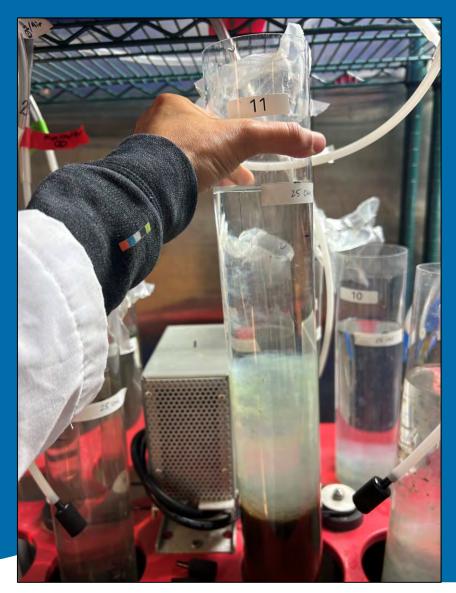
Lake Campbell Sediment Incubation Study Report

Prepared for Skagit County

Prepared by Herrera Environmental Consultants, Inc.

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1. Introduction

This report presents the results of a lake sediment incubation study conducted on Lake Campbell, located on Fidalgo Island in western Skagit County, Washington. This study was performed for Skagit County by Herrera Environmental Consultants, Inc. (Herrera), in partnership with Western Washington University, in response to a recommendation by the 2024 Lake Campbell Lake Cyanobacteria Management Plan (LCMP) (Herrera 2024). This study provides a better estimation of sediment phosphorus release and evaluates the effectiveness of an alum treatment at varying pH and oxygen conditions.

1.1. Background

In 1985, Lake Campbell was treated with aluminum sulfate ("alum") to reduce internal phosphorus sources fueling harmful algae (cyanobacteria) blooms (HABs); however, harmful blooms returned in the summer and fall of 2021, 2022, and 2023, exceeding the Washington State Department of Health recreational cyanotoxin guidelines. The 2024 LCMP, prepared by Herrera, agreed with the findings of previous studies (Entranco 1983, 1987) that phosphorus is the limiting nutrient for algae growth and most phosphorus input to the lake is from internal loading (sediment release) during the summer months. A long-term management approach was recommended, using a buffered aluminum sulfate ("alum") treatment to inactivate phosphorus in the sediments. The applied aluminum binds to mobile phosphorus released due to organic decomposition and chemical reduction and prevents the phosphorus from reaching the water column (Herrera 2024). A follow-up incubation study, addressed in this report, was recommended to better estimate sediment phosphorus release, evaluate the effectiveness of the alum treatment, and determine an optimum buffered alum dose to control toxic cyanobacteria blooms for at least 10 years.

1.2. Objectives

The objectives of the study described in this report include:

- Collect 16 sediment core samples from the deepest location of Lake Campbell (identified as the CAM-DEEP monitoring station in the LCMP)
- Collect vertical depth-profile parameters of temperature, dissolved oxygen, and pH at CAM-DEEP
- Expose 16 sediment cores and overlying water to varying oxygen, pH, and alum treatment conditions via an incubation experiment
- Measure temperature, dissolved oxygen, and pH and collect subsamples for analysis of total phosphorus (TP) and orthophosphate at 5 sampling events during the sediment incubation experiment
- Quantify internal phosphorus content of sediment in Lake Campbell



• Confirm the efficacy of the sediment inactivation alum and sodium aluminate dosage recommended by the LCMP

Each of the study objectives were met.



2. Study Methods

This section provides a high-level overview of the study's methodology. See the QAPP (Herrera 2024) for additional details.

- On August 19, 2024, 16 sediment cores were collected from the deepest location in Lake Campbell (CAM-DEEP) using a hammer corer. Before core collection, a vertical depth-profile of temperature, dissolved oxygen, and pH was completed, with measurements taken at half-meter increments to a depth of 5.0 meters. A 20-liter (L) carboy was filled with filtered (0.45 micron) lake water from a depth of approximately 4.5 meters and subsamples were collected for analysis of total phosphorus (TP) and orthophosphate.
- Eight (8) study groups were established (see Table 1) with a duplicate of each study group. These represent a combination of neutral or high pH (7 or 8.5 units), aerobic or anaerobic oxygen conditions, and alum treatment (no treatment or 18.0 g Al/m²). The dosage was achieved by adding 0.5 mL of liquid aluminum sulfate (58 mg Al/mL) and 0.25 mL of liquid sodium aluminate buffer (146 mg Al/mL).
- Samples were taken from the sediment cores' overlying water at hour 0 (the start of incubation; HR 0), approximately 12 to 18 hours after beginning incubation (HR 12-18), 46 hours (HR 46), 70 hours (HR 70), and 185 hours (HR 185).
- Each overlying water sample was measured for temperature, dissolved oxygen (DO), and pH, and analyzed for orthophosphate and total phosphorus (TP).

	Table	e 1. Redox Trea	tments of Se	diment Cores.
Core Number	Oxygen Condition	pH Condition	Alum Treated	Description ^{a, b}
1	Aerobic	Neutral pH (~7)		Overlying water was bubbled with ambient air at a rate of 0.500 standard liter per minute (slm) and
2	Aerobic	Neutral pH (~7)	No	with CO_2 at a rate of 5.5106 standard cubic centimeters per minute (sccm).
3	Anaerobic	Neutral pH (~7)		Overlying water was bubbled with N_2 gas at a rate
4	Anaerobic	Neutral pH (~7)	No	of 0.750 slm and with CO_2 at a rate of 7.700 sccm.
5	Aerobic	High pH (~8.5)		Overlying water was bubbled with ambient air at a rate of 5.600 slm and with CO_2 at a rate of 0.400
6	Aerobic	High pH (~8.5)		sccm.



7	Anaerobic	High pH (~8.5)	No	Overlying water was bubbled with N ₂ gas at a rate of 3.700 slm and with CO ₂ at a rate of 0.100
8	Anaerobic	High pH (~8.5)	No	sccm.
9	Aerobic	Neutral pH (~7)	Yes	Overlying water was bubbled with ambient air at a rate of 0.500 slm and with CO_2 at a rate of 5.5106 sccm.
10	Aerobic	Neutral pH (~7)	Yes	0.5 milliliters (mL) of aluminum sulfate (0.0654 g alum) and 0.25 mL of sodium aluminate were added.
11	Anaerobic	Neutral pH (~7)	Yes	Overlying water was bubbled with N_2 gas at a rate of 0.750 slm and with CO_2 at a rate of 7.700 sccm.
12	Anaerobic	Neutral pH (~7)	Yes	0.5 milliliters (mL) of aluminum sulfate and 0.25 mL of sodium aluminate were added.
13	Aerobic	High pH (~8.5)	Yes	Overlying water was bubbled with ambient air at a rate of 5.600 slm and with CO_2 at a rate of 0.400 sccm.
14	Aerobic	High pH (~8.5)	Yes	0.5 milliliters (mL) of aluminum sulfate (0.0654 g alum) and 0.25 mL of sodium aluminate were added.
15	Anaerobic	High pH (~8.5)	Yes	Overlying water was bubbled with N_2 gas at a rate of 3.700 slm and with CO_2 at a rate of 0.100 sccm.
16	Anaerobic	High pH (~8.5)	Yes	0.5 milliliters (mL) of aluminum sulfate (0.0654 g alum) and 0.25 mL of sodium aluminate were added.

^a In the QAPP, the gas injection was provided in terms of a concentration (e.g., 10,600 ppm CO₂). This table provides the flow rate of the bubbled pure gasses, which was modified throughout the study to maintain the target oxygen and pH conditions. The flow rate listed is of hour 185.

^b The alum dose calculation is provided in the QAPP.

slm - standard liter per minute; sccm - standard cubic centimeter per minute.

mL – milliliters; g – grams



3. Quality Assurance Review

3.1. Deviations from Work Plan

Sampling was conducted in accordance with the Lake Campbell Phase II Sediment Incubation Study Quality Assurance Project Plan (QAPP) with the following exception:

We suspected the DO sensor measurements were inaccurate due to the continued level of oxygen measured in the anaerobic core study group (an average of 160.8 µmol/L at HR 185) despite being bubbled with pure nitrogen gas. While a minor amount of oxygen generation via photosynthesis may have occurred, the levels of measured oxygen were higher than would be expected in a dark chamber. For this reason, a YSI was used to measure DO at HR 185 (the last sampling event). Substantial differences in measurements were found between the YSI and the DO sensor. It is possible this may have been due to equipment or calibration issues. Based on the observed differences in oxygen concentrations between the aerobic and anaerobic cores during the incubation period, we believe that the anaerobic conditions were maintained for the desired cores.

3.2. Laboratory Data Review

Laboratory reports for the water samples underwent a quality assurance (QA) review, in accordance with the 2024 QAPP. The following deviation from the QAPP was noted during quality assurance review:

- Core 7 at HR 0 had a TP measurement of 459.1 µg P/L. This differed substantially from the rest of the cores at HR 0, which averaged 67.3 µg P/L. This data point was considered an outlier and reanalysis of the sample resulted in a far lower value. Therefore, this value was flagged for rejection (R) and was not used in the calculations.
- Core 3, from an anaerobic study group, at HR 185 was qualified as rejected (R) and not used in the calculations due to elevated measured DO in the sample according to YSI multimeter readings, which may have resulted in depressed orthophosphate and total phosphorus due to oxidation of iron in the sediment.
- The QAPP matrix spike recovery ranged from 80-100 percent. The core 8 (anaerobic, high pH) TP sample at HR 0 had a high spike recovery of 176 percent. The core 12 (anaerobic, neutral pH, alum treated) HR 46 and core 14 (aerobic, high pH, alum treated) HR 70 TP samples had a low recovery rate, 76 percent and 72 percent, respectively. It is possible this may have been due to a matrix interference. These data were qualified as estimated (J).

The quality assurance review determined that the laboratory results are valid and acceptable for use with no further qualification.



4. Results

4.1. Aluminum Concentration

The measured aluminum concentration in the alum sample was 60.1 g/L and in the sodium aluminate sample was 108.0 g/L. For the dosage calculations, the assumed concentrations were 57.9 g/L and 146 g/L, respectively. The aluminum concentration in alum between the assumed and measured were comparable; however, the aluminum concentration in the sodium aluminate was approximately three-quarters that assumed. This resulted in an aluminum dose of 57.1 mg or 15.7 g/m², compared to the planned dose of 65.4 mg or 18.0 g/m², which is 13 percent lower.

4.2. Physical Measurements of Overlying Water

A comparison of DO, pH, and temperature between the study groups is shown in

Figure 1. Duplicate cores within a study group are represented by red and blue lines labeled with core numbers. The dashed line represents the time alum was added to the cores receiving alum treatment. Conditions prior to treatment are to the left of the dashed line and conditions post-treatment are to the right of the dashed line.

Key DO observations include:

• Oxygen levels in the anaerobic study group were lower than in the aerobic study group. As noted above, there were concerns with the accuracy of the DO sensor, but these results can be interpreted qualitatively such that we are confident that the anaerobic cores experienced depleted oxygen levels during the incubation period.

Key pH observations include:

- The pH measurements in cores not treated with alum remained relatively stable in the neutral pH group, with some variability in the pH 8.5 group (high pH group).
- Core 6, in the aerobic, high pH, untreated experimental group, became more acidic than its duplicate, core 5, and exhibited a higher-than-expected phosphorus concentration and release rate under those lower pH conditions.
- The experimental groups receiving the alum treatment were also dosed with sodium aluminate (a pH buffer). All 8 of 8 cores in this treatment group experienced a drop in pH after the alum dose, with more marked decreases in the high pH group. The decrease in pH was expected due to the acidic nature of the aluminum hydroxide floc forming from the alum reacting with water.
- In the alum treated high pH experimental group, the most substantial drop in pH was observed in anaerobic conditions. For example, cores 15 and 16 had a pH of 8.63 and 8.56 (respectively) prior to the alum dose and a pH of 7.54 and 6.98 (respectively) after the addition of alum. This demonstrates the importance of properly applying alum with a buffer and monitoring pH to avoid impacts on aquatic biota.



For temperature, the key observation was that the temperature of the overlying core water during incubation (averaging 19.4 degrees Celsius (°C) at hour 185) was slightly lower than that of the lake at a depth of 5 meters (20.5 degrees Celsius (°C).



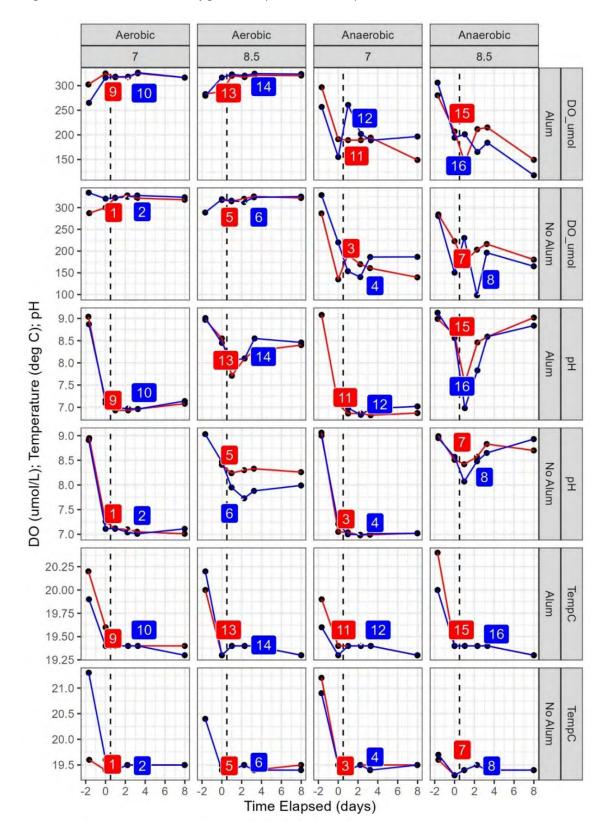


Figure 1. Dissolved Oxygen, Temperature, and pH over time.



4.3. Phosphorus Measurements

A comparison of total phosphorus (TP) and orthophosphate concentrations between the study groups is shown in Figure 2. Duplicate cores within a study group are represented by red and blue lines labeled with core numbers. The dashed line represents the time alum was added to the cores receiving alum treatment. Conditions prior to treatment are to the left of the dashed line and conditions post-treatment are to the right of the dashed line.

Key findings include:

- The concentrations of total phosphorus (TP) and orthophosphate were lower in the aerobic experimental group than in the anaerobic experimental group not treated with alum.
- TP and orthophosphate concentrations remained stable throughout the study in the aerobic groups, except in core 6 (aerobic, high pH, untreated), for which orthophosphate increased by nearly 50 times the original concentration by the end of the study. The higher-than-expected concentration and release rate may be due to natural variation in the samples.
- There was a decrease in TP and an increase in orthophosphate, over time, in the anaerobic, neutral pH group not treated with alum. TP and orthophosphate both increased throughout the study in the anaerobic, high pH, untreated group.
- In all alum dosed cores, at the first sampling event post-alum treatment (HR 12-18), concentrations were less than the detection limits, (5.0 µg/L) in 5 of 8 cores, and (3.0 µg/L) 8 of 8 cores, for TP and orthophosphate, respectively.
- Following the initial substantial decline in TP and orthophosphate in all treated cores after the alum application, concentrations increased slightly through the end of the study. Despite this, TP remained low in alum-treated cores, with an HR 185 average of 6.9 μg P/L for the aerobic neutral pH group, 13.2 μg P/L for the aerobic high pH group, 13.5 μg P/L for the anaerobic neutral pH group, and 16.7 μg P/L for the anaerobic high pH group.
- Orthophosphate remained low throughout the study in all alum-treated groups, with 5 of 8 cores remaining under the detection limit at hour 185. Core 15, in the anaerobic, high pH group, core 14, in the aerobic, high pH group, and core 12 in the anaerobic, neutral pH group still had detectible concentrations of 6.7 µg/L, 3.1 µg/L, and 8.3 µg/L, respectively. Table 2 and Table 3 list TP and orthophosphate concentrations of the overlying core water, respectively, over time.



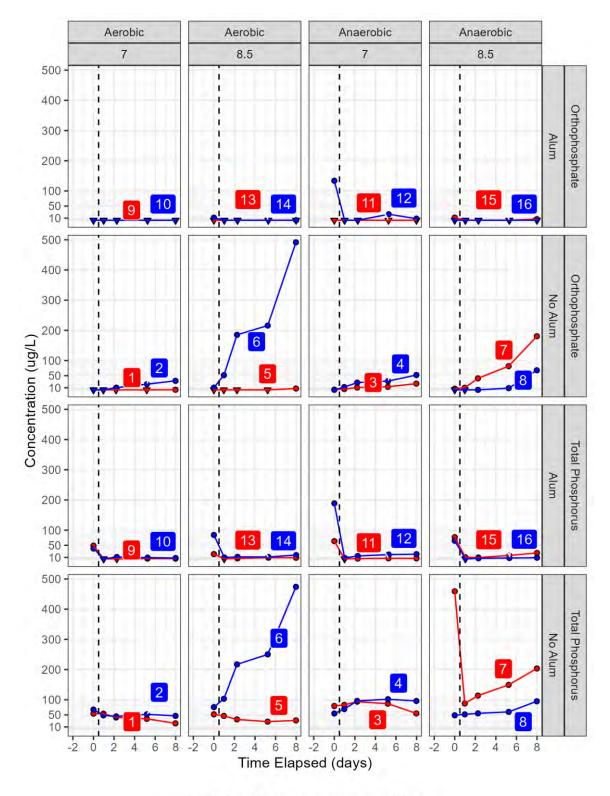


Figure 2. Concentration of Orthophosphate and Total Phosphorus Over Time.

nonDetectFlag ○ FALSE ⊽ TRUE



	Table 2. Total Phosphorus Concentration and Mass of Overlying Core Water.														
								Тс	otal Phosp	horus					
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)		
1	HRO	8/21/2024 10:06	45	40	54.1		49.1	0.0	0.0	0.0	0.0	49.1	NA		
1	HR12-18	8/22/2024 9:15	75	75	54.1		49.1	2.4	1.3	-1.2	-1.2	50.3	1.1		
1	HR46	8/23/2024 14:50	75	75	41.5		37.7	4.1	2.4	-1.7	-2.8	40.5	-9.8		
1	HR70	8/26/2024 14:28	75	75	37.0		33.6	3.1	2.4	-0.7	-3.6	37.1	-3.4		
1	HR185	8/29/2024 9:26	75	0	22.1		20.1	2.8	2.4	-0.4	-4.0	24.0	-13.1		
2	HR0	8/21/2024 10:11	45	40	67.5		61.3	0.0	0.0	0.0	0.0	61.3	NA		
2	HR12-18	8/22/2024 9:22	75	75	48.6		44.1	3.0	1.3	-1.8	-1.8	45.9	-15.4		
2	HR46	8/23/2024 15:18	75	75	45.0		40.9	3.6	2.4	-1.3	-3.0	43.9	-2.0		
2	HR70	8/26/2024 14:59	75	75	51.9		47.1	3.4	2.4	-1.0	-4.0	51.1	7.2		
2	HR185	8/29/2024 9:34	75	0	46.7		42.4	3.9	2.4	-1.5	-5.5	48.0	-3.2		



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
								Тс	otal Phosp	horus				
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
3	HRO	8/21/2024 10:16	45	40	79.5		72.2	0.0	0.0	0.0	0.0	72.2	NA	
3	HR12-18	8/22/2024 9:28	70	70	83.0		75.4	3.6	1.3	-2.3	-2.3	77.7	5.5	
3	HR46	8/23/2024 15:33	75	75	93.8		85.2	5.8	2.2	-3.6	-5.9	91.1	13.4	
3	HR70	8/26/2024 15:15	150	150	87.1		79.0	7.0	2.4	-4.7	-10.5	89.6	-1.5	
3	HR185	8/29/2024 9:42	75	0	55.0	R	49.9	13.1	4.8	-8.3	-18.8	68.7	-20.9	
4	HR0	8/21/2024 10:21	45	40	54.6		49.6	0.0	0.0	0.0	0.0	49.6	NA	
4	HR12-18	8/22/2024 9:33	75	75	69.2		62.8	2.5	1.3	-1.2	-1.2	64.0	14.4	
4	HR46	8/23/2024 15:44	85	85	96.2		87.4	5.2	2.4	-2.8	-4.0	91.4	27.4	
4	HR70	8/26/2024 15:41	75	75	101.8		92.5	8.2	2.7	-5.5	-9.5	101.9	10.5	
4	HR185	8/29/2024 9:52	75	0	96.0		87.2	7.6	2.4	-5.3	-14.7	101.9	0.0	



