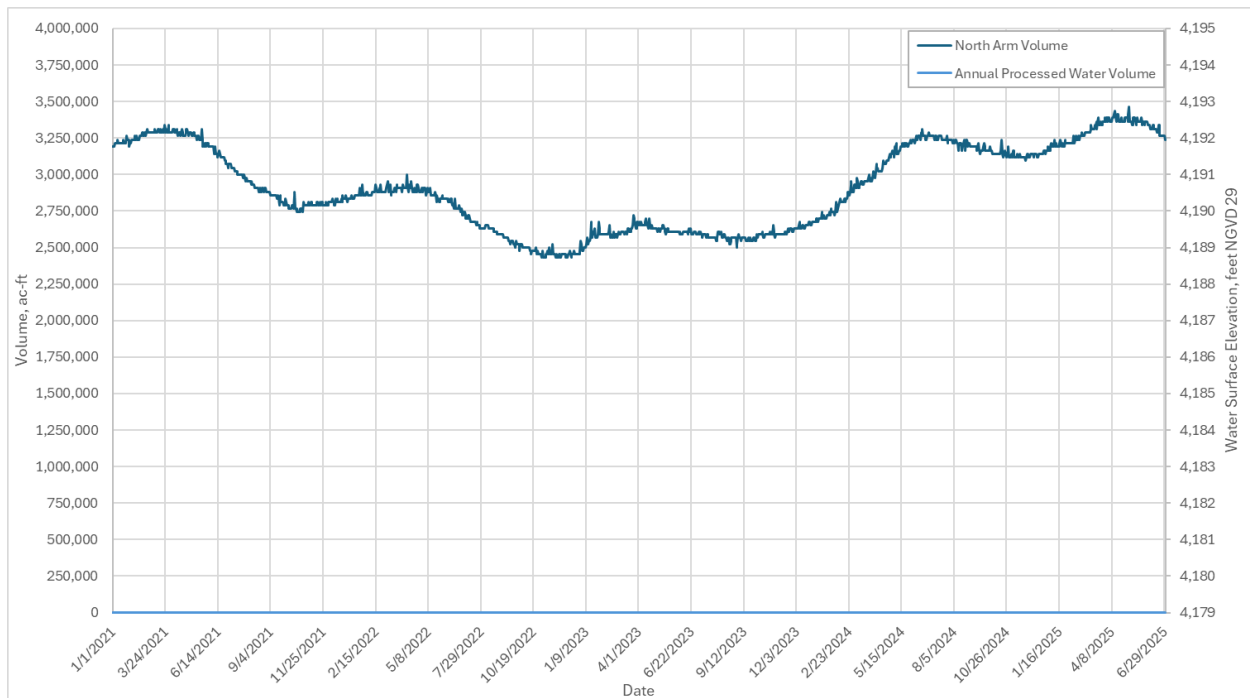


Table 12. Influent and Discharge
Density Results

Date	Influent Density	Discharge Density
2/6/25	1.216	1.183
2/13/25	1.181	1.171
2/20/25	No discharge	
2/26/25	1.215	1.171
3/4/25	1.215	1.177
3/13/25	1.213	1.183
3/18/25	1.190	1.189
3/25/25	1.213	1.197
4/2/25	1.213	1.203
4/8/25	1.212	1.204
4/15/25	1.213	1.213
4/22/25	1.213	1.210
5/1/25	1.202	1.201
5/6/25	1.213	1.205
5/12/25	No discharge	
5/20/25	1.212	1.198
5/29/25	1.205	1.206
6/03/25	1.214	1.193
6/12/25	1.188	1.174
6/17/25	1.204	1.205
6/24/25	1.178	1.201
7/1/25	1.210	1.196
7/10/25	1.211	1.204
7/15/25	1.213	1.204
7/22/25	No discharge	
7/29/25	1.204	1.197
8/7/25	1.210	1.203
8/12/25	1.216	1.215

4 Flow Monitoring Results

In accordance with the UPDES permit requirements, continuous influent and discharge flow monitoring results were used to determine average weekly and monthly maximum and average flows. These data were used to calculate average weekly and annual loads. These flow values were used to calculate monthly volumes for the influent and discharge.

Instantaneous flow monitoring results are documented on weekly field data sheets and were used to determine flow-weighted composite sampling.

In addition, groundwater added to the process was recorded.

4.1 Monthly Volume Results

Continuous flow monitoring during the Demonstration Plant's operation recorded a final influent volume of 3.35 af and a final discharge volume of 3.48 af. Monthly average flows and volumes are shown in Table 13.

Table 13. Demonstration Plant Influent and Discharge Flow Volume

Month	Total Volume (af)	
	Influent	Discharge
February 2025	0.306	0.238
March 2025	0.201	0.237
April 2025	0.662	0.694
May 2025	0.427	0.431
June 2025	0.644	0.627
July 2025	0.730	0.781
August 2025	0.385	0.470
Total	3.355	3.477

Definitions: af = acre-feet

4.2 Total Water Balance

Total water is defined as sum of the brine and externally sourced water (UAC R317-16-2(21)). The Demonstration Plant's total water balance is provided below based on data from the intake and outfall continuous flow meters. The discharge volume includes the flow from the externally sourced groundwater.

- North Arm brine influent volume: 3.355 af
- Externally sourced groundwater: 0.265 af
- Discharge volume to North Arm: 3.477 af

The water balance shows that about 4% of the brine and groundwater flow is not discharged. This residual water was retained in the lithium sulfate product, which is a liquid. The lithium sulfate was shipped off site for further processing into the lithium carbonate equivalent product, which is a powder.

Based on USGS bathymetric and topographic data, the North Arm's volumes at WSEs of 4,190 and 4,198 feet (NVGD 1929) are 2.7 maf and 4.9 maf, respectively (USGS 2006). As of June 25, 2025, the North Arm's WSE was about 4,192.1 feet, and the North Arm had a volume of 3,241,855 af (USGS 2025).



5 Biota Monitoring Results

Three monitoring events were conducted by Dr. Bonnie Baxter of Westminster University during the Demonstration Plant's operation (Baxter 2025). By design, the first monitoring event occurred during the first month of operation, and the second monitoring event occurred 2 months later. The third monitoring event was added during the summer as the algae community began to grow as a result of the warmer brine temperatures. The first monitoring event occurred on February 28, 2025, during week 4 of operation; the second on April 24, 2025, during week 12 of operation; and the third on June 23, 2025, during week 21 of operation. The study design captured seasonal biota presence in the North Arm and the plant's discharge during its operation. This section summarizes the biota monitoring report, which is provided as Appendix C, *Biota Monitoring Report*.

In summary, North Arm biota were present in both the influent and discharge flows collected during all monitoring events, and the abundance and diversity of biota in the samples varied seasonally, as anticipated. The growth rates of biota in the influent, discharge, and mixed samples were similar. The study provides evidence that the Demonstration Plant's DLE process does not harm North Arm biota.

5.1 Presence of Biota

A hemacytometer (which provides a grid and special cover glass to control the distributed volume) was used to estimate the cell density in each of the influent and discharge samples. The results are shown in Table 14. The first samples, from February, demonstrated a robust cell density in the influent sample, but the discharge sample (with observed rust flakes) had few if any visible cells. The April samples had comparable numbers of cells in the discharge as in the influent, and the cells-per-milliliter counts were in the billions. The June samples had more cells in the influent than in the discharge. This decrease is mostly due to the presence of algae (which was not present in February and April) in the influent and reduced numbers in the discharge due to filtration. By comparing influent and discharge samples, this analysis provides evidence that the Demonstration Plant's DLE process does not reduce biota cell count for archaea, bacteria, or fungi; algae reductions, when they occurred, were due to filtration.

Table 14. Biota Cell Counts and Dry Weight

Month	Number of Cells Observed via Hemacytometer (cells per mL)		Dry Weight of Biota (g/L)	
	Influent	Discharge	Influent	Discharge
February 2025	2.8×10^8	None observed ¹	Not analyzed	
April 2025	3.6×10^9	4.6×10^9	3.7	4.5
June 2025	8.1×10^9	5.3×10^9	5.2	4.2

Definitions: g/L = grams per liter; mL = milliliters

- Although no cells were observed using the hemacytometer, DNA sequencing revealed the presence and abundance of archaea, bacteria, and fungi in the discharge sample.

5.2 Biota Diversity

To document the species of biota that are present in both the influent and discharge flows, a consulting laboratory was contracted for DNA sequencing. The laboratory amplified DNA genes (16S rRNA, 18S rRNA, or ITS) associated with bacteria, archaea, algae, or fungi. The DNA is very specific to communities that might be present in North Arm brine. For the February and April monitoring events, archaea, bacteria, and fungi were present and abundant, but algae was not present. This is to be expected because the colder temperatures of North Arm brine in February and April do not support algae communities. Algae communities were observed in samples from the June monitoring event.

This analysis provides the relative abundance of the specific biota. It is important to note that the abundance is relative to other species in the influent or discharge samples, but no comparison of the influent to the discharge is valid. The abundance of archaea, bacteria, and fungi for the April monitoring event is shown in Figure 11. The abundance of archaea and bacteria (prokaryotes) and algae (eukaryotes) for the June monitoring event is shown in Figure 12.

By comparing influent and discharge (effluent) flow samples, this analysis provides evidence that the Demonstration Plant's DLE process does not reduce biota cell diversity in the North Arm of the GSL for archaea, bacteria, and fungi species. These biota are not affected by the DLE processes, including filtration, due to the small size (1–2 microns) of the individual organisms. When algae species are present during the warm summer months, the number of species is reduced by the filtration process due to the larger size (10–20 microns) of the individual organisms.

Figure 11. April 2025 Biota Abundance Graphs

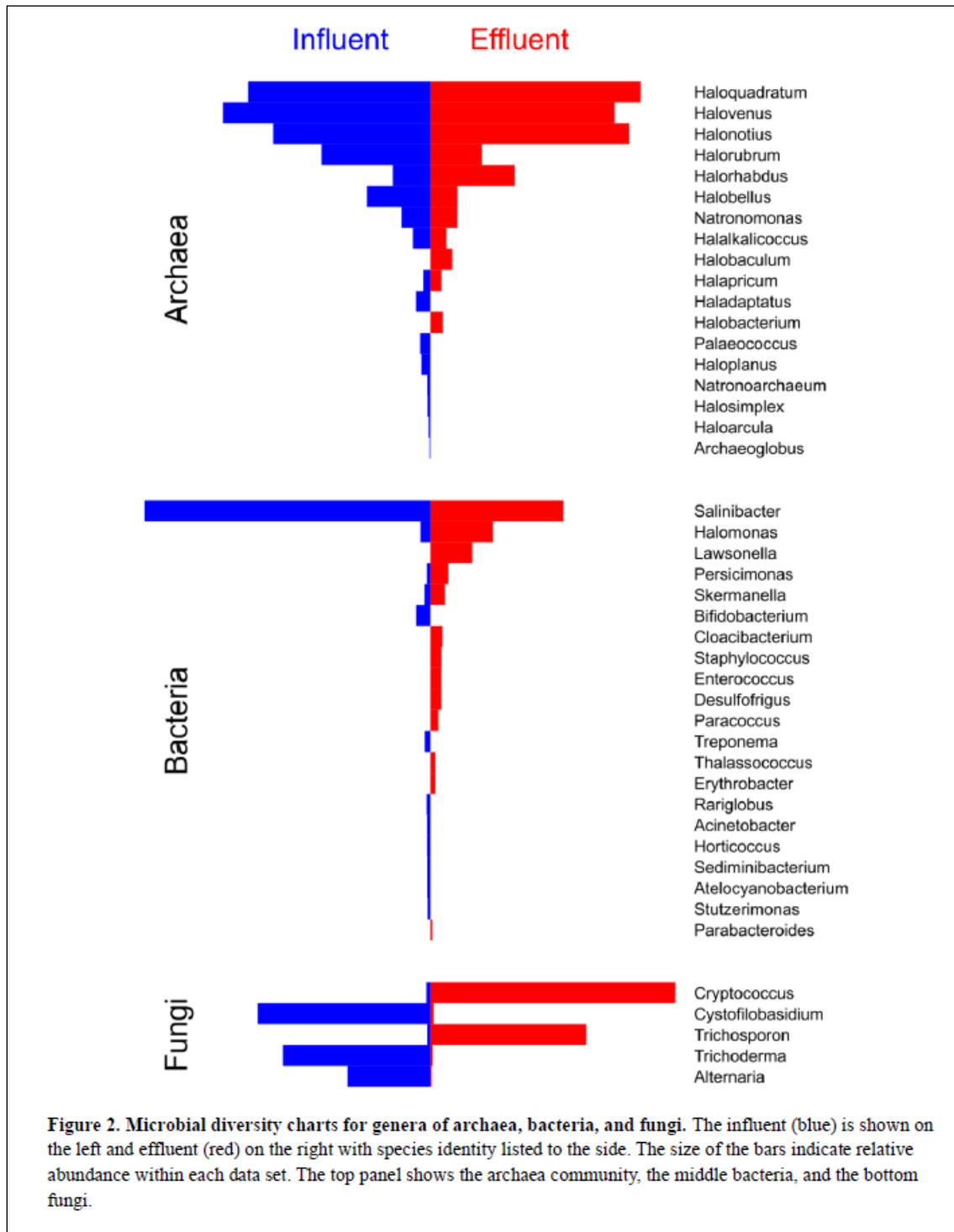
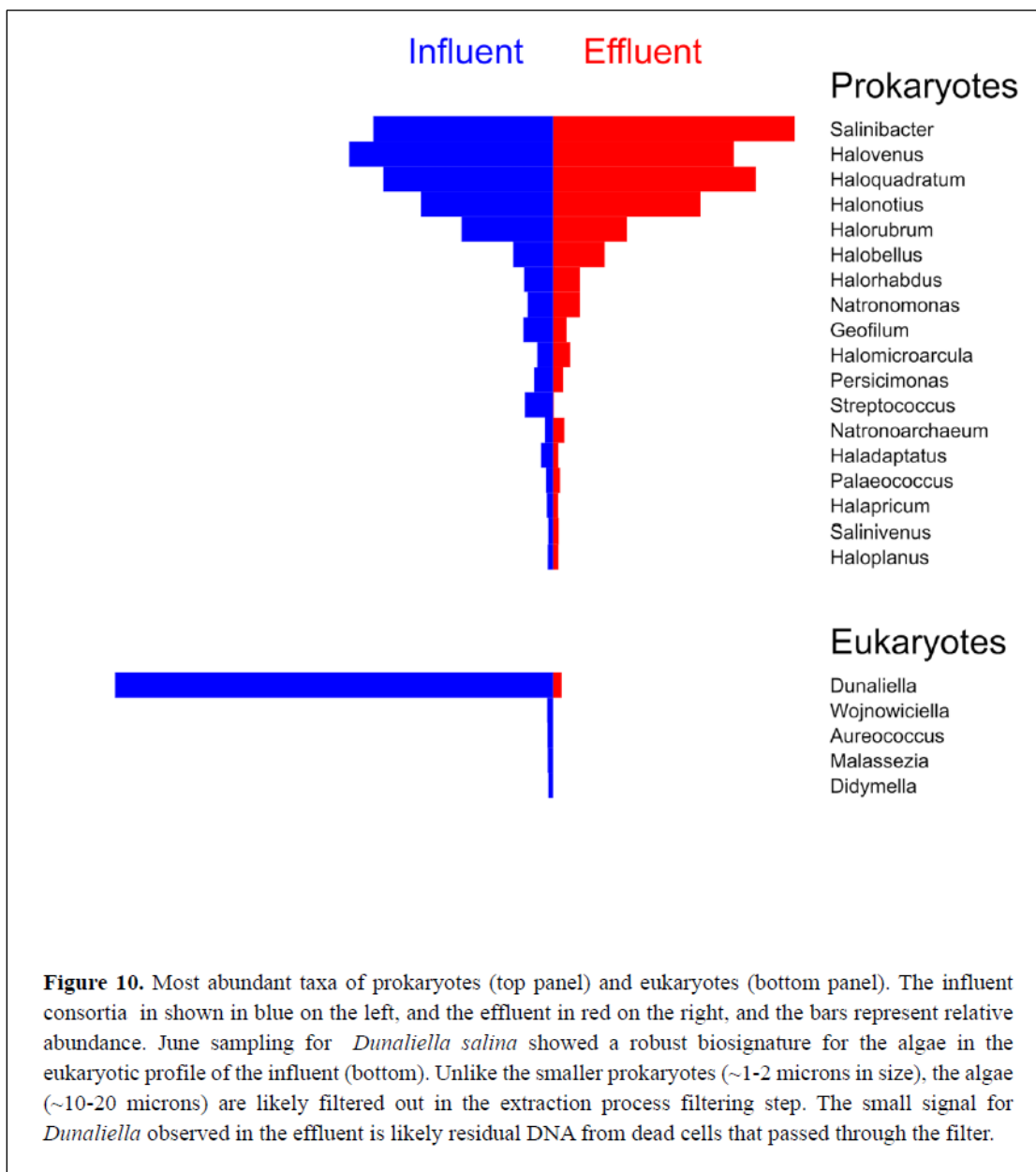


Figure 12. June 2025 Biota Abundance Graphs

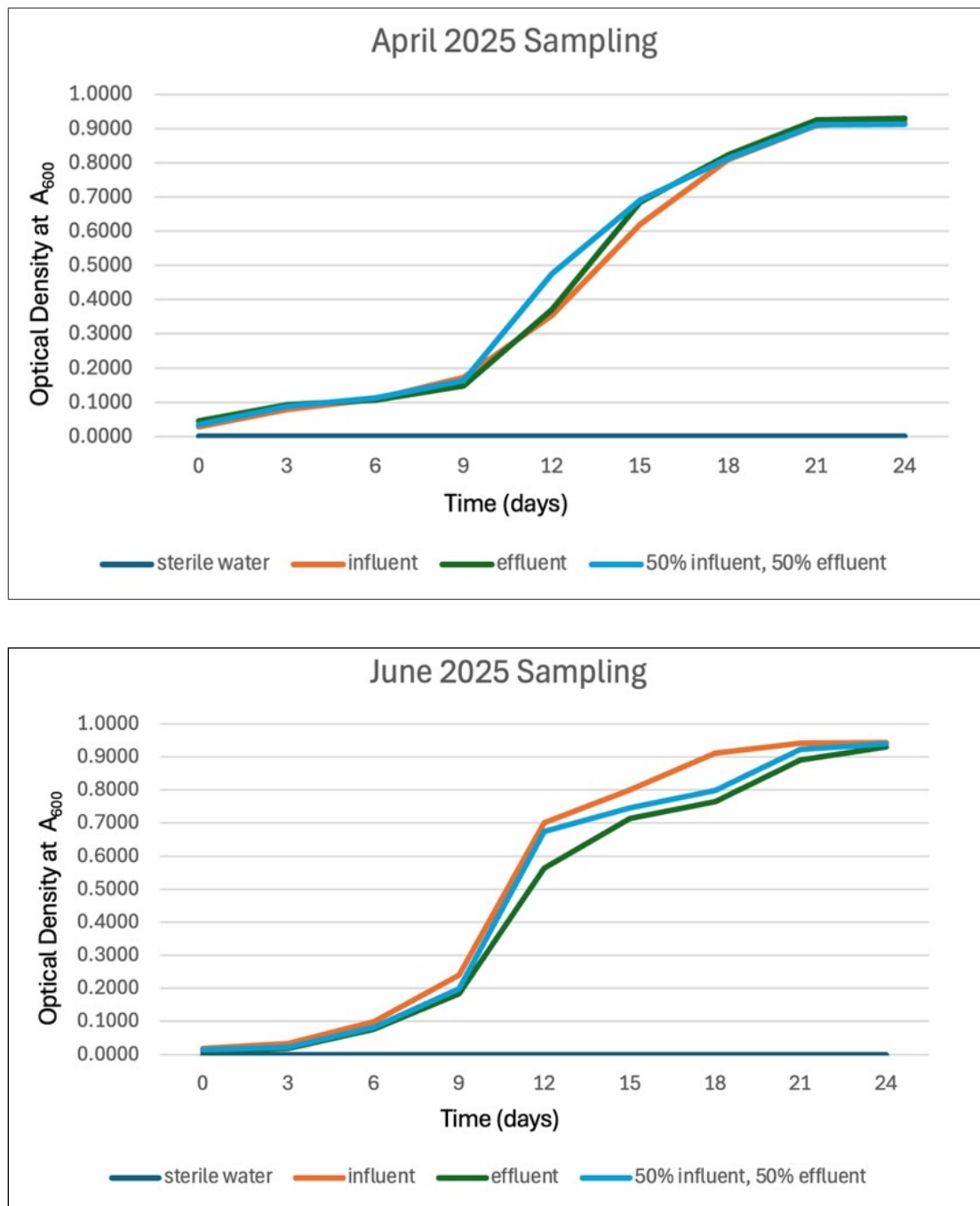


5.3 Biota Growth in Discharge

To understand the effects of discharges into the North Arm on biota growth, a time course growth experiment was conducted on influent, discharge, or a mix of the influent and discharge (representing North Arm brine after discharge). The protocol that was used consisted of inoculating 9 milliliters (mL) of 23% salt modified growth media (Dyall-Smith 2009) with 1 mL of sample. The inoculated samples consisted of (1) sterile deionized water serving as a control, (2) influent flow, (3) discharge (effluent) flow, and (4) a 50:50 mix of influent and discharge, which represents the in-lake mixture of discharge and brine.

Figure 13 shows the growth curves of the samples collected during the April and June monitoring events. All samples follow a standard growth curve. The microbial communities appear to have reached a stationary growth phase over this period of study. This is expected of healthy cultures. Also note that the sample representing the North Arm brine mixed with the discharge flow did not visibly affect growth of the biota. By comparing influent, discharge, and mixture sample results, this analysis provides evidence that the Demonstration Plant's DLE process does not prevent biota cell growth in the North Arm of the GSL.

Figure 13. April and June 2025 Biota Growth Results



6 Evaluation of No Negative Impact on the GSL from Demonstration Plant Operation

Waterleaf evaluated the results of the chemistry and biota analyses to determine whether negative impacts on the North Arm's chemistry and biota occurred during the operation of the Demonstration Plant.

Negative impact is defined by UDWQ R317-16-16 to include the following evaluation criteria:

Negative impact includes any activity or action that:

- Causes pollution, or negatively alters the salinity or other aspects of water chemistry in Great Salt Lake;
- Negatively alters the volume or timing of water flows to Great Salt Lake, or water levels in Great Salt Lake or Great Salt Lake wetlands;
- Reduces, degrades, or otherwise negatively alters habitat in and around Great Salt Lake; or
- Results in harmful physiological impacts to Great Salt Lake biota, including disruptions to survival, reproduction, or growth.

Waterleaf asserts no negative impacts on the North Arm of the GSL based on the above criteria. These evaluation criteria are discussed below.

6.1 Impacts on North Arm Salinity or Water Quality Chemistry

Waterleaf asserts that there were no negative impacts on North Arm salinity or water quality chemistry from operation of the Demonstration Plant, based on the results, analysis and review provided in Section 3.3, *Chemistry Monitoring Results Discussion and Graphs*. This assertion is based on the following:

- Compliance monitoring met the requirements of the UPDES permit for protecting the beneficial uses of the North Arm of the GSL. No water quality standards were exceeded.
- The incremental decrease in volume discharged (0.142 af; influent and groundwater volume subtracted from discharge volume) compared to the total volume of the North Arm of the GSL (3.24 maf) indicates that the Demonstration Plant's retained volume is *de minimis* and would not impact North Arm salinity or water quality.
- The Demonstration Plant's operation was temporary (7 months).
- The results of the compliance monitoring analysis, comparing average discharge concentrations to average influent concentrations and MDLs, uncertainty and error consideration, association of specific monitoring results due to operational phases, comparison of the mass load to the North Arm from Demonstration Plant operations to existing North Arm mass loads, and results of the biota monitoring study provide evidence that the Demonstration Plant did not harm North Arm water quality.

- Manganese, a component of the DLE process, had higher average discharge concentrations compared to the average influent concentrations. Examination of federal and state standards for lake recreational contact revealed that no standards or guidelines exist. Discharge concentrations are well below federal guidelines for dermal exposure due to showering in drinking water.
- The density of the North Arm discharge did not vary significantly from the density of the influent. This data shows that the density (salinity) of the North Arm was not changed due to the operation of the Demonstration Plant.

6.2 Impacts on North Arm Volume, Flows, or Water Levels

Waterleaf asserts that there were no negative impacts on North Arm volume, flows, or water levels from operation of the Demonstration Plant. This assertion is based on continuous flow monitoring data collected during operation of the Demonstration Plant. The flow monitoring data documented that the influent and discharge flows were comparable during operation. The Demonstration Plant diverted raw brine directly from the open waters of the GSL and discharged depleted brine back to the open waters of the GSL. The processing time from when the raw brine was diverted to when the depleted brine was discharged was less than 8 hours. The Demonstration Plant did not divert any surface water flows for its operation.

The results of the flow monitoring events are summarized in Section 4, *Flow Monitoring Results*.

Based on the Demonstration Plant's flow monitoring and the final water balance, the volume of North Arm raw brine diverted and groundwater added was documented to be discharged back to the North Arm, less water lost to processing the product. The amount of water (about 0.142 af) used to produce the liquid product is considered by Waterleaf to be *de minimis* compared to the 3.24 maf in the North Arm (at a WSE of 4,192 feet). Because no surface waters were diverted, the Demonstration Plant did not alter the timing of water flows to the North Arm of the GSL.

Waterleaf asserts that the Demonstration Plant did not alter the volume or timing of water flows to the GSL or the water levels in the GSL or GSL wetlands.

6.3 Impacts on North Arm Habitat

Waterleaf asserts that there were no negative impacts on North Arm habitat. This assertion is based on evaluating the presence of microbialites that could be present or could grow in and along the open waters of the GSL. Based on the survey conducted on the intake and outfall pipe easements before construction of the Demonstration Plant, no microbialite structures were identified (HDR 2024).

Therefore, Waterleaf asserts that the Demonstration Plant did not reduce, degrade, or otherwise negatively alter habitat in and around the North Arm of the GSL.

6.4 Impacts on North Arm Biota

To evaluate impacts on North Arm biota, Waterleaf contracted with Dr. Bonnie Baxter of Westminster University to conduct biota monitoring during operation of the Demonstration Plant (Baxter 2025). The biota monitoring documented the presence and abundance of biota (archaea, bacteria, algae, and fungi) in the influent to and the discharge from the Demonstration Plant during its operation. The study also investigated whether biota could reproduce and grow in the discharge water from the Demonstration Plant.

The results of the biota analyses are summarized in Section 5, *Biota Monitoring Results*, and the complete report is provided as Appendix C, *Biota Monitoring Report*.

Based on the biota monitoring study and results, North Arm biota were documented to be present and abundant in the raw brine influent and Demonstration Plant discharge water during its operation. Biota were also documented to grow and reproduce in the discharge water from the Demonstration Plant. Therefore, Waterleaf asserts that the Demonstration Plant did not disrupt survival, reproduction, or growth of North Arm biota (archaea, algae, bacteria, and fungi) and did not have a negative impact on the biota of the North Arm of the GSL.

7 References

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2025 Manganese Risk Evaluation Memo.

[UDWQ] Utah Division of Water Quality

2025a Utah Pollutant Discharge Elimination System Permit No. UT0026280. February 4.

2025b Email from L. Shull, UDWQ, to N. Nichols, HDR. September 24.

[UGS] Utah Geological Survey

2020 Standard Operating Procedure – Great Salt Lake Water Density Measurement and Salinity Calculation. Open-File Report 0728. June.

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[USGS] U.S. Geological Survey

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2025 Great Salt Lake Hydro Mapper [website]. <https://webapps.usgs.gov/gsl/data.html>. Accessed June 25, 2025.

[Waterleaf] Waterleaf Resources

2025a Data Quality Objectives Memo. May 9.

2025b Great Salt Lake Lithium Feasibility Project – Final Report. **October**

APPENDIX A

UPDES Permit

STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH

UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM (UPDES) PERMITS

Minor Industrial Permit No. **UT0026280**

In compliance with provisions of the Utah *Water Quality Act, Title 19, Chapter 5, Utah Code* (the “Act”),

WATERLEAF RESOURCES, LLC (Permittee),

is hereby authorized to discharge from

GREAT SALT LAKE LITHIUM PROJECT (Facility),

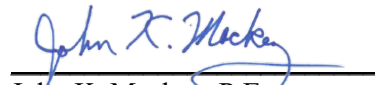
to receiving waters named **GUNNISON BAY, THE GREAT SALT LAKE,**

in accordance with specific limitations, outfalls, and other conditions set forth herein.

This permit shall become effective on **February 4th, 2025.**

This permit expires at midnight on **February 4th, 2028.**

Signed this **fourth day of February 2025.**



John K. Mackey, P.E.
Director

DWQ-2024-000479

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PART I
DISCHARGE PERMIT NO. UT0026280
WASTEWATER

I. DISCHARGE LIMITATIONS AND REPORTING REQUIREMENTS

- A. Description of Discharge Points. The authorization to discharge wastewater provided under this part is limited to those outfalls specifically designated below as discharge locations. Discharges at any location not authorized under a UPDES permit are violations of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

Outfall Number
001

Location of Discharge Outfall
Discharge to Gunnison Bay, Great Salt Lake.
Located at latitude 41° 26' 44.16" and longitude
112° 41' 36.04".

- B. Narrative Standard. It shall be a violation of this permit, for Permittee to discharge effluent or place any waste, pollutant, or other substance into Waters of the State in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life, objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by a bioassay or other tests performed in accordance with standard procedures.

C. Specific Limitations and Self-Monitoring Requirements.

1. Effective immediately, and lasting through the life of this permit, there shall be no acute or chronic toxicity in Outfall 001 as defined in *Part VIII*.
2. Discharge Limitations and Reporting Requirements:
 - a. The limitations specified in this section shall be applied on a net basis, unless otherwise noted, if the source of the applicant's water supply is the same body of water into which the discharge is made. With the exception of calcium, there shall be no discharge of process wastewater pollutants into navigable waters. See Fact Sheet Statement of Basis for more information.
 - b. Permittee must notify the Division of Water Quality (DWQ) fourteen (14) days prior to discharge. From the date the Permittee begins discharge, Permittee will be authorized to discharge from Outfall 001 for twelve (12) consecutive months only.
 - c. Such discharges shall be limited and monitored by the Permittee as specified below:

Parameter	Effluent Limitations *a				
	Maximum Weekly Avg	Annual Load	Weekly Load	Daily Minimum	Daily Maximum
Total Flow *b, *c, *d Demonstration Plant	0.06	--	--	--	0.12
Temperature *d	Report	--	--	--	Report
pH, Standard Units	--	--	--	6.5	9
Oil & Grease	--	--	--	--	10.0
Total Alkalinity, *d	Report	--	--	--	Report
Total Dissolved Solids *d	Report	--	--	--	Report
Total Suspended Solids *d	Report	--	--	--	Report

PART I
DISCHARGE PERMIT NO. UT0026280
WASTEWATER

Sulfate *d	Report	--	--	--	Report
Nitrate *d	Report	--	--	--	Report
Nitrite *d	Report	--	--	--	Report
Carbonate *d	Report	--	--	--	Report
Hydroxide *d	Report	--	--	--	Report
Chemical Oxygen Demand *d	Report	--	--	--	Report
Biological Oxygen Demand *d	Report	--	--	--	Report
Silica *d	Report	--	--	--	Report
Sodium *d	Report	--	--	--	Report
Calcium *d *e	Report	--	--	--	Report
Potassium *d	Report	--	--	--	Report
Boron *d	Report	--	--	--	Report
Bromine *d	Report	--	--	--	Report
Silicon *d	Report	--	--	--	Report
Total Lithium *d	Report	--	--	--	Report
Total Arsenic *d, *f	--	*g	*h	--	--
Total Cadmium *d, *f	--	*g	*h	--	--
Total Chromium *d, *f	--	*g	*h	--	--
Total Copper *d, *f	--	*g	*h	--	--
Total Lead *d, *f	--	*g	*h	--	--
Total Molybdenum *d, *f	--	*g	*h	--	--
Total Nickel *d, *f	--	*g	*h	--	--
Total Selenium *d, *f	--	*g	*h	--	--
Total Silver *d, *f	--	*g	*h	--	--
Total Zinc *d, *f	--	*g	*h	--	--
Total Cyanide *d, *f	--	*g	*h	--	--
Total Mercury *d, *f	--	*g	*h	--	--

Self-Monitoring and Reporting Requirements *a			
Parameter	Frequency	Sample Type	Units
Total Flow *b, *c, *d	Continuous	Recorder	MGD
pH	Weekly	Instantaneous	SU
DO	Weekly	Instantaneous	mg/L
Temperature *d	Weekly	Instantaneous	mg/L
Oil & Grease *i	Weekly	Grab	mg/L
Total Alkalinity, *d	Weekly	Composite	mg/L
Total Dissolved Solids *d	Weekly	Composite	mg/L
Total Suspended Solids *d	Weekly	Composite	mg/L
Sulfate *d	Weekly	Composite	mg/L
Nitrate *d	Weekly	Composite	mg/L
Nitrite *d	Weekly	Composite	mg/L
Carbonate *d	Weekly	Composite	mg/L
Hydroxide *d	Weekly	Composite	mg/L
Chemical Oxygen Demand *d	Weekly	Composite	mg/L
Biological Oxygen Demand *d	Weekly	Composite	mg/L
Silica *d	Weekly	Composite	mg/L
Sodium *d	Weekly	Composite	mg/L
Calcium *d, *e	Weekly	Composite	mg/L
Potassium *d	Weekly	Composite	mg/L
Boron *d	Weekly	Composite	mg/L

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Bromine *d	Weekly	Composite	mg/L
Silicon *d	Weekly	Composite	mg/L
Total Lithium *d	Weekly	Composite	mg/L
Total Arsenic	Weekly	Composite	mg/L, kg/day
Total Cadmium	Weekly	Composite	mg/L, kg/day
Total Chromium	Weekly	Composite	mg/L, kg/day
Total Copper	Weekly	Composite	mg/L, kg/day
Total Lead	Weekly	Composite	mg/L, kg/day
Total Molybdenum	Weekly	Composite	mg/L, kg/day
Total Nickel	Weekly	Composite	mg/L, kg/day
Total Selenium	Weekly	Composite	mg/L, kg/day
Total Silver	Weekly	Composite	mg/L, kg/day
Total Zinc	Weekly	Composite	mg/L, kg/day
Total Cyanide	Weekly	Composite	mg/L, kg/day
Total Arsenic	Yearly	Composite	kg/year
Total Cadmium	Yearly	Composite	kg/year
Total Chromium	Yearly	Composite	kg/year
Total Copper	Yearly	Composite	kg/year
Total Lead	Yearly	Composite	kg/year
Total Molybdenum	Yearly	Composite	kg/year
Total Nickel	Yearly	Composite	kg/year
Total Selenium	Yearly	Composite	kg/year
Total Silver	Yearly	Composite	kg/year
Total Zinc	Yearly	Composite	kg/year
Total Cyanide	Yearly	Composite	kg/year

*a See Definitions, *Part VIII*, for definition of terms.

*b Flow measurements of influent/effluent volume shall be made in such a manner that Permittee can affirmatively demonstrate that representative values are being obtained.

*c If the rate of discharge is controlled, the rate and duration of discharge shall be reported.

*d In addition to monitoring the final discharge, influent samples shall be taken and analyzed for this constituent at the same frequency as required for this constituent in the discharge.

*e Discharge of calcium is allowed as a process wastewater pollutant. See Fact Sheet Statement of Basis for more information.

*f The minimum detection limit (MDL) of the test method used for analysis must be below this limit in mg/L. If a test method is not available, Permittee must submit documentation to the Director regarding the method that will be used. Total Arsenic 0.180 mg/L, Total Cadmium 0.0052 mg/L, Total Chromium 0.0166 mg/L, Total Copper 0.067 mg/L, Total Lead 0.0465 mg/L, Total Molybdenum NA, Total Nickel 0.376 mg/L, Total Selenium 0.0079 mg/L, Total Silver 0.0899 mg/L, Total Zinc 0.675 mg/L, Total Cyanide 0.0093 mg/L, Total Mercury 0.000022 mg/L.

*g The average annual load for this parameter in the final discharge shall not exceed +10% of the load in the intake water as reported in kg/year.

*h The average weekly load for this parameter in the final discharge shall not exceed +10% of the load in the intake water as reported in kg/day.

*i Oil & Grease sampled when sheen is present or visible. If no sheen is present or visible, report NA.

d. As authorized in Part VII.E.:

(1) Permittee shall establish laboratory quality performance for the Great Salt Lake North Arm matrix as soon as possible, and present and review the laboratory quality performance with the Director.

(a) Based on the laboratory quality performance, Permittee shall work with the Director to define suitable data quality objectives for the Demonstration Plant, that evidence protection of Great Salt Lake

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chemistry and biota. Following the work with the Director, Permittee shall formalize the recommended data quality objectives, in writing, and submit to the Director prior to completion of testing at the Demonstration Plant.

- (2) Permittee shall submit a Level IV data quality package with each compliance sample.
- (3) Permittee shall coordinate with DWQ on the collection and delivery of a split sample for each compliance sample taken. Permittee shall handle and deliver split samples using proper chain of custody procedures as described in 40 C.F.R. § 136.

D. Reporting of Monitoring Results.

- 1. Reporting of Wastewater Monitoring Results Monitoring results obtained by the Permittee during the previous month shall be summarized for each month and reported to DWQ on a Discharge Monitoring Report Form (EPA No. 3320-1) * or by NetDMR, post-marked or entered into NetDMR no later than 28 days after the last day of the reporting period. The first report is due on **March 28, 2025**. If no discharge occurs during the reporting period, “no discharge” shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part VII.G)*, and submitted by NetDMR, or to the Division of Water Quality at the following address:

Department of Environmental Quality
Division of Water Quality
PO Box 144870
Salt Lake City, Utah 84114-4870

* Starting January 1, 2017 monitoring results must be submitted using NetDMR unless Permittee has successfully petitioned for an exception.

PART II
DISCHARGE PERMIT NO. UT0026280
PRETREATMENT

II. PRETREATMENT REQUIREMENTS

A. Definitions. For this section, the following definitions shall apply:

1. *Indirect Discharge* means the introduction of pollutants into a publicly-owned treatment works (POTW) from any non-domestic source regulated under section 307 (b), (c) or (d) of the CWA.
2. *Interference* means a discharge which, alone or in conjunction with a discharge or discharges from other sources, both:
 - a. Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
 - b. Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.
3. *Pass Through means* a Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).
4. *Publicly Owned Treatment Works or POTW* means a treatment works, as defined by section 212 of the CWA, which is owned by a State or municipality (as defined by section 502(4) of the CWA). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW Treatment Plant. The term also means the municipality, as defined in section 502(4) of the CWA, which has jurisdiction over the Indirect Discharges to and the discharges from such a treatment works.
5. *Significant Industrial User (SIU)* is defined as an Industrial User discharging to a POTW that satisfies any of the following:
 - a. Has a process wastewater flow of 25,000 gallons or more per average work day;
 - b. Has a flow greater than five percent of the flow carried by the municipal system receiving the waste;
 - c. Is subject to Categorical Pretreatment Standards, or
 - d. Has a reasonable potential for adversely affecting the operation of the POTW or violating any pretreatment standard or requirement.
6. *User or Industrial User (IU)* means a source of Indirect Discharge.

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PRETREATMENT

- B. Discharge to POTW. Any wastewaters discharged to a Publicly Owned Treatment Works (POTW), either as an Indirect Discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of The Water Quality Act of 1987, Permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at 40 CFR 403, the State Pretreatment Requirements at Utah Administrative Code (UAC) R317-8-8, and any specific local discharge limitations developed by the POTW accepting the wastewaters. At a minimum, the discharge into a POTW must meet the requirements of Part II. C., D. and E. of the permit.
- C. Hazardous Waste Notification. Permittee must notify the POTW, the EPA Regional Waste Management Director, the Director and the State hazardous waste authorities in writing if they discharge any substance into a POTW that, if otherwise disposed of, would be considered a hazardous waste under 40 CFR 261. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).
- D. General and Specific Prohibitions.
1. General Prohibitions. Permittee may not introduce into a POTW any pollutant(s) which cause Pass Through or Interference. These general prohibitions and the specific prohibitions in II. D. 2. of this section apply to the introducing pollutants into a POTW whether or not Permittee is subject to other National Pretreatment Standards or any national, State, or local Pretreatment Requirements.
 2. Specific Prohibitions. The following pollutants shall not be introduced into a POTW:
 - a. Pollutants which create a fire or explosion hazard in the publicly owned treatment works (POTW), including, but not limited to, wastestreams with a closed cup flashpoint of less than 140°F (60°C);
 - b. Pollutants, which will cause corrosive structural damage to the POTW, but in no case, discharges with a pH lower than 5.0;
 - c. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in Interference;
 - d. Any pollutant, including oxygen demanding pollutants (BOD, etc.), released in a discharge at such volume or strength as to cause Interference in the POTW;
 - e. Heat in amounts, which will inhibit biological activity in the POTW, resulting in Interference, but in no case, heat in such quantities that the influent to the sewage treatment works exceeds 104°F (40°C));
 - f. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause Interference or Pass Through;
 - g. Pollutants, which result in the presence of toxic gases, vapor, or fumes within the POTW in a quantity that may cause worker health or safety problems;
 - h. Any trucked or hauled pollutants, except at discharge points designated by the POTW;
or
 - i. Any pollutant that causes Pass Through or Interference at the POTW.

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- j. Any specific pollutant which exceeds any Local Limitation established by the POTW.
- E. Categorical Standards. In addition to the general and specific limitations expressed in *Part II. D.* of this section, applicable National Categorical Pretreatment Standards must be met by all Industrial Users discharging into a POTW. These standards are published in the federal regulations at *40 CFR 405 through 471*.

III. BIOSOLIDS REQUIREMENTS

- A. Biosolids Treatment and Disposal. UAC R317-8-1.10 regulates the disposal of sewage sludge (biosolids), which incorporates the federal standards found in 40 CFR Part 503 by reference. However, this is an industrial facility that does not regularly produce regulated biosolids. Therefore, R317-8-1.10 does not apply at this time.
- B. Biosolids – Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate biosolids limitations (and compliance schedule, if necessary), management practices, other appropriate requirements to protect public health and the environment, or if there have been substantial changes (or such changes are planned) in biosolids use or disposal practices; applicable management practices or numerical limitations for pollutants in biosolids have been promulgated which are more stringent than the requirements in this permit; and/or it has been determined that Permittee's biosolids use or land application practices do not comply with existing applicable state or federal regulations.

PART IV
STORM WATER PERMIT

IV. STORM WATER REQUIREMENTS.

- A. Industrial Storm Water Permit. Based on the type of industrial activities occurring at the Permitted Facility, Permittee is required to maintain separate coverage or an appropriate exclusion under the Multi-Sector General Permit (MSGP) for Storm Water Discharges Associated with Industrial Activities (UTR000000). If the Permitted Facility is not already covered, Permittee has thirty (30) days from when this permit is issued to submit the appropriate Notice of Intent (NOI) for the MSGP or exclusion documentation.
- B. Construction Storm Water Permit. Any construction at the Permitted Facility that disturbs an acre or more of land, including less than an acre if it is part of a common plan of development or sale, is required to obtain coverage under the UPDES Construction General Storm Water Permit (UTRC000000). Permittee must obtain permit coverage prior to land disturbance. If the site qualifies, the Permittee may submit a Low Erosivity Waiver (LEW) Certification instead of permit coverage.

PART V
DISCHARGE PERMIT NO. UT0026280
MONITORING & REPORTING

V. MONITORING, RECORDING & GENERAL REPORTING REQUIREMENTS

- A. Representative Sampling. Permittee shall collect samples in compliance with the monitoring requirements established under *Part I* from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Samples of biosolids shall be collected at a location representative of the quality of biosolids immediately prior to the use-disposal practice.
- B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under UAC R317-2-10, UAC R317-8-4.1(10)(d), and/or 40 CFR § 503 utilizing sufficiently sensitive test methods unless other test procedures have been specified in this permit. Monitoring must be conducted according to the test procedures listed above unless another method is required under 40 CFR Chapter I subchapters N or O. Sufficiently sensitive test method means: (1) The method minimum level (ML) is at or below the level of the effluent limit established in the permit for the measured pollutant or pollutant parameter; or (2) The method has the lowest ML of the analytical methods approved under 40 CFR part 136 or required under 40 CFR chapter I, subchapter N or O for the measured pollutant or pollutant parameter as per 40 CFR 122.44(i)(1)(iv)(A).
- C. Penalties for Tampering. Utah Code § 19-5-115(4) of the Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per day of violation, or by imprisonment for not more than six (6) months per violation, or by both.
- D. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than fourteen (14) days following each schedule date.
- E. Additional Monitoring by the Permittee. If Permittee monitors any parameter more frequently than required by this permit, using test procedures approved under Permit Part V.B., the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or the Biosolids Report Form.
- F. Records Contents. Records of monitoring information shall include:
1. The date, exact place, and time of sampling or measurements;
 2. The individual(s) who performed the sampling or measurements;
 3. The date(s) and time(s) analyses were performed;
 4. The individual(s) who performed the analyses;
 5. The analytical techniques or methods used; and,
 6. The results of such analyses.
- G. Retention of Records. Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least five (5) years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location
- H. Twenty-four (24) Hour Notice of Noncompliance Reporting.

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1. In accordance with UAC R317-8-4, Permittee shall (orally) report any noncompliance which may endanger health or the environment, including transportation accidents, spills, and uncontrolled runoff from biosolids transfer or land application sites which may seriously endanger health or environment, as soon as possible, but no later than twenty-four (24) hours from the time Permittee first became aware of circumstances. The report shall be made to the DWQ via the 24-hour answering service (801) 536-4123.
 2. The following occurrences of noncompliance shall initially be reported by telephone to the DWQ via the 24-hour answering service as soon as possible but no later than twenty-four (24) hours from the time Permittee becomes aware of the circumstances:
 - a. Any noncompliance which may endanger health or the environment;
 - b. Any unanticipated bypass, which exceeds any effluent limitation in the permit (See *Part VI.G, Bypass of Treatment Facilities.*);
 - c. Any Upset which exceeds any effluent limitation in the permit (See *Part VI.H, Upset Conditions.*);
 - d. Violation of a daily discharge limitation for any of the pollutants listed in the permit. For other permit violations which will not endanger health or the environment, DWQ may otherwise be notified during business hours (801) 536-4300; or,
 - e. Violation of any of the Table 3 metals limits, the pathogen limits, the vector attraction reduction limits or the management practices for biosolids that have been sold or given away.
 3. A written submission shall also be provided within five (5) days of the time that Permittee becomes aware of the circumstances. The written submission shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times;
 - c. The estimated time noncompliance is expected to continue if it has not been corrected;
 - d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and,
 - e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.
 4. The Director may waive the written report on a case-by-case basis if the oral report has been received within twenty-four (24) hours by the Division of Water Quality, (801) 536-4300.
 5. Reports shall be submitted to the addresses in *Part I.D, Reporting of Monitoring Results.*
- I. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within twenty-four (24) hours shall be reported at the time that monitoring reports for *Part I.D* are submitted. The reports shall contain the information listed in *Part V.H.3.*

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MONITORING & REPORTING

- J. Inspection and Entry Permittee shall allow the Director, or an authorized representative (including an authorized contractor acting as a representative of the Director) upon the presentation of agency credentials and other documents as may be required by law, to:
1. Enter upon Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;
 2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, including but not limited to, biosolids treatment, collection, storage facilities or area, transport vehicles and containers, and land application sites;
 4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location, including, but not limited to, digested biosolids before dewatering, dewatered biosolids, biosolids transfer or staging areas, any ground or surface waters at the land application sites or biosolids, soils, or vegetation on the land application sites; and,
 5. The Permittee shall obtain permission or clearance from the landowner or leaseholder, if the landowner is someone other than the Permittee, to permit the Director, or authorized representative, to access the permitted facilities and activities for entry and inspection. The Permittee shall make necessary arrangements with any legally interested parties so as to permit the Director, or authorized representative, to enter and inspect without delay.