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
								Тс	tal Phosp	horus				
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
5	HRO	8/21/2024 10:26	75	70	51.8		47.1	0.0	0.0	0.0	0.0	47.1	NA	
5	HR12-18	8/22/2024 9:36	75	75	46.5		42.2	3.9	2.2	-1.7	-1.7	43.9	-3.2	
5	HR46	8/23/2024 16:16	75	75	35.0		31.8	3.5	2.4	-1.1	-2.8	34.6	-9.3	
5	HR70	8/26/2024 15:53	75	75	27.7		25.1	2.6	2.4	-0.2	-3.0	28.1	-6.5	
5	HR185	8/29/2024 9:58	75	0	31.8		28.8	2.1	2.4	0.3	-2.7	31.5	3.4	
6	HR0	8/21/2024 10:31	45	40	75.8		68.8	0.0	0.0	0.0	0.0	68.8	NA	
6	HR12-18	8/22/2024 9:51	75	75	103.4		93.9	3.4	1.3	-2.1	-2.1	96.0	27.2	
6	HR46	8/23/2024 16:30	75	75	217.2		197.2	7.8	2.4	-5.4	-7.5	204.7	108.7	
6	HR70	8/26/2024 16:11	75	75	250.3		227.2	16.3	2.4	-13.9	-21.4	248.6	43.9	
6	HR185	8/29/2024 10:00	75	0	474.0		430.4	18.8	2.4	-16.4	-37.8	468.2	219.6	



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
								Тс	otal Phosp	horus				
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
7	HRO	8/21/2024 10:36	44	39	459.1	R	416.8	0.0	0.0	0.0	0.0	416.8	NA	
7	HR12-18	8/22/2024 9:59	75	75	87.6		79.6	20.2	1.2	-19.0	-19.0	98.5	-318.3	
7	HR46	8/23/2024 16:45	75	75	113.9		103.4	6.6	2.4	-4.2	-23.1	126.5	28.0	
7	HR70	8/26/2024 16:24	75	75	149.4		135.6	8.5	2.4	-6.2	-29.3	164.9	38.4	
7	HR185	8/29/2024 10:15	75	0	203.7		184.9	11.2	2.4	-8.8	-38.1	223.0	58.1	
8	HR0	8/21/2024 10:46	45	40	48.7	J	44.2	0.0	0.0	0.0	0.0	44.2	NA	
8	HR12-18	8/22/2024 10:11	75	75	51.7		46.9	2.2	1.3	-0.9	-0.9	47.9	3.7	
8	HR46	8/23/2024 17:00	75	75	55.1		50.0	3.9	2.4	-1.5	-2.4	52.4	4.6	
8	HR70	8/26/2024 16:40	75	75	59.9		54.4	4.1	2.4	-1.7	-4.2	58.5	6.1	
8	HR185	8/29/2024 10:20	75	0	95.0		86.3	4.5	2.4	-2.1	-6.3	92.5	34.0	



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
							1	Тс	tal Phosp	horus	1			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
9	HRO	8/21/2024 10:51	43	38	48.6		44.1	0.0	0.0	0.0	0.0	44.1	NA	
9	HR12-18	8/22/2024 10:29	79	79	5.0 U		4.5	2.1	1.2	-0.9	-0.9	5.4	-38.7	
9	HR46	8/23/2024 17:20	75	75	5.0 U		4.5	0.4	2.5	2.1	1.2	3.3	-2.1	
9	HR70	8/26/2024 16:51	85	85	6.0		5.4	0.4	2.4	2.0	3.2	2.2	-1.1	
9	HR185	8/29/2024 10:25	75	0	5.9		5.4	0.5	2.7	2.2	5.4	-0.1	-2.3	
10	HR0	8/21/2024 10:56	45	40	39.4		35.8	0.0	0.0	0.0	0.0	35.8	NA	
10	HR12-18	8/22/2024 10:45	75	75	5.0 U		4.5	1.8	1.3	-0.5	-0.5	5.0	-30.7	
10	HR46	8/23/2024 17:30	150	150	11.1		10.1	0.4	2.4	2.0	1.5	8.6	3.5	
10	HR70	8/26/2024 17:16	75	75	9.1		8.3	1.7	4.8	3.1	4.6	3.7	-4.9	
10	HR185	8/29/2024 10:31	75	0	7.8		7.1	0.7	2.4	1.7	6.3	0.8	-2.9	



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
								Тс	otal Phosp	horus				
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
11	HRO	8/21/2024 11:01	45	40	63.7		57.8	0.0	0.0	0.0	0.0	57.8	NA	
11	HR12-18	8/22/2024 10:58	75	75	5.0 U		4.5	2.9	1.3	-1.6	-1.6	6.1	-51.7	
11	HR46	8/23/2024 17:43	75	75	5.9		5.4	0.4	2.4	2.0	0.4	4.9	-1.2	
11	HR70	8/26/2024 17:26	75	75	6.9		6.2	0.4	2.4	1.9	2.4	3.9	-1.1	
11	HR185	8/29/2024 10:40	75	0	6.5		5.9	0.5	2.4	1.9	4.2	1.7	-2.2	
12	HR0	8/21/2024 11:06	45	40	188.8		171.4	0.0	0.0	0.0	0.0	171.4	NA	
12	HR12-18	8/22/2024 11:05	75	75	8.1		7.3	8.5	1.3	-7.2	-7.2	14.6	-156.8	
12	HR46	8/23/2024 17:55	75	75	14.5	J	13.2	0.6	2.4	1.8	-5.4	18.6	4.1	
12	HR70	8/26/2024 18:03	75	75	19.2		17.4	1.1	2.4	1.3	-4.1	21.5	2.9	
12	HR185	8/29/2024 10:55	150	0	20.5		18.7	1.4	2.4	0.9	-3.2	21.9	0.3	



	Table 2 (continued). Total Phosphorus Concentration and Mass of Overlying Core Water.													
								То	tal Phosp	horus				
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)	
13	HRO	8/21/2024 11:11	45	40	20.8		18.9	0.0	0.0	0.0	0.0	18.9	NA	
13	HR12-18	8/22/2024 11:15	75	75	5.0 U		4.5	0.9	1.3	0.3	0.3	4.2	-14.7	
13	HR46	8/23/2024 18:09	75	75	6.6		6.0	0.4	2.4	2.0	2.3	3.6	-0.6	
13	HR70	8/26/2024 18:14	75	75	8.9		8.1	0.5	2.4	1.9	4.2	3.9	0.3	
13	HR185	8/29/2024 11:02	75	0	8.9		8.0	0.7	2.4	1.7	5.9	2.1	-1.8	
14	HR0	8/21/2024 11:16	45	40	84.2		76.4	0.0	0.0	0.0	0.0	76.4	NA	
14	HR12-18	8/22/2024 11:33	75	75	9.5		8.6	3.8	1.3	-2.5	-2.5	11.2	-65.2	
14	HR46	8/23/2024 18:24	75	75	11.7		10.6	0.7	2.4	1.7	-0.8	11.5	0.3	
14	HR70	8/26/2024 18:22	75	75	11.3	J	10.3	0.9	2.4	1.5	0.7	9.6	-1.9	
14	HR185	8/29/2024 11:10	75	0	17.5		15.9	0.8	2.4	1.5	2.2	13.7	4.1	



		Table 2	(continu	ed). Tota	al Phosphorus	Conc	entrati	on and M	ass of O	verlying C	ore Water		
							1	Тс	otal Phosp	horus	1	1	
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (μg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
15	HRO	8/21/2024 11:21	45	40	76.8		69.7	0.0	0.0	0.0	0.0	69.7	NA
15	HR12-18	8/22/2024 12:01	85	85	10.2		9.3	3.5	1.3	-2.2	-2.2	11.5	-58.3
15	HR46	8/23/2024 18:38	75	75	9.4		8.6	0.9	2.7	1.8	-0.4	8.9	-2.6
15	HR70	8/26/2024 18:46	75	75	16.3		14.8	0.7	2.4	1.7	1.3	13.5	4.6
15	HR185	8/29/2024 11:11	75	0	24.6		22.4	1.2	2.4	1.2	2.5	19.9	6.4
16	HR0	8/21/2024 11:26	55	50	64.9		59.0	0.0	0.0	0.0	0.0	59.0	NA
16	HR12-18	8/22/2024 12:15	144	144	5.0 U		4.5	3.6	1.6	-2.0	-2.0	6.5	-52.4
16	HR46	8/23/2024 18:46	75	75	6.9		6.3	0.7	4.6	3.9	1.9	4.4	-2.1
16	HR70	8/26/2024 18:57	75	75	7.9		7.2	0.5	2.4	1.9	3.7	3.4	-1.0
16	HR185	8/29/2024 11:20	75	0	8.9		8.0	0.6	2.4	1.8	5.5	2.5	-0.9

^a Values immediately followed by "U" signify the measurement was under the TP detection limit of 5.0 μ g/L.

J – estimated R – rejected

mL – milliliters µg –micrograms µg/L –micrograms per liter



		т	able 3. C	Orthopho	osphate Conce	ntrati	on and	Mass of (Overlyin	g Core Wa	ater.		
								0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
1	HRO	8/21/2024 10:06	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
1	HR12-18	8/22/2024 9:15	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
1	HR46	8/23/2024 14:50	75	75	3.0 U		2.7	0.2	1.1	0.8	1.3	1.5	-0.8
1	HR70	8/26/2024 14:28	75	75	3.0 U		2.7	0.2	1.1	0.8	2.1	0.6	-0.8
1	HR185	8/29/2024 9:26	75	0	3.5		3.2	0.2	1.1	0.8	2.9	0.2	-0.4
2	HRO	8/21/2024 10:11	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
2	HR12-18	8/22/2024 9:22	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
2	HR46	8/23/2024 15:18	75	75	10.4		9.4	0.2	1.1	0.8	1.3	8.2	5.9
2	HR70	8/26/2024 14:59	75	75	21.8		19.8	0.8	1.1	0.3	1.5	18.3	10.1
2	HR185	8/29/2024 9:34	75	0	33.0		29.9	1.6	1.1	-0.6	1.0	29.0	10.7



		Table 3	(contin	ued). Ort	hophosphate	Conce	entratio	on and Ma	ass of Ov	verlying C	ore Water.		
								0	rthophos	ohate	-		
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
3	HRO	8/21/2024 10:16	45	40	3.6		3.3	0.0	0.0	0.0	0.0	3.3	NA
3	HR12-18	8/22/2024 9:28	70	70	5.7		5.2	0.2	0.6	0.4	0.4	4.8	1.5
3	HR46	8/23/2024 15:33	75	75	10.8		9.8	0.4	1.0	0.6	1.0	8.8	4.0
3	HR70	8/26/2024 15:15	150	150	13.2		11.9	0.8	1.1	0.2	1.2	10.7	1.9
3	HR185	8/29/2024 9:42	75	0	23.7	R	21.5	2.0	2.1	0.1	1.4	20.1	9.4
4	HRO	8/21/2024 10:21	45	40	3.2		2.9	0.0	0.0	0.0	0.0	2.9	NA
4	HR12-18	8/22/2024 9:33	75	75	12.3		11.1	0.1	0.6	0.4	0.4	10.7	7.8
4	HR46	8/23/2024 15:44	85	85	27.0		24.5	0.9	1.1	0.1	0.6	24.0	13.2
4	HR70	8/26/2024 15:41	75	75	32.0		29.0	2.3	1.2	-1.1	-0.5	29.6	5.6
4	HR185	8/29/2024 9:52	75	0	52.1		47.3	2.4	1.1	-1.3	-1.9	49.2	19.6



		Table 3	(contin	ued). Ort	hophosphate	Conce	entratio	on and Ma	ass of Ov	verlying C	ore Water.		
							-	0	rthophosp	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
5	HRO	8/21/2024 10:26	75	70	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
5	HR12-18	8/22/2024 9:36	75	75	3.0 U		2.7	0.2	1.0	0.8	0.8	2.0	-0.8
5	HR46	8/23/2024 16:16	75	75	3.0 U		2.7	0.2	1.1	0.8	1.6	1.1	-0.8
5	HR70	8/26/2024 15:53	75	75	3.0 U		2.7	0.2	1.1	0.8	2.4	0.3	-0.8
5	HR185	8/29/2024 9:58	75	0	7.4		6.8	0.2	1.1	0.8	3.3	3.5	3.2
6	HRO	8/21/2024 10:31	45	40	10.5		9.5	0.0	0.0	0.0	0.0	9.5	NA
6	HR12-18	8/22/2024 9:51	75	75	51.5		46.8	0.5	0.6	0.1	0.1	46.7	37.2
6	HR46	8/23/2024 16:30	75	75	185.2		168.1	3.9	1.1	-2.8	-2.7	170.9	124.2
6	HR70	8/26/2024 16:11	75	75	215.9		196.0	13.9	1.1	-12.8	-15.5	211.6	40.7
6	HR185	8/29/2024 10:00	75	0	491.4		446.2	16.2	1.1	-15.1	-30.7	476.9	265.3



		Table 3	(contin	ued). Ort	hophosphate	Conce	entratio	on and Ma	ss of Ov	verlying C	ore Water.		
								0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
7	HRO	8/21/2024 10:36	44	39	6.8		6.2	0.0	0.0	0.0	0.0	6.2	NA
7	HR12-18	8/22/2024 9:59	75	75	10.1		9.1	0.3	0.5	0.2	0.2	8.9	2.7
7	HR46	8/23/2024 16:45	75	75	41.1		37.3	0.8	1.1	0.3	0.6	36.8	27.9
7	HR70	8/26/2024 16:24	75	75	81.6		74.0	3.1	1.1	-2.0	-1.5	75.5	38.7
7	HR185	8/29/2024 10:15	75	0	180.4		163.8	6.1	1.1	-5.1	-6.5	170.3	94.8
8	HRO	8/21/2024 10:46	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
8	HR12-18	8/22/2024 10:11	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
8	HR46	8/23/2024 17:00	75	75	3.1		2.8	0.2	1.1	0.8	1.3	1.5	-0.8
8	HR70	8/26/2024 16:40	75	75	8.7		7.9	0.2	1.1	0.8	2.1	5.8	4.3
8	HR185	8/29/2024 10:20	75	0	67.8		61.6	0.6	1.1	0.4	2.5	59.1	53.3



	Table 3 (continued). Orthophosphate Concentration and Mass of Overlying Core Water.												
								0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
9	HRO	8/21/2024 10:51	43	38	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
9	HR12-18	8/22/2024 10:29	79	79	3.0 U		2.7	0.1	0.5	0.4	0.4	2.3	-0.4
9	HR46	8/23/2024 17:20	75	75	3.0 U		2.7	0.2	1.1	0.9	1.3	1.4	-0.9
9	HR70	8/26/2024 16:51	85	85	3.0 U		2.7	0.2	1.1	0.8	2.1	0.6	-0.8
9	HR185	8/29/2024 10:25	75	0	3.0 U		2.7	0.3	1.2	0.9	3.1	-0.3	-0.9
10	HRO	8/21/2024 10:56	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
10	HR12-18	8/22/2024 10:45	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
10	HR46	8/23/2024 17:30	150	150	3.0 U		2.7	0.2	1.1	0.8	1.3	1.5	-0.8
10	HR70	8/26/2024 17:16	75	75	3.0 U		2.7	0.5	2.1	1.7	2.9	-0.2	-1.7
10	HR185	8/29/2024 10:31	75	0	3.0 U		2.7	0.2	1.1	0.8	3.8	-1.0	-0.8



		Table 3	(contine	ued). Ort	hophosphate	Conce	entratio	on and Ma	iss of Ov	verlying Co	ore Water.		
							-	0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
11	HRO	8/21/2024 11:01	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
11	HR12-18	8/22/2024 10:58	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
11	HR46	8/23/2024 17:43	75	75	3.0 U		2.7	0.2	1.1	0.8	1.3	1.5	-0.8
11	HR70	8/26/2024 17:26	75	75	3.0 U		2.7	0.2	1.1	0.8	2.1	0.6	-0.8
11	HR185	8/29/2024 10:40	75	0	3.0 U		2.7	0.2	1.1	0.8	2.9	-0.2	-0.8
12	HRO	8/21/2024 11:06	45	40	133.8		121.5	0.0	0.0	0.0	0.0	121.5	NA
12	HR12-18	8/22/2024 11:05	75	75	3.0 U		2.7	6.0	0.6	-5.5	-5.5	8.2	-113.3
12	HR46	8/23/2024 17:55	75	75	3.0 U		2.7	0.2	1.1	0.8	-4.6	7.3	-0.8
12	HR70	8/26/2024 18:03	75	75	22.9		20.8	0.2	1.1	0.8	-3.8	24.6	17.2
12	HR185	8/29/2024 10:55	150	0	8.3		7.5	1.7	1.1	-0.7	-4.5	12.0	-12.6



		Table 3	(contin	ued). Ort	hophosphate	Conce	entratio	on and Ma	ass of Ov	verlying C	ore Water.		
								0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (µg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
13	HRO	8/21/2024 11:11	45	40	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
13	HR12-18	8/22/2024 11:15	75	75	3.0 U		2.7	0.1	0.6	0.4	0.4	2.3	-0.4
13	HR46	8/23/2024 18:09	75	75	3.0 U		2.7	0.2	1.1	0.8	1.3	1.5	-0.8
13	HR70	8/26/2024 18:14	75	75	3.0 U		2.7	0.2	1.1	0.8	2.1	0.6	-0.8
13	HR185	8/29/2024 11:02	75	0	3.0 U		2.7	0.2	1.1	0.8	2.9	-0.2	-0.8
14	HRO	8/21/2024 11:16	45	40	11.5		10.4	0.0	0.0	0.0	0.0	10.4	NA
14	HR12-18	8/22/2024 11:33	75	75	3.0 U		2.7	0.5	0.6	0.0	0.0	2.7	-7.7
14	HR46	8/23/2024 18:24	75	75	3.0 U		2.7	0.2	1.1	0.8	0.9	1.8	-0.8
14	HR70	8/26/2024 18:22	75	75	3.0 U		2.7	0.2	1.1	0.8	1.7	1.0	-0.8
14	HR185	8/29/2024 11:10	75	0	3.1		2.9	0.2	1.1	0.8	2.5	0.3	-0.7



		Table 3	(contin	ued). Ort	hophosphate	Conce	entratio	on and Ma	ss of Ov	verlying C	ore Water.		
								0	rthophos	ohate			
Core	Batch	Date/Time	Volume Pulled (mL)	Volume Added from Carboy (mL)	Concentration ^a (µg/L)	Flag	Mass (µg)	Mass Removed Before Sample (μg)	Mass Added Before Sample (µg)	Net Mass Added/ Removed (µg)	Cumulative Mass Added/ Removed (µg)	Corrected Mass (µg)	Change in Mass (µg)
15	HRO	8/21/2024 11:21	45	40	11.7		10.7	0.0	0.0	0.0	0.0	10.7	NA
15	HR12-18	8/22/2024 12:01	85	85	3.0 U		2.7	0.5	0.6	0.0	0.0	2.7	-8.0
15	HR46	8/23/2024 18:38	75	75	3.0 U		2.7	0.3	1.2	0.9	1.0	1.7	-0.9
15	HR70	8/26/2024 18:46	75	75	3.0 U		2.7	0.2	1.1	0.8	1.8	0.9	-0.8
15	HR185	8/29/2024 11:11	75	0	6.7		6.1	0.2	1.1	0.8	2.6	3.4	2.5
16	HRO	8/21/2024 11:26	55	50	3.0 U		2.7	0.0	0.0	0.0	0.0	2.7	NA
16	HR12-18	8/22/2024 12:15	144	144	3.0 U		2.7	0.2	0.7	0.5	0.5	2.2	-0.5
16	HR46	8/23/2024 18:46	75	75	3.0 U		2.7	0.4	2.0	1.6	2.1	0.6	-1.6
16	HR70	8/26/2024 18:57	75	75	3.0 U		2.7	0.2	1.1	0.8	3.0	-0.2	-0.8
16	HR185	8/29/2024 11:20	75	0	3.0 U		2.7	0.2	1.1	0.8	3.8	-1.1	-0.8

^a Values immediately followed by "U" signify the measurement was under the orthophosphate detection limit of 3.0 µg/L.