PART VI
DISCHARGE PERMIT NO. UT0026280
COMPLIANCE

VI. COMPLIANCE RESPONSIBILITIES

- A. Duty to Comply. Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of *the Act* and is grounds for administrative and civil enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. Permittee shall give sufficient advance notice to the Director of any planned changes in the Permitted Facility or activity, which may result in noncompliance with permit requirements so as to provide the Director with adequate time to review the changes and potentially appropriate remedies.
- B. Penalties for Violations of Permit Conditions. Utah Code § 19-5-115 of the *Act* provides that any person who violates a permit condition, rule, or order implementing provisions of the *Act* is subject to a civil penalty not to exceed \$10,000 per day of such violation. Except as provided at *Part VI.G, Bypass of Treatment Facilities* and *Part VI.H, Upset Conditions*, nothing in this permit shall be construed to relieve Permittee of the civil or criminal penalties for noncompliance.
- C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
- D. Duty to Mitigate. Permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit, which has a reasonable likelihood of adversely affecting human health or the environment. Permittee shall also take all reasonable steps to minimize or prevent any land application in violation of this permit.
- E. Proper Operation and Maintenance. Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.
- F. Removed Substances. Collected screening, grit, solids, sludge, or other pollutants removed in the course of treatment shall be disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter backwash shall not directly enter either the final effluent or waters of the state by any other direct route.
- G. Bypass of Treatment Facilities.
 - 1. Bypass Not Exceeding Limitations. Permittee may allow any bypass to occur which does not cause Permittee to exceed its permitted effluent limitations, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to paragraph 2 and 3 of this section.
 - 2. Prohibition of Bypass.
 - a. In accordance with Utah Admin. Code R317-8-4.1, bypass is prohibited, and the Director may take enforcement action against Permittee for bypass, unless:

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COMPLIANCE

- (1) Bypass was unavoidable to prevent loss of human life, personal injury, or Severe Property Damage;
 - (2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and
 - (3) Permittee submitted notices as required under *Part VI.G.3*.
 - b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in *Parts VI.G.2.a (1), (2) and (3)*.
3. Notice.
- a. *Anticipated bypass.* Except as provided above in *Part VI.G.2* and below in *Part VI.G.3.b*, if Permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety (90) days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:
 - (1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages;
 - (2) A specific bypass plan describing the work to be performed including scheduled dates and times. Permittee must notify the Director in advance of any changes to the bypass schedule;
 - (3) Description of specific measures to be taken to minimize environmental and public health impacts;
 - (4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;
 - (5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and,
 - (6) Any additional information requested by the Director.
 - b. *Emergency Bypass.* Where ninety (90) days advance notice is not possible, Permittee must notify the Director, and the director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in *Part VI.G.3.a.(1) through (6)* to the extent practicable.
 - c. *Unanticipated bypass.* Permittee shall submit notice of an unanticipated bypass to the Director as required under *Part IV.H*, Twenty-Four Hour Reporting. Permittee shall also immediately notify the director of the Department of Natural Resources,

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the public and downstream users through means reasonably calculated to provide adequate advance notice of the unanticipated bypass and shall implement measures to minimize impacts to public health, safety, and environment to the extent practicable.

H. Upset Conditions.

1. Effect of an Upset. An Upset constitutes an affirmative defense to an action brought for noncompliance with technology-based permit effluent limitations if the requirements of paragraph 2 of this section are met. Director's administrative determination regarding a claim of Upset cannot be judiciously challenged by Permittee until such time as an action is initiated for noncompliance.
2. Conditions necessary for a demonstration of Upset. A permittee who wishes to establish the affirmative defense of Upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - a. An Upset occurred and that the permittee can identify the cause(s) of the Upset;
 - b. The permitted Facility was at the time being properly operated;
 - c. The permittee submitted notice of the Upset as required under *Part V.H, Twenty-four Hour Notice of Noncompliance Reporting*; and,
 - d. The permittee complied with any remedial measures required under *Part VI.D, Duty to Mitigate*.
3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an Upset has the burden of proof.

I. Toxic Pollutants. Permittee shall comply with effluent standards or prohibitions established under 33 U.S.C. § 1317,)(Section 307(a), *The Water Quality Act of 1987*) for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

J. Changes in Discharge of Toxic Substances. Permittee shall provide notice to the Director as soon as Permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":
 - a. One hundred micrograms per liter (100 ug/L);
 - b. Two hundred micrograms per liter (200 ug/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/L) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
 - c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(7)* or (10); or,

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COMPLIANCE

- d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.
- 2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":
 - a. Five hundred micrograms per liter (500 ug/L);
 - b. One milligram per liter (1 mg/L) for antimony;
 - c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(9)*; or,
 - d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

PART VII
DISCHARGE PERMIT NO. UT0026280

VII. GENERAL REQUIREMENTS

- A. Planned Changes. Permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the Permitted Facility. Notice is required only when:
1. The alteration or addition to a Permitted Facility may meet one of the criteria for determining whether a facility is a new source in 122.29(b); or
 2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit nor to notification requirements under Utah Admin. Code R317-8-4.1(15).
 3. The alteration or addition results in a significant change in Permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. Permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.
- B. Anticipated Noncompliance. Permittee shall give advance notice to the Director of any planned changes to the Permitted Facility or activity, which may result in noncompliance with permit requirements.
- C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.
- D. Duty to Reapply. If Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, Permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.
- E. Duty to Provide Information. Permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. Permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.
- F. Other Information. When Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.
- G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.
1. All permit applications shall be signed by either a principal executive officer, ranking elected official or duly authorized representative of the signatory. A person is a duly authorized representative only if:

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- a. The authorization is made in writing by a person described above and submitted to the Director, and,
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the Permitted Facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. A duly authorized representative may thus be either a named individual or any individual occupying a named position.
 - (1) For a corporation. By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
 - (a) A president, secretary, treasurer, vice-president or officer of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or
 - (b) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the Permitted Facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
 - (2) For a partnership or sole proprietorship. By a general partner or the proprietor, respectively; or
 - (3) For a municipality, State, Federal, or other public agency. By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:
 - (a) The chief executive officer of the agency, or
 - (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).
2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person.
 3. Changes to authorization. If an authorization under *Part VII.G.2* is no longer accurate because a different individual or position has responsibility for the overall operation of the Permitted Facility, a new authorization satisfying the requirements of *Part VII.G.2* must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.
 4. Certification. Any person signing a document under this section shall make the following certification:

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"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant administrative, criminal and civil penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

- H. Penalties for Falsification of Reports. Section 19-5-115(4) of the *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than \$10,000.00 per day of violation, or by imprisonment for not more than six months per violation, or by both.
- I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential.
- J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude Permittee of any legal action or relieve Permittee from any responsibilities, liabilities, or penalties to which Permittee is or may be subject under the *Act*.
- K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.
- L. Severability. The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.
- M. Transfers. This permit may be automatically transferred to a new permittee if:
 - 1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;
 - 2. The notice includes a written agreement between the existing and new permittee's containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,
 - 3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.
- N. State or Federal Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by

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Sections 19-5-117 and 510 of the Clean Water Act or any applicable Federal or State transportation regulations, such as but not limited to the Department of Transportation regulations.

- O. Water Quality - Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:
1. Water Quality Standards for the receiving water(s) to which Permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.
 2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.
 3. Revisions to the current CWA § 208 areawide treatment management plans or promulgations/revisions to TMDLs (40 CFR 130.7) approved by the EPA and adopted by DWQ which calls for different effluent limitations than contained in this permit.
- P. Toxicity Limitation - Reopener Provision. Use the following paragraph if WET testing is required at the Permitted Facility:

This permit may be reopened and modified (following proper administrative procedures) to include, whole effluent toxicity (WET) limitations, a compliance date, a compliance schedule, a change in the whole effluent toxicity (biomonitoring) protocol, additional or modified numerical limitations, or any other conditions related to the control of toxicants if one or more of the following events occur;

1. Toxicity is detected, as per *Part I.C.4.a/b* of this permit, during the duration of this permit.
2. The TRE results indicate that the toxicant(s) represent pollutant(s) or pollutant parameter(s) that may be controlled with specific numerical limits, and the Director concludes that numerical controls are appropriate.
3. Following the implementation of numerical control(s) of toxicant(s), the Director agrees that a modified biomonitoring protocol is necessary to compensate for those toxicants that are controlled numerically.
4. The TRE reveals other unique conditions or characteristics, which in the opinion of the permit issuing authority justify the incorporation of unanticipated special conditions in the permit.

Use the following paragraph if there is no WET testing is required at the Permitted Facility:

This permit may be reopened and modified (following proper administrative procedures) to include WET testing, a WET limitation, a compliance schedule, a compliance date, additional or modified numerical limitations, or any other conditions related to the control of toxicants if toxicity is detected during the life of this permit.

VIII. DEFINITIONS

A. Wastewater.

1. The "7-day (and weekly) average", other than for *E. coli* bacteria, fecal coliform bacteria, and total coliform bacteria, is the arithmetic average of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. Geometric means shall be calculated for *E. coli* bacteria, fecal coliform bacteria, and total coliform bacteria. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week, which begins on Sunday and ends on Saturday, shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for that calendar week shall be included in the data for the month that contains Saturday.
2. The "30-day (and monthly) average," other than for *E. coli* bacteria, fecal coliform bacteria and total coliform bacteria, is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. Geometric means shall be calculated for *E. coli* bacteria, fecal coliform bacteria and total coliform bacteria. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.
3. "Average annual discharge limit" means maximum allowable average of monthly discharges over a calendar year, calculated as the sum of all monthly discharges measured during a calendar year divided by the number of monthly discharges measured during the year. The timeframe is defined as from January 1st to December 31st.
4. "Act," means the *Utah Water Quality Act*.
5. "Acute toxicity" occurs when 50 percent or more mortality is observed for either test species at any effluent concentration (lethal concentration or "LC₅₀").
6. "Bypass," means the diversion of waste streams from any portion of a treatment facility.
7. "Chronic toxicity" occurs when the IC₂₅ < XX% effluent. The XX% effluent is the concentration of the effluent in the receiving water, at the end of the mixing zone expressed as per cent effluent.
8. "IC₂₅" is the concentration of toxicant (given in % effluent) that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population.
9. "Composite Samples" shall be flow proportioned. The composite sample shall, as a minimum, contain at least four (4) samples collected over the compositing period. Unless otherwise specified, the time between the collection of the first sample and the last sample shall not be less than six (6) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:

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- a. Constant time interval between samples, sample volume proportional to flow rate at time of sampling;
 - b. Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample, the flow rate at the time the sample was collected may be used;
 - c. Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,
 - d. Continuous sample volume, with sample collection rate proportional to flow rate.
10. "CWA" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987*.
11. "Daily Maximum" (Daily Max.) is the maximum value allowable in any single sample or instantaneous measurement.
12. "EPA," means the United States Environmental Protection Agency.
13. "Director," means Director of the Division of Water Quality.
14. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.
15. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.
16. "Severe Property Damage," means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
17. "Upset," means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An Upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

APPENDIX B

Laboratory Data Results

[illegible]

CLIENT	PROJECT	PROG/CNTR	Latitude	SAMPLE/NAME	LAB/ANALYST	HATCH	SP/THATCH	SAMPLE/DATE	PREP/DATE	ANALYST	BATCH	HERC/DOCK	HERC/DOCK/NAME	PREP/NAME	ANALYST	CAD/NAME	SUBSTRATE	Result	SL	UNITS	RP/NAME	BASIC	DILUTION	SP/LEVEL	RECOVERY	UPPER/L	LOWER/L	ANALYST/DATE	
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-01	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	5	mgtL	FALSE	NA	1			TTW		
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-02	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	22.2	5	mgtL	FALSE	NA	20			TTW	
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-03	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.7	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-04	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-05	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-06	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-07	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-08	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-09	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-10	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-11	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-12	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-13	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-14	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-15	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-16	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-17	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-18	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-19	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-20	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-21	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-22	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-23	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-24	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-25	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-26	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-27	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-28	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-29	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-30	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-31	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-32	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-33	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-34	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-35	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-36	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-37	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-38	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-39	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-40	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-41	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2	5	mgtL	FALSE	NA	25			TTW
LiAc Solutions	Deep Water	GLS GLD Pilot Plant	Chertom-Fork Inc.	Intake	Grab	208110-42	Water	02/12/2015 16:30:00	02/12/2015 11:30:00	02/12/2015 14:30:00	8206747	OMG	EP-0668	NO PREP	ANALYST	OM & Omega (HM)	Ca125699	FALSE	NO	1.2	1.2								

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CLIENT	PROJECT	PROJECTNAME	LOCATION	SAMPLETYPE	LABSAMPLER	HATCH	WPPHYSICAL	SAMPLEDATE	PREPDATE	ANALYST	BATCH	METHODCODE	METHODNAME	PREPNAME	ANALYTE	CADSWHSE	SUBSTRATE	CR	Result	SL	UNITS	APPROVAL	BASE	DILUTION	SPKLEVEL	RECOVERY	UPPERCL	LOWERCL	ANALYTES	PROBLEMS	UNITS	ANALYST	LATITUDE	LONGITUDE	SCHEMATIC	SHOT1	SHOT2	SHOT3	SHOT4	SHOT5	SHOT6	SHOT7	SHOT8	SHOT9	SHOT10	SHOT11	SHOT12	SHOT13	SHOT14	SHOT15	SHOT16	SHOT17	SHOT18	SHOT19	SHOT20	SHOT21	SHOT22	SHOT23	SHOT24	SHOT25	SHOT26	SHOT27	SHOT28	SHOT29	SHOT30	SHOT31	SHOT32	SHOT33	SHOT34	SHOT35	SHOT36	SHOT37	SHOT38	SHOT39	SHOT40	SHOT41	SHOT42	SHOT43	SHOT44	SHOT45	SHOT46	SHOT47	SHOT48	SHOT49	SHOT50	SHOT51	SHOT52	SHOT53	SHOT54	SHOT55	SHOT56	SHOT57	SHOT58	SHOT59	SHOT60	SHOT61	SHOT62	SHOT63	SHOT64	SHOT65	SHOT66	SHOT67	SHOT68	SHOT69	SHOT70	SHOT71	SHOT72	SHOT73	SHOT74	SHOT75	SHOT76	SHOT77	SHOT78	SHOT79	SHOT80	SHOT81	SHOT82	SHOT83	SHOT84	SHOT85	SHOT86	SHOT87	SHOT88	SHOT89	SHOT90	SHOT91	SHOT92	SHOT93	SHOT94	SHOT95	SHOT96	SHOT97	SHOT98	SHOT99	SHOT100	SHOT101	SHOT102	SHOT103	SHOT104	SHOT105	SHOT106	SHOT107	SHOT108	SHOT109	SHOT110	SHOT111	SHOT112	SHOT113	SHOT114	SHOT115	SHOT116	SHOT117	SHOT118	SHOT119	SHOT120	SHOT121	SHOT122	SHOT123	SHOT124	SHOT125	SHOT126	SHOT127	SHOT128	SHOT129	SHOT130	SHOT131	SHOT132	SHOT133	SHOT134	SHOT135	SHOT136	SHOT137	SHOT138	SHOT139	SHOT140	SHOT141	SHOT142	SHOT143	SHOT144	SHOT145	SHOT146	SHOT147	SHOT148	SHOT149	SHOT150	SHOT151	SHOT152	SHOT153	SHOT154	SHOT155	SHOT156	SHOT157	SHOT158	SHOT159	SHOT160	SHOT161	SHOT162	SHOT163	SHOT164	SHOT165	SHOT166	SHOT167	SHOT168	SHOT169	SHOT170	SHOT171	SHOT172	SHOT173	SHOT174	SHOT175	SHOT176	SHOT177	SHOT178	SHOT179	SHOT180	SHOT181	SHOT182	SHOT183	SHOT184	SHOT185	SHOT186	SHOT187	SHOT188	SHOT189	SHOT190	SHOT191	SHOT192	SHOT193	SHOT194	SHOT195	SHOT196	SHOT197	SHOT198	SHOT199	SHOT200	SHOT201	SHOT202	SHOT203	SHOT204	SHOT205	SHOT206	SHOT207	SHOT208	SHOT209	SHOT210	SHOT211	SHOT212	SHOT213	SHOT214	SHOT215	SHOT216	SHOT217	SHOT218	SHOT219	SHOT220	SHOT221	SHOT222	SHOT223	SHOT224	SHOT225	SHOT226	SHOT227	SHOT228	SHOT229	SHOT230	SHOT231	SHOT232	SHOT233	SHOT234	SHOT235	SHOT236	SHOT237	SHOT238	SHOT239	SHOT240	SHOT241	SHOT242	SHOT243	SHOT244	SHOT245	SHOT246	SHOT247	SHOT248	SHOT249	SHOT250	SHOT251	SHOT252	SHOT253	SHOT254	SHOT255	SHOT256	SHOT257	SHOT258	SHOT259	SHOT260	SHOT261	SHOT262	SHOT263	SHOT264	SHOT265	SHOT266	SHOT267	SHOT268	SHOT269	SHOT270	SHOT271	SHOT272	SHOT273	SHOT274	SHOT275	SHOT276	SHOT277	SHOT278	SHOT279	SHOT280	SHOT281	SHOT282	SHOT283	SHOT284	SHOT285	SHOT286	SHOT287	SHOT288	SHOT289	SHOT290	SHOT291	SHOT292	SHOT293	SHOT294	SHOT295	SHOT296	SHOT297	SHOT298	SHOT299	SHOT300	SHOT301	SHOT302	SHOT303	SHOT304	SHOT305	SHOT306	SHOT307	SHOT308	SHOT309	SHOT310	SHOT311	SHOT312	SHOT313	SHOT314	SHOT315	SHOT316	SHOT317	SHOT318	SHOT319	SHOT320	SHOT321	SHOT322	SHOT323	SHOT324	SHOT325	SHOT326	SHOT327	SHOT328	SHOT329	SHOT330	SHOT331	SHOT332	SHOT333	SHOT334	SHOT335	SHOT336	SHOT337	SHOT338	SHOT339	SHOT340	SHOT341	SHOT342	SHOT343	SHOT344	SHOT345	SHOT346	SHOT347	SHOT348	SHOT349	SHOT350	SHOT351	SHOT352	SHOT353	SHOT354	SHOT355	SHOT356	SHOT357	SHOT358	SHOT359	SHOT360	SHOT361	SHOT362	SHOT363	SHOT364	SHOT365	SHOT366	SHOT367	SHOT368	SHOT369	SHOT370	SHOT371	SHOT372	SHOT373	SHOT374	SHOT375	SHOT376	SHOT377	SHOT378	SHOT379	SHOT380	SHOT381	SHOT382	SHOT383	SHOT384	SHOT385	SHOT386	SHOT387	SHOT388	SHOT389	SHOT390	SHOT391	SHOT392	SHOT393	SHOT394	SHOT395	SHOT396	SHOT397	SHOT398	SHOT399	SHOT400	SHOT401	SHOT402	SHOT403	SHOT404	SHOT405	SHOT406	SHOT407	SHOT408	SHOT409	SHOT410	SHOT411	SHOT412	SHOT413	SHOT414	SHOT415	SHOT416	SHOT417	SHOT418	SHOT419	SHOT420	SHOT421	SHOT422	SHOT423	SHOT424	SHOT425	SHOT426	SHOT427	SHOT428	SHOT429	SHOT430	SHOT431	SHOT432	SHOT433	SHOT434	SHOT435	SHOT436	SHOT437	SHOT438	SHOT439	SHOT440	SHOT441	SHOT442	SHOT443	SHOT444	SHOT445	SHOT446	SHOT447	SHOT448	SHOT449	SHOT450	SHOT451	SHOT452	SHOT453	SHOT454	SHOT455	SHOT456	SHOT457	SHOT458	SHOT459	SHOT460	SHOT461	SHOT462	SHOT463	SHOT464	SHOT465	SHOT466	SHOT467	SHOT468	SHOT469	SHOT470	SHOT471	SHOT472	SHOT473	SHOT474	SHOT475	SHOT476	SHOT477	SHOT478	SHOT479	SHOT480	SHOT481	SHOT482	SHOT483	SHOT484	SHOT485	SHOT486	SHOT487	SHOT488	SHOT489	SHOT490	SHOT491	SHOT492	SHOT493	SHOT494	SHOT495	SHOT496	SHOT497	SHOT498	SHOT499	SHOT500	SHOT501	SHOT502	SHOT503	SHOT504	SHOT505	SHOT506	SHOT507	SHOT508	SHOT509	SHOT510	SHOT511	SHOT512	SHOT513	SHOT514	SHOT515	SHOT516	SHOT517	SHOT518	SHOT519	SHOT520	SHOT521	SHOT522	SHOT523	SHOT524	SHOT525	SHOT526	SHOT527	SHOT528	SHOT529	SHOT530	SHOT531	SHOT532	SHOT533	SHOT534	SHOT535	SHOT536	SHOT537	SHOT538	SHOT539	SHOT540	SHOT541	SHOT542	SHOT543	SHOT544	SHOT545	SHOT546	SHOT547	SHOT548	SHOT549	SHOT550	SHOT551	SHOT552	SHOT553	SHOT554	SHOT555	SHOT556	SHOT557	SHOT558	SHOT559	SHOT560	SHOT561	SHOT562	SHOT563	SHOT564	SHOT565	SHOT566	SHOT567	SHOT568	SHOT569	SHOT570	SHOT571	SHOT572	SHOT573	SHOT574	SHOT575	SHOT576	SHOT577	SHOT578	SHOT579	SHOT580	SHOT581	SHOT582	SHOT583	SHOT584	SHOT585	SHOT586	SHOT587	SHOT588	SHOT589	SHOT590	SHOT591	SHOT592	SHOT593	SHOT594	SHOT595	SHOT596	SHOT597	SHOT598	SHOT599	SHOT600	SHOT601	SHOT602	SHOT603	SHOT604	SHOT605	SHOT606	SHOT607	SHOT608	SHOT609	SHOT610	SHOT611	SHOT612	SHOT613	SHOT614	SHOT615	SHOT616	SHOT617	SHOT618	SHOT619	SHOT620	SHOT621	SHOT622	SHOT623	SHOT624	SHOT625	SHOT626	SHOT627	SHOT628	SHOT629	SHOT630	SHOT631	SHOT632	SHOT633	SHOT634	SHOT635	SHOT636	SHOT637	SHOT638	SHOT639	SHOT640	SHOT641	SHOT642	SHOT643	SHOT644	SHOT645	SHOT646	SHOT647	SHOT648	SHOT649	SHOT650	SHOT651	SHOT652	SHOT653	SHOT654	SHOT655	SHOT656	SHOT657	SHOT658	SHOT659	SHOT660	SHOT661	SHOT662	SHOT663	SHOT664	SHOT665	SHOT666	SHOT667	SHOT668	SHOT669	SHOT670	SHOT671	SHOT672	SHOT673	SHOT674	SHOT675	SHOT676	SHOT677	SHOT678	SHOT679	SHOT680	SHOT681	SHOT682	SHOT683	SHOT684	SHOT685	SHOT686	SHOT687	SHOT688	SHOT689	SHOT690	SHOT691	SHOT692	SHOT693	SHOT694	SHOT695	SHOT696	SHOT697	SHOT698	SHOT699	SHOT700	SHOT701	SHOT702	SHOT703	SHOT704	SHOT705	SHOT706	SHOT707	SHOT708	SHOT709	SHOT710	SHOT711	SHOT712	SHOT713	SHOT714	SHOT715	SHOT716	SHOT717	SHOT718	SHOT719	SHOT720	SHOT721	SHOT722	SHOT723	SHOT724	SHOT725	SHOT726	SHOT727	SHOT728	SHOT729	SHOT730	SHOT731	SHOT732	SHOT733	SHOT734	SHOT735	SHOT736	SHOT737	SHOT738	SHOT739	SHOT740	SHOT741	SHOT742	SHOT743	SHOT744	SHOT745	SHOT746	SHOT747	SHOT748	SHOT749	SHOT750	SHOT751	SHOT752	SHOT753	SHOT754	SHOT755	SHOT756	SHOT757	SHOT758	SHOT759	SHOT760	SHOT761	SHOT762	SHOT763	SHOT764	SHOT765	SHOT766	SHOT767	SHOT768	SHOT769	SHOT770	SHOT771	SHOT772	SHOT773	SHOT774	SHOT775	SHOT776	SHOT777	SHOT778	SHOT779	SHOT780	SHOT781	SHOT782	SHOT783	SHOT784	SHOT785	SHOT786	SHOT787	SHOT788	SHOT789	SHOT790	SHOT791	SHOT792	SHOT793	SHOT794	SHOT795	SHOT796	SHOT797	SHOT798	SHOT799	SHOT800	SHOT801	SHOT802	SHOT803	SHOT804	SHOT805	SHOT806	SHOT807	SHOT808	SHOT809	SHOT810	SHOT811	SHOT812	SHOT813	SHOT814	SHOT815	SHOT816	SHOT817	SHOT818	SHOT819	SHOT820	SHOT821	SHOT822	SHOT823	SHOT824	SHOT825	SHOT826	SHOT827	SHOT828	SHOT829	SHOT830	SHOT831	SHOT832	SHOT833	SHOT834	SHOT835	SHOT836	SHOT837	SHOT838	SHOT839	SHOT840	SHOT841	SHOT842	SHOT843	SHOT844	SHOT845	SHOT846	SHOT847	SHOT848	SHOT849	SHOT850	SHOT851	SHOT852	SHOT853	SHOT854	SHOT855	SHOT856	SHOT857	SHOT858	SHOT859	SHOT860	SHOT861	SHOT862	SHOT863	SHOT864	SHOT865	SHOT866	SHOT867	SHOT868	SHOT869	SHOT870	SHOT871	SHOT872	SHOT873	SHOT874	SHOT875	SHOT876	SHOT877	SHOT878	SHOT879	SHOT880	SHOT881	SHOT882	SHOT883	SHOT884	SHOT885	SHOT886	SHOT887	SHOT888	SHOT889	SHOT890	SHOT891	SHOT892	SHOT893	SHOT894	SHOT895	SHOT896	SHOT897	SHOT898	SHOT899	SHOT900	SHOT901	SHOT902	SHOT903	SHOT904	SHOT905	SHOT906	SHOT907	SHOT908	SHOT909	SHOT910	SHOT911	SHOT912	SHOT913	SHOT914	SHOT915	SHOT916	SHOT917	SHOT918	SHOT919	SHOT920	SHOT921	SHOT922	SHOT923	SHOT924	SHOT925	SHOT926	SHOT927	SHOT928	SHOT929	SHOT930	SHOT931	SHOT932	SHOT933	SHOT934	SHOT935	SHOT936	SHOT937	SHOT938	SHOT939	SHOT940	SHOT941	SHOT942	SHOT943	SHOT944	SHOT945	SHOT946	SHOT947	SHOT948	SHOT949	SHOT950	SHOT951	SHOT952	SHOT953	SHOT954	SHOT955	SHOT956	SHOT957	SHOT958	SHOT959	SHOT960	SHOT961	SHOT962	SHOT963	SHOT964	SHOT965	SHOT966	SHOT967	SHOT968	SHOT969	SHOT970	SHOT971	SHOT972	SHOT973	SHOT974	SHOT975	SHOT976	SHOT977	SHOT978	SHOT979	SHOT980	SHOT981	SHOT982	SHOT983	SHOT984	SHOT985	SHOT986	SHOT987	SHOT988	SHOT989	SHOT990	SHOT991	SHOT992	SHOT993	SHOT994	SHOT995	SHOT996	SHOT997	SHOT998	SHOT999	SHOT1000
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[illegible]

CIENT	PROJECT	PROCIUMTRN	LabiName	SAMPLENAME	LASBPMDP	MATRIX	RPTMATRX	SMPARTSE	PREFDATE	ANADATE	BATCH	METHODCODE	METHODNAME	PREPNAME	ANALYTE	Result	DIL	RL	UNC	UNIT	RFPMOLD	BASIC	DILUTION	SPELWELVEL	RECOVERY	UPPERCL	LOWERCL	ANALYST	FIDUCIUS	LNOTE	ANOTE	LATITUDE	LONGITUDE	sComment	SN0TE1	SN0TE2	SN0TES	SN0TE4	SN0TES	SN0TE6	SN0TE7	SN0TES	SN0TES	SN0TE9	ANALYZERDRUG
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	Gub	Water	03/25/2025 10:50:00	03/26/2025 10:50:00	03/31/2025 10:50:00	03/31/2025 10:50:00	EPA 1684B	OAG	EPA 1684B	No PREP	Oil & Grease (HEM)	5	5		mgr/L	FALSE	NA	1	YFW																						
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	Crab	Water	03/25/2025 10:50:00	03/26/2025 10:50:00	03/31/2025 10:50:00	03/31/2025 10:50:00	EPA 1684B	OAG	EPA 1684B	No PREP	Oil & Grease (HEM)	5	5		mgr/L	FALSE	NA	1	TW																						
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	04/01/2025 10:55:00	04/01/2025 15:55:04	KD20038	Mercury (T) 1631	EPA 1631	No PREP	Mercury, Total	23.2	9	20	ug/L	FALSE	NA	1	AB																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ca (T) 200.7	EPA 200.7	EPA 200.2	Aluminum, Total	1.9	1.2	1.5	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Bt (T) 200.7	EPA 200.7	EPA 200.2	Boron, Total	61.7	0.61	1.25	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ba (T) 200.7	EPA 200.7	EPA 200.2	Barium, Total	0.182	0.057	0.125	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ca (T) 200.7	EPA 200.7	EPA 200.2	Calcium, Total	31.2	0.7	5	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Pt (T) 200.7	EPA 200.7	EPA 200.2	Iron, Total	1.8	0.07	0.1	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Li (T) 200.7	EPA 200.7	EPA 200.2	Lithium, Total	81.6	8.07	10	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Mg (T) 200.7	EPA 200.7	EPA 200.2	Magnesium, Total	161.00	48	100	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Potassium (T) 200.7	EPA 200.7	EPA 200.2	Phosphorus, Total	0.114	0.04	0.03	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 SiO2 (T) 200.7	EPA 200.7	EPA 200.2	Silica, (as SiO2) Total	Nd	4.2	5	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Sodium (T) 200.7	EPA 200.7	EPA 200.2	Sodium, Total	96700	343	500	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1229 Se (T) 200.8	EPA 200.8	200.2	Selenium, Total	20.7	0.2	0.2	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Cd (T) 200.8	EPA 200.8	200.2	Cadmium, Total	Nd	0.001	0.005	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Cu (T) 200.8	EPA 200.8	200.2	Chromium, Total	0.023	0.006	0.013	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Co (T) 200.8	EPA 200.8	200.2	Copper, Total	0.436	0.018	0.025	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Lead (T) 200.8	EPA 200.8	200.2	Lead, Total	Nd	0.009	0.013	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Mn (T) 200.8	EPA 200.8	200.2	Manganese, Total	0.0264	0.016	0.018	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Ni (T) 200.8	EPA 200.8	200.2	Nickel, Total	0.114	0.04	0.03	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Ni (T) 200.8	EPA 200.8	200.2	Nickel, Total	0.0146	0.011	0.013	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Se (T) 200.8	EPA 200.8	200.2	Selenium, Total	0.0765	0.04	0.015	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Silver (T) 200.8	EPA 200.8	200.2	Silver, Total	Nd	0.008	0.012	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:44:00	03/27/2025 13:58:34	KIC1230 Zn (T) 200.8	EPA 200.8	200.2	Zinc, Total	Nd	0.05	0.25	mgr/L	FALSE	NA	1	AME																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 13:22:00	03/26/2025 22:48:00	KIC1210 Chlorine (C)	EPA 300.0	No PREP	Chloride	177000	1800	500	mg/L	FALSE	NA	1	000	EX																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 22:32:00	03/26/2025 22:32:00	KIC1210 Sulfate (C)	EPA 300.0	No PREP	Sulfate	18400	49.4	100	mg/L	FALSE	NA	1	000	EX																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:30:00	03/26/2025 18:30:00	KIC1210 Bromine (C)	EPA 300.1	No PREP	Bromide	170	0.5	1	mgr/L	FALSE	NA	1	000	EX																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:30:00	03/26/2025 18:30:00	KIC1210 Cyanide, Total	EPA 300.1	No PREP	Cyanide, Total	Nd	0.02	0.01	mgr/L	FALSE	NA	1	000	EX																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 11:13:00	03/26/2025 16:59:55	KIC13170 COD	HAU 8000	No PREP	Chemical Oxygen Demand	200	154	250	mg/L	FALSE	NA	1	25	LLC																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:17:00	03/26/2025 18:17:16	KIC1196 Alkalinity (as CaCO3)	SN 23208	No PREP	Alkalinity - Bicarbonate (as CaCO3)	578	0.2	1	mgr/L	FALSE	NA	1	000	DAN																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:17:00	03/26/2025 18:17:16	KIC1196 Alkalinity (as CaCO3)	SN 23208	No PREP	Alkalinity - Carbonate (as CaCO3)	578	0.2	1	mgr/L	FALSE	NA	1	000	DAN																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:17:00	03/26/2025 18:17:16	KIC1196 Alkalinity (as CaCO3)	SN 23208	No PREP	Alkalinity - Hydroxide (as CaCO3)	Nd	0.2	1	mgr/L	FALSE	NA	1	000	DAN																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 18:17:00	03/26/2025 18:17:16	KIC1196 Alkalinity (as CaCO3)	SN 23208	No PREP	Alkalinity - Total (as CaCO3)	578	0.2	1	mgr/L	FALSE	NA	1	000	DAN																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Hardness AP	EPA 200.7	200.2	Hardness AP	67	0.2	0.2	mgr/L	FALSE	NA	1	000	AME																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 12:46:00	03/26/2025 13:10:00	KIC1206 TSS	SN 2040-C	No PREP	Total Dissolved Solids (TDS)	334000	1000	1000	mg/L	FALSE	NA	1	000	HH																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:34:00	03/26/2025 14:46:00	SN 2040-D	No PREP	Total Suspended Solids (TSS)	71	5	7	mgr/L	FALSE	NA	1	000	HH																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:11:00	03/26/2025 14:28:54	KIC1220 DOA	HAU 8000	200.2	DOA	1	0.01	0.1	mgr/L	FALSE	NA	1	000	KC																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Intake	25C1894-03	Water	03/25/2025 15:55:00	03/26/2025 14:11:00	03/26/2025 14:28:54	KIC1220 DOA	HAU 8000	200.2	DOA	1	0.01	0.1	mgr/L	FALSE	NA	1	000	KC																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	04/01/2025 10:55:00	04/01/2025 14:19:32	KD20038	Mercury (T) 1631	EPA 1631	No PREP	Mercury, Total	23.2	9	20	ug/L	FALSE	NA	1	AB																							
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ca (T) 200.7	EPA 200.7	EPA 200.2	Aluminum, Total	1.9	1.2	1.5	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Bt (T) 200.7	EPA 200.7	EPA 200.2	Boron, Total	61.4	0.61	1.25	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ba (T) 200.7	EPA 200.7	EPA 200.2	Barium, Total	0.132	0.057	0.125	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Ca (T) 200.7	EPA 200.7	EPA 200.2	Calcium, Total	30.8	0.7	5	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Pt (T) 200.7	EPA 200.7	EPA 200.2	Iron, Total	1.8	0.07	0.1	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Li (T) 200.7	EPA 200.7	EPA 200.2	Lithium, Total	52.6	8.07	10	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Mg (T) 200.7	EPA 200.7	EPA 200.2	Magnesium, Total	14500	48	100	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Potassium (T) 200.7	EPA 200.7	EPA 200.2	Phosphorus, Total	0.210	0.02	0.03	mgr/L	FALSE	NA	1	AB																								
LiAc Solutions	Stewie Money	Great Salt Lake Die Plant	Chemtech-Ford, Inc	Outfall	25C1894-04	Water	03/25/2025 15:55:00	03/26/2025 14:42:00	03/27/2025 11:19:40	KIC1229 Sodium (T) 200.7	EPA 200.7	EPA 200.2	Silica, (as SiO2) Total	Nd	4.2	5	mgr/L	FALSE	NA	1																									

[illegible]

CIENT	PJECT	PROJECTNAM	LATITUDE	SAMPLEID	LASSAFOID	HASTIN	OPFNAME	SAMPLETIME	PREPDATE	ANALYTE	BATCH	METHODCODE	METHODNAME	PREPNAME	ANALYTE	CADMIUM	SULPHURIC ACID	Result	D	Rc	UNITS	UPPER	LOWER	ANALYTICAL
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 09:40:00	05/22/2025 15:38:00	05/20/2025 14:27:00	821151 OMO	EPA 166B	NO PREP	NO PREP	Oil & Grease (HEM)	CF151669	FALSE	NONE	5	m/g	FALSE	NA	1	WP
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 09:50:00	05/22/2025 15:38:00	05/20/2025 14:27:00	821151 OMO	EPA 166B	NO PREP	NO PREP	Oil & Grease (HEM)	CF151669	FALSE	NONE	5	m/g	FALSE	NA	1	WP
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 14:15:00	821151 Al HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Aluminum, Total	7429-06-05	FALSE	NONE	23.3	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 Ba HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Barium, Total	7440-39-03	FALSE	NONE	0.27	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 Ba HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Calcium, Total	7440-70-2	FALSE	NONE	0.27	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 Cu HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Iron, Total	7439-86-4	FALSE	NONE	0.27	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 Li HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Lithium, Total	7439-93-2	FALSE	NONE	0.8	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 Mg HJ 2008	EPA 200-7	EPA 200-2	EPA 200-2	Magnesium, Total	7439-95-7	FALSE	NONE	0.8	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 K HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Potassium, Total	7440-09-7	FALSE	NONE	0.28	m/g	FALSE	NA	20	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Silica, See SeO2 Test	7433-86-5	FALSE	NONE	5.4	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Silver, Total	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Zinc, Total	7440-66-3	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Chlorine	7440-42-8	FALSE	NONE	0.385	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Chromium, Total	7440-47-2	FALSE	NONE	0.00	m/g	FALSE	NA	10	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Cadmium, Total	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Lead, Total	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Manganese, Total	7439-96-5	FALSE	NONE	0.044	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Molybdenum, Total	7439-98-7	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Nickel, Total	7440-02-0	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Silver, Total	7440-22-4	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Zinc, Total	7440-66-3	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Chlorine	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Nitrate as N	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	100	DO
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Bromide	74609-87-4	FALSE	NONE	0.00	m/g	FALSE	NA	100	DO
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Cyanide	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	100	DO
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Chemical Oxygen Demand	CF151669	FALSE	NONE	100	mg/L	FALSE	NA	100	LLC
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Acidity-Aluminum (as CaCO3)	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Acidity-Carbonate (as CaCO3)	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Acidity-Hydroxide (as CaCO3)	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Hardness, Total (as CaCO3)	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	20	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Total Dissolved Solids (TDS)	CF151669	FALSE	NONE	1000	mg/L	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Total Suspended Solids (TSS)	CF151669	FALSE	NONE	100	mg/L	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Nitrate as N	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Chemical Oxygen Demand	CF151669	FALSE	NONE	100	mg/L	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Monney, Total	7440-06-1	FALSE	NONE	24.9	m/g	FALSE	NA	20	AME
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Aluminum, Total	7429-06-05	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Boron, Total	7440-06-1	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Barium, Total	7440-39-03	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Iron, Total	7439-86-4	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Lithium, Total	7439-93-2	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Magnesium, Total	7439-95-7	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Potassium, Total	7440-09-7	FALSE	NONE	0.00	m/g	FALSE	NA	20	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05/20/2025 15:30:25	821151 SeO2 HJ 2007	EPA 200-7	EPA 200-2	EPA 200-2	Silica, See SeO2 Test	7433-86-5	FALSE	NONE	0.00	m/g	FALSE	NA	1	TM
LiAc Solutions	Deep Water	Gusat Salt Lake DLE Pilot Plant	Chemtech-Ford, Inc.	Outfall - Grub	261806-02	Water	Water	05/20/2025 14:15:00	05/22/2025 15:38:00	05														

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CLIENT	PROJECT	PRECEDENCE	LABORATORY	SAMPLE NAME	LABSAPPROVAL	MATERIAL	WARRANTY	SAMPLEID	PREPDATE	ANALYST	BATCH	METHOD	PREPNAME	ANALYST	CASNUMBER	SUBSTRATE	Result	RL	UNC	UNIT	RIPIRALS	BASIS	SOLUTION	SPINWHEEL	RECOVERY	LOWERS	ANALYST	PROLOGS	INQRE	ANOTE	LATITUDE	LONGITUDE	SCHEMATIC	SNOTES	SNOTES1	SNOTES2	SNOTES3	SNOTES4	SNOTES5	SNOTES6	SNOTES7	SNOTES8	SNOTES9	SNOTES10	SNOTES11	SNOTES12	SNOTES13	SNOTES14	SNOTES15	SNOTES16	SNOTES17	SNOTES18	SNOTES19	SNOTES20	SNOTES21	SNOTES22	SNOTES23	SNOTES24	SNOTES25	SNOTES26	SNOTES27	SNOTES28	SNOTES29	SNOTES30	SNOTES31	SNOTES32	SNOTES33	SNOTES34	SNOTES35	SNOTES36	SNOTES37	SNOTES38	SNOTES39	SNOTES40	SNOTES41	SNOTES42	SNOTES43	SNOTES44	SNOTES45	SNOTES46	SNOTES47	SNOTES48	SNOTES49	SNOTES50	SNOTES51	SNOTES52	SNOTES53	SNOTES54	SNOTES55	SNOTES56	SNOTES57	SNOTES58	SNOTES59	SNOTES60	SNOTES61	SNOTES62	SNOTES63	SNOTES64	SNOTES65	SNOTES66	SNOTES67	SNOTES68	SNOTES69	SNOTES70	SNOTES71	SNOTES72	SNOTES73	SNOTES74	SNOTES75	SNOTES76	SNOTES77	SNOTES78	SNOTES79	SNOTES80	SNOTES81	SNOTES82	SNOTES83	SNOTES84	SNOTES85	SNOTES86	SNOTES87	SNOTES88	SNOTES89	SNOTES90	SNOTES91	SNOTES92	SNOTES93	SNOTES94	SNOTES95	SNOTES96	SNOTES97	SNOTES98	SNOTES99	SNOTES100	SNOTES101	SNOTES102	SNOTES103	SNOTES104	SNOTES105	SNOTES106	SNOTES107	SNOTES108	SNOTES109	SNOTES110	SNOTES111	SNOTES112	SNOTES113	SNOTES114	SNOTES115	SNOTES116	SNOTES117	SNOTES118	SNOTES119	SNOTES120	SNOTES121	SNOTES122	SNOTES123	SNOTES124	SNOTES125	SNOTES126	SNOTES127	SNOTES128	SNOTES129	SNOTES130	SNOTES131	SNOTES132	SNOTES133	SNOTES134	SNOTES135	SNOTES136	SNOTES137	SNOTES138	SNOTES139	SNOTES140	SNOTES141	SNOTES142	SNOTES143	SNOTES144	SNOTES145	SNOTES146	SNOTES147	SNOTES148	SNOTES149	SNOTES150	SNOTES151	SNOTES152	SNOTES153	SNOTES154	SNOTES155	SNOTES156	SNOTES157	SNOTES158	SNOTES159	SNOTES160	SNOTES161	SNOTES162	SNOTES163	SNOTES164	SNOTES165	SNOTES166	SNOTES167	SNOTES168	SNOTES169	SNOTES170	SNOTES171	SNOTES172	SNOTES173	SNOTES174	SNOTES175	SNOTES176	SNOTES177	SNOTES178	SNOTES179	SNOTES180	SNOTES181	SNOTES182	SNOTES183	SNOTES184	SNOTES185	SNOTES186	SNOTES187	SNOTES188	SNOTES189	SNOTES190	SNOTES191	SNOTES192	SNOTES193	SNOTES194	SNOTES195	SNOTES196	SNOTES197	SNOTES198	SNOTES199	SNOTES200	SNOTES201	SNOTES202	SNOTES203	SNOTES204	SNOTES205	SNOTES206	SNOTES207	SNOTES208	SNOTES209	SNOTES210	SNOTES211	SNOTES212	SNOTES213	SNOTES214	SNOTES215	SNOTES216	SNOTES217	SNOTES218	SNOTES219	SNOTES220	SNOTES221	SNOTES222	SNOTES223	SNOTES224	SNOTES225	SNOTES226	SNOTES227	SNOTES228	SNOTES229	SNOTES230	SNOTES231	SNOTES232	SNOTES233	SNOTES234	SNOTES235	SNOTES236	SNOTES237	SNOTES238	SNOTES239	SNOTES240	SNOTES241	SNOTES242	SNOTES243	SNOTES244	SNOTES245	SNOTES246	SNOTES247	SNOTES248	SNOTES249	SNOTES250	SNOTES251	SNOTES252	SNOTES253	SNOTES254	SNOTES255	SNOTES256	SNOTES257	SNOTES258	SNOTES259	SNOTES260	SNOTES261	SNOTES262	SNOTES263	SNOTES264	SNOTES265	SNOTES266	SNOTES267	SNOTES268	SNOTES269	SNOTES270	SNOTES271	SNOTES272	SNOTES273	SNOTES274	SNOTES275	SNOTES276	SNOTES277	SNOTES278	SNOTES279	SNOTES280	SNOTES281	SNOTES282	SNOTES283	SNOTES284	SNOTES285	SNOTES286	SNOTES287	SNOTES288	SNOTES289	SNOTES290	SNOTES291	SNOTES292	SNOTES293	SNOTES294	SNOTES295	SNOTES296	SNOTES297	SNOTES298	SNOTES299	SNOTES300	SNOTES301	SNOTES302	SNOTES303	SNOTES304	SNOTES305	SNOTES306	SNOTES307	SNOTES308	SNOTES309	SNOTES310	SNOTES311	SNOTES312	SNOTES313	SNOTES314	SNOTES315	SNOTES316	SNOTES317	SNOTES318	SNOTES319	SNOTES320	SNOTES321	SNOTES322	SNOTES323	SNOTES324	SNOTES325	SNOTES326	SNOTES327	SNOTES328	SNOTES329	SNOTES330	SNOTES331	SNOTES332	SNOTES333	SNOTES334	SNOTES335	SNOTES336	SNOTES337	SNOTES338	SNOTES339	SNOTES340	SNOTES341	SNOTES342	SNOTES343	SNOTES344	SNOTES345	SNOTES346	SNOTES347	SNOTES348	SNOTES349	SNOTES350	SNOTES351	SNOTES352	SNOTES353	SNOTES354	SNOTES355	SNOTES356	SNOTES357	SNOTES358	SNOTES359	SNOTES360	SNOTES361	SNOTES362	SNOTES363	SNOTES364	SNOTES365	SNOTES366	SNOTES367	SNOTES368	SNOTES369	SNOTES370	SNOTES371	SNOTES372	SNOTES373	SNOTES374	SNOTES375	SNOTES376	SNOTES377	SNOTES378	SNOTES379	SNOTES380	SNOTES381	SNOTES382	SNOTES383	SNOTES384	SNOTES385	SNOTES386	SNOTES387	SNOTES388	SNOTES389	SNOTES390	SNOTES391	SNOTES392	SNOTES393	SNOTES394	SNOTES395	SNOTES396	SNOTES397	SNOTES398	SNOTES399	SNOTES400	SNOTES401	SNOTES402	SNOTES403	SNOTES404	SNOTES405	SNOTES406	SNOTES407	SNOTES408	SNOTES409	SNOTES410	SNOTES411	SNOTES412	SNOTES413	SNOTES414	SNOTES415	SNOTES416	SNOTES417	SNOTES418	SNOTES419	SNOTES420	SNOTES421	SNOTES422	SNOTES423	SNOTES424	SNOTES425	SNOTES426	SNOTES427	SNOTES428	SNOTES429	SNOTES430	SNOTES431	SNOTES432	SNOTES433	SNOTES434	SNOTES435	SNOTES436	SNOTES437	SNOTES438	SNOTES439	SNOTES440	SNOTES441	SNOTES442	SNOTES443	SNOTES444	SNOTES445	SNOTES446	SNOTES447	SNOTES448	SNOTES449	SNOTES450	SNOTES451	SNOTES452	SNOTES453	SNOTES454	SNOTES455	SNOTES456	SNOTES457	SNOTES458	SNOTES459	SNOTES460	SNOTES461	SNOTES462	SNOTES463	SNOTES464	SNOTES465	SNOTES466	SNOTES467	SNOTES468	SNOTES469	SNOTES470	SNOTES471	SNOTES472	SNOTES473	SNOTES474	SNOTES475	SNOTES476	SNOTES477	SNOTES478	SNOTES479	SNOTES480	SNOTES481	SNOTES482	SNOTES483	SNOTES484	SNOTES485	SNOTES486	SNO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APPENDIX C

Biota Monitoring Report

Microbial analyses at the Waterleaf Resources pilot plant, Great Salt Lake, Utah

This reports presents data from an analysis of the microbial communities in the brine flowing into the plant, “influent,” and the post-extraction brine that is in a holding tank before being released back into the lake, “effluent.” The research question at hand is: *what is the impact of introducing post-extraction effluent into the Great Salt Lake north arm.* This analysis includes microscopy, genomic surveys, and inoculation experiments to measure growth in the laboratory.