J – estimated R – rejected

mL – milliliters µg –micrograms µg/L –micrograms per liter



4.4. Phosphorus Flux Rate

Phosphorus flux rate refers to the rate at which phosphorus (the mass of phosphorus) is released from the sediments into the overlying water, per a specific unit of time. Phosphorus flux rates can give us an indication of the lake's internal loading.

The mass of TP and orthophosphate in the overlying core water was calculated by taking the phosphorus concentration in the core water ($C_{i,j} * V_{i,j}$) at a specific sampling event, adding the concentration of phosphorus in the water removed at the previous sampling event (*VolumeRemoved*_{*i*-1,*j*} * $C_{i-1,j}$), and subtracting the concentration of phosphorus in the water replaced at the same previous sampling event (*VolumeReplaced*_{*i*-1,*j*} * C_{carboy}). The equation used is listed below:

 $Mass_{i,j} = C_{i,j} * V_{i,j} - (VolumeReplaced_{i-1,j} * C_{carboy}) + (VolumeRemoved_{i-1,j} * C_{i-1,j})$

Where

- *i* is the time step, and *j* is the core
- *C* is the concentration of phosphorus (TP or orthophosphate)
- V is the volume of the core's overlying water
- VolumeRemoved is the volume of overlying water removed from the core
- VolumeReplaced is the volume of water used to replace the overlying core water removed
- carboy is filtered lake water used to replace the overlying core water

A comparison of the mass of TP and orthophosphate concentrations between the study groups is shown in Figure 3. Duplicate cores within a study group are represented by red and blue lines labeled with core numbers. The dashed line represents the time alum was added to the cores receiving alum treatment. Conditions prior to treatment are to the left of the dashed line and conditions post-treatment are to the right of the dashed line.



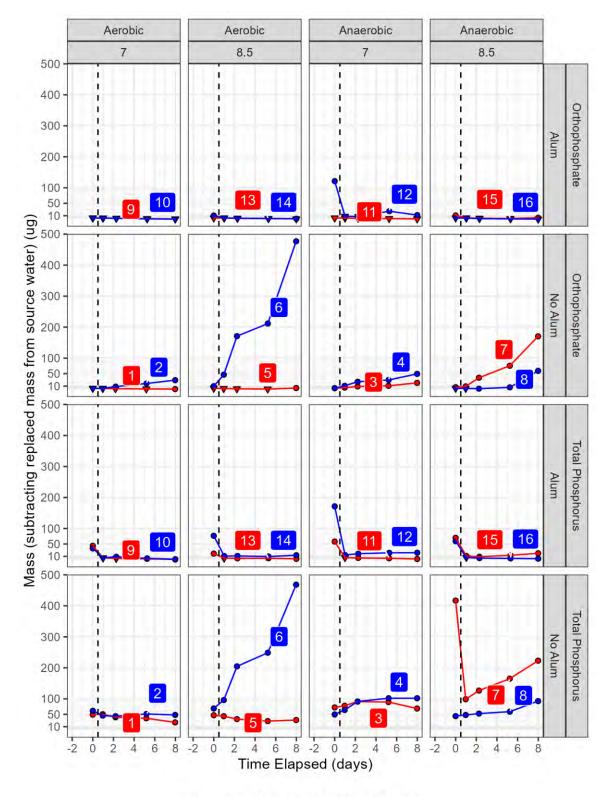


Figure 3. Mass of Orthophosphate and Total Phosphorus Over Time.

nonDetectFlag ○ FALSE ⊽ TRUE



The flux rate of the alum dosed cores was calculated using a linear regression slope, beginning at the HR 12-18 sampling event and ending at the HR 185 sampling event (the last sampling event). The flux rate of the cores that did not receive alum was calculated using a linear regression slope, beginning at the HR 0 sampling event and ending at the HR 185 sampling event.

Total phosphorus and orthophosphate flux rates are shown in Table 4. Negative flux rates under aerobic and neutral pH conditions are likely indicative of the settling rate of phosphorus (-0.18 to -0.87 mg/m²/day). As mentioned previously, the following samples collected at these specific time steps were not used in the flux rate calculations:

• Core 7 at HR 0 (outlier; total TP concentration differed substantially from the rest of the cores at HR 0)

	Table 4. Total Phosphorus and Orthophosphate Flux Rates.												
				TP Flux Rat	e	Orthophosphat	te Flux Rate						
Core	Oxygen Condition	pH Condition	Alum Treated	(mg/m²/day) (regression slope)	Regression p-value	(mg/m²/day) (regression slope)	Regression p-value						
1	Aerobic	7	No Alum	-0.87	0.007	-0.09	0.007						
2	Aerobic	7	No Alum	-0.18	0.603	0.95	0.001						
3	Anaerobic	7	No Alum	0.90	0.195	0.39	0.057						
4	Anaerobic	7	No Alum	1.73	0.057	1.46	0.005						
5	Aerobic	8.5	No Alum	-0.57	0.075	0.02	0.821						
6	Aerobic	8.5	No Alum	12.93	0.006	14.93	0.008						
7	Anaerobic	8.5	No Alum	4.70	0.006	6.04	0.023						
8	Anaerobic	8.5	No Alum	1.52	0.021	1.74	0.084						
9	Aerobic	7	Alum	-0.20	0.027	-0.10	0.012						
10	Aerobic	7	Alum	-0.23	0.194	-0.13	0.011						
11	Anaerobic	7	Alum	-0.16	0.014	-0.09	0.012						
12	Anaerobic	7	Alum	0.27	0.103	0.33	0.534						

• Core 3 at HR 185 (removed due to oxygenation of sample, according to YSI)

mg/m²/day -milligrams per square meter per day





	Table 4 (continued). Total Phosphorus and Orthophosphate Flux Rates.												
				TP Flux Rat	e	Orthophospha	te Flux Rate						
Core	Oxygen Condition	pH Condition	Alum Treated	(mg/m²/day) (regression slope)	Regression p-value	(mg/m ² /day) (regression slope)	Regression p-value						
13	Aerobic	8.5	Alum	-0.07	0.156	-0.09	0.012						
14	Aerobic	8.5	Alum	0.07	0.531	-0.09	0.016						
15	Anaerobic	8.5	Alum	0.37	0.104	0.02	0.755						
16	Anaerobic	8.5	Alum	-0.14	0.069	-0.12	0.054						

mg/m²/day –milligrams per square meter per day



5. Conclusions and Recommendations

The results agree with the long-standing understanding that oxygen and pH have an impact on total phosphorus and orthophosphate release from sediments in lakes. In the Lake Campbell sediment incubation study, phosphorus concentrations and flux rates generally increased under anaerobic conditions and were further elevated in anaerobic conditions with a higher pH (pH 8.5).

The alum treatment substantially decreased TP and orthophosphate concentration and flux rate. The TP concentration in most cores and the orthophosphate concentration in all cores were below the detection limit in the first sample after the addition of alum (HR 12-18) and remained low through the end of the study. Sodium aluminate was used in alum dosed cores as a pH buffer; however, the treated groups still experienced a decrease in pH, with more impact on the high pH group. If Lake Campbell is treated with alum as the prescribed chemical, the use of a buffer is necessary, and pH should be monitored continuously to avoid ecologically impactful declines in pH.

The aluminum dosage was 13 percent lower than initially planned at 15.7 g/m² rather than 18.0 g/m² due to lower aluminum concentrations in the sodium aluminate than assumed. This slightly lower dose was still effective as inactivating phosphorus release from the sediments. However, the variation in aluminum concentrations between batches of alum and aluminate stresses the importance of measuring the aluminum concentration prior to the alum treatment in order to appropriately adjust the dosage to achieve the desired areal application.

A literature review, below (Table 5), compares the release rate with similar experiments, including the Entranco (1987) study. The 2024 LCMP estimated the internal loading to be at least 208 kg per year on average. The LCMP estimate was based on the accumulated mass during the summer (June to September) for the years 2017, 2018, 2019, and 2021 from Samish Indian Nation monitoring data. Assuming that sediment release is occurring primarily in the summer growing period (May to October, 184 days), the sediment release rate would be 0.75 mg/m²/day.

During the summer, we expect the sediment of Lake Campbell to be exposed to elevated pH and low oxygen levels. Because the lake is shallow and has a large fetch, it is expected to undergo wind-induced mixing such that the oxygen levels at the sediment-water interface may increase during those events. This sediment incubation study captured and compared Lake Campbell's dynamic summer conditions (aerobic, anaerobic, and neutral and high pH). In these cores, the phosphorus flux rate ranged from 0.9 to 12.9 mg/m²/day. These data suggest that the total phosphorus mass released from the sediments in Lake Campbell may greatly exceed the minimum estimate of 208 kg per year. In agreement with the LCMP, this study confirms that there is substantial release of phosphorus from the sediments during the summer and likely throughout the year during low oxygen and/or elevated pH conditions.

This sediment incubation study confirms that the internal release rate is a major source of phosphorus to Lake Campbell and that alum would be an effective strategy to reduce the sediment release rate, the lake water phosphorus concentration, and, ultimately, the algae biomass in the lake.



		Tabl	e 5. Compariso	n of Release	Rates as Affe	cted by Alum).	
				Incubation	Conditions			
Lake (Source)	Year	Incubation Length	Temperature (°C)	рН	Oxygen	Alum areal dose (Al g/m²)	TP release rate (P mg/m²/day)	Orthophosphate release rate (P mg/m²/day)
				NA	Aerobic	0	low, but detectable	
Spring Lake, MI (Steinman 2004)	2003	20 days	15.3-23.6	NA	Aerobic	6.6	virtually undetectable	unreported, suspected
(Steinman 2004)				NA	Anaerobic	0	1.6-29.5	interference
				NA	Anaerobic	6.6	virtually undetectable	
					Ν	lorth Site		
				6.9-7.5	Aerobic	0	NA	0.67
			18-22	9-10	Aerobic	0	NA	3.71
				9-10	Aerobic	0.42	NA	2.90
						Mid Site		
	1985 Exp I	~1 month		6.9-7.5	Aerobic	0	NA	0.31
	1909 Exp 1	a month	18-22	9-10	Aerobic	0	NA	2.85
Lake Erie, WA				9-10	Aerobic	0.42	NA	2.35
(Entranco 1987)					S	outh Site		
				6.9-7.5	Aerobic	0	NA	0.05
			18-22	9-10	Aerobic	0	NA	1.35
				9-10	Aerobic	0.42	NA	1.08
					Ν	lorth Site		
	1985 Exp II	~1 month		7.3-7.6	Aerobic	0	NA	2.32
	1903 LAP II		18-22	9-10	Aerobic	0	NA	16.26
				9-10	Aerobic	17.7	NA	0.63

°C – degrees Celsius Al – aluminum P – phosphorus

g/m² – gram per square meter mg/m²/day –milligrams per square meter per day



		Table 5 (co	ontinued). Co	mparison	of Release	Rates as Affe	ected by Alum.	
				Incubation	Conditions			
Lake (Source)	Year	Incubation Length	Temperature (°C)	рН	Oxygen	Alum areal dose (Al g/m²)	TP release rate (P mg/m²/day)	Orthophosphate release rate (P mg/m²/day)
						East Sit	e	
				6.9-7.8	Aerobic	0	NA	0.01
			18-22	9-10	Aerobic	0	NA	1.28
				9-10	Aerobic	0.42	NA	1.31
					L	Mid Site	e	
				6.9-7.8	Aerobic	0	NA	0.19
	1985 Exp I	~1 month	18-22	9-10	Aerobic	0	NA	2.89
Lake Campbell, WA				9-10	Aerobic	0.42	NA	3.41
(Entranco 1987)						West Sit	te	
				6.9-7.8	Aerobic	0	NA	0.04
			18-22	9-10	Aerobic	0	NA	1.15
				9-10	Aerobic	0.42	NA	1.31
					1	Mid Site	e	
				7.4-7.9	Aerobic	0	NA	1.73
	1985 Exp II	~1 month	18-22	9-10	Aerobic	0	NA	4.70
				9-10	Aerobic	17.7	NA	-0.01

°C – degrees Celsius Al – aluminum P – phosphorus

 g/m^2 – gram per square meter $mg/m^2/day$ –milligrams per square meter per day



		Table 5 (co	ontinued). Co	mparison	of Release	Rates as Af	fected by Alum.			
				Incubation Conditions						
Lake (Source)	Year Incubation Length Temperature (°C)		рН	Oxygen	Alum areal dose (Al g/m²)	TP release rate (P mg/m²/day)	Orthophosphate release rate (P mg/m²/day)			
				7.0	Aerobic	0	-0.87 to -0.18	-0.09 to 0.95		
				8.5	Aerobic	0	-0.57 to 12.93	0.02 to 14.93		
				7.0	Anaerobic	0	0.90 to 1.73	0.39 to 1.46		
Lake Campbell, WA	2024	105 h a	19-21	8.5	Anaerobic	0	1.52 to 4.70	1.74 to 6.04		
(this study)	2024	4 185 hours	2024 185 hours	24 165 Hours	19-21	7.0	Aerobic	15.7	-0.23 to -0.20	- 0.13 to -0.10
						8.5	Aerobic	15.7	-0.07 to 0.07	-0.09
						7.0	Anaerobic	15.7	-0.16 to 0.27	-0.09 to 0.33
				8.5	Anaerobic	15.7	-0.14 to 0.37	-0.12 to 0.02		

°C – degrees Celsius Al – aluminum P – phosphorus

g/m² – gram per square meter mg/m²/day –milligrams per square meter per day



6. References

Entranco, 1987. Erie and Campbell Lakes Final Report, Restoration, Implementation and Evaluation. Entranco Engineers. Kirkland, Washington.

Herrera. 2023. Quality Assurance Project Plan, Lake Campbell Cyanobacteria Management Plan. Prepared for Skagit County by Herrera Environmental Consultants, Inc., Seattle, Washington. September 8, 2023.

Herrera. 2024. Lake Cyanobacteria Management Plan. Prepared for Skagit County by Herrera Environmental Consultants, Inc., Seattle, Washington. June 28, 2024.

Steinman, A., R. Rediske, and K. R. Reddy. 2004. The reduction of internal phosphorus loading using alum in Spring Lake, Michigan. Journal of Environmental Quality 33:2040-2048.



Appendices



Appendix A

Field and Incubation Forms



Date	Time	Site	Temp (°C)	DO %	DO mg/L	SPC-µS/cm	рН	DEP m
8/19/2024	10:02:01 AM	lake campbell	22.168	168.5	14.68	259.3	9.41	0.046
8/19/2024	10:07:44 AM	lake campbell	21.909	166.9	14.61	258.8	9.41	0.498
8/19/2024	10:09:17 AM	lake campbell	21.557	150.4	13.25	259.1	9.33	0.999
8/19/2024	10:12:43 AM	lake campbell	21.441	140.5	12.41	259.4	9.23	1.499
8/19/2024	10:14:30 AM	lake campbell	21.286	131.8	11.68	259.8	9.15	1.999
8/19/2024	10:17:01 AM	lake campbell	21.229	127.8	11.33	259.9	9.15	2.502
8/19/2024	10:18:40 AM	lake campbell	21.19	123.2	10.94	260.2	9.14	2.999
8/19/2024	10:20:30 AM	lake campbell	21.18	122.4	10.87	260.2	9.14	3.504
8/19/2024	10:25:49 AM	lake campbell	21.111	112.7	10.02	261	9.17	3.997
8/19/2024	10:28:58 AM	lake campbell	20.575	64.4	5.78	266.3	8.64	4.508
8/19/2024	10:30:32 AM	lake campbell	20.484	56.4	5.08	267.2	8.51	5
8/19/2024	10:32:24 AM	lake campbell	21.988	161.7	14.13	259.2	9.47	0.048

YSI_EXO1_Calibration_blank

\$11/24

Calibration Date		5/19/24		Time	(e:25	- 4	· .ð	Me	1
Sonde Serial Numb	er	1711 100	67		<u>de</u> lo	. (10mg	0	đ
		- What	10:1	1				V	
Technician									
Barometer @ KBLI	(inches/Hg)		30.08		Time	(e:35			``
Corrected Baromet	ter (mm Hg, se	ee notes)	75	4.2			1 Ohe	w/2021	ov.
Barometer on EXO	handheld (mr	mHg)	75	3.00	754	2	L 81	20/2020	AST !!
(If off m	nore than 2.5	mmHg, see Joan or	Mike).					-pretta	0
EXO 1 Battery volta	age	25 V	_	- 10	If < 2.3 VDC	, replace (2 [O cells)		
Dissolved Oxygen	(ODO)	% Saturation							
Initial Temp (°C)	22.41	Initial DO (m	ng/l)	8.57	-	Initial DC) (% sat)	98.8	-
Post Temp (°C)	22.4	Post DO (mg	/I)	8.60)	Post DO	(% sat)	99.	2
ODO Gain (12384								
ODO gain's nominal	value is 1, accu	rate calibration will or	nly sligh	nly deviate fro	om 1.				
Specific Conductar	nce								
Cal standard uS/cn	100c)		Temp	24.4	19			
Initial read uS/cm	977								
Post Cal uS/cm	1001			Temp	245	-	_		
Cond. cell constant	1 5.19	08							
An ideal cell constan	nt is 5.1 +/- 10%	, 4.59 to 5.61							
рН									
Buffer	Temp (°C)	Corrected pH buffer		Initial pH	Initial mV	Post pH	Post mV		
	4D	245		402	153.9	4.00	l	1	
4	7.0	24.6		9.04	-23.7	7.01	-	1	
7	12 00					12 07			
10	10.00	29.6		10.06	203,6	10.00	1		
pH 4 - 7 delta slop pH 7-10 delta slop mv/decade is the s	e	7 7.	e.	mv/decade mv/decade		59.2	3	2	

Notes on barometer readings:

For KBLI barometer, go to http://www.weather.gov, type in KBLI. Note indicated barometer and time. Convert to mm Hg: KBLI barometer(inches Hg) x 25.4 = mm Hg

Correct to ES building elvation: 3rd floor: subtract 9.1 from mmHg, 5th floor subract 9.8 from mm Hg.

Notes:

2024 LAKE CAMPBELL PHASE II SEDIMENT INCUBATION STUDY FIELD DATA SHEET

Field Equipment Checklist

YSI EXO meter
2 lines of rope, in length to extend to lake bottom, plus 10 feet in excess
5 small bags of ice
Flathead screwdriver
Core end caps (32)
svringe
Notepad/pencil/pen

Van Dorn

- Yan born / Reminerer
 20 L carboy
 Peristaltic pump + high capacity
 0.45 µm filter
 Large black garbage bags (4)
 Cores (16)
 60 ml sample bottle for TP
 Labeling tape
 Permanent marker
- Hammer corer
 Anchor
 5 gal buckets (4)
 Duct tape
 Nitrile gloves
 Core plugs (16)
 10 ml sample vial for SRP
 Mini cooler for TP/SRP
 bucy flored for 2000

Project: Lake Campbell Phase II Sediment Incubation Study Project No.: 24-08365-000

Client Name: Skagit County

Weather: Sunny, clim, 62°F/16.67°C	_
Wind (still, windy, choppy):	
Observations: pern algae in water	

Field Personnel: Claudia Basso Rob Zisette Conmen Archambauft

8/19/24

CAM-DEEP (at deepest point south of island) Collection date:	Start time:	9: So am	
Depth to bottom (m): 5.5 m	End time:	15:00	(3:00 pm
Water color:	_		
Notes:			

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

Profile Readings:

Depth (m)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)	рН
0.5	21.89	14.50	166.2	9.42
1.0	21.55	13.23	150.0	4.33
1.5	द्धार्थी- पप 21.54	12.75	144.7	4.25
2.0	21.27	11.62	[3].]	9.15
2.5	21.23	11.29	127.4	1.15
3.0	21.19	10.93	123.2	9.13
3.5	21.18	10.17	122.4	9.14
4.0	21.10	10.04	113.1	9.17
4.5	20.58	5.77	63.9	8.63
5.0	20.48	5.08	56.3	8.5

Notes: surface 0.04 7 22.15°C 10:02an DO 109/11/14.64 mg/L DO 7. 167.5 pH 9.42

QC surface post reading 5:0.05 10:33 an T 21.98 °C DO 14.2 my/L DO 7. 162.5 pH 9.47

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

Water Quality Samples Collected* :

Fill in the Sample IDs and depths below. Check the box (X) for each sample bottle filled.

Sample ID (sample site-date)	Sample Time	Sample Depth (m)	TP* (60 mL HDPE) Collect at least 20 mL	SRP */** (10 mL HDPE) Do not collect past 10 mL line
CAM-DEEP-08192024	10:53a	×4.5	×	×

*All water quality samples must be kept on ice or refrigerated until delivered to lab.

**Soluble reactive phosphate samples must be field filtered into bottles using syringes.

Notes: Both TP and SRP samples were filtered (they were subsamples from the 20 L carboy of filtered water.

Label sample bottles with the following:

- Sample ID (sample site-date)
- Date of collection
- Time of collection
- Analytical parameters
- Initials of personnel and client

filterny canboy water 10; 22 001/11/24 start time sample depth 15ft from surface (2 4.5m)

Sediment Cores Collected* :

Sample ID (core #)	Time Collected	Comments
1	14:02	sediment very soft / odorous, no
2	11:40am	sediment very soft / odorous, no hammening needed
3	11: SYAM	J
4	11:59 au	
5	12:10 pm	
6	17:20 pm	
7	12:24 pm	
8	14:01	
9	14:13	
10	14:18	
11 -	14:25	
12	14:30	
13	14:37	
14	14:44	
15	14:50	
16	15:00	V

*All sediment cores must be kept on ice until delivered to lab.

- Label cores with the Sample ID (core #). - stacking to cathen US. 437482, -122.616677. - Moving SAL NW for each core 2-7 - for 8-16, 1t storted SOH west from starting pt. Moving 3ft W for each core. - * I recollected due to sedement feel out while adjusty 12. - seeche depth 11: 21 am 23.5 inclus
- the core sample times were written on waterproof notepad (attached) and transcribed to table above.

4

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

2.9 ave 14:02 3:14:37 14:44 11:40 14:50 5 11:59 16:15:00 12:10 2:20 6 2:24 14:09 8 14:13 9 14:18 0 14:25 2 14:30 11:21 Seech - 23:12 in dre at Rite in the Rain

ISK	
plean	
profile	
readings	

YSI logged puble reading	Shir									icyd hu
Date Time Site °C	-17L101532 mmH	Ig-17M100762 DO %	-17L103032 DO mg/	1-17L103032 SPC-µS	°C-17L101532 mmHg-17M100762 DO %-17L103032 DO mg/L-17L103032 SPC-µS/cm-17L101532 pH-17M100773	7M100773	pH mV-17M100773 DEP m-17L103993 Vpos m-17L103993 Batt V-17M100762	-17L103993 Vp	os m-17L103993 B	att V-17M100762
8/19/2024 10:02:01 AM lake campb	22,168	762.2	168,5	14.68	259.3	9.41	-164.4	0.046	0.046	2.47
8/19/2024 10:07:44 AM lake campb	21.909	762.2	166.9	14.61	258.8	9.41	-164.8	0.498	0.501	2.45
8/19/2024 10:09:17 AM lake campb	21.557	762.1	150.4	13.25	259.1	9.33	-159.4	0.999	1	2.46
8/19/2024 10:12:43 AM lake campb	21.441	762.1	140.5	12.41	259.4	9.23	-153.8	1.499	1.503	2.43
8/19/2024 10:14:30 AM lake campb	21.286	762.1	131.8	11.68	259,8	9.15	-149.2	1.999	1.999	2.44
8/19/2024 10:17:01 AM lake campb	21.229	762.1	127.8	11.33	259.9	9.15	-149	2.502	2.502	2.45
8/19/2024 10:18:40 AM lake campb	21.19	762.1	123.2	10.94	260.2	9.14	-148.2	2.999	2.999	2.44
8/19/2024 10:20:30 AM lake campb	21.18	762.1	122.4	10.87	260.2	9.14	-148.1	3.504	3.503	2.43
8/19/2024 10:25:49 AM lake campb	21.111	762.1	112.7	10.02	261	9.17	-150.2	3.997	3.995	2.42
8/19/2024 10:28:58 AM lake campb	20.575	762.1	64.4	5.78	266.3	8.64	-118.9	4.508	4.511	2.43
8/19/2024 10:30:32 AM lake campb	20.484	762	56.4	5.08	267.2	8.51	-111.5	c5	4.999	2.43
8/19/2024 10:32:24 AM lake campt	21.988	762	161.7	14.13	259.2	9.47	-167.8	0.048	0.049	2.42

Project Number/Name:	Lake Camp	obell Sedime	Lake Campbell Sediment Incubation Phase II	Calibration Procedures:	
Personnel Performing Calibration.	CLOND	Claudia Basso	CVS.	Rinse Probe Between Each Operation	
pH Meter: Date/Time:	SU XIX	Sur a	Then mo Second the Open Shar A214 So XIS 241 8/19/24 S:15pm	Rinse with deionized water, then with the solution to be used for calibrating or testing. Use KimWipes [®] to carefully dab/dry water from probe.	HERRERA
PRE-Event Calibration	Meter Reading	Buffer / Cal Std	Comments	pH Calibration Notes:	
	7.00	7		1. Perform 3-point callbration, starting with pH 7 buffer, followed by 10 and 4 buffers.	4 buffers.
Н	0.4.0/	10		2. Follow calibration instructions in the instrument's user manual.	
	NA	4	NA		
POST-Event Calibration Check	Meter Reading	Buffer / Cal Std	Comments		
	NA	7	NA		
Н	10.03	10			
	NA	4	NA		

POST-Event Calibration Check Readin	Network Country of the second	Claudic Basso Itermolicentific Orionslerd 8/21/24 9:Steauc Meter Buffer/ Comm Reading Calstd Comm 10.00 10 10.00 10 NA 4 NA 10 NA 10	Clauder, Basso AleumoRcoulder Basso AleumoRcoulder Baffer/ Reading Calstd Comments NA NA	Calibration Procedures: Rinse Probe Between Each Operation Rinse with deionized water, then with the solution to be used for calibrating or testing. Use KimWipes® to carefully dab/dry water from probe. Photoe. Photoe Photoe Photoe
N	AN	4		

Project Number/Name:	Lake Campt	sell Sediment	Lake Campbell Sediment Incubation Phase II	Calibration Procedures:	
Personnel Performing Calibration:	Claudin	in Danc	Or	Rinse Probe Between Each Operation	
pH Meter: SW`; ۲۱۶ Z५) Date/Time:	HermoScu BIZZ/24	HermoSceenthe Orch Star BIZZZY 9:10 ann	anstar Aziy	the solution to be used for to carefully dab/dry water from	
					I IEANEAN
PRE-Event Calibration	Meter Reading	Buffer / Cal Std	Comments	pH Calibration Notes:	
	6.99	7		1. Perform 3-point calibration, starting with pH 7 buffer, followed by 10 and 4 buffers.	4 buffers.
рн	!	10		2. Follow calibration instructions in the instrument's user manual.	
	NA	4			
POST-Event Calibration Check	Meter Reading	Buffer / Cal Std	Comments		
	6.99	7			
Hd	1	10			
	AN	4			

[HERRERA		and 4 buffers.						
pH Meter Calibration Log	Calibration Procedures:	Rinse Probe Between Each Operation	-	calibrating or testing. Use KimWipes [®] to carefully dab/dry water from probe.	pH Calibration Notes:	1. Perform 3-point calibration, starting with pH 7 buffer, followed by 10 and 4 buffers.	2. Follow calibration instructions in the instrument's user manual.					
pH Met	Lake Campbell Sediment Incubation Phase II	1280	dervis Scienton Over Stard 214	2:43 pur	Comments				Comments			
	ell Sedimer	Claudie Oasso	creed	2	Buffer / Cal Std	7	10	4	Buffer / Cal Std	7	10	4
	Lake Campbo	Clau	ther wo S	8123 24	Meter Reading	0.2.2	0.0, 01	NA	Meter Reading	2.20	\	NA NA
	Project Number/Name:	Personnel Performing Calibration:	PH Meter: SN : X 18 241	Date/Time:	PRE-Event Calibration		Н		POST-Event Calibration Check		Н	

			2	HEDDEDA	IJEKKENA	-	and 4 buffers.						
pH Meter Calibration Log	Calibration Procedures:	Rinse Probe Between Each Operation	Rinse with deionized water, then with the solution to be used for	calibrating or testing. Use kimwipes [®] to carefully dab/dry water from probe.		pH Calibration Notes:	1. Perform 3-point calibration, starting with pH 7 buffer, followed by 10 and 4 buffers.	2. Follow calibration instructions in the instrument's user manual.					
pH Mete	Lake Campbell Sediment Incubation Phase II	and	dunioScientlee Own Star A 214	2:16pm		Comments	re-calibrated to 7.00 pH			Comments			
	oell Sedime	Vandi Barr	echbre			Buffer / Cal Std	- 7	10	4	Buffer / Cal Std	2	10	4
	Lake Campt	Jane	uniosce	h2/h2/8		Meter Reading	200% Male	10.00	NA	Meter Reading	6.99	١	NA
	Project Number/Name:	Personnel Performing Calibration:	1281 × 18241	Date/Time:		PRE-Event Calibration	Walt	Hd		POST-Event Calibration Check		НЧ	

			YSI MET	YSI METER CALIBRATION LOG
project Number/Name:	Lake Campb	sell Sedimer	Lake Campbell Sediment Incubation Phase II	Calibration Procedures:
Personnel Performing Calibration:	Clauden		Barro	Rinse Multimeter Sonde Between Each Operation
Meter:	YSI Pro Plus			Bines with deionized water then with the solution to be used for
Date/Time:	8/24/24	4 1:00	nota	calibrating or testing.
PRE-Event Calibration	Meter Reading	Buffer / Cal Std	Comments	pH Callbration Notes:
	NA	7		1. Perform 3-point calibration, starting with pH 7 buffer, followed by 10 and 4 buffers.
Hd	NA NA	10		 Fill calibration cup to bottom line with each pH buffer, ensure all sensors are submerged, wait until meter indicates that it has stabilized, hit "Calibrate/OK".
	AN	4		Conductivity Calibration Notes:
Conductivity (µS/cm)	NA	0		1. Dry the conductivity probe with a lab tissue (e.g., KimWipes®) and calibrate @ 0 μ S.
Conductivity (µS/cm)	NA	1,413		2. Fill the calibration cup to bottom line with 1,413 µS standard and ensure that the temperature/conductivity probes are completely submerged. Unexpectedly low pre-calibration readings may be a result of an incompletely submerged probe.
DO % Saturation	LOW	100		3. Make sure there are no bubbles in the conductivity sensor.
				4. Enter the appropriate standard value (1,413 µS/cm) for Sp Cond. and calibrate once meter indicates that it has stabilized.
POST-Event Calibration Check	Meter Reading	Buffer / Cal Std	Comments	Dissolved Oxygen Calibration Notes:
	NA	7		1. Fill calibration cup with \sim 1/2 inch of water; it should be below the DO sensor cap.
Н	AM	10		2. Use KimWipes [®] to carefully dab/dry water from the sensor cap.
	NN	4		3. Invert sonde and gently rest it on the storage cup without screwing shut the cup.
Conductivity (µS/cm)	AN	1,413		4. Wait for the meter to stabilize; when it indicates it has stabilized, hit "Calibrate/OK".
DO % Saturation	1:001	100		5. To retain calibration accuracy between measurements, keep a small amount of water in the storage cup between sample sites.

i h

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T

			HERRERA		and 4 buffers.							
pH Meter Calibration Log	Calibration Procedures:	Rinse Probe Between Each Operation	Rinse with deionized water, then with the solution to be used for calibrating or testing. Use KimWipes [®] to carefully dab/dry water from probe.	pH Calibration Notes:	1. Perform 3-point calibration, starting with pH 7 buffer, followed by 10 and 4 buffers.	2. Follow calibration instructions in the instrument's user manual.						
pH Met	Lake Campbell Sediment Incubation Phase II	occo	Juence Eccentric Onin Ezan AZI4 8/29/24 9:14 am	Comments				Comments				
	ell Sedimen	le C	Ali Onin B	Buffer / Cal Std	7	10	4	Buffer / Cal Std	7	10	4	
	Lake Campb	Claude	Auc Suer 8/29/24	Meter Reading	202	00.01	M	Meter Reading	7.02	1	NA	
	Project Number/Name:	Personnel Performing Calibration:	<u>PH Meter:</u> Date/Time:	PRE-Event Calibration		НЧ		POST-Event Calibration Check		Н		

 Project
 Lake Campbell Phase II Sediment Incubation Study
 Project No:
 24-08365-000

 Client:
 Skagit County
 Lab Personnel:
 Client:

CORE 9 __ AEROBIC and pH 7 and NO ALUM (NOALUM) HIGH CO2 / AIR

ALLIM (NO ALLIM)

ALUM (NO M				unal/L	-			
Hour	Date	Time	Temp (°C)	D.O. -(%)	D.O. (mg/L)	pН	Observations	DUPE?
PRIOR TO BUBBLE START	8/19/2 8/23/24		19.6 198	287.Z	839	8.95	NO SAMPLE COLLECTED	N
0	8/21/24	13:30	19.4	299.8	2993		10+30 *	N
(1)R-17) 12-18	8/24/24	9:15 AM	19.4	322.60	1		SPP: TP 10+60 ml+5 wrepland	N
1R4648			19.5	328.0	_	7.10	10 + 60 m/ +5 preplud	N
nc 70 72	9/24/2	12:41	19.5	321.7	-	7.05	15+00	N
85 168	8/29/24	4:24a	19.5	318.0	-	7.01	15+60 -	N

Alum Dose: _____ uL (goal: 508.1) cb 8/21/24

Sodium Aluminate. _____ uL (goal 250 uL) 8/21/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

or actual vol. pulled was 45 mL due to noticed later that

tube attached to syringe pulls out an extra SmL. Only 40 nel was replaced

Hour	Date	Time	Temp (°C)	D.O. (%)	umoff t	pН	Observations	DUPE?
PRIOR TO	8/ 19/24	5:34 pm	21-3	-	334.2	8.9/	NO SAMPLE COLLECTED	placed N
0	8/21/24	09:22	19.6	-	320-5 2349 058212124	7.11	10+30 *	N
17 12-18	8/22/24	04:22	19.4	372.3 -	7	7.12	10 + 60 mis uplan	I/ N
46 48	8/23/24		19.5	324.7	324.7	7.04	15 + mbe + 60 PIJO	N
10 72		4 2,591	19,5	-	327.9	7.01	15×60	N
85 188	8/29/24	-	19.5	1	323,7	7-01	15760 -	- N
Num Dose: odium Alumina 24 Lake Campbe X a c Mal	te 1 Il Phase II Se Vol pulle	diment Incub) uL) 9/21 pation Stud	ly-Incubation	n Data Sheet S <i>va</i> L ии	7.11	that	

Project Lake Campbell Phase II Sediment Incubation Study Project No :: 24-08365-000 Client: Skagit County Lab Personnel: Claude -Basso

CORE 3 - ANAEROBIC and pH 7 and NO ALUM HIGH CO2 / N2 NO ALLIM

high CO2 / N NO ALUM	2					29/19/24		
Hour	Date	Time	Temp (°C)	D.O. (%)	umol/L	pH	Observations	DUPE?
PRIOR TO BUBBLE START	8/19/24	5:48 p	21. 82	_	286.6	9.06	NO SAMPLE COLLECTED	Y-
0	8/21/24		19.5	-	134.9	7.05	10+30 * 1	N
17 12-78	8/22/24	09:28	19.4	_	191.1	7.04	SPP. TP 10+60 replaud	N
46 48	9/23/24	3.339	19.5	-	169.9	6.98	15 roube reserpt	N
70 22	8/24/24	3:15p	19.5	-	160.7	6.99	(15+60)2	Y
196 168	1/29/24	9:422	19.5	-	139.6	7.02	15160 -	N

Alum Dose _____ uL (goal: 0 uL) 3 21/24

Sodium Aluminate: _____ uL (goal: 0 uL) { 24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

* synnepulled an extre 5 ml unknown at time twee for total of 45 ml pulled - 40 ml replaced

 Project
 Lake Campbell Phase II Sediment Incubation Study
 Project No.:
 24-08365-000

 Client:
 Skagit County
 Lab Personnel:
 Claudur Basso

<u>CORE 4 – AN</u>AEROBIC and pH 7 and NO ALUM HIGH CO2 / N2 NO ALUM

NO ALUM						19/24		
Hour	Date	Time	Temp (°C)	D.O. (%)	umo//L	рН	Observations	DUPE?
PRIOR TO BUBBLE START	5/19/24	5;57pm	20.9	-	328.7	9.00	NO SAMPLE COLLECTED vol pulled (mc) vol replaced	N
0	8 21/24		19.5	-	220.0	7.21	10+30#	N
17 12-18	8/22/24	09:33	19.4	-	153.6	7.00	10 + CEO + 5 replaced	N
46 48	3 23 24	3:440	19.5	-	140.2	6.99	15 + hibe 30 00 + 470 TPISER SPIRE	spike
70 7/2	2/24/24	3:41p	1938/24	lay_	186.3	7.01	15+60 V	N
85 165	8/29/24	9:52a	195	-	186.6	7.02	15+100 -	N

Alum Dose: _____ uL (goal: 0 uL) au

Sodium Aluminate _____ uL (goal: 0 uL) \$/21/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

* syringe hebe pulled extre SML unknown at time for total of 45 mL, 40 mL replaced

Project Lake Campbell Phase II Sediment Incubation Study Client Skagit County

Lab Personnel

Project No.: 24-08365-000 Claudia Basso

<u>CORE 5</u> <u>AEROBIC</u> and pH 8.5 and NO ALUM LOW CO2 / AIR NO ALUM

Hour	Date	Time	Temp (°C)	D.O. (%)	umol/L (mg/L)	pН	Observations	DUPE?
PRIOR TO BUBBLE START	8/19/24	6:07pm	21.2	-	283.0	9.02	NO SAMPLE COLLECTED vol. pulled (ML) vol replaced	N
0	8/21/24		19.5	_	317.5	8.41	10+30+30	Na
7 12=18	8/22/24	09:36	19.4	-	314.6	8.24	10 + LO + 5 replaced	N
6 48	9/23/24	4:16p	19.5	-	322.2	8.30	STUDE +60 PHIDO	N
70 72	8/24/24	3:53p	19.4	-	325.6	8.33	15+60	N
15,168	8/27/24	9:58a	19.5	-	322.1	8.26	15760	N

Alum Dose _____ uL (goal 0 uL) cog/21/24

Sodium Aluminate _____ uL (goal. 0 uL) 8/21/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

Sor - pulled out 75mL; replaced 70 mL

 Project:
 Lake Campbell Phase II Sediment Incubation Study
 Project No:
 24-08365-000