Sampling:

Influent and effluent samples were obtained at the Utah Waterleaf Lilac facility on February 28, April 24, and June 24, 2025 (Figure 1). At each timepoint, 100 ml each were collected for laboratory analysis.



Figure 1. Samples were taken from the north tank for influent brine (valve circled in yellow) and the south tank for effluent (valve circled in red).

In addition, 100 ml of brine from each sample were filtered through a sterile PVDF membrane pressure filter unit, pore size 0.22 μm , which captures all the cells present in the microbial communities of the brine. The filters were used to extract DNA and create the sequencing libraries (Figure 2).

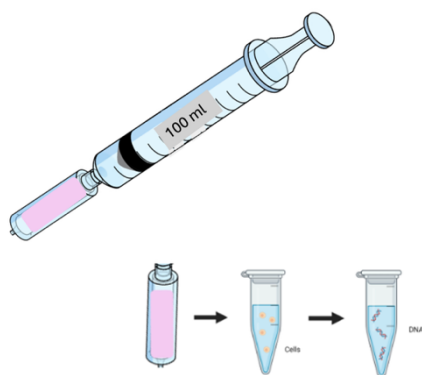


Figure 2. North arm brine from the influent tank and post-extraction effluent brine were filtered separately through a PVDF membrane cartridge to collect all cells in the sample. These filters were subsequently used to isolate DNA with a DNA extraction kit (QIAGEN, Venlo, Netherlands).

Biomass:

The relative biomass of aquatic communities can be assessed by centrifuging at high speeds to force cells to the bottom of the tube. I centrifuged 1 ml of the influent (I) sample and 1 ml of the effluent (E) sample at each sampling. These tubes were allowed to dry for two days. The dry weight was measured. I was unable to do this properly at the February sampling since I did not see a cell pellet in the effluent, only rust flakes, which likely came from corrosion of the holding tank and affected the dry weight. The other samples, however, yielded reliable data, and there were no rust flakes present. The April influent pellet was 3.7 mg of dry mass per milliliter of brine, and the effluent pellet was 4.5 mg per milliliter. The June influent pellet was 5.2 mg of dry mass per milliliter of brine, and the effluent pellet was 4.2 mg per milliliter. All were pink in color, which indicated that halophilic bacteria, archaea, and/or algae (all of which contain carotenoid pigments) were present in abundance in both (Figure 3). ***This colorful cell pellet was a good sign that there was a healthy population in the effluent.***



Figure 3. From the April samples, 1 ml of the influent (I) and effluent (E) were separately centrifuged to pellet the cells in the sample, which were both pink in color, indicating an abundance of halophiles (salt-tolerant bacteria and archaea have carotenoid pigments that make the cells pink).

Cell Counts:

Another way to assess biomass is to count the individual cells. Using a hemacytometer, which provides a grid and special cover glass to control the distributed volume, I estimated the cell density in each of the samples (e.g. Figure 4).

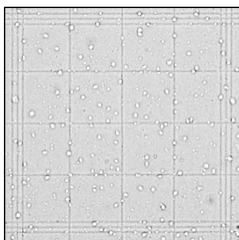


Figure 4. February influent sample on a hemacytometer. Note the grid that allows one to quantify the cells/ml. The cells are translucent but reflect light. They appear as small reflective orbs.

The results are shown in Table 1. The first samples from February demonstrated a robust cell density in the influent sample, but the effluent had very few if any visible cells. It's possible that the cell density was not zero, just low and not detectable by these methods. The April sampling had comparable numbers of cells in the effluent as the influent, the cells per milliliter counts were in the billions. The June samples also showed similar numbers for influent and effluent but higher cell counts.

Table 1. Cell counts by hemacytometer for each sampling

Sampling Date	Influent	Effluent
February 28, 2025	2×10^8 cells per ml	None detected, rust flakes present.
April 24, 2025	3.6×10^9 cells per ml	4.6×10^9 cells per ml
June 24, 2025	8.1×10^9 cells per ml	5.3×10^9 cells per ml

Note the values for April and June are higher at these warmer sampling times likely because the increased temperature supported microbial growth in the brine. The optimal temperature of GSL microorganisms is typically around the same as human cells, 37°C. ***Most importantly, the lithium extraction procedure did not reduce the cell count or have adverse effects on the cells.***

Given the intrusion of rust flakes and the results of the biomass and microscopy assays for the February sampling, I focused on the April and June samplings for addressing the question regarding impact on the extraction process on the microbial community.

Microbial Diversity:

In the GSL north arm, prior studies have revealed evidence for microorganisms in all three domains of life (Figure 5). The eukaryotes have nuclei and a higher-level organization; we typically see low levels of algae and fungi in the hypersaline brine. The prokaryotes have a simpler cell structure, such as salt thriving bacteria. The most prevalent domain in the north arm is archaea, which are abundant in all extreme environments on Earth (Baxter and Zalar, 2019; Ameida-Dalmet and Baxter, 2020).

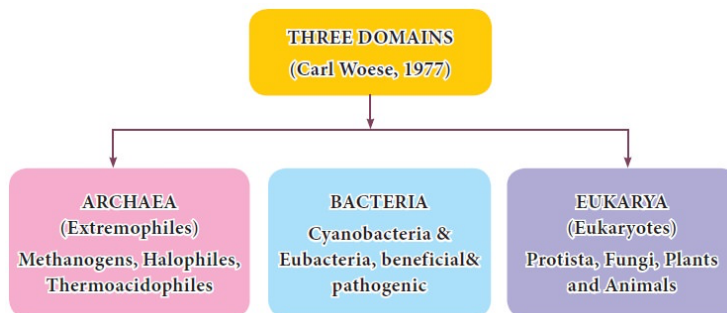


Figure 5. The three domains of life are all represented in the microbial diversity of Great Salt Lake.

To examine the microbial diversity of the influent and effluent, I wanted to sequence all the DNA from the onsite filtration described above. The microbial cells in the brine adhere to the sampling filters while the liquid is pumped through. After filtration, I froze the filters in a dry ice bath so that no degradation would occur, and the samples could be transported back to the lab for extraction. Under sterile conditions, the filter casings were cracked, and DNA was extracted from each membrane. This pool of DNA is derived from all of the life forms in the water sample. The next step is to figure out the species of life that are present. For this I used a consulting lab for

DNA sequencing. They amplify genes (16S rRNA, 18S rRNA, or ITS) associated with either bacteria, archaea, algae, or fungi. The DNA in the regions targeted is very specific, and this allows us to see “who” is present in the community and in what relative abundance. I analyzed the genetic data by first running a programming script that we developed in my lab to prune out any contaminants present in the controls and to connect to a taxonomic database to assign their phylogenetic classification. From here we can produce charts that help in visualizing the data.

Although the February effluent I analyzed did not seem to have cells (by microscopy nor a cell pellet), there were DNA signatures of microorganisms. This could be because the cells were in small numbers and therefore escaped the less sensitive methods, or it could be because there are biosignatures; the DNA from dead cells adhered to the filter but no intact cells did. A quick review of the prokaryotes in these samples indicate a similar community profile in the effluent when compared with the influent community e.g. the most prominent members of the community were common to both data sets.

The cell counts suggested that the April sampling would provide an excellent data set for sequencing analysis. I have confidence in the comparison between influent and effluent communities, and therefore, I have analyzed the April sample species composition below. The prokaryotes were split into bacteria and archaea for visual simplicity. The eukaryotic primers that would reveal algae species gave no hits (apart from plants that were blown in from the surrounding steppe), so there is no chart representing algae for April. We do know of two species that are present in the north arm, but in low numbers and only in warmer temperatures. Fungi require specific primers for reliable sequencing, so they were probed separately. Below I present the taxonomic profiles for each category of microorganisms. I have aligned the data for ease of comparison of the influent versus the effluent (Figure 6).

Archaea. Many of Earth’s extremophiles fall in the category of Archaea, simple prokaryotes that look like bacteria but are genetically distinct. These make up the bulk of the Great Salt Lake north arm microbiota as shown in past studies (Baxter and Zalar, 2019; Almeida-Dalmet and Baxter, 2020). In this experiment, ***The difference between the Waterleaf influent and effluent genera present is negligible*** (Fig. 6, top panel).

Bacteria. In past work, because archaea are more typical in extreme environments, we were surprised to find robust bacterial communities at the north arm (Almeida-Dalmet and Baxter, 2020). ***In the Waterleaf samples, the bacterial genera present were also similar between the influent and effluent*** (Fig. 6, middle panel). Note the bacteria (and archaea) that are present in small abundance, towards the bottom of the graphics, are likely small in number because they prefer more moderate salinity and are introduced by the south arm water. The north arm salinity may suppress their growth.

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Fungi. Recently my lab has explored the fungal species of the Great Salt Lake north arm (Parrott and Baxter, 2024). The Internal Transcribed Spacer (ITS) segment is widely used as a universal fungal barcode because of its variability between species. In the Waterleaf experiment, this marker revealed only a few species and different yeast taxa present in the influent and effluent (Fig. 6, bottom panel). Some of these species, in our prior study, have been associated with plants, soils or animals from the surrounding landscape. For example, *Alternaria* and *Cryptococcus* were discovered in the plant soil microbiomes. Because the spores of fungi can become airborne, wind can introduce spores to the brine. ***The differences in the fungi present in the Waterleaf influent and effluent are likely not important with regards to the ecosystem since these species do not play a role in nutrient cycling.***

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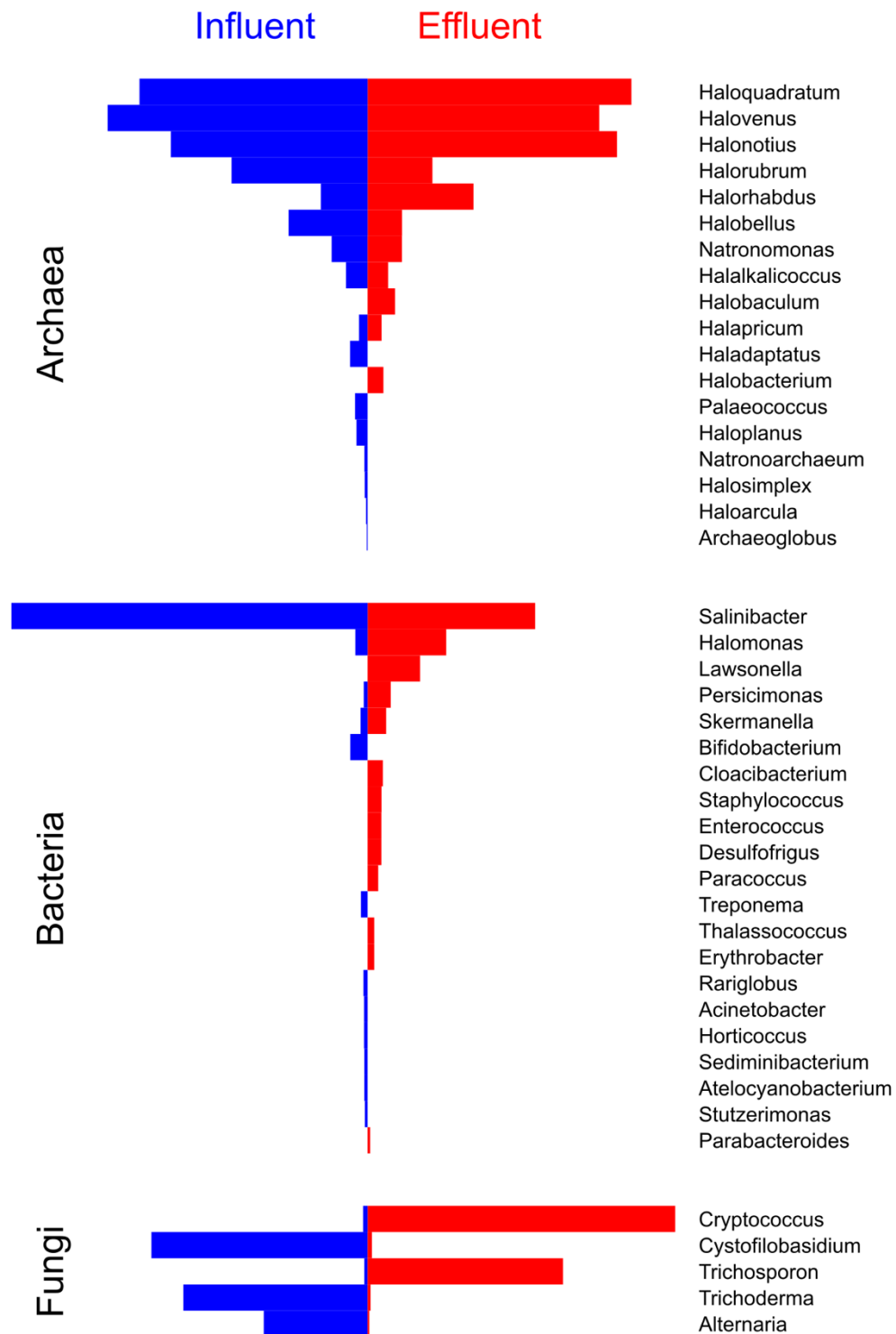


Figure 6. Microbial diversity charts for genera of archaea, bacteria, and fungi. The influent (blue) is shown on the left and effluent (red) on the right with species identity listed to the side. The size of the bars indicate relative abundance within each data set. The top panel shows the archaea community, the middle bacteria, and the bottom fungi.

Inoculation Experiment:

In order to probe more deeply into the potential impacts of discharging the effluent into the Great Salt Lake north arm, I performed a time course growth experiment, growing either influent, effluent, or a mixture. Optical density measurement at a light absorbance of 600nm (A_{600}) is a common methodology in microbiology for following growth of a culture over time (e.g. Stevenson et al. 2016). The cells absorb light at this wavelength, and so the concentration of microbes is proportional to the light absorbed. I used a spectrophotometer to measure the optical density over time, which allows us to see the growth curve of the population as the cells grow and divide. Since the initial levels of microorganisms are very low (and non-existent in the sterile water blank control), this is called the “lag phase.” As the population starts to double rapidly, you can see logarithmic growth for some species “log phase.” Beyond these phases, the bacterial population will stabilize and then decline. Figure 7 shows a standard growth curve for lab model microbes; we would expect slower growth in environmental organisms.

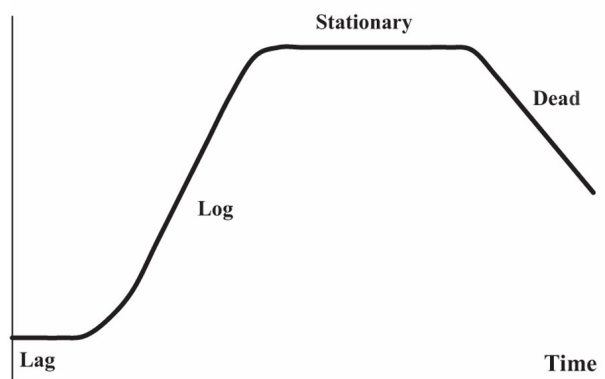


Figure 7. A textbook growth curve to show the expected phases of bacterial proliferation. My goal was to plot log phase in the samples and examine if introducing effluent to influent communities had an impact.

I attempted a couple of early trials to work out conditions, and this revealed that the experiment moved too slowly without growth media to enhance growth rates. The protocol that gave the best results for our timeframe was inoculating 9 ml of 23% salt MGM media (Dyall-Smith, 2025) with 1 ml of sample. The samples were 1) sterile deionized water serving as a control, 2) influent, 3) effluent, 4) a 50:50 mixture of effluent and influent. I did this experiment with brine from all three sampling dates. In each experiment, I used the control as a blank to set the optical density to zero. Thus, any absorbance observed was due to cells proliferating.

In Figure 8, the top panel shows growth curves featuring the February samples inoculated. The influent sample, which was rich in microorganisms, displays a typical growth curve, with a short lag phase, followed by fast growth, and then the beginnings of a plateau (orange line, top panel). The effluent (green line, top panel) by contrast, has delayed growth, but it does appear to have a low-density community that begins to take off albeit slowly. The mixture has a middle of the road growth curve (light blue line, top panel), which means that nothing in the effluent is inhibiting the growth of the microbes in the influent.

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The middle panel of Figure 8 represents the growth curves of the April samples and the bottom panel is June. *All of the samples from the April and June samplings follow a standard growth curve.* The microbial communities appear to have just reached stationary phase over this period of study. This is expected of healthy cultures. Also to note, *mixing effluent and influent had no visible impact on growth.*

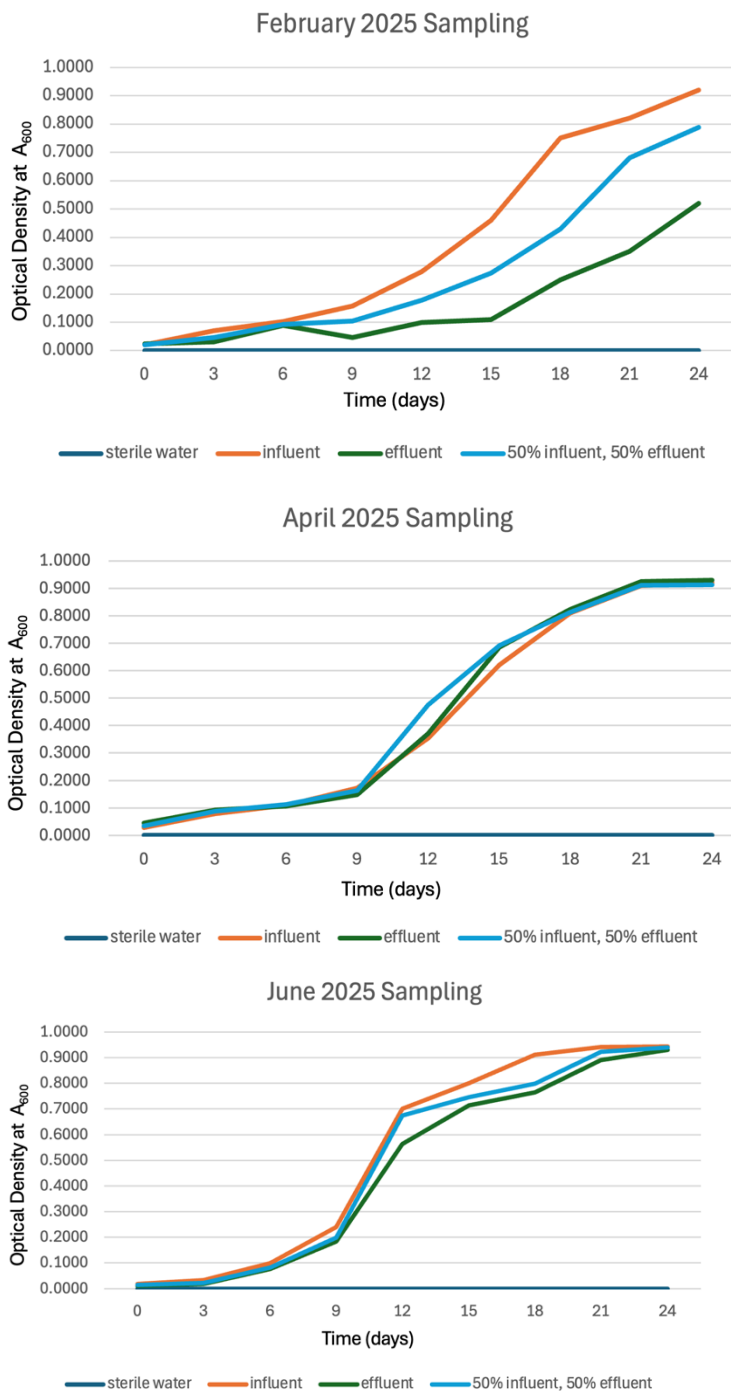


Figure 8. The top panel represents the February sampling at Waterleaf while the middle represents April and the bottom represents June. The sterile water inoculation control, dark blue, served as a blank for the optical density measurements at A₆₀₀ and showed no contamination in the experiment. The influent samples are shown in orange, the effluent in green, and the 50:50 mixture in light blue.

Algae Experiments

In the February and April samples, there was no evidence for the presence of algae. I did not see the larger distinctive cells in the microscopy examinations nor the signature for them in the DNA sequencing for microbial diversity. This is not unusual as the main algae species of the north arm, *Dunaliella salina*, blooms in the warm summer months (Baxter and Zalar, 2019). These eukaryotes do photosynthesis for the lake, accumulate glycerol to balance the inside of the cell with the outside hypersaline water, and make pigments to mediate cellular damage from the extreme environment (Figure 9). Despite being a seasonal participant, they are a key player to supplying nutrients to the north arm microbial community.

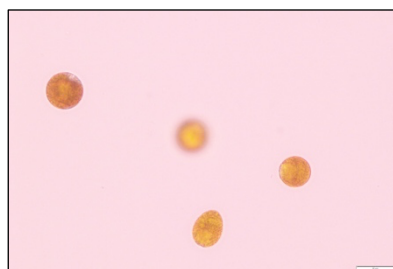


Figure 9. GSL north arm *Dunaliella salina*, a prevalent algae species in the summer months at Rozel. Beta carotene gives them the notable orangish color. A 20 micron scale bar is indicated in the lower right corner. Prokaryotes (bacteria and archaea) are typically only 1-2 microns, for comparison.

In the June sampling, I wanted to examine the impact of effluent on *Dunaliella salina* in the brine. For the DNA sequencing, I probed the broad categories of prokaryotes and eukaryotes. For this experiment, there is no need to distinguish between archaea and bacteria amongst the prokaryote signals and it was not important to track fungi separately amongst the eukaryotes. ***In future experiments for monitoring at this site, this streamlined approach would offer an option for routine checks.*** The results are shown in Figure 10.

The DNA sequencing surveys of the prokaryotes in the influent versus effluent shows the same pattern as before (Figure 6), making this a good control for standardization. The species distribution of the influent are preserved in similar abundances in the post-extraction effluent (Figure 10, top panel). These prokaryotes represent small archaea and bacteria, only ~1-2 microns, which are not filtered in the lithium extraction process. The *Dunaliella salina* algae are high in abundance in the influent as predicted for the summer season, but they are lacking in the effluent (Figure 10 bottom panel). ***These algae are much larger, ~10-20 microns, than the prokaryotes and were likely filtered in the early filtration step of the mineral extraction process.*** Note the small signal of *Dunaliella* in the effluent; this is likely from DNA released from dead cells in the environment, and these molecules would pass through filtration.