 Client:
 Skagit County
 Lab Personnel:
 Clienter

<u>CORE 6</u> <u>AEROBIC</u> and pH 8.5 and NO ALUM LOW CO2 / AIR NO ALUM

Hour	Date	Time	Temp (°C)	D.O. (%)	D.O. (mg/L)	рН	Observations	DUPE?
PRIOR TO SUBBLE START	5/19/24	6 15	20.4	-	238.7	9.03	NO SAMPLE COLLECTED vol. pulled (ML) vol. replaced	N
0	8/21/24		19.4	-	319.2	8.47	10+30*	Ņ
17 12/18	8/22/24	09:51	19.4	-	315.8	7.95	10 + WD +5 replaced	N
46 48	9/23/24	4:501	19.5	-	312.7	7.73	-01588 04/00	2
70 7/2	9/24/24	4.110	19.4	_	323.5	7.89	15+60	N
75 1\$8		10; 00a	19.4	_	325.3	7.99	15760 -4	N

6

Alum Dose _____ uL (goal: 0 uL) 8/21/24

Sodium Aluminate ______ uL (goal. 0 uL) 8/21/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

& unknown extre SML pulled due to symmetrube, total US ML pulled, 40 replaced mL

ALUM NO AL	um			MM				
Hour	Date	Time	Temp (°C)	D.O. (%)	D.O. (mg/L)	pН	Observations	DUPE
PRIOR TO BUBBLE START	8/19/24 8/23/24	7:29pm		284.1	890 -	8.99	NO SAMPLE COLLECTED	N
0	9/21/24		19.3	222.7	-	8.51	9+30 * 129mL	N
17 12/18	8/24/24	09:59	19.4	174.2	-	8.42	COUL TO	N
44 48	3/23/2	14:45p	19.5	203.1	-	8.57	15 the polar	N
70 72	8124124	4: 24p	19.4	216.2	1	8.83	15160	N
185 168	8/22/24	10:15a	19.4	180.3	-	8.70	15+60 -	N

44 m2 pulled, 39 mL replaced

	Lake Campbel Skagit County		currient int	ubation stud	лу	Lab P	ersonnel	Project No.:	24-08365- Bases	000
ORE <u>18 - A</u> OW CO2 / 1	NAEROBIC a	nd pH 8.5	and AK	лиМ					fratin,	/
Hour	Date	Time	Temp (°C)	D.O.	D.O (mg/L)	pН		Observatio	ons	DUPE
PRIOR TO BUBBLE STAR	8 14 24 8 123/24	7:34pm	19.7	280.4	_	8,95	NC vol. pulle	SAMPLE CO	ULECTED Vol. replaced	N
0	8/21/24		19.3	150.3	-	8.57	10+30		\checkmark	2
17 12-18	8/22/24	j0:11	19.4	230,2	-	8.07	10+60		replaced	N
46 18	1 23 24	5:001	19.5	98.4	-	8.48	15 +60		~	N
70 1/2	8/24/24	4:400	19.4	196.2	-	8.65	15+60		/	N
15 768	8/27/24	10:20a	19.4	165.0	-	8,93	15760		+	N
lum Dose	ø uL (go	Dal: 500 UL)		21/24					N	.5cm

Sodium Aluminate: ______ uL (goal: 250 uL) / uL 1/21/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet & extra SML venues by syvinge John venues 45mg 40 replaced

120 Lown

HIGH CO2 / AI	OBIC and p R		ALUM			3/19/24			
Hour	Date	Time	Temp (°C)	D.O. (%)	D.O.UD y mol (mg/L)	gr pH	Observations	DUPE?	
PRIOR TO BUBBLE START	8/19/24	523 pm	20.2	_	302.3	4.04	NO SAMPLE COLLECTED VOL-pulled(mL) vol replaced	Ν	
0	3/21/24		19.6	_	324.6	7.09	vol-pulled(mL) vol replaced	N	
17 12-18	8/22/24	10:29 10:29	19.4	-	317.1	6.93			place
46 48	8/23/29	5.200	19.4	-	318,5	6.35	15 tube + 60	N	
70 72	3 24 /24	4:51p	19.4	-	324.9	6.96		Spilce	
15 100	8/29/24	10:25a	19.4	-	316.2	7.08	15+60 -	N	

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet * realized later syvinge fubr versoving exotra 5ml Not accounted for, tatel palled 43ml, vepliced 38ml

Project L	ake Campbe	I Phase II Se	ediment Inc	ubation Stu	dy			Project No.:	24-08365	-000	
Client: S	kagit County					Lab Pe	Lab Personnel: Clauder Basso				
<u>CORE 10 – </u> A HIGH CO2 / / ALUM		ە» pH 7 and	ALUM	NM							
Hour	Date	Time	Temp (°C)	D.O.MA (95)	(mg/L)	pН		Observatio	ns	DUPE?	
PRIOR TO BUBBLE STAR	8/19/24 8/23/24	ESI PM	i9.9	265.0	_	8.87	vol pulle	O SAMPLE COL	LECTED	Ŋ	
0	8/21/24		19.4	316.1	_	7.16	10 1 30	¥	\checkmark	N	
17 12/18	8/22/24	10:45~	2/19.4	318.0	-	10.99	10+6	TPISTP	replaced/	N	
46 48	8/23/24	5:30	19.4	318.1	-	6.97	is tube	eHIDOLTP SEPTEP	60 /	Y	
To The	3/24/24	5:161	19.4	326.2	-	6.96	15260		/	N	
85 108	3/29/24	10:31A	19.3	316.4	-	7.14	15+6	0	-	N	

Alum Dose _ 500 uL (goal 500 uL) 8/24 24

Sodium Aluminate 250 uL (goal 250 uL) 8/2/24

~ 1.0 cm Hzedown

ke Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

It extra Smipulled by synthe Juke, 45 mi pulled, 40 replaced

ORE 11 - AN	AEROBIC an	d pH 7 and	ALU	M				
IGH CO2 / N LUM				иM				
Hour	Date	Time	Temp (°C)	D.O (%)	D. gr (prg/L)	pН	Observations	DUPE?
PRIOR TO BUBBLE START	8/19/24 8/23/21	2:01	19.9	296,6	_	9.08	NO SAMPLE COLLECTED	μ
0	8/21/24	0.	19.4	191.2	_	7.06	10+30 × V	N
	8/21/24	10:58	19.4	189.3	-	6.86	10+ 60+5 upland	N
7 12/18	8/23/24	5:430	19.4	175.5	-	6.78	15 thibe + 60 tp/sper/ 00/p/+ /	N
46 48	8 2 4 24	5:260	19.4	194.4	-	6.82	15+60	W
10 7 <u>¢</u>	9/29/24	10:402	19.3	149.0	1	6.87	15160 -	N
185 168 Alum Dose								N 1.00

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

& ether SML pulled due to syringe tube, not realized, actual soil pulled 45mL, replaced 40ML

	ake Campbe kagit County				~1	Lab P	Project No.: 24-08365 Personnel: Claudic Basso	-000
<u>CORE 12 – AM</u> HIGH CO2 / N ALUM		and pH 7 ar	nd NO(AL	umol			Canada Dasky	
Hour	Date	Time	Temp (°C)	D.O. (%)	D.O. (mg/L)	pН	Observations	DUPE?
PRIOR TO BUBBLE START	8/19/24 8/23/29	7:080m	19.6	256.7			NO SAMPLE COLLECTED	N
0	8/21/24		19.3	155.1	-	7.09	10+30 + V	N
17 12-18	8/22/24/24	11:05 AM	19.4	260.8	_	6.98	TPBRP 10+ 60 +5 replaced	N
46 48	8/23/24	5:550	19,4	201.8	-	6.83	15 +60 po V	N
o X	1/24/24	6:030	19.4	188.9	-	6,97	15760 V	N
5 158	8/29/24	10:550	19.3	196.6	-	7.02	15+60 15+60 -	V

Sodium Aluminate 250 uL (goal: 250 uL) \$ (21/24 05

120 Laun

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

+ actual vol pulled y5mL due to extra 5mL tube attacked to sy ruge holds. Replaced YOML

Project	Lake Campbell F	hase II Sedi	iment Incul	bation Study			4	Project No.:	24-08365-00	0
Client	Skagit County					Lab Pers	sonnel:	Claudin.	Dergo	
<u>ore 13 –</u> ow co2 / lum	AEROBIC and p AIR	9H 8.5 and		иM						
Hour	Date	Time	Temp (°C)	D.O. (96)	D.O. (mg/L)	рН		Observati	ons	DUPE?
PRIOR TO BUBBLE ST		7:17pm	20,0	282,8	—	8,97		NO SAMPLE CO 22 (ML)	DLLECTED	N
0	8/21/24		19.3	288.1	-	8.55	10+30	*	\checkmark	N
17 12/18	2122/24	11:15AM	19.4	370.0	_	7.71	10+60	125RP 1+5	septiced/	N
46 48	8/23/24	6:09 p	19.4	317.3	-	8.10	15+6	0	\checkmark	N
70 th	8/24/24	6:14p	19.4	321.0	-	3.27	Br(00	\checkmark	N
15 1/8	2/27/24	11:02 a	19.3	320-4	-	8.40	1570	0	-	N

Alum Dose: STD uL (goal: 500 uL) 2/21/2468

Sodium Aluminate: 250 uL (goal: 250 uL) (24 03

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

* unaware syringe tube pulled rut extra 5 mL for total of 45mL, 40 mL replaced.

120 Javn

	ke Campbell I agit County		internet inter	bation study		Lab Per	Project No sonnel: Clause	24-08365-0 lia Based	00
<u>CORE 14 -</u> AE OW CO2 / A LUM		85 and	NO ALUN	D MM					
Hour	Date	Time	Temp (°C)	D.O. (%)	D.O. (mg/L)	pН	Observ	vations	DUPE?
PRIOR TO BUBBLE STAR	8/19/24 8/23/24	7:22.Pm	20.2	279.5	-	9,01	NO SAMPLE	COLLECTED replaced	N
0	8/21/24		19.3	316.5	-	8.45	10+30 *	\checkmark	N
17 13-18	\$ 22/24	11:33a	19.4	322.6	-	1.05	10760+5	replaced	N
46 28	8/23/24	6:24p	19.4	320.3	-	3.10	15+60	\checkmark	N
70 72	8/24/24	4:22p	19.4	324.2	-	3.55	15+60	\checkmark	N
15 168	8/29/24	11:10a	19.3	323.4	-	8,46	15+60	-	N

Sodium Aluminate 250 uL (goal: 250 uL) 8/21/24

420 Jown

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

of 45ml, replaced 40ml

Project: Lake Campbell Phase II Sediment Incubation Study 24-08365-000 Project No.: Client Skagit County Lab Personnel: Clouder Basso CORE 7-ANAEROBIC and pH 8.5 and NO ALUM) LOW CO2 / N2 NOALUM Hour Date 4mg// Time Temp pH Observations DUPE? (°C) (%) PRIOR TO 8.99 NO SAMPLE COLLECTED N 2/19/24 20.4 6:21pw 280.3 BUBBLE START vol pulled (mL) replaced P 8/21/24 19.4 8.63 10+20 206.9 0 past philps 111SPFtser spile 8/22/24 12:010 10 + 30 pull1 Inplacede 19.4 Spike 7.54 17 12-18 144.0 40 pull 2 +5 19.4 8/23/24 6:381 1.46 15760 46 #8 211.6 1 N 8/24/24 215.0 6.469 19.4 -8.59 15+60 11 N 70 TR N 19.5 168 1/29/24 11:11 a 19.3 149.4 9.02 15460

Alum Dose 500 ul (goal & ul) 500 ul ces 24/24

Sodium Aluminate: 250 uL (goal: & uL) 250 uL (p)/21/24

pHV at end w.25 cm W/7 button - 7.02 W20 down

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet * syring tube pulled extra SML, total 45 mL pulled, 40 mL replaced

Project:	Lake Campbel	I Phase II Se	diment Incu	ibation Stu	ıdy	_		Project No ::	24-08365-	000
Client	Skagit County					Lab Pe	rsonnel	Claude	60580	
OW CO2,		nd pH 8.5 a	nd NO ALI	M						
Hour	Date	Time	Temp (°C)	D.O. (%)	D.O. (mg/L)/L	рН		Observatio	ons	DUPE?
PRIOR TO BUBBLE ST	0 8/19/24	6:25 pm	20.0	_	306.0	9.13		O SAMPLE CO	DLLECTED	N
0	8/21/24		19.4	_	194.3	8.56	10+40	¥-	de Van	ASPIK
17 12/18	8/22/24	12:15pm	19.4	1	201.2	6.98	10+60	ault w	TSPOT PH	Y
16 48	8/23/24	6:461	19.4	-	165.3	7.83	15+61	0	1	N
10 X	8/24/24	U:57p	19.4	-	184.1	8.59	15+60		11	N
115 188	8/21/24	11:200	19.3	_	118.0	8:84	15+60	0	-	spike

Alum Dose: 500 uL (goal & uL) 500,4 6 00 8/21/24

Sodium Aluminate: 250 uL (goal: Jul) 2504 L 28 /24/24

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet It syringe Lube pulled where SML for to fail of SSML, SOML replaced

N. 25 420 Jown

DUPLICATE SAMPLE

Hour	CORE	Date	Time	Temp (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mgrt)	pН	Observations
0 /	NONE	THEF	Jof pu/	<i>∞</i>)	_	11mol/L		vol pulled (ml.) 30 CB 272/24
12/18	16	8/22/24		19.4		182.3	6.96	P14/00/ 78/382 6044+5
48	10	8/23/24	1.5:39	19.4	-	320 -1	erz 90	060 pullodite/see +15
o 7/2	3	8/24/24	3:150	19.5		171.4	7.12	15760
168	12	8/29/24		19.3		162.7	7.04	
PELOR TO IBBLE STAN	x 73	8/19/24	5:48 pm 5:37 pm	21.1		286.9	8.89	alleling only Durol ph/DO/t

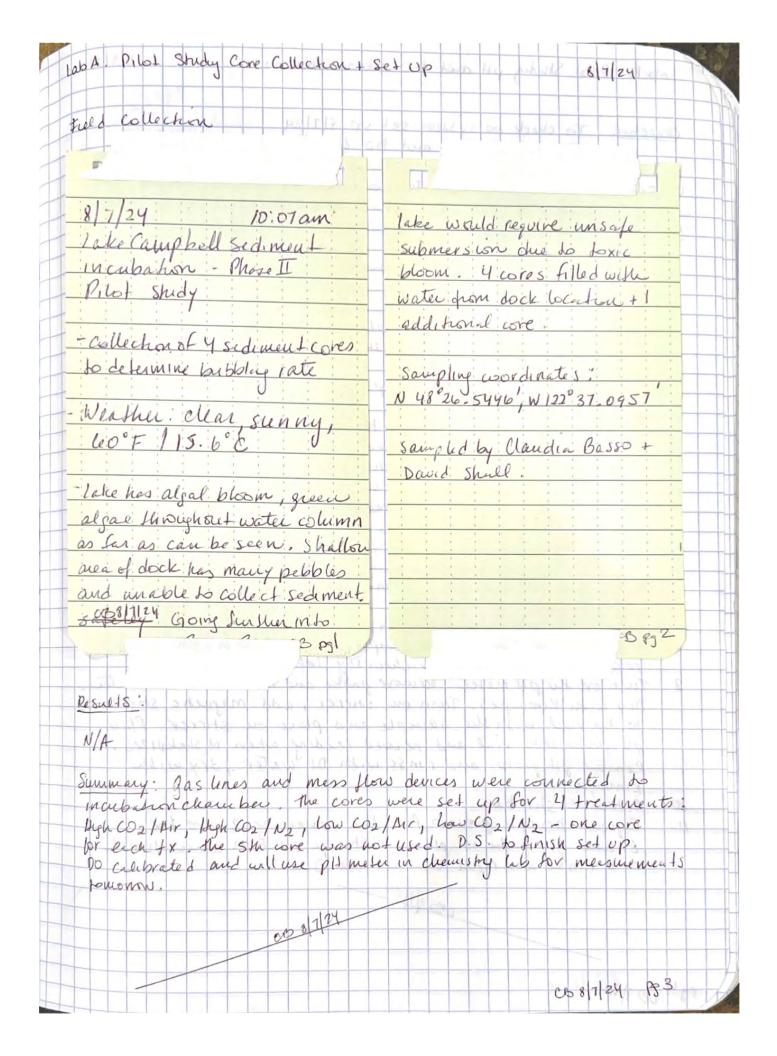
this relacts only volume pulled for duplicates. Individual core sheets show volume pulled for samples + duplicates or spikes 17

2024 Lake Campbell Phase II Sediment Incubation Study-Incubation Data Sheet

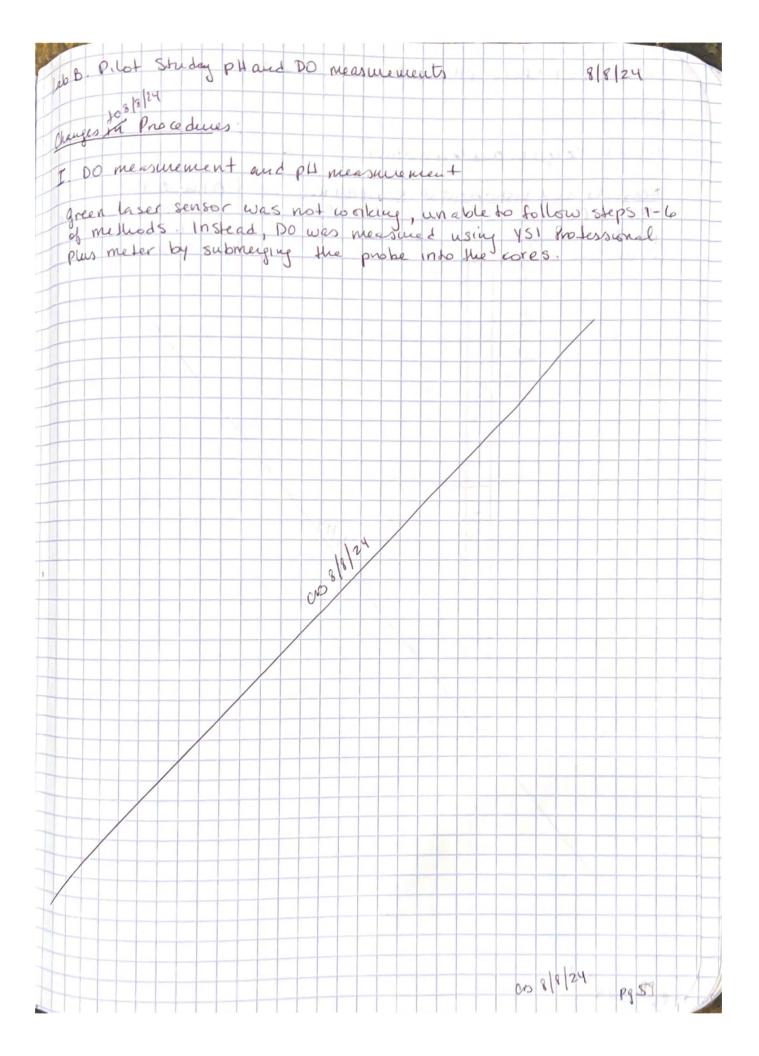
Wels 20 A.	Table of Consents		
	phell sedement Incubation Study		1
Lab A	. Pilot study one collection + set up	. 881	
Lab B	Pilot Study pH and Dissolved Oxygen	· . P34	
Labc.	Pilot 2 Shidy - water samping + pH/DO measurements.	- P39	
Lab D.	Sediment Inaibation Study - Sediment Core	Pz 13	
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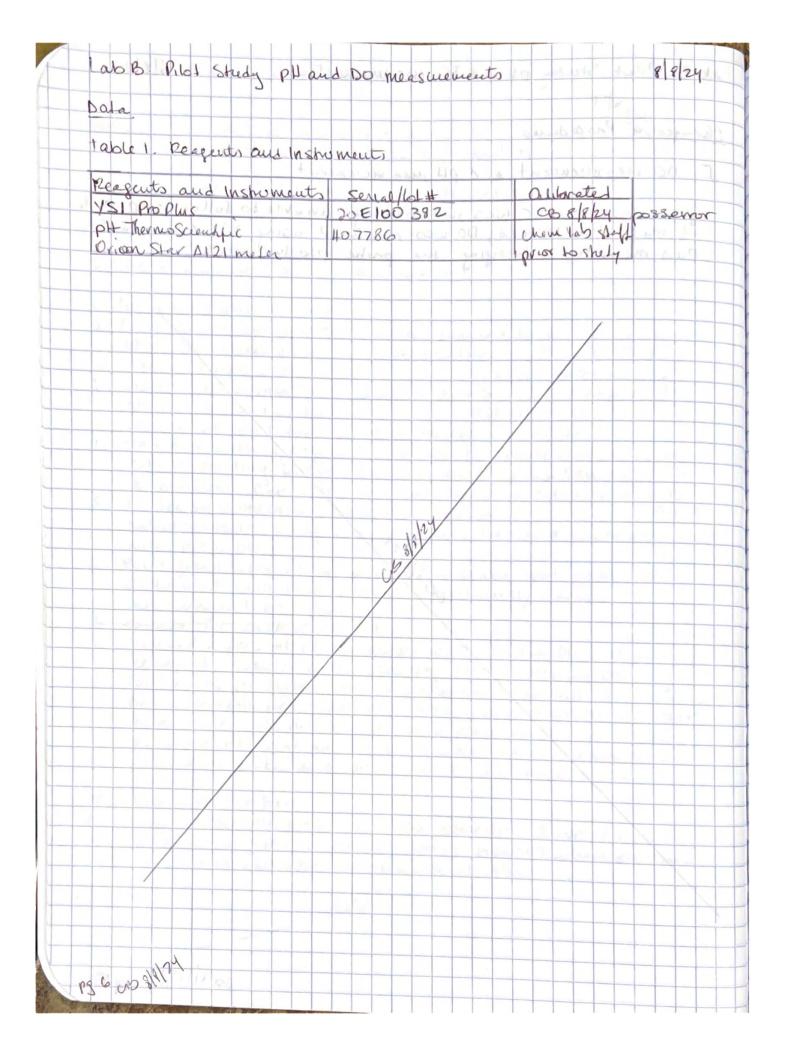
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Lake Campbell Phase II Sediment Incubation Study Pilot Study

Name: <u>Claudia Basso</u> Project Number: <u>24 - 08365 - 050</u> Date: <u>8/8/24</u> 8

MARALS

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Lab B

Study pH and

DO MU

033/8/24.

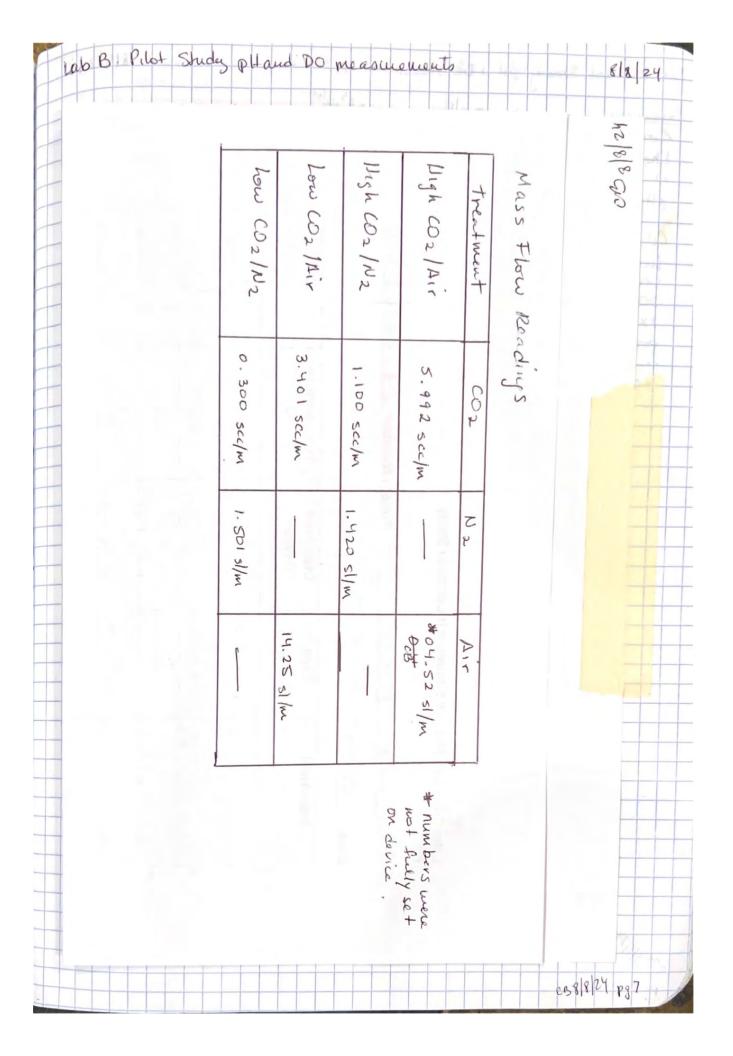
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1:32pm	83.2%. 7.98 mg/L	NA	7.94 11:28 am
1: 40 pm	10.8%. 1.00 mg/L	NA	8.53 11: 44am
1:36pm	3.8%. 0.36 mg/L	NA	8.23 11:46an
	1: 30 рт 1: 32 рт 1: 40 рт	Oxygen 1:30 pm 98.2%. 1:32 pm 9.37 mg/L 1:32 pm 7.98 mg/L 1:40 pm 10.8%. 1:00 mg/L 3.8%.	Oxygen °C 1:30 pm 98.2% NIL 1:30 pm 9.37 mg/L NIL 1:32 gm 7.98 mg/L NIL 1:40 pm 10.8% NA 1:00 mg/L NA

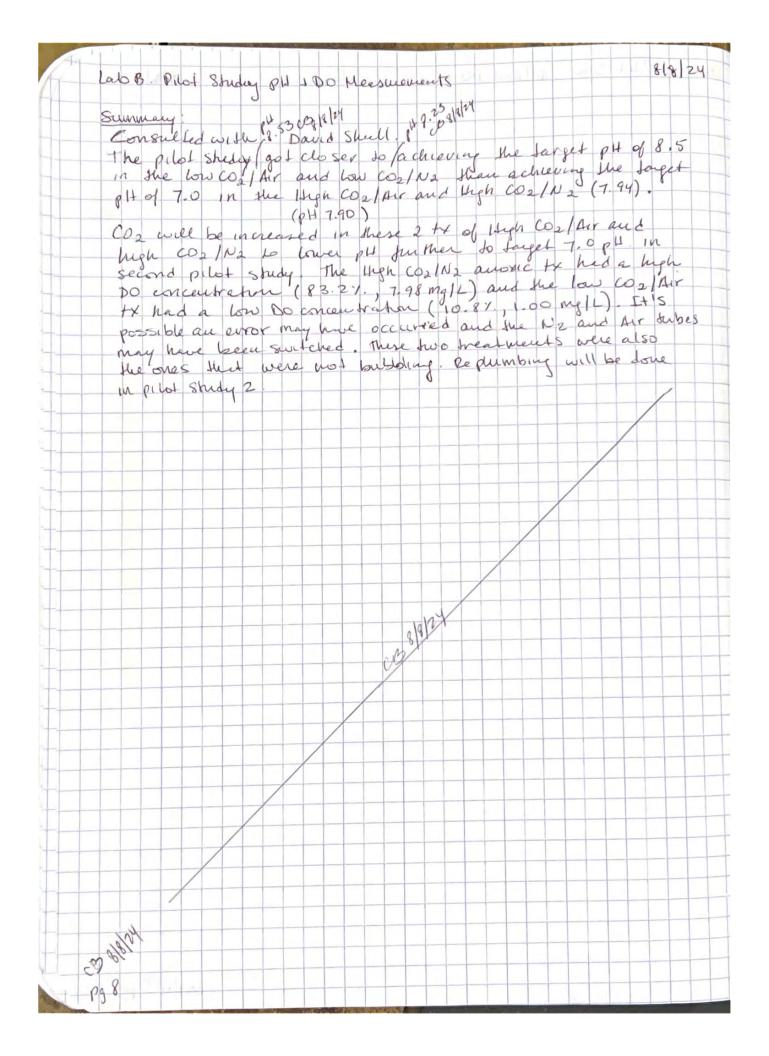
Notes: avrived 10:15 and, chicked 4 core tx. "High CO2/N2 not bubbling, main tribe feeding care tribe had come off at some point in night/morning. *Low CO2/Air core also not bubbling. Unable to identify problem. Leck heard country from mass flow system. Identified I lick coming from N2 tank connection. Unable to identify lick shee heard from mass flow system.

N2 gas tank psi 400 at 1:44pm CO2 gas tank psi 600 at 1:44pm Turned off.

688121 p

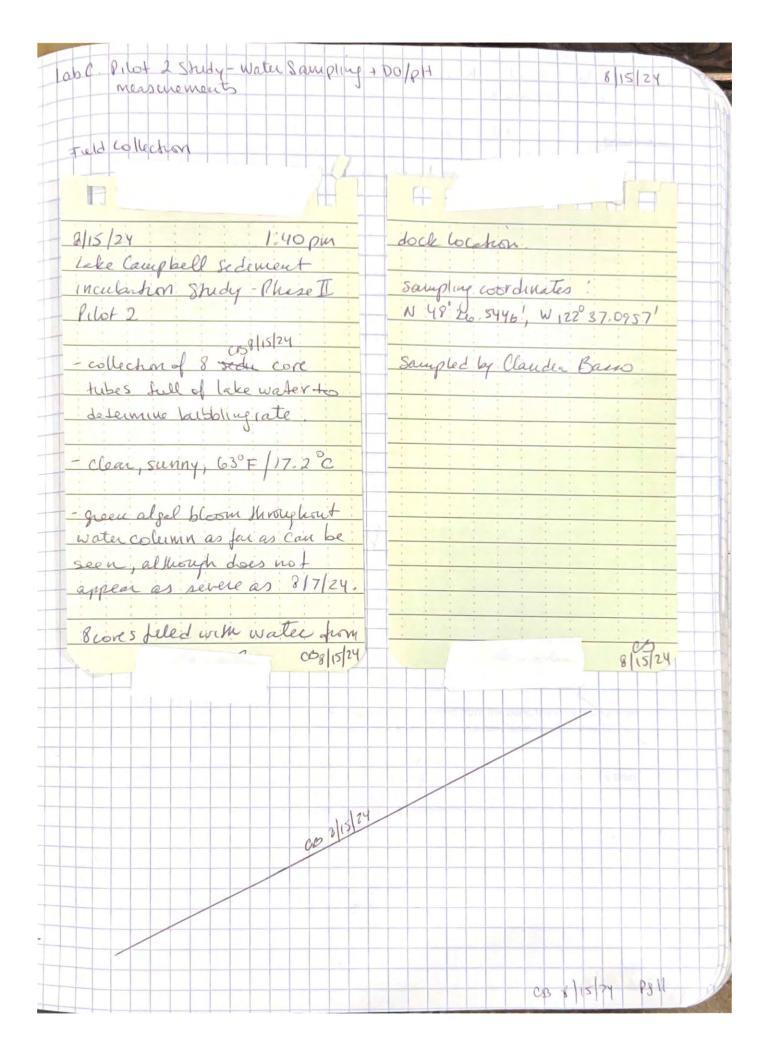
Send information to / consulted with David Shull.

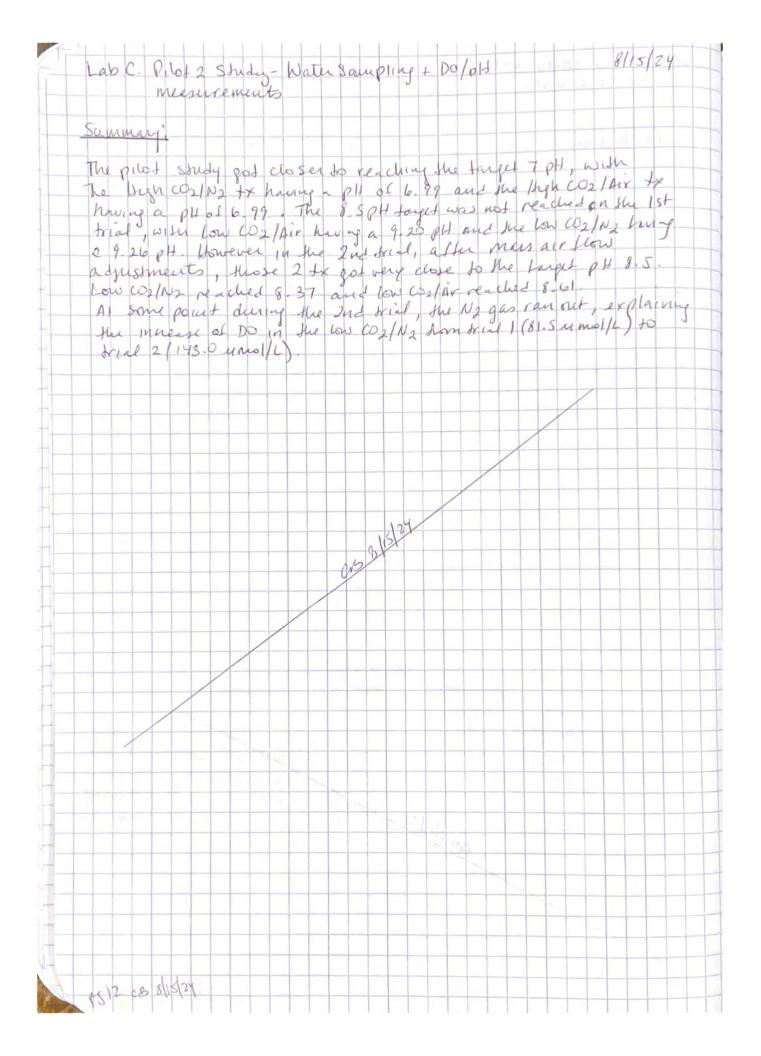




are	0.10+ 2	Study - W	Lersampin	and DoleH	8/15/24
leb C.	measurer	neuts		gand DO/PH	
1	Tocal	hot & core	S of Joka C	emphall water	diam
Object	the dioc	k to dele	unine No 1	CO2 pubbling	rate to
	be use	d in but	un sedimen	1 incubation	shedy.
	The 4 -	tx target 0	H: High Co:	LAir 27 pH	/
			High CO.	2/N2 27 pH 1/Arr 28.5 pH	
			Con the	MAR 28.5 PH	
			9115/24 1000 0	D2/N2~8.5 PH	
			Corr		
QAQC	: Inshum	eut Calibra	thon, good l	ab practices	
Nethor	15				
	12 Sampli	n P			
teru	10 sumpli	3			
. Pla	e 8 core d	nubes (asso	mbled with	stopper and cap	al bottom) into
jae	plastic	tub, along	with 8 top	Caps.	
2 From	n the do	ck, dip a	core into H	e lake and fil	1 11 with water
un	he full to	o the top.	Place top c	ap and on w	re and place
and the second se			0	ining I cores	
Cov	tainer. K	s to SPMC	n the revia	ming 100123	
3.114	uspati				
П.А.	ssist with	Core set.	1p		
				here har	
1. ASS	IST DS.	with set y.	per his ins	marine.	
7 00	10H meas	unomento			
0. 20	IPH Weeks	suce me noto			
I. For	DO measu	lement, fo	low method	s on pg 4, steps	1-6.
				1 of sample w	
Via	and re-c	ep CB 8/15/24	lan on pH	meter and unc	over the small
		the top of			
3.7200	68/15/24 CC	nhoue will	1 meshods o	Npg4, steps 8.	- 10
4 rep	ent DO/pl	1 for all the	res.		
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changes to g	t cours o ave			~							
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Slasks	and each	one u	as but	bled -	recien	e one	of -	the	4+	×	
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permo Sce			× 18 21		12.00		PS				
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	Date: <u>8/15/</u>	24		_		Proje	ct Ni	umbe	er:	2	
			paramet	-		Proje	ct Ni	umbe	er:_	2	
	Date: <u>8/15/</u> Table 1. Core s	ample j	paramet Time	ers Tr	ZIAL 1 Dissolved						
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Tube	Table 1. Core s	ample j		ers Tr	ZIAL Dissolver	b b b b b b b b b b b b b b b b b b b	Diss	olved	d	Те	
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white #12 yellow #6	Table 1. Core s Treatment	sample j	Time	ers Tr	리AL Dissolver Oxygen	1	Disso OXy 6 (m) 9 4 1	olved gen g/L)	d	Те	
while #12	Table 1. Core s Treatment	sample j		ers Tr	리AL Dissolver Oxygen	1146 3	Disso OXy B (m) B (1) B 1	olveo gen g/L) . 0	d	Те	
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QAQ	c :	SOP	5,	cal	libr	ad	nm	d	, in	sh	N	ner	uts	1	80	od	6	b	Pr	'a'	H	ce	2								
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- 10. St 11. Re	tho tore the	steps 7	tube 7-11	ised e upr for e	with right each	t in a	ke wa a buo re, m	ater cket novi	, an t wit ng a	d th th ic	e co e ai oxir	nd onat	will	be	re-c	olle h bl	cteo ack	d at pla	a n	ew to	loc	atio ck	on (s	see t.	ste	p 12	2).				
12. W	/hen al	l core	tube	es ar	ecc	ollec	cted,	imi	med	liate	ly t	ran	spo	rt s	amı	oles	to t	hes	SPM	1C 1	ors	set-	up	ofi	ncu	bati	on.				
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Sediment incubation set up

(Ogdahl et al., 2014; Lake Campbell Phase II Sediment Incubation Study QAPP, 2024)

Sediment Incubation

 Adjust core to contain 25 cm of water column overlying the 20 cm of sediment. Slowly remove or add water as needed using collected lake water and a siphon or pipette.

Up

Note: If cores contain more than 20 cm of sediment, remove excess sediment by removing the bottom cap, carefully releasing sediment from the bottom of the core, and recapping the core to retain 20 cm of sediment. If necessary, a clean plastic disk with an O ring will be placed on the water surface and pushed down to extrude sediment out of the core bottom.

 Place the 16 sediment cores into a darkened environmental growth chamber, with the temperature maintained to match the ambient bottom water temperature measured in the field.

 Set up the cores in the chamber core holders and insert the corresponding gas tube with air stone into each core (middle of water column), following Table 1 below. DO NOT turn gases on yet.