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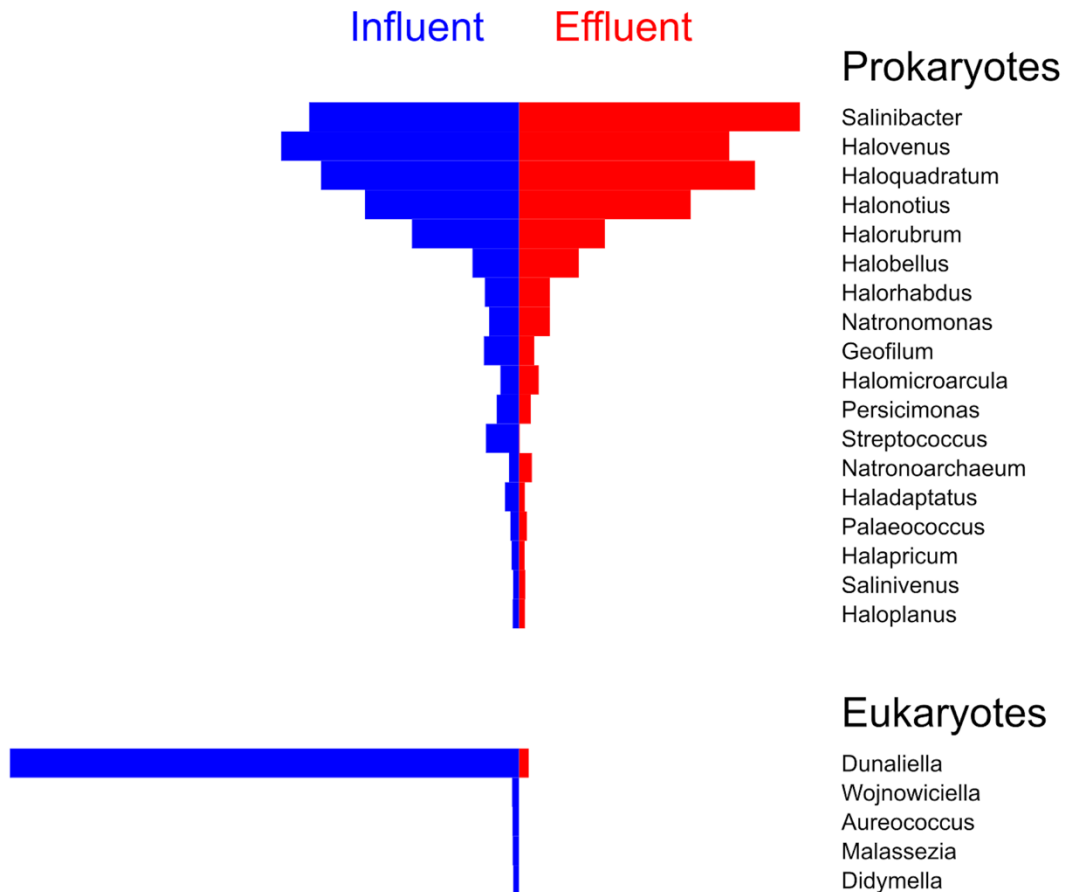


Figure 10. Most abundant taxa of prokaryotes (top panel) and eukaryotes (bottom panel). The influent consortia in shown in blue on the left, and the effluent in red on the right, and the bars represent relative abundance. June sampling for *Dunaliella salina* showed a robust biosignature for the algae in the eukaryotic profile of the influent (bottom). Unlike the smaller prokaryotes (~1-2 microns in size), the algae (~10-20 microns) are likely filtered out in the extraction process filtering step. The small signal for *Dunaliella* observed in the effluent is likely residual DNA from dead cells that passed through the filter.

Conclusions:

Is the extraction process changing the microbial community?

- The biomass analysis (Figure 3), cell counting (Table 1), and DNA sequencing (Figure 6 and 10) demonstrate that the extraction process is allowing prokaryotic microorganisms to remain in and survive in the effluent.
- The inoculation experiment (Figure 8) demonstrated that the effluent brine population is as healthy as the influent. There is no evidence of a longer lag time in the growth curves and they approach log phase at the same rate.
- The archaea and bacteria genera composition and abundance measures are remarkably similar between the influent and effluent (Figures 6 and 10), suggesting the survival/recovery of the microorganisms following the lithium extraction process.
- The fungi, however, have a different composition post extraction (Figure 6). There are only a few species that emerged in our study, but they are different in the influent versus the effluent. Since fungi have amazing dispersal mechanisms, the origin of the fungi we observed may have been introduced from the surrounding landscape, given the species present. There is no need to track fungi for surveying the health of the lake ecosystem.
- Algae were absent in both February and April samples, likely due to time of year. In the June sampling, the *Dunaliella salina* summer bloom was detected in the influent. However, filtration in the lithium extraction process appears to remove the *Dunaliella salina* as it is not present in the effluent (Figure 10).

Would the introduction of effluent to lake brine have impacts on the native biota?

- The inoculation experiment, where the influent and effluent are mixed 50:50, is a proxy for modeling the recovery of the microbial community after discharge. There is no evidence of negative impacts in the 50:50 mixed sample (Figure 8).
- Although the filtration step in the lithium extraction process may remove the *Dunaliella salina*, the absence of algae in the effluent should not be a problem when the effluent is discharged to the lake. The microbial community is not impacted by the introduction of effluent in the inoculation experiments (Figure 8).

Recommendations for future monitoring of the microbial communities:

- Fungal signatures are introduced from the environment and are not valuable for this study. Monitoring of fungi going forward is not necessary.
- Most of the microbial community in the north arm are mesophiles, meaning they are more prolific at moderately warm temperatures, optimal 20 to 45 °C (68 to 113 °F). Summer sampling is recommended for future monitoring efforts, and this approach would also allow you to see the bloom of *Dunaliella salina*.
- Continual monitoring the prokaryotes (the most prolific life forms) would give a nice benchmark for microbial communities surviving in the effluent. Any changes in process, scale up, or seasonal impacts could be followed over time.

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Dyall-Smith, M. 2025. The HaloHandbook. https://haloarchaea.com/wp-content/uploads/2025/02/Halohandbook_2009_REV_v2.pdf (Accessed June 2, 2025).

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Appendix C. Additional Minerals Eluate Mass Balance

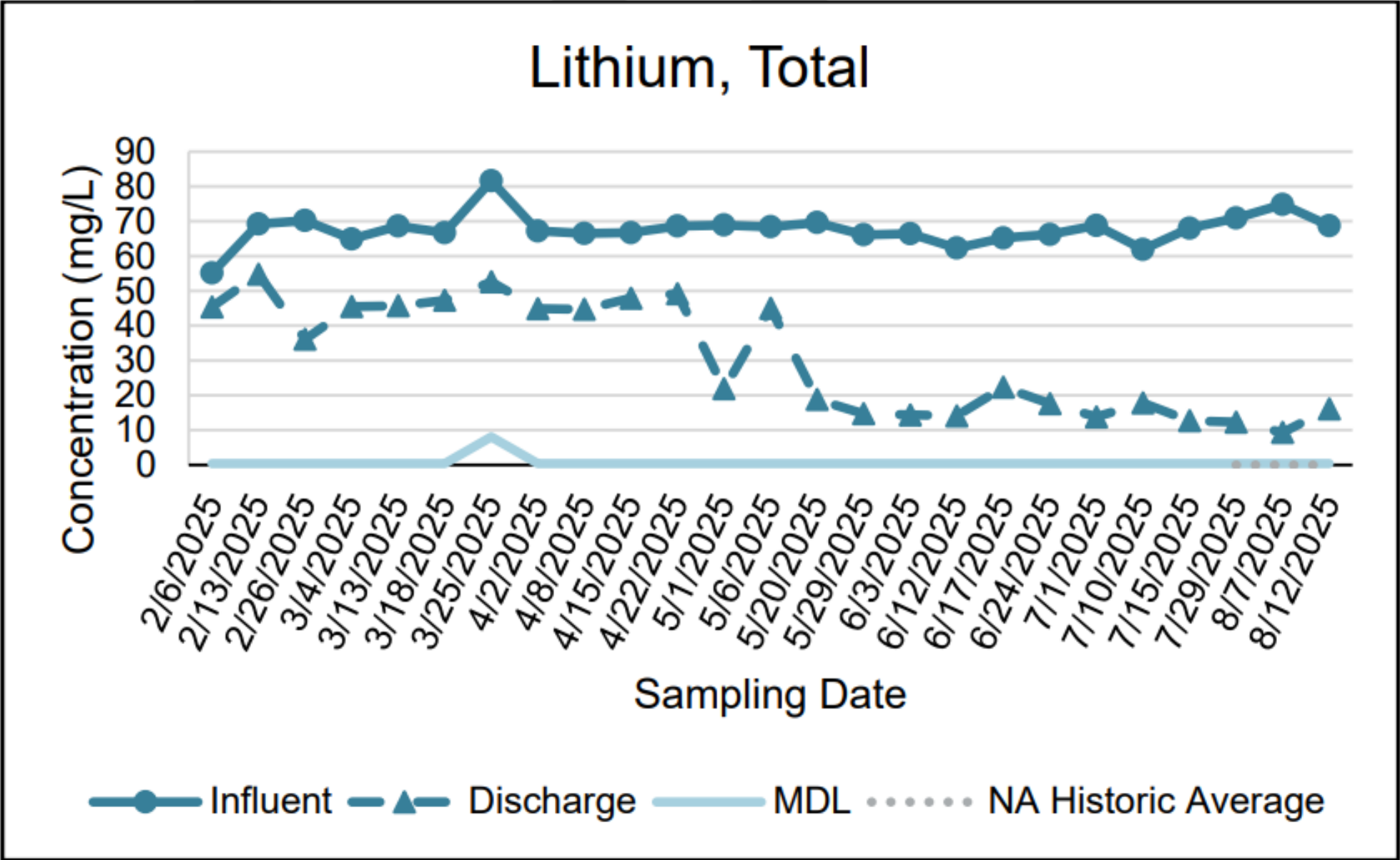
September 19, 2025

GSL Phase 1 DWQ & FFSL Meeting

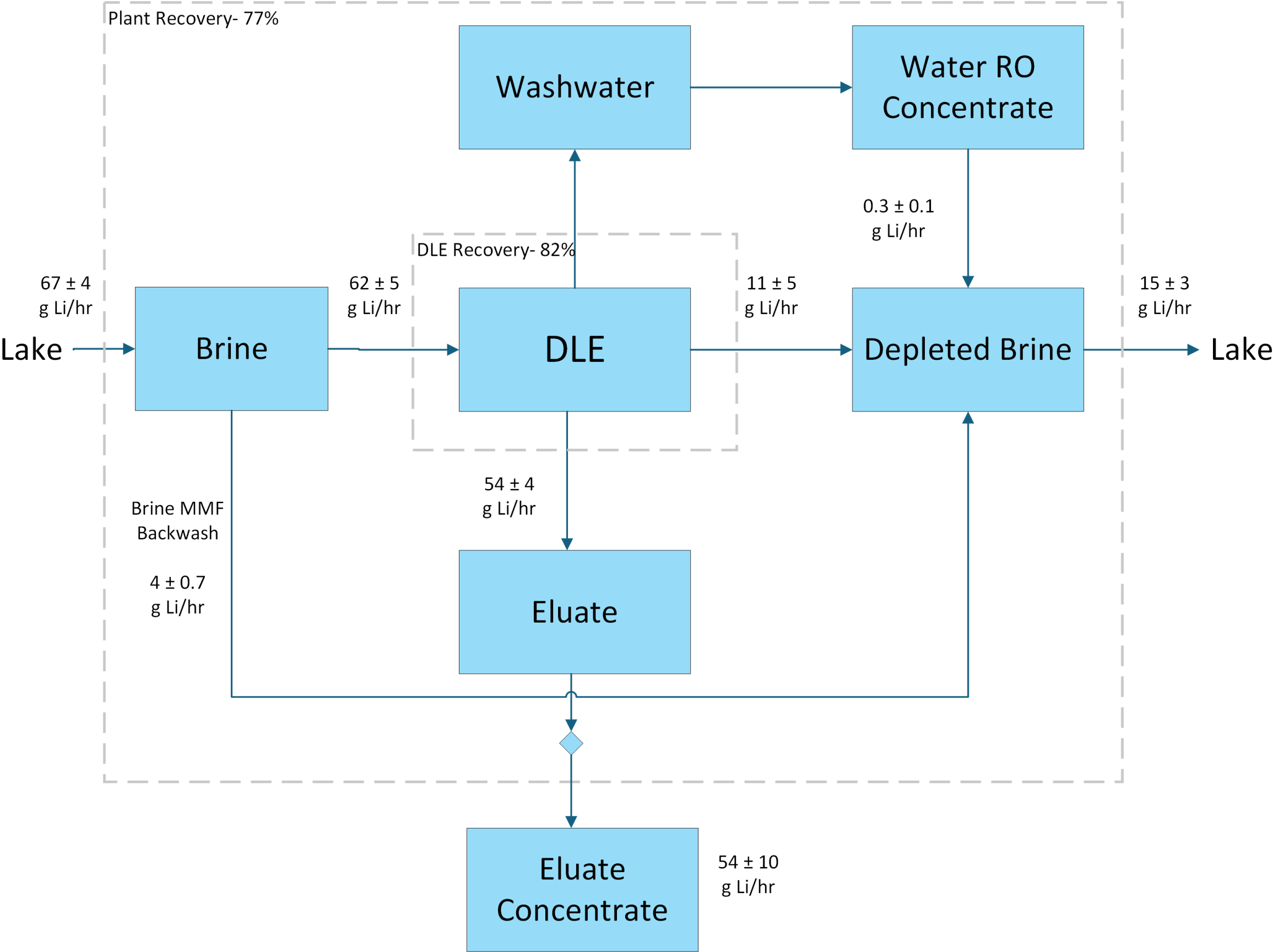
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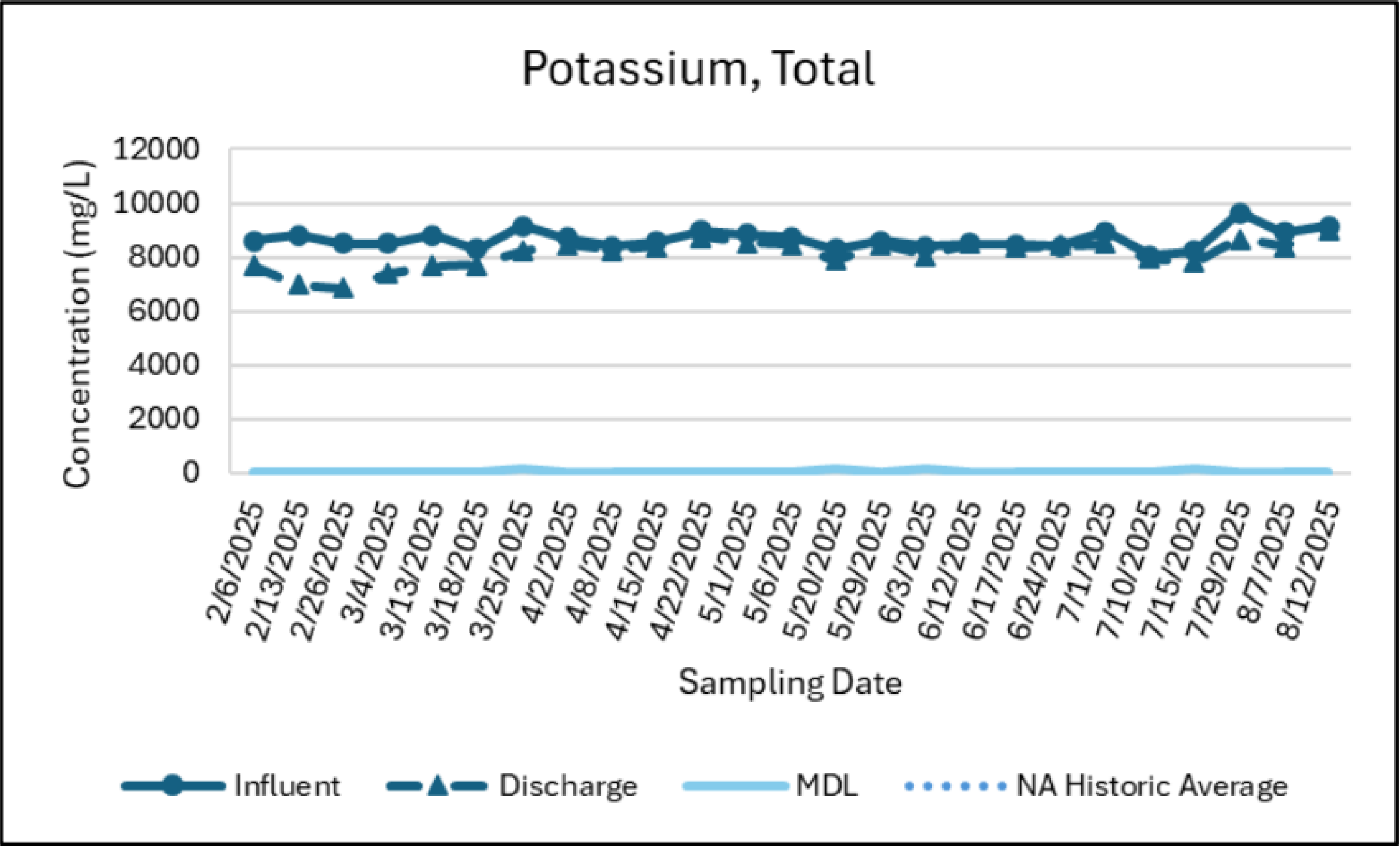
Lithium concentration



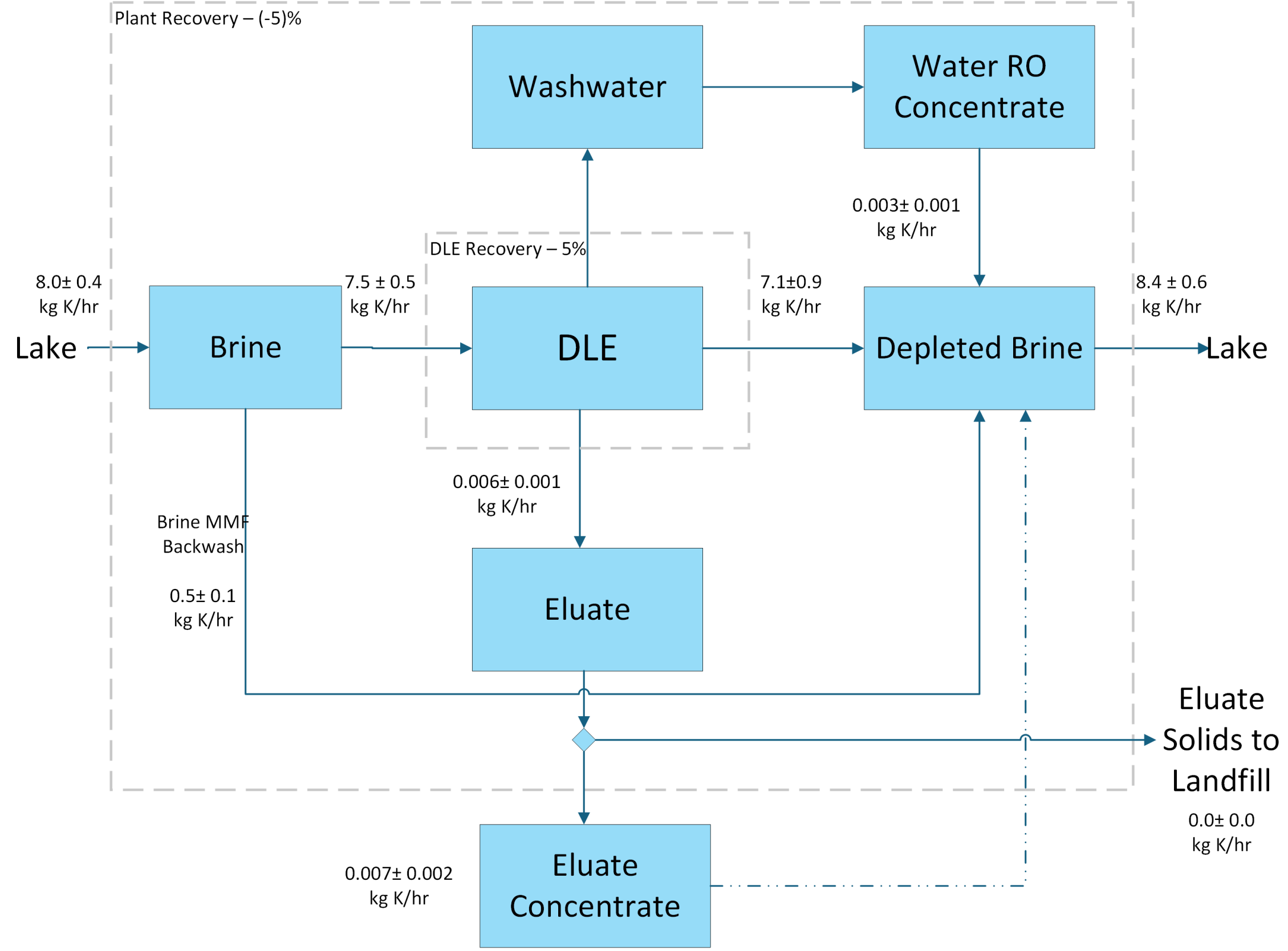
Lithium mass balance



Potassium concentration

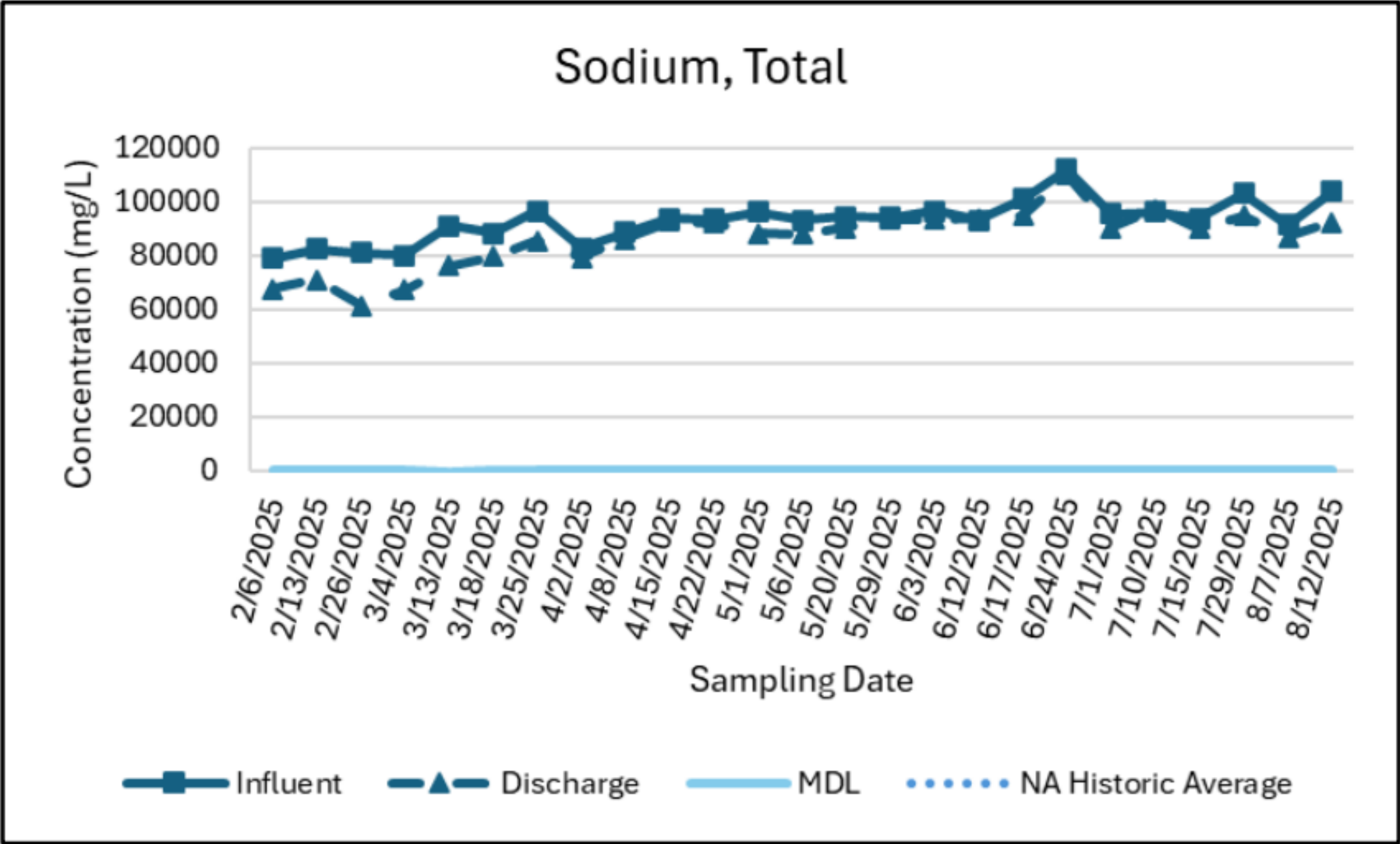


Potassium mass balance

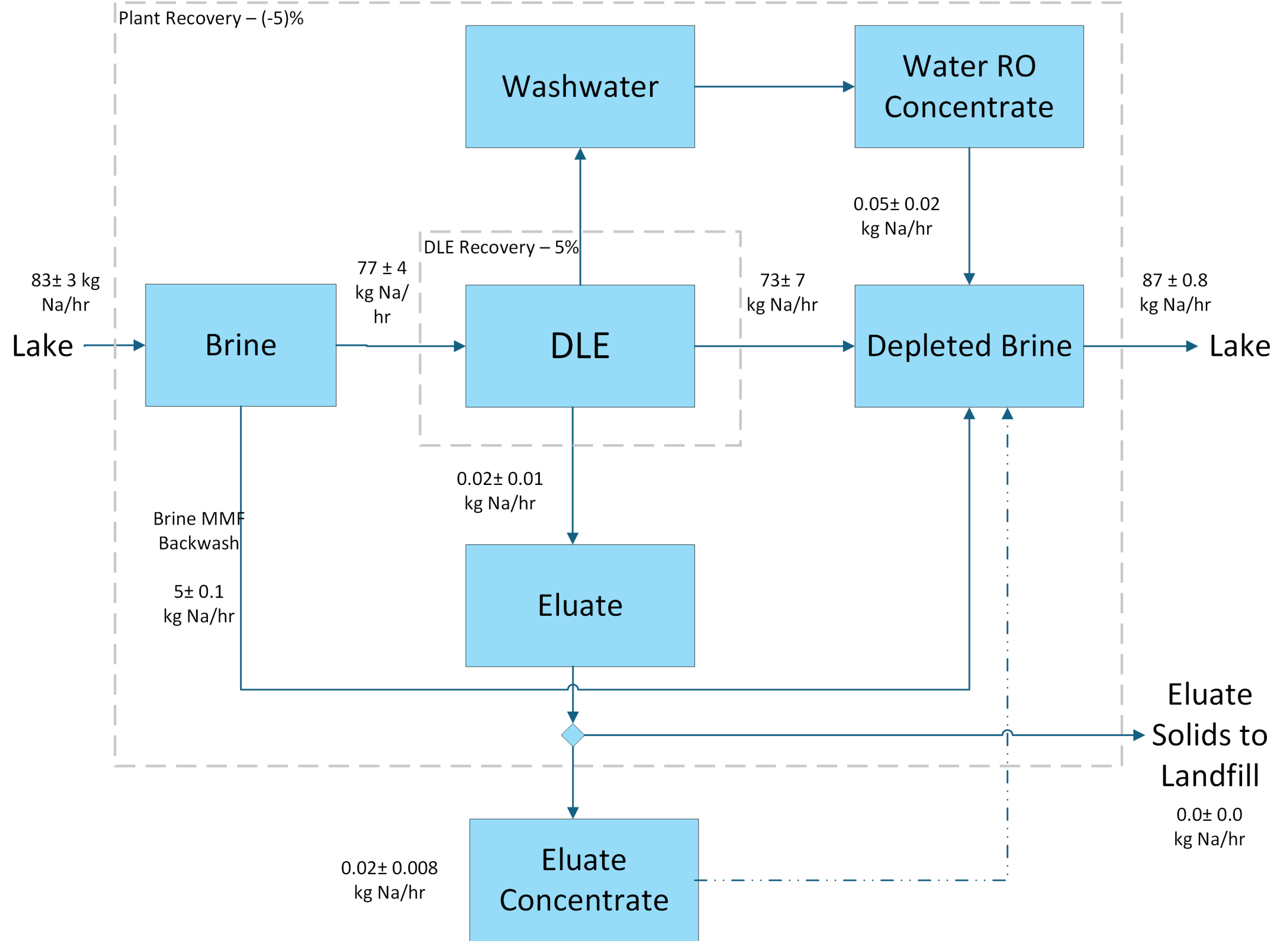


*Potassium returns to the depleted brine in the commercial design via recycle streams

Sodium concentration

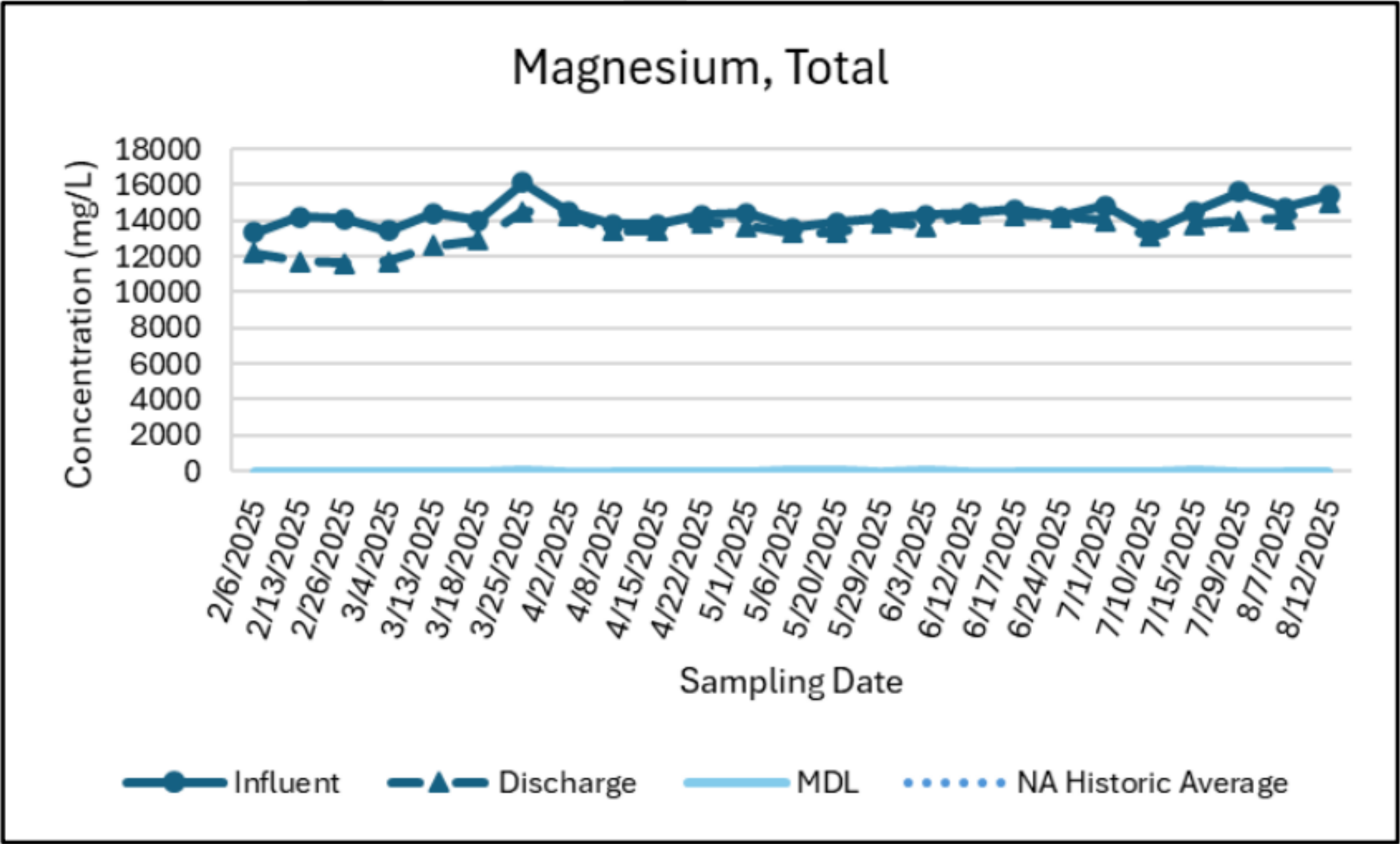


Sodium mass balance

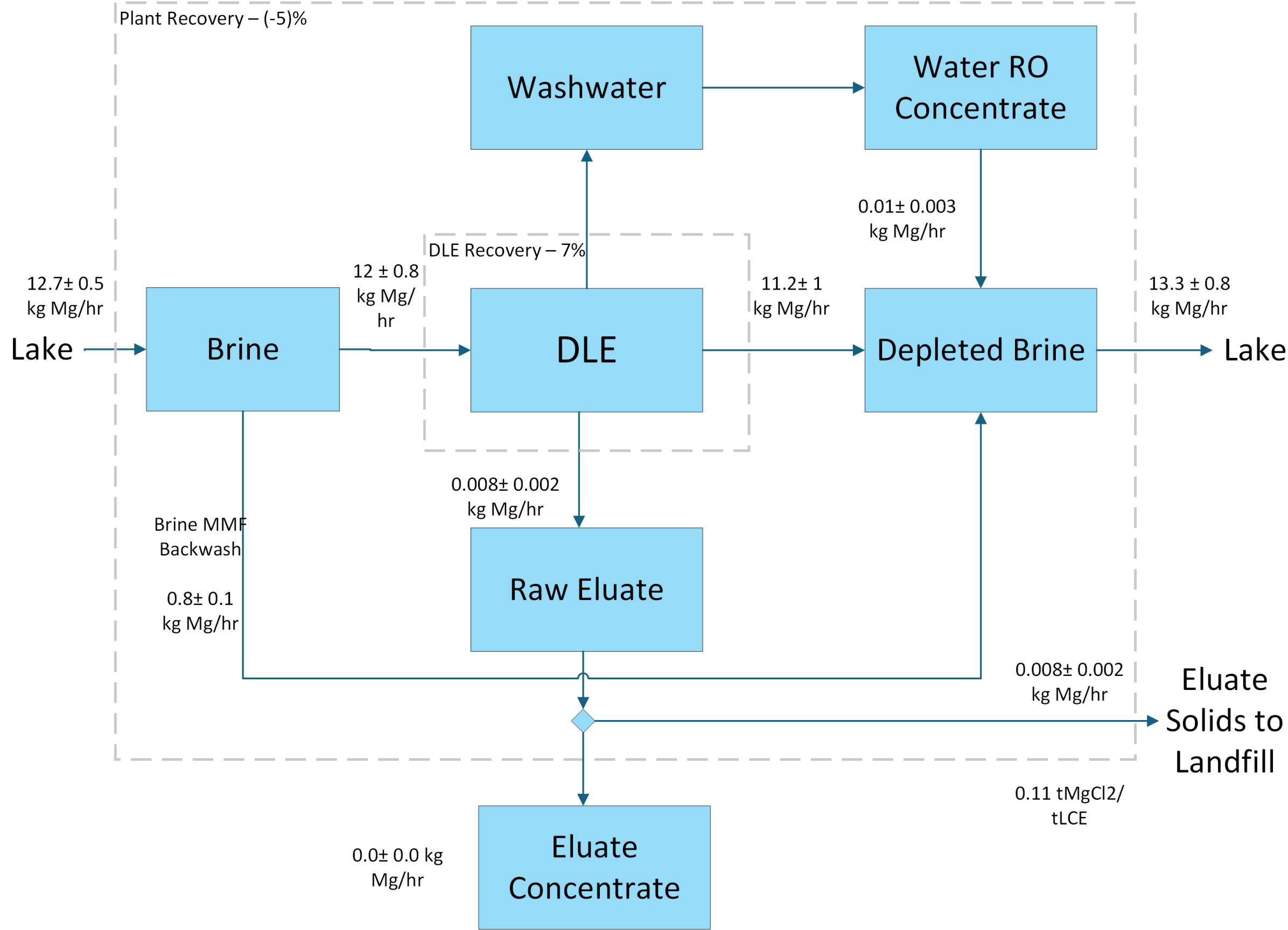


**Sodium returns to the depleted brine in the commercial design via recycle streams*

Magnesium concentration



Magnesium mass balance



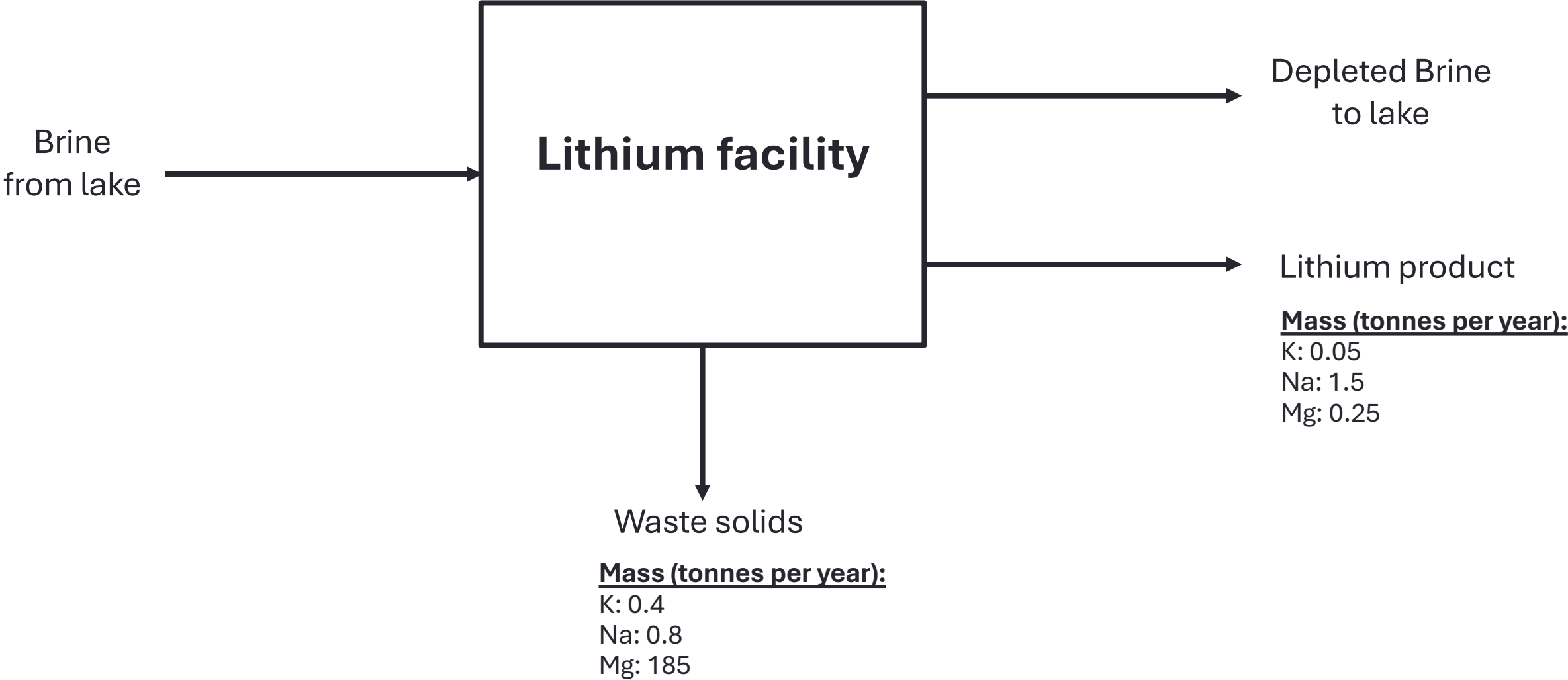
Magnesium calculations

Pilot Stream	Li	K	Na	Mg
Eluate (mg/L)	1922	197	634	284

Note: these are the averages of the constituents during the permit performance run period of 20 May to 10 June

- Phase 1 brine flowrate: 12,500 gpm (equivalent to 18 mgpd)
- Calculates to magnesium of 185 tonnes per year
- Destination of magnesium: waste solids from eluate goes to landfill (the magnesium is part of a solids from eluate neutralization, where there are other constituents in the solids)
- Both sodium and potassium do not come out of solution and recycle to depleted brine back to the lake

Commercial plant block diagram



Eluate neutralization waste solids

Constituent	Value	Units
Total Solids	40.1	%
Chloride	45.35	mg/kg dry
Sulfate	32,700	mg/kg dry
Calcium	287,000	mg/kg dry
Iron	392	mg/kg dry
Lithium	510	mg/kg dry
Magnesium	10,100	mg/kg dry
Potassium	22.6	mg/kg dry
Silica, (as SiO2)	21.6	mg/kg dry
Sodium	44.6	mg/kg dry
Antimony	1.87	mg/kg dry
Arsenic	15.1	mg/kg dry
Cadmium	0	mg/kg dry
Cobalt	0.546	mg/kg dry
Chromium	2.59	mg/kg dry
Copper	5.86	mg/kg dry
Lead	0.762	mg/kg dry
Manganese	3,700	mg/kg dry
Molybdenum	2.5	mg/kg dry
Nickel	6.05	mg/kg dry
Selenium	0	mg/kg dry
Thallium	0	mg/kg dry
Vanadium	12.9	mg/kg dry
Zinc	68.6	mg/kg dry
Mercury	0.103	mg/kg dry
Solids, Other constituents	66,347	mg/kg dry
TOTAL, Solids	401,000	mg/kg dry

Notes

- Bulk of the solids is gypsum
- Magnesium constitutes 2.5% of the overall solids
- 95% wash efficiency for sodium and potassium has been used to calculate residual interstitial losses
- Sodium & potassium are 0.01% of the waste solids
- Total annual tonnes of sodium and potassium lost to landfill is 1.2 tonnes per annum
 - Potassium: 0.4 tonnes per annum
 - Sodium: 0.8 tonnes per annum

Note: this analysis was done by Chemtech-Ford on a grab sample from the pilot plant

Final product calculations

Constituent	Units	Value
Li ₂ CO ₃	wt%	99.5
K	mg/kg	10
Na	mg/kg	300
Mg	mg/kg	50

- Phase 1 product tonnage: 5,000 tpa LCE
- Calculates to following tonnes of constituents that goes out with the final product:

Item	Units	Value
Potassium tonnes in product	tpa	0.05
Sodium tonnes in product	tpa	1.5
Magnesium tonnes in product	tpa	0.25



Appendix D. Dispersion Model

Waterleaf conducted discharge flow dispersion hydrodynamic modeling performed by hrwallingford. (*Dispersion Model DER7185-RT002 R03-00 23 July 2025*). Dispersion modeling simulates North Arm conditions during Commercial Plant operations and was developed to assess the short and long term circulation impacts of the discharge flows. The results of the dispersion modeling indicated that the discharge flows from the plant will extend into the North Arm, within 100 feet of the outfall, prior to being fully mixed. This is based on the characteristics of the discharge flows being comparable to North Arm brine in density, temperature and salinity, which promotes mixing. This model simulation provides evidence that the discharges from the Commercial Plant are limited to the North Arm and would not be directly conveyed to the South Arm through the UPRR causeway breach, in circumstances when the water levels (and the management berm) allow North Arm brine conveyance to the South Arm.

Sections of the report are included below.

Ref. Dispersion Model DER7185-RT002 R03-00 23 July 2025

4 Model results

4.1 Short-term model results

4.1.1 Predicted currents near the project area

The dispersion and dilution of the depleted brine plume away from the outlet largely depends on the lake's currents. Faster currents (which occur during stronger winds) will help dilute the plume by mixing it with higher lithium concentrated brine in the lake, and disperse it more quickly, potentially carrying it away from the inlet point. However, during periods of low current speeds (during weaker winds), the depleted brine plume may build up near the outlet, and may then reach the inlet over time, resulting in lower lithium concentrations in the extracted brine.

Examples of surface current patterns predicted during the Scenario 1 test are shown in Figure 4.1. The inlet and outlet are close to the shore, where the wind tends to generate currents that are directed mostly parallel to the shore, either towards south-east or north-west.

Predicted surface current speeds in the North Arm and project area are generally lower than 0.4 m/s for the modelled period (2023). As currents are driven by wind in the model, fast current speeds require persistent high wind speeds, sustained for long periods. However, strong wind conditions are rarely sustained for long durations in the selected dataset.

The maximum surface current speed predicted near the inlet/outlet during 2023 is slightly above 0.3 m/s. However, for 90% of the simulation duration, surface current speeds at this location are lower than 0.1 m/s. The predicted annual average surface current speed near the inlet/outlet is 0.05 m/s.

The predicted surface current speeds are reasonable, and consistent with those that would be expected for shallow water conditions, under the applied wind speeds. However, we recommend that current data are collected at the site to confirm the speeds predicted by the model. Available information on currents in GSL is mostly focused on the South Arm. Although there are some studies on current patterns in the North Arm, these are either short term observations (dye marker tracing) or previous model predictions, which note the contribution of the two culverts at the west and east end of the causeway (Ref. 10). As these culverts are now closed, the results of these studies are not applicable to verify the predicted current patterns.

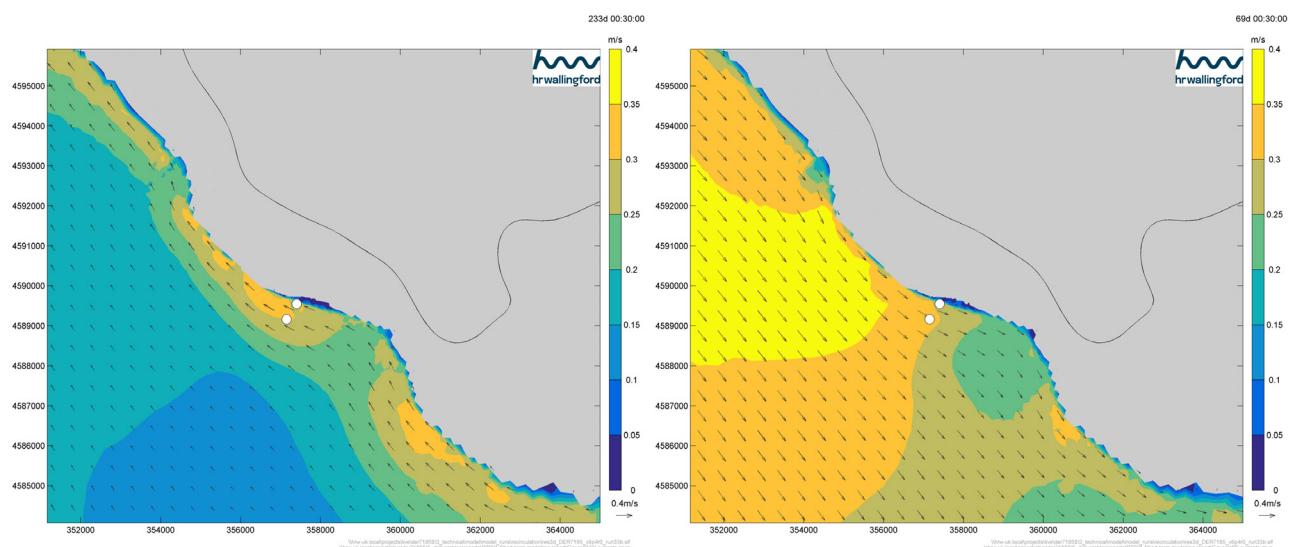


Figure 4.1: Examples of predicted surface current patterns near the outlet/inlet area, showing currents flowing towards north-west (left) and south-east (right), Scenario 1

4.1.2 Dispersion and recirculation predictions

Model results for each of the three scenarios are presented as:

- contour plots of minimum, 5th-percentile and mean lithium concentrations at the lake surface;
- cross-section contour plots of the minimum, 5th-percentile and mean lithium concentrations through the water depth along the outlet-inlet alignment;
- timeseries of predicted lithium concentrations at the inlet (at the lake surface).

The locations of the cross-section and modelled outlet/inlet points are shown in Figure 4.2.

Plots and cross-sections of minimum lithium concentrations show the minimum predicted values at each point in the model over the course of the simulation. As the minima do not occur at the same time at each location, these plots do not indicate the concentration distributions at any specific instant and they should instead be thought of as overall plume “footprints” over the simulation period.