Core Number	talle Tube	Oxygen Condition	pH Condition	Alum Treated	Description
* 19 33.5cm	HIGH CO2/AIR	Aerobic	Neutral pH (~7)	No	Overlying water will be bubbled with ambient air with 10,600 ppm CO2.
wales 33cm	HIGH CO ₂ /AIR ²	Aerobic	Neutral pH (~7)	No	
33cm	HIGH CO ₂ /N ₂	Anaerobic	Neutral pH (~7)	No	Overlying water will be bubbled with N ₂ gas and 10,600 ppm CO ₂ .
Wata 34cm	HIGH CO ₂ /N ₂	Anaerobic	Neutral pH (~7)	No	
water 33cm	LOW CO ₂ /AIR	Aerobic	High pH (~8.5)	No	Overlying water will be bubbled with ambient air and 326.3 ppm CO ₂ .
ivata 31.5	LOW CO ₂ /AIR ²	Aerobic	High pH (~8.5)	No	
Mater 15	LOW CO2/N2 ()	Anaerobic	High pH (~8.5)	No	Overlying water will be bubbled with N2 gas and 326.3 ppm CO2.
obulay da	LOW CO2/N2 2 ALUM	Anaerobic	High pH (~8.5)	No	
water	HIGH CO ₂ /AIR NO ALUM	Aerobic	Neutral pH (~7)	Yes	Overlying water will be bubbled with ambient air with 10600 ppm CO2 and
33 cm watu 32,5	HIGH CO ₂ /AIR ALUM	Aerobic	Neutral pH (~7)	Yes	_0.0654 g of alum will be added.
water 34 cm	HIGH CO ₂ /N ₂	Anaerobic	Neutral pH (~7)	Yes	Overlying water will be bubbled with N ₂ gas, 10,600 ppm CO ₂ and 0.0654 g of alur will be added.
Water 35cm	HIGH CO ₂ /N ₂	Anaerobic	Neutral pH (~7)	Yes	
Water 34 cm	LOW CO ₂ /AIR	Aerobic	High pH (~8.5)	Yes	

	Incul	och	on Se	tu(2 2	- uau	Ĵ-	269	unic	ni (iore	G	olle	ch	m	+		-	8	19	24	-	+
Tablel	Con	tinu	red. 1	2e de	x T	κo	15	edi	mer	+ 0	ore	S											-
Core		tub	x		oxyse	n		H			ALL				D	esc	NI	she	sh				
14 Jahn 34 cm	L	OW CO	O ₂ /AIR	-	erobic		High	pH (*	~8.5)		4 Yes		am	erlyin Ibien alum	t air,	, 326	5.3 p	pm	oubb CO2	and	wit	h 0654	4 g
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water 33cm		ALUM		-					8/12/	1													
throu throu	ghout	over	need to ght. The	wa	ving da	ay, ch	neck f	or de	esired	cond	itions	es o s and	d rec	e first ord t	t day he d	and lata.	dlet	ting	the o	cor	es b	ubt	ole
Chang	es d	0 0	mind	1.100						-												1	
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Drion Star A 214 pH meter		,	
	Ma azi ayA		
	33619		
	788831		
	787687		
	4100671	C.A. 8/19/24	
Table 3.			
pill Calibration, buffer, reading			
buffer, reading			
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7 pl buffer 7-00 10 pH higher 10.04 culebr	ated to 10.00		
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rg16 8/19/24			

LASS FLOW	Reading				8/19/2
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8119124	1 2	1 PAGA		111	
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ets that w	Il be atta	ched to the	ast pg. of	this st	idy.
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					1014
	Inert IN2 2. IAir 2. IAir 2. IAir 2. IAir 2. IAir Paramet Tubing mgh CO2/IAir Mgh CO2/IAir Mgh CO2/IAir Mgh CO2/IAir Mgh CO2/IAir Mgh CO2/IAir Tow CO2/IAir Tow CO2/IAir 8)19/24	nent hime IN2 9 38p 2 Air 9 37p 1 Air 9 40p Parameters Prior d Tubing Tarr Could high CO2/Air (D) Acrob Migh CO2/Air (D) Araeve Migh CO2/N2 (D) Araeve Migh CO2/Air (D) A	$\frac{1}{102}$ $\frac{1}$	Labor 1 Labor 1 Line (Sce/m) (SU/m) Labor 9 38p 0.300 4.001 22/N2 9 38p 4.994 0.00 22/N2 9 37p 7.000 0.702 21/N2 9 400 New (02/N2 0. Arabor 100 81/9/24 5:37p Ngh (02/N2 0. Anaerobic 1017 81/9/24 5:37p Ngh (02/N2 0. Anaerobic 1018 5. 90 5	next hunc (sc/m) (sl/m) (sl/m) IN_2 $9.38p$ 0.300 4.001 $2_2/N_2$ $9.38p$ 4.974 9.702 $2_2/N_2$ $9.31p$ 7.000 0.702 $2_1/N_2$ $9.30p$ 0.601 $ 5.5$ $2_1/N_2$ $9.30p$ 0.601 $ 5.5$ 10000 70210000 702 $ 5.000$ 0.70210000 702 $ 5.000$ 0.70210000 702 $ 5.000$ 0.70210000 702 $ 5.000$ 0.702 $ 5.000$ 0.70210000 702 $ 5.000$ 0.702 $ 5.000$ 0.702 $ 0.000$ 0.702100000 1000 0.601 $ 5.000$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 $ 0.200$ 0.702 0.200 0.702 0.200 0.702 0.200 0.702 0.200 0.702 0.200 0.700 0.702 0.200 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.700

Lake Campbell Phase II Sediment Incubation Study Pilot 2

Name: Cloudia BASSO Project Number: 24-08365-000

Date: 8/15/24

Table 1. Core sample parameters TRIAL 1

		le parameters	1		Tenen enchurge	
	Treatment	Time	Dissolved Oxygen (%) 1	Dissolved Oxygen	(°C)	pН
#12	1 00 14 ·		(/*/	341.0	16.4	9.20
	Low CO2/Air			81.5	16.4	9.26
w #6	Low W2/N2	6:45 pm		115.7	16.4	6.99
#5	high aD2/N2			334.3	16.4	6.99
# 16	high coalAir	6:50 pm		334.5	10.1	0.71
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			000 8 15	24		
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-	/			1		
	Notes/Observations so lution post p 03/15/2	ч			J	
	Table 2. Core sa	1	alors tRIG			
		imple parall	cetter 2 licit	HL 2		
ae	Treatment	Time	DO (umol/L)	T	P 14	
WH6	Treatment	time	DO	T	рЦ 8.37	
WH6	Treatment	1	(umol/L)	(°C)		
	Treatment 1000 CO2/N2 1000 CO2/Air pH elechode	Time 7:10 pm 7:14 pm storage solution	DO (143.0 143.0 337.1 N 5.68PH B	T (°C) 16.4 16.4 16.4	8.37 8.61	0
WH6	Treatment 1000 CO2/N2 1000 CO2/Air pH elechode	Time 7:10 pm 7:14 pm storage solution	DO (143.0 143.0 337.1 N 5.68PH B	T (°C) 16.4 16.4 16.4	8.37 8.61	0
WH6	Treatment 100 CO21N2 100 CO21Air pHelechode Notes: \$ A+7: We no D.S.1	Time 7:10 pm 7:14 pm storage solution 10 pm, when ticed N2 to Adjusted Air	DO (Mmol/L) 143.0 337.1 N S.68PH B we went to me had ra	T (°C) 16.4 16.4 re-readings take the au out of U setting 1"	8.37 8.61 , 5.74 post- n , 6.74 post- n , 7.74 post	2 readings
WH6	Treatment 100 CO21N2 100 CO21Air pHelechode Notes: \$ A+7: We no D.S.1	Time 7:10 pm 7:14 pm storage solution 10 pm, when ticed N2 to Adjusted Air	DO (Mmol/L) 143.0 337.1 N S.68PH B we went to me had ra	T (°C) 16.4 16.4 re-readings take the au out of U setting 1"	8.37 8.61 , 5.74 post- n , 6.74 post- n , 7.74 post	e readings fir. 1
WH6	Treatment 100 CO2/N2 100 CO2/Air pHelechode Notes: \$ A+7: We no D.S. M2 m	Time 7:10 pm 7:14 pm storage solution 10 pm, when ticed N2 to Adjusted Air	DO (Mmol/L) 143.0 337.1 N S.68PH B we went to me had ra	T (°C) 16.4 16.4 re-readings take the au out of U setting 1"	8.37 8.61 , 5.74 post-n , 5.74 post-n , 5.74 post-n , 5.74 post-n , 5.74 post-n , 5.74 post-n	2 readings

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		8]	19/24
2024 L	AKE CAMPBELL	PHASE II	
	ENT INCUBATIO		
	FIELD DATA SHE		
Field Equipment Checklist	not needplat vy	/	
YSI EXO meter	□ Van Dorn / Kemmerer →	Hammer corer	
2 lines of rope, in length to extend to lake bottom, plus 10 feet	☐ 20 L carboy ☑ Peristaltic pump + high capacity	G 5 gal buckets (4)	
in excess	0.45 µm filter	Duct tape	
 ✓ 5 small bags of ice ✓ Flathead screwdriver 	Large black garbage bags (4)	Nitrile gloves	
Core end caps (32)	☑ Cores (16) ☑ 60 ml sample bottle for TP	Core plugs (16)	
🗹 syringe	🗹 Labeling tape	Mini cooler for TP/SRP	
🗹 Notepad/pencil/pen	Permanent marker	buoy 1/19/24	
Project: Lake Campbell Phase II	Sediment Incubation Study Pro	ject No.: 24-08365-000	
Client Name: Skagit County		d Personnel: Claudia Ba	1550
Weather: Sunny, clign, G	2°F/16.67°C	Rob Zise	tte
Weather: <u>Sunny, clian, G</u> Wind (still, windy, choppy): <u>Shi</u>	/	Conver A	rchambauft
Observations: <u>pern alpa</u>	e n water		
CAM-DEEP (at deepest po		art time: 9: 9: 9: 00 am	
Collection date: <u>\$/17/24</u> Depth to bottom (m): <u>5</u> .		art time: <u>9.200</u>	(3. 07) pm)
Water color:			(0.00)
Notes:			
Notes			
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2024 Lake Campbell Phase II Sedim	ant Incubation Study Field Det Cl		

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-	roti		KO:	20	inc	0.0	
	rofi	10	ne			13.	

PS 20 C20 8/19/24

Depth (m)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)	рН
0.5	21.89	14.50	166.2	9.42
1.0	21.55	13.23	150.0	9.33
1.5	द्धार्थी पर 21.54	12.75	144.7	4.25
2.0	21-27	11.62	[31.]	9.15
2.5	21.23	11.29	127.4	1.15
3.0	21.19	10.93	123.2	9.13
3.5	21.18	10.87	122.4	9-14
4.0	21.10	10.04	113-1	9.17
4.5	20.50	5.77	63.9	8.63
5.0	20.48	5.08	56.3	8.5

Notes: Sur	face 0.04	T 22.15 Cm	10:02am	
		T 22.15 C. Do toginizi 14.	64 mg/L	
		DO 7. 167	.5	
		pH 9.42		
QC surfac	e post ne.	adiys:0.05 T21.9	10:33 an	
		τ 21.9	8C	

DO 14.2 my/L DO7. 162.5 pH 9.47

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

abb Sedemen Mauba stron Set up to Spright Sediment Cont Collection and 19 22 ab D. sediment Incubetion Study Seduney

Hd	0 110	24.4	9.33	9.25	9.15	9.15	9.13	9.14	9.17	8.63	8.51
Dissolved Oxygen	(% saturation)	166.2	1 S0 . O	144.7	[31.]	127.4	123.2	4.261	113.1	63.9	56.3
Dissolved Oxygen	(mg/L)	14.50	13.23	12.75	29.11	11.29	10.93	10.87	40.01	5.77	5.08
Temperature (°C)		21.89	21.55	15.12 माम 21.54	21.27	21.23	21.19	21.18	21.10	30.50	34.02
Depth (m)	L	0.5	1.0	1.5 0	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Water Quality Samples Collected* :

Fill in the Sample IDs and depths below. Check the box (X) for each sample bottle filled.

Sample ID (sample site-date)	Sample Time	Sample Depth (m)	TP* (60 mL HDPE) Collect at least 20 mL	SRP */** (10 mL HDPE) Do not collect past 10 mL line
CAM-DEEP-08192024	10:53a	×4.5	×	×

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3

*All water quality samples must be kept on ice or refrigerated until delivered to lab. **Soluble reactive phosphate samples must be field filtered into bottles using syringes.

Notes: Both TP and SRP samples were filtered (they were subsamples from the 20 L carboy of filtered water.

Label sample bottles with the following:

- Sample ID (sample site-date)
- Date of collection

603/19/24 PS 21

- Time of collection
- Analytical parameters
- Initials of personnel and client

filtering canboy water 10; 22 con start time sample depth 15ft from surface (2 4.5m)

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

Sample ID (core #)	Time Collected	Comments
1	14:02	sediment very soft / odorous, no
2	11: YORM	sediment very soft / odorous, no hammening needed '
3	11: SYam	
4	11:59 au	
5	12:10 pm	
6	12:20 pm	
7	12:24 pm	
8	14:01	
9	14:13	
10	14:18	
11 -	14:25	
12	14:30	
13	14:37	
14	14:44	
15	14:50	
16	15:00	V

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Sedenation

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Incubation Sodemen

Set -up

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core.

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Incubation Set-up

*All sediment cores must be kept on ice until delivered to lab.

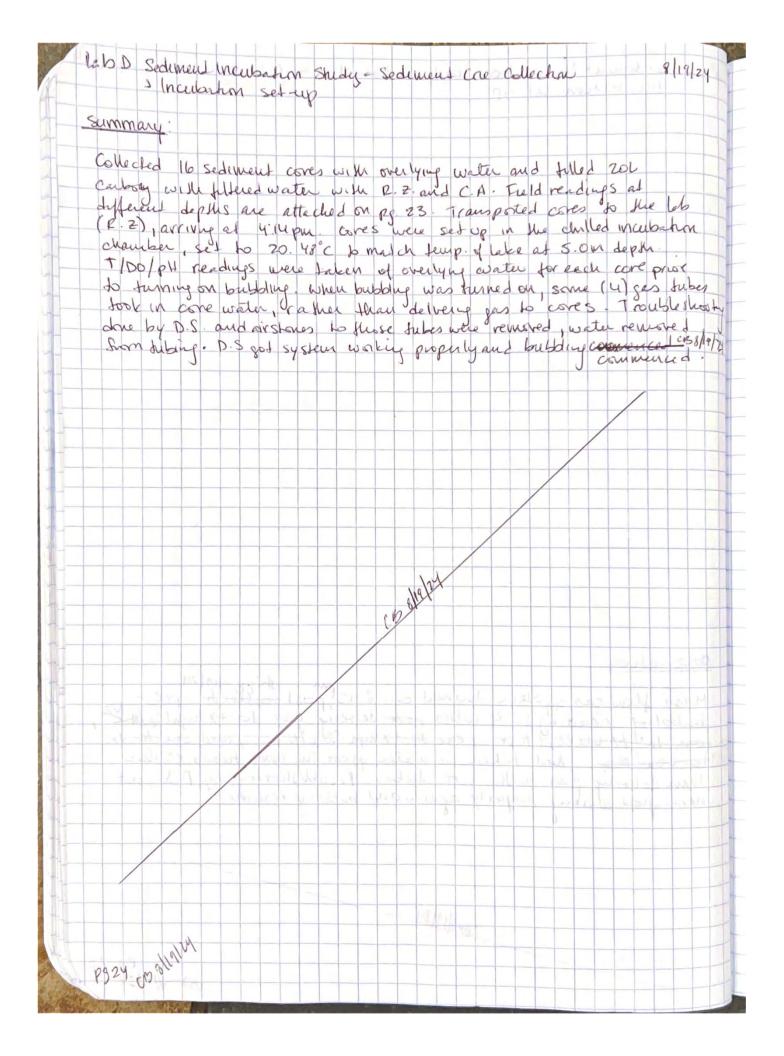
Label cores with the Sample ID (core #). - sharing to color 48, 437482, -122.616677. - maring SAL NW for each core 2-7 8-16, 1t storted SOFI west from starty pt. Moving Sft W for each core. for * I recollected due to sedement fell out while adjusty 14. seeche depth 11:21 am 23.5 inches

- the core sample times were written on waterproof notepad (attached) and transcribed to table above.

2024 Lake Campbell Phase II Sediment Incubation Study-Field Data Sheet

Lab D Sedement Incubation Study EHHHHHH 15 pt 15 pt Core times 8/19/24 1 #3214024314:37 2 11:40 14 14:44 3 H:401154 15 14:50 4 11:50 4 11:59 16 15:00 5 12:10 6 12:20 7 12:24 8 14:09 9 14:13 10 14:18 11 14:25 12 4:30 11:21 Seech - 23.1/2 indres At Rite in the Rain. observations Mass flow gas system turned on 8:15 post-collecte pre-bubbling readings. 4 tubes for detrein gas to tx hyh Co2/Hic2, one do tx two co21 A ir, one to tx hyh Co2/W2, and one to tx glight too co21 N2 had taken in water from the core trebes rather than detwein cas to the core tubes. Trouble shooting by D.S., got mess flow working properly again and bubbling rescurred. 12 119/24 P9.23 8/19/24

15 pt 15 pt 15 pt Cove times 8/19/24 Cove times 8/19/24 1 # 32 140243 101:37 1 # 32 140243 101:37 2 11:40 14 14 144 3 H + 4101154 15 14:50 4 11:59 16 15:00 5 12:10 6 12:20	Date Time Site °C- 8/19/2024 10:02:01 AM lake campb 8/19/2024 10:07:44 AM lake campb 8/19/2024 10:09:17 AM lake campb 8/19/2024 10:102:43 AM lake campb 8/19/2024 10:12:43 AM lake campb 8/19/2024 10:14:30 AM lake campb 8/19/2024 10:14:30 AM lake campb 8/19/2024 10:17:01 AM lake campb 8/19/2024 10:18:40 AM lake campb 8/19/2024 10:20:30 AM lake campb 8/19/2024 10:20:30 AM lake campb 8/19/2024 10:25:49 AM lake campb 8/19/2024 10:28:58 AM lake campb 8/19/2024 10:30:32 AM lake campb 8/19/2024 10:32:24 AM lake campb 8/19/2024 10:32:24 AM lake campb	YSI logged profile readings
7 12:24 8 14:09 9 14:13 10 14:18 11 14:25	 C-17L101532 mmHg-17M100762 22.168 762.2 21.909 762.1 21.557 762.1 21.441 762.1 21.229 762.1 21.19 762.1 21.11 21.11 762.1 21.111 762.1 20.484 762 21.988 762 	Str
1214:30 11:21 Scech - 23.1/2 in dues		
Ass flow gas sy stein turned. bubbling readings. 4 tubes	DO %-17L103032 DO mg/L-17L103032 168.5 14.68 166.9 14.61 150.4 13.25 140.5 12.41 131.8 11.68 127.8 11.33 123.2 10.94 122.4 10.87 112.7 10.02 64.4 5.78 56.4 5.08	
19/19/100 Coal No had Jaken in wo Might too coal No had Jaken in wo Man delivering pas to the core tu mess flow working property again	/L-17L103032 SPC-μ 14.68 14.61 13.25 12.41 11.68 11.33 10.94 10.87 10.87 5.78 5.78 5.78 14.13	
Cos Migley		
CO2 WEAT	05 8/19/24	.23



abt. Co	ne Equilibration Confirmation, Hour O measurements, 8/20/24 ud Alum dosing
bjectives.	aerobic, and anaerobic. To take How O measurements of T, D.O., pH and
	TP and SEP samples once target conditions achieved. To dose cores with aluminum sulfate (alum) and sodium aluminate after the measurements and
	souples have been taken.
lettods	
Core equilit	pration confirmation
examp	raise the air/N2 flow or reduce the CO2 flow. If you do adjust the flow, change the second digit by one unit. For le, if the flow is 4.000, change it to either 4.100 or 3.900. If the flow is 0.400, change it to either 0.410 or 0.390. If the new readings.
1. Switch tank ar	TEGRETER
	to the N2 gas tank previously used: Turn off the flow controllers using the power strip switch. Turn off the N2 and switch the regulator to the tank next to the CO2 tank. Turn on the gas, then turn on the flow controllers using wer strips, then start the flow by pushing the button on the right side of each flow controller. Record the N2
and CO	to the N2 gas tank previously used: Turn off the flow controllers using the power strip switch. Turn off the N2 and switch the regulator to the tank next to the CO2 tank. Turn on the gas, then turn on the flow controllers using wer strips, then start the flow by pushing the button on the right side of each flow controller. Record the N2
and CC Adjust the o 1. Adjust mark o 2. Suck o	to the N2 gas tank previously used: Turn off the flow controllers using the power strip switch. Turn off the N2 nd switch the regulator to the tank next to the CO2 tank. Turn on the gas, then turn on the flow controllers using wer strips, then start the flow by pushing the button on the right side of each flow controller. Record the N2 O2 psi. by everlying water in the cores the water level on the cores to a uniform 25cm height: Measure 25 cm from the sediment surface and make a on the core tubes with a piece of label tape. The water from each core to the level marked. Then all tubes have the same volume of overlying water. (You will o add a longer tube to the 60-cc syringe because you'll have to reach deeper into each tube after you drop the
and CO Adjust the o 1. Adjust mark o 2. Suck o need to water h HOUR 0 me	to the N2 gas tank previously used: Turn off the flow controllers using the power strip switch. Turn off the N2 nd switch the regulator to the tank next to the CO2 tank. Turn on the gas, then turn on the flow controllers using wer strips, then start the flow by pushing the button on the right side of each flow controller. Record the N2 D2 psi. overlying water in the cores the water level on the cores to a uniform 25cm height: Measure 25 cm from the sediment surface and make a on the core tubes with a piece of label tape. The water from each core to the level marked. Then all tubes have the same volume of overlying water. (You will o add a longer tube to the 60-cc syringe because you'll have to reach deeper into each tube after you drop the level.
Adjust the of Adjust the of 1. Adjust mark of 2. Suck of need to water to HOUR 0 me (Ogdahl et of	to the N2 gas tank previously used: Turn off the flow controllers using the power strip switch. Turn off the N2 nd switch the regulator to the tank next to the CO2 tank. Turn on the gas, then turn on the flow controllers using wer strips, then start the flow by pushing the button on the right side of each flow controller. Record the N2 D2 psi. overlying water in the cores the water level on the cores to a uniform 25cm height: Measure 25 cm from the sediment surface and make a on the core tubes with a piece of label tape. The water from each core to the level marked. Then all tubes have the same volume of overlying water. (You will o add a longer tube to the 60-cc syringe because you'll have to reach deeper into each tube after you drop the level.