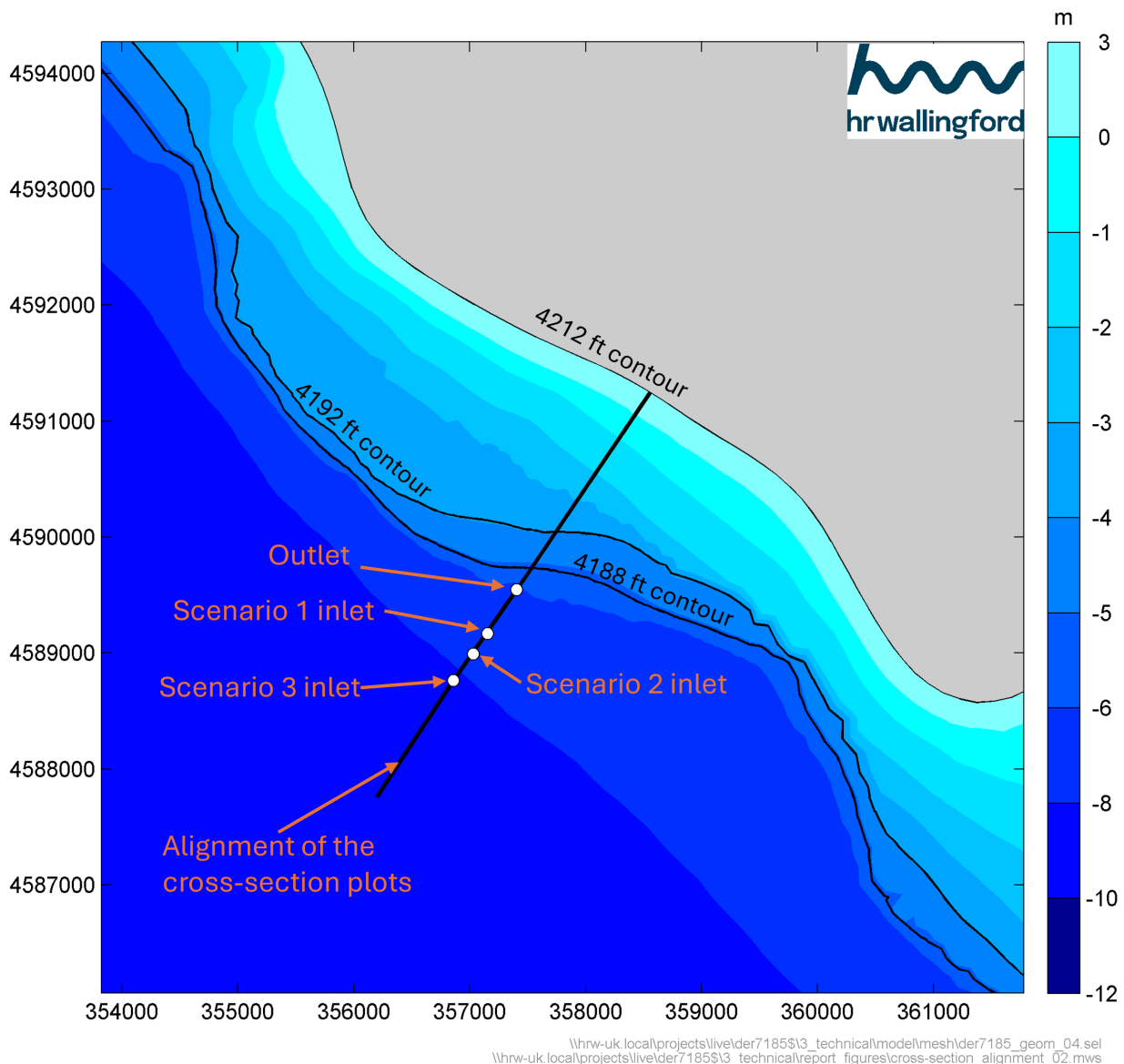


Figure 4.2: Location of the cross-section alignment and modelled outlet/inlet points

Note: Model vertical datum: 0 m = 4205 ft (NGVD29)

Predicted minimum, 5th-percentile and mean lithium concentrations are presented over the inlet/outlet area in Figure 4.3 to Figure 4.5, and over the wider North Arm in Figure 4.6.

Timeseries of predicted lithium concentrations at the inlet are presented in Figure 4.7 to Figure 4.9. Timeseries for Scenarios 2 and 3 also include the Scenario 1 results for reference. Predicted lithium concentrations at the inlet are also summarised in Table 4.1.

The outlet is close to the shore, where the model predicts that winds tend to generate currents that are directed mostly parallel to the shore, either towards north-west or south-east. The contour plots show that these currents are predicted to carry the plume alongshore, with limited offshore spreading. As would be expected, the extents of the plume footprint are much larger for Scenario 3 than predicted for Scenarios 1 and 2, due to the increased flowrate.

For Scenario 1 (5 kTPA production target), predicted minimum, 5th-percentile and average lithium concentrations at the inlet were 87.2, 90.8 and 92.2 mg/l, respectively.

For Scenario 2, moving the inlet offshore by 200 m resulted in predicted minimum, 5th-percentile and average lithium concentrations at the inlet of 89.7, 91.8 and 92.6 mg/l, respectively.

For Scenario 3 (20 kTPA production target, inlet moved offshore by 500 m), predicted minimum, 5th-percentile and average lithium concentrations at the inlet were 86.6, 90.0 and 91.9 mg/l, respectively.

Levels of recirculation predicted during the short-term (1-year tests) are therefore a similar order for all three scenarios.

However, as shown in Figure 4.5 and Figure 4.6, the inlet (particularly for Scenario 3) is in an area of strong horizontal lithium concentration gradient. Only small changes in the plume position would be needed to significantly reduce lithium concentrations at the inlet. Therefore, this raises the importance of measuring currents in the lake to validate the model predictions.

The lake level used in the modelling (4188 ft) results in a limited water depth at the outlet location (~3 ft). In such limited water depth, the discharged brine has the potential to disturb/mobilise bed material. Therefore, it may be necessary to move the outlet to deeper locations if/when the lake water levels drop, to avoid disturbances due to the discharge.

For the modelled scenarios, the return brine is of a similar temperature, and therefore density, to the receiving ambient brine. Combined with the shallow water depth at the outfall, and the mixing induced by the outfall itself, this is predicted to result in the depleted brine plume mixing through the water depth, with similar concentrations at the surface and bed, within a few tens of metres of the outfall (the “near-field” region).

If the depleted brine was to be significantly warmer or cooler than the ambient water (more than, say, a few degrees Celsius), then the residual temperature differences at the end of the near-field region may result in some re-stratification of the depleted brine plume, a few tens to a few hundreds of metres from the outfall. This would potentially give lower lithium concentrations at:

- the lake surface (if the return brine plume remains warmer than the lake);
- the bed (if the return brine plume remains colder than the lake).

Due to the level of mixing and dilution that would already have occurred by this point, we might only expect small variations in lithium concentrations through the water depth. However, if Lilac expects temperature differences of more than just a few degrees Celsius between the depleted brine and receiving water, further optimisation may be possible by varying the height of the inlet pipe on the floating platform, to draw water in from different levels in the water column, depending on the relative temperature of the discharge and receiving water.

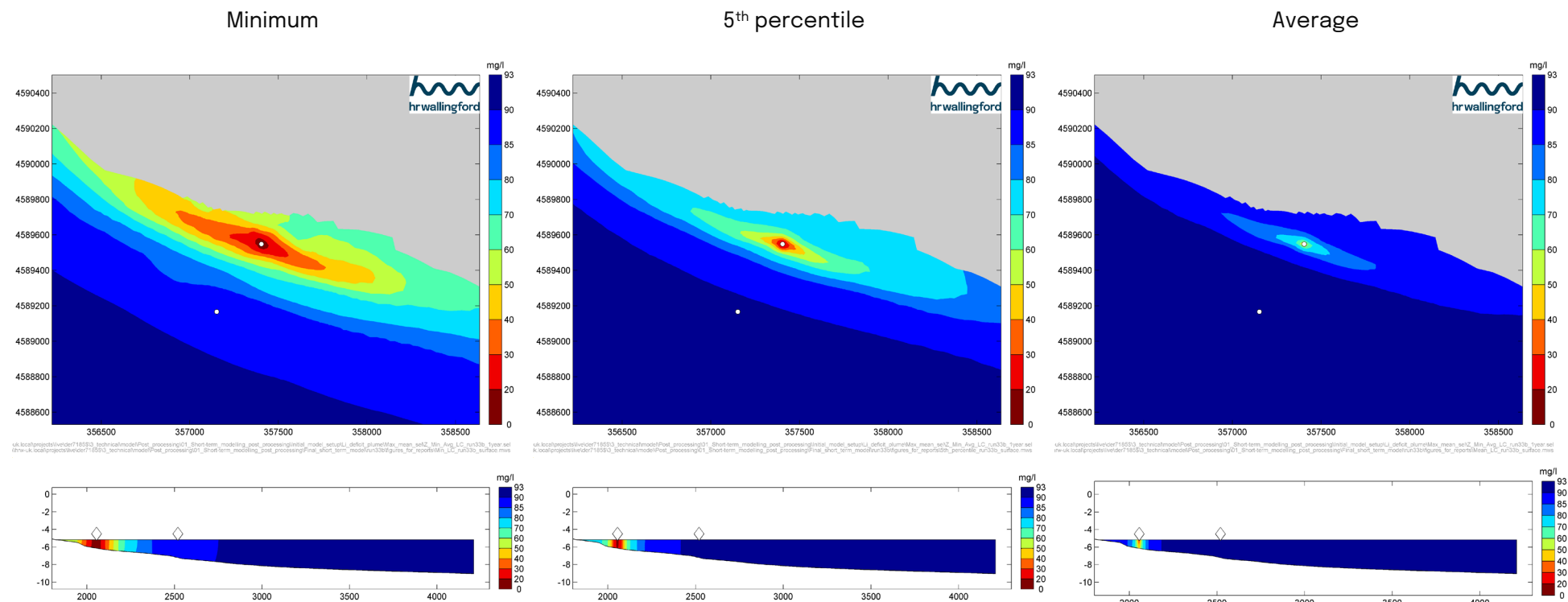


Figure 4.3: Predicted minimum, 5th-percentile and average lithium concentration plots, and cross sections along the outlet/inlet alignment (Scenario 1)

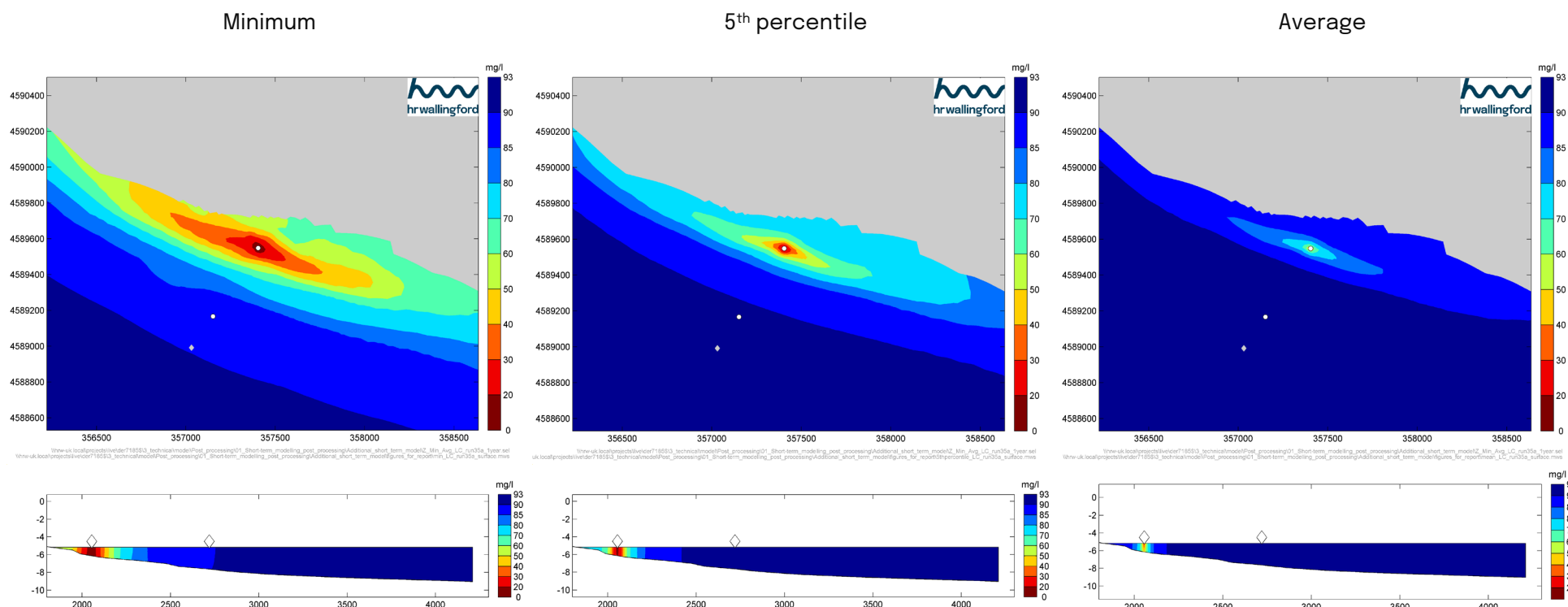


Figure 4.4: Predicted minimum, 5th-percentile and average lithium concentration plots, and cross sections along the outlet/inlet alignment (Scenario 2)

Note: Inlet location for the base case scenario (middle point) is also shown in the plan view plots for reference

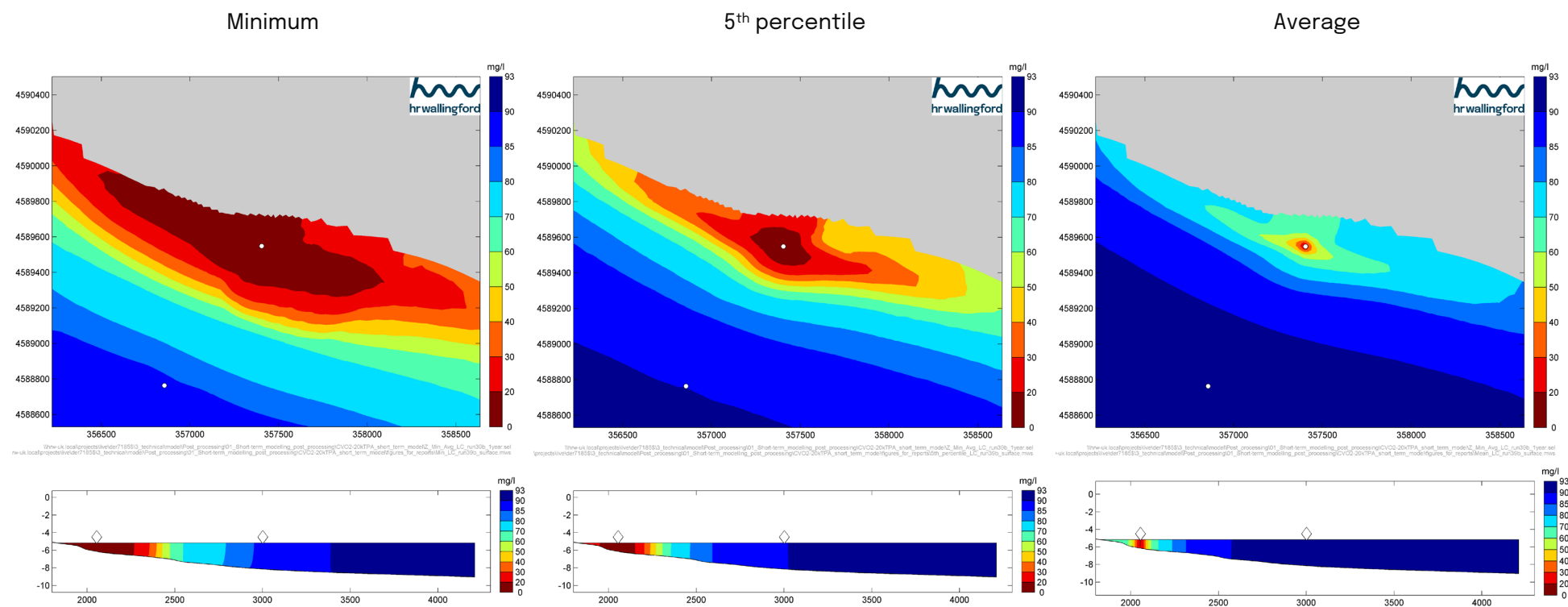


Figure 4.5: Predicted minimum, 5th-percentile and average lithium concentration plots, and cross sections along the outlet/inlet alignment (Scenario 3)

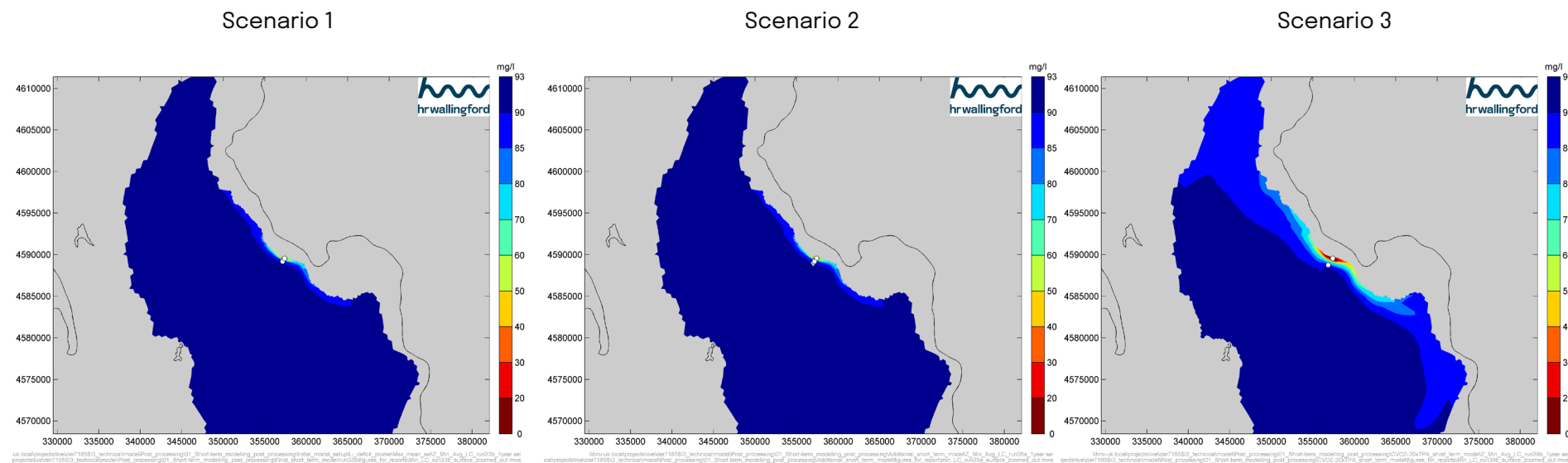


Figure 4.6: Predicted minimum lithium concentration – wider view (plume footprint in the North Arm)

5 Conclusions and recommendations

Hydrodynamic modelling was carried out to predict the dispersion of the depleted brine plume and the change in lithium concentrations at the inlet.

5.1 Short-term modelling conclusions

Three 1-year duration scenarios were simulated for a constant lake level of 4188 ft, with a corresponding background lithium concentration of 93 mg/l. Production efficiency (lithium extraction ratio) and wind fields were kept the same for all three scenarios.

The first and second scenarios assessed a production target of 5 kTPA, with the inlet point shifted 200 m further offshore for the second scenario.

The third scenario assessed an increased production scenario of 20 kTPA, with the inlet shifted 500 m offshore of the base case (Scenario 1) location.

Predicted minimum, 5th-percentile and average lithium concentrations for each scenario were of the same order:

- Scenario 1: 87.2, 90.8 and 92.2 mg/l respectively;
- Scenario 2: 89.7, 91.8 and 92.6 mg/l respectively;
- Scenario 3: 86.6, 90.0 and 91.9 mg/l respectively.

The predicted dispersion of the discharged depleted brine plume, and the resulting lithium concentrations at the inlet depend on current directions and velocities simulated in the model. We note that the inlet, particularly for Scenario 3, is in an area of strong horizontal lithium concentration gradient. Only small changes in the plume position would be needed to significantly reduce lithium concentrations at the inlet. Therefore, this raises the importance of obtaining current measurements in the lake to validate the model predictions.

The lake level tested in the modelling (4188 ft) results in a limited water depth at the outlet location, with the risk of discharged brine disturbing/mobilising bed material. Therefore, it may be necessary to move the outlet to deeper locations if/when the lake water levels drop, to avoid disturbances due to the discharge.

5.2 Long-term modelling conclusions

Four 20-year duration scenarios were tested to cover a range of water level projections and operational conditions, including additional water flow through the breach in the causeway, and two water extractions from Compass Minerals.

The initial lake level and corresponding background lithium concentration for all four scenarios was 4192 ft and 67 mg/l, respectively.

From the results of the scenarios tested, the main factors affecting longer-term lithium concentrations at the inlet are likely to be as follows:

- **Water levels in the North Arm:** Lower water levels generally give higher concentrations across the lake and at the intake. Higher water levels generally give lower concentrations.
- **Breach flow:** Currently, the available data show that the breach brings in water from the South Arm with a lower lithium concentration than in the North Arm. Based on the assumptions made, the lithium mass in the North Arm is predicted to increase due to the lithium influx through the breach, which (despite its lower concentration) acts as a source of lithium recharge over time. Therefore, although the breach inflow can temporarily reduce concentrations at the intake, it potentially increases the total mass of lithium in the North Arm.

Lithium concentrations predicted at the inlet for the scenarios tested varied from as low as 55 mg/l (Scenario 1c) to as high as 146 mg/l (Scenario 1a).

Due to evaporation, the shallower areas in the north of the lake typically have higher lithium concentrations than those in the deeper sections to the south. In addition, due to the inflow of water with lower lithium concentration through the breach, lithium concentrations in the south-west part of the lake are predicted to be lower than those in the north. The model predicted that these areas with contrasting lithium concentrations are transported through the North Arm by the currents, which can cause relatively large concentration fluctuations at the inlet, depending on the current direction and persistence.

The model predicts that Lilac's proposed discharge will mainly cause short-term fluctuations in lithium concentration at the inlet, with variations that are typically much smaller than the changes due to the varying water levels and effects of the overall currents within the North Arm.

Based on the modelling assumptions made, the total mass of lithium in the North Arm does not deplete for any of the modelled scenarios, including the highest production rate of 20 kTPA. Only in the extreme water level drop scenario (Scenario 1a) a temporary decrease in the lithium mass is predicted, which later on recovers and even exceeds the initial mass.

5.3 Limitations and recommendations

At the time of the study, no survey data or other information were available to calibrate or validate the model predictions. While a detailed sensitivity analysis has been carried out, and the predicted surface current speeds are reasonable (and consistent with those that would be expected for shallow water conditions, under the applied wind speeds), we recommend that current data are collected to give further confidence in the model.

As currents in the lake are mostly driven by the effects of wind, we also recommend that wind data local to the site are collected from a meteorological station to validate the operational forecast model winds used in the study. For model calibration and validation, the wind data would need to cover the same period as the current data.

It should be noted that the lithium mass added to the North Arm by the flow through the breach is predicted to have an important effect in offsetting the extractions by both Lilac and Compass Minerals. Depending on the management of the breach, the flow and corresponding lithium mass fluxes may be different than those modelled.

All water level projections provided by Lilac assume continued inflow to the North Arm through the breach. In reality, this flow depends on the management of the breach, which is understood to be currently evolving together with the strategic directions (by Utah's Division of Forestry, Fire and State Lands) concerning the water levels of the Great Salt Lake. A range of water level projections have been tested in the modelling, but it is not possible to simulate all potential future water level scenarios, or to predict how the breach flow may be managed in future.

Apart from the breach, the rest of the causeway separating the North and South Arms was represented as an impermeable structure, i.e. with no water transfer between the North and South Arms through the causeway. This was considered appropriate as we expect that the volumes of water passing through will be small compared to the overall volume of the lake, and are unlikely to affect currents near the proposed outlet/inlet. However, given that the flows through the breach were found to affect lithium concentrations at the intake, we recommend that the impermeability of the causeway is confirmed to verify the modelling assumption.

6 References

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