05 8/21/24 99 25

- Pre-made labels
- Glass DO bottle labeled V1

	8/20/24
labe. Core Equilibration confirmation, itom o measurements,	A Lower
and alum dosing	

- 1. Label the sample bottles and vials with pre-made labels. Place them in their racks and set them aside.
- 2. Turn on the DO sensor, you will be using the V1 bottle to measure T, DO, and pH. Press the back arrow for the menu, navigate to the sensor screen, select V1, press ok.
- 3. Turn on the pH meter, unplug the blue hole at the top of the electrode, remove the electrode from the storage solution, rinse the electrode with DI water, dab dry with a Kimwipe.
- 4. Use randomchoicegenerator.com to select the core from which to collect the duplicate and spike samples. Core 5 dup, core & spilce.
- 5. Begin with Core 1. Rinse syringe with deionized water and discard. Rinse the syringe with 10 mL of core water and discard.
- 6. Remove 60 mL of core water. With the syringe pointing up, push out any air space and ensuring there aren't any air bubbles in the syringe.
- 7. Dispense 28 mL of water into the V1 vial (approx. 24 mL + overflow). Cap the vial and turn it over slowly to ensure you don't see any air bubbles.
- 8. Measure DO with the DO sensor: Press ok twice on the DO instrument. Hold the V1 vial upside down by the cap only, hold the laser to the middle of the sensor dot on the bottom of the vial. Record the T and DO readings on the Incubation Data Sheet.
- 9. Pour out a small amount of the sample to avoid spilling when measuring pH. Place a small stir bar into the vial and place vial on stir plate. Insert electrode into the sample vial and press the measure button on the pH meter. Record pH on the Incubation Data Sheet once the reading stabilizes.
- 10. Dispense 20 mL of the sample in the syringe into a 60mL sample bottle for analysis of TP. Write the sample time on the label.
- 11. Attach the 0.45 µm filter to the syringe and rinse by filtering 1 mL of the sample and disposing it. Dispense a 10 mL subsample into the 10 mL sample vial for analysis of SRP. Write the sample time on the label.
- 12. Discard any left-over sample from the syringe.
- 13. Place the TP and SRP samples in the freezer upright, in the holding racks.
- 14. Repeat for the remaining cores, including a duplicate TP and SRP from the core in step 4 and an SRP spike for the core from step 4.
- 15. Replace the 70 mL of water extracted from each core (60 mL for the measurements and samples + 10 mL for rinsing) with water from the carboy. After replacing the water, the water level should reach the mark you made when you previously adjusted the water height.
- Aluminum sulfate (alum) and sodium aluminate buffer dosing
 - (Lake Campbell Phase II Sediment Incubation Study OAPP, 2024)

- 1. Use the balance in the analytical chem lab to measure 8 aliquets of each of the two chemicals into weigh boats Invert each jar 3 times before drawing up chemical.
- 2. Turn off the gas flow by turning off the power strips. You do not need to turn off the gas tanks.
- 3. Using a micropipette and a clean tip, add 0.5 mL Alum (500 uL) to Core 1. Discard the tip.
- 4. Add a new tip to the pipette and dose the same core 0.25 mL sodium aluminate (250 uL).
- 5. Use the pipette to stir the surface of overlying water. A floc should form and settle to the bottom.
- 6. After all floc settles, turn gas power strips back on.

Record dose on Incub-hondate sheet

N2 gas tank and mass flow check

Pg 26 039/21/21

- 1. Check the pressure in the N2 tank. Move it to a tank that has enough pressure to make it to the next sampling time (turn off power strips, move regulator, turn on gas, turn on power strips, hit buttons on mass flow controllers to start them pumping). Record the N2 and CO2 psi.
- 2. Record any change in mass flow readings.

Return to the lab in 12-18 hrs for measurements and sample collection.

	1 OOSIN	4				rents,	
		J					
Data:			1 1 1				
Table 1. Reagents an	id instr	vinente					
abo, grin							
Reagents Instrum	ents	Serial	161#	C C	Celib	ceted	4
DO sensor Presen		SAAADD	10000 80	3	D.5.	8/15/24	1
Fibox 4 Thurmo Scientific		×1820			C.A /	CB. 8/21/	24
Orion Star A 214 pt	Imaler	NIOG	4			10.1	
N2	anceres	W 24222	IZUA	THE LE		-	
(CO)		41 336					
0H7 buffer sol.		ec 78	8831			-	
pH 10 buffer sol		C C 787		3	88	-	
Table 2. N2 gas tr	acking		Tab	le 3. co.	2 ses tri	acking	
No lot # 1 Tir	me	psi	CO,	Lot #	Time	psi	_
W24 222124 H 8:4	13a	400	2173	3619	B:47a	600	
1247771210	12a -	900	5 2 2 2 8				
W24222124A 6	310	400	Paren	1. 1	1		
WZ4222124A 6.	340	2900	1 3 1	1 1 1 1	your diff	Sh 1	_
Table 4. Moss Flo	su Read	lings 3	: 44 am				-
Treatment	coal	(scc/m)	N2 (s1/m)	NAIR (si/m)	all a
thigh CO2/Air	4.9	(scc/m) 99 obstation	F	C 9/21	0.50		11
then con IN	7.00	+ 7,709	- 3-	100 0.7	50		
low cos / Air	0-68	00	-11711-	-	5.40	0	
	0.30	00	- 3	101			-
Low con /No							
	6 1		1 4 41 117 1				
Low con / N2	NA		1.410				
	N/A	1.1	1.910	11 (h)			
Low con / N2	N/A		1410	i u.			
Low con / N2	N/A		14101	11 11. 191			
Low con / N2	N/A		1970				
Low con / N2	N/A						
Low con / N2	N/A	21242	14101				
Low con / N2	N/A	-1 3 1 -1 3 -1 3 -1 3 -1 3 -1 3 -1 3 -1					
Low con / N2	N/A	-1 3 1 -1 3 1 					
Low con / N2	N/A	-1 -3 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -					
Low con / N2	N/A	-4 3 1 -4 3 -4 - - - - - - - - - - - - - - - - - -					
Low con / N2	N/A	13 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					

Labe Cae Equilibration, Un O measurements, Alum dosig Butbling check: 8 21/24 Core 4, receiving high CO2/N2 tx, attached to gas tube 1 15 not bubbling. adjusted knob for flow in near 8:52am 10,43 039/21/24 pt celipradem after cal. buffer solution before cal. cd 10 7.00 pH buffer 7 7.00- 7.01 cul to 10.00 10.03-10.04 of buffer 10 Slope 98.47. 99.9%. 00T/pttT Start: 10:06 TX aerobic/heutral 19. 10 0 19. 10 20 324. 10 19. 10 20 324. 10 anaerobic/heutral 19.5/19.9134. 9 -18.8 eH09 core -19.5 7.11 ogula 75.7 7.05 3 not bubbling c sample 19.5/19.6 220.0 accobic/line at 19.5/19.9 317.5 -25.3 7.21 4 - 94.7 8. HI aerobic/high pH 5 -98,1 19.4/19.7 319.2 8.47 -107.4 19.4/19.6 206.9 8.43 713 anaerobic/hghpt 052/4/14 216 052/4/14 216 051/4/14 216 10 10 19 19 19 19.4/19.7 299.8 19.8/19.4/<u>5/6.7</u> 3161 10 19.4/20,0 191.2 10 19.20,0 191.2 - 105.8 8.56 -283 7.26 -27.2 Tille 7.06 -16.6 19,3/19,7 155,1 709 18.1 12 19.3 /19.5 289.1 19.3 /19.7 316.5 19.3 /19.9 222 7 - 103,1 8.55 13 perobic/high pH - 931 8,45 colato 14 anaerobic/hypet 8.4 8.51 - 100,3 CO82/1 115 8 19.3/ 19.6 150.3 8.51 102.4 -103.9 and : 11 20 - used as top o generneters 900. 11:22 - new tank psi ps 23 populati

E. Core Equilibrati	n, URO measu	conto, alun dosig	8/4/24	
12,8,7,15,16 Jo be switch	0,9,8,12,3, ed.	4, 11 not bullility	- gas Jank heeds	
and the second se	and the second s	uk at 10:58am		
			Isblag - turned Ibalas blag bestred.	nce
8/21/2024	TP / SR	P. sampling / O	sing	0
Core # Time	Vol pull SR	78 Volud revenus 738 (Jomis) L	0052 time	
1 9 2 galary 13:30 3 13:40	10. 3-	1 40 L	N/A	
4 13:55	10+30 V 10+30+30 V	10 DC 14:01	NIA	
6 00 12 14:04 715 912 14:11 8 16 51217 14:11	10+30 V 10+30 V	y 40	N/A 4:15p	
9 1 14:22 10 Control 14:26	10+40	1 40 40 40	4:13p N/A	
U 14:31 12 14:34	10+30 V	40	5:05p 5:00p 4:08p	
13 14:39	10 +30 1	7 40 40 7 40	4:06p 5:02p	-
13 14 14 15 15 1 10 14 14 14 14 14 14 14 14 14 15 3 14 14 14 14 14 14 14 14 14 14 14 14 14	$ \begin{array}{c} 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 \\ 10 + 30 $	V 39 V 40	4:06p 5:02p N/A N/A	
notes:				
D= duplicale s	ampe			
f = Spike.				
8/22/24 pH7-	ott check			
pH7.	7 6.99 -1	2.7 MV	1.104	
			c3 1/2/04/	9

N	Labe. Core Equilibration, IRO measurements, alum to sig uminum sulfate/sodium aluminate dosig
2 .	1 - 1 sodumn autominate asso
0	50p gas flow was turned off
11'	
9	060 began to dose cores 13, 12, 1, 8, 7 with 500 a
-	alum and 250 ul so divin aluminate. Realize
-	cores 1, 8,7 should not have reve dose. After cons
+-	with D.S. switched labels withe undosed dupliced
_	tx and suitched fixed all labels on samples + re
	1-79, 8- 688/21/24 -
5.	tx and switched fixed all labels on samples + re 1-29, 8-208/21/24 DOP dosed the remaining cores 10, 11, 14 200
	A (5) 91 1
6	16p Hocologe12/124 on core 13 hes settled to bottom 18 cm
	water odumn core 9 floc settled to 12
	bottom 9.5 cm of water column, core 16 to bottom
	War Coales I than Game and I bottom 9
-	14 cm. Core 15 to bottom 6 cm. core 11 to bottom 9.
	Core 14 to bottom 9 cm. Core to 10 bottom 8 cm. Core
	Core 12 to bottom 12 cm.
	(measurements approx)
	Switched N2 Jank 6:31pm psi 400 old Jank
	PSi 2900 neustauk
-	
	"Bp gas turned back on Disturbed flow on core " Turned gas off unde floc settled.
1	Turned gers off unde floc settled.
-	
-	28p gas back on Floc in all ores undisturbed
-	
-	
	Summary:
-	
-	Today there were a few instances of cores not busbling,
	were corrected by adjustice knobs for increased flow. plice
-	Do were checked to see the target tx was reached. pH was
-	target. Checked with D.S there measurements rais los 1
-	used for the o measurements. Do measurements not show
+	used first readings, informed D.S.
-	
-	Totsep enotion by water level in each core was then adjusted
-	nught or as con weave me sectment, which was marked in
-	sheiple and type on each core.
4	
	P830 (28/24/24)

Lab E.	Core Equilibra	tim, HRO	meesmements, shim dosing	8/21/24

Summary cont

TPISRP samples were collected

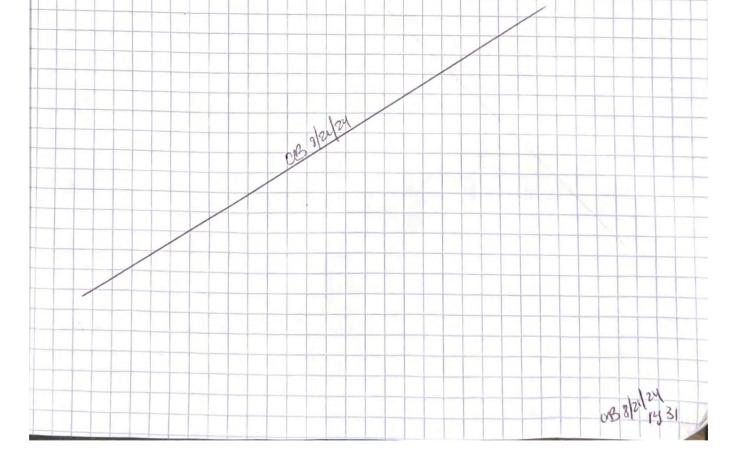
gas flow was surved off and 8 cores were dosed with aluminum subjacte Soo ul and so dum aluminate 250 ul. :

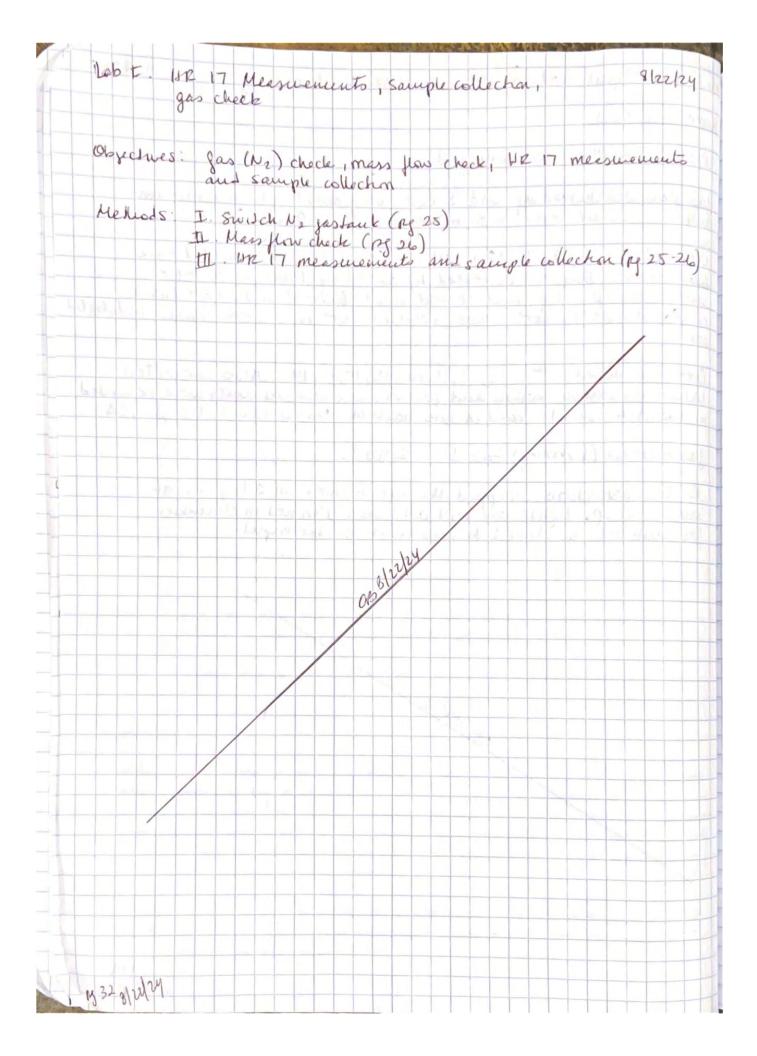
Cores 13, 12, 1, 8, 7, 10, 11, 14. Cores 1, 8, 7 shouldn't have been dosed. This was corrected by switching lables with their undosed duplicates that should have been dosed. core I was re-labled core 9. Core 8 was relified core 16. Core 7 was re-labeled core 15.

Corrected dosed cores: 13, 12, 9, 16, 15, 10, 11, 14. Also corrected labels on sample bottles and places where measurements were recorded in the data sheets and in this notebook. Consulted with D.S., TC, CA.

Sas restored (budding) once Sloc settled

Per DS instructions, wrapped the top of cores w/ 2 layers of sanan wrap. Lights are kept off when I'm not in chamber. Jas tank was switched to new tank for the night.





bF, UK 17 V	reasurement	s samp	le collection	, sas check.	-	-	2/22/24
Data					1		
						14	
Table 1. Rea	egents + M	shume	its				
Respector In:	shimeuto		enel/1014	1.0 1.0 1.0	Cilil	orated	1
DO SENSOL PORS	anse Fiboxy	SA	ADDS DODD .	73	0.S	8/15/24	_
thems Scientila AZIY pH mete	Orion Sher		×18241	- WARTER	CALC	8 8/21/24	- X2. X
0H7buffer		cc	788331			-	
N2		w	24222124A			-	
CO,		14	33619			_	
-					6.0		1
Tablez N2	Sas tracku	ſ		Toble 3	02	sas brai	cherg
No hot #	Time	PSL		lot #	Hin	1	RSI
W24272174A	8:38an	1300	will smilch		8: -	san	600
N24272174A	8:46a	350					
W24777124A	10: 37a	1 300					1. 1.
417.4722124A	6:5500	350	will switch				
W24222124B	7:030	2800					
			5			1:230	un
Table 4 M	asstlen 1	2eadings	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	N2 (sL)	m)	8:23a Air (
	asstlen 1	2eadings	im		m)		
Table 4 M	asstlen 1	2eadings	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.		m)		
Table 4 M tx	asstlen 1	2eadings	im		m)		
Table 4 M tx low CO2 M2	ur	2eadings D2 (scc/ D 300 7.681 5.111	im) > adjusted D 0.100 at Sizepr	3.700	m)		(sl/m)
Table 4 M Hr Jaw CO2/N2 Jugh CO2/N2	asstlow 1	2eadings 02 (scc/ 0300 7.681 5.111	im) > adjusted D 0. 100 at Sizepv	<u>3.700</u> 0.750	m)		(sl/m)
Table 4 M +x low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2	ur	2eadings 02 (scc/ 0300 7.681 5.111	2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24 2/24	<u>3.700</u> 0.750	m)	Ai- ((sl/m)
Table 4 M +x low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N Core check;	455 Flow 1 C	2eadings D2 (scc/ 0.300 7.681 5.111 5.111 5.111 5.111	in) = adjusted & 0.100 df 5.21pv 2/24 = adjusted = adjusted = 3.2 5.2	a.t		Ai- ((sl/m)
Table 4 M Hx low CO3/N2 Jugh CO3/N2 Jugh CO3/N2 Jugh CO2/N2 Jow CO2/N Core check:	255 Flow 1 C	$2e_{a} dinys$ $2e_{a} dinys$ $2e_{a} dinys$ $2e_{a} dinys$ $0_{2} (sec/$ 0_{300} 7.681 5.111 5.111 5.111 5.911 0,600	in) = adjusted D 0-100 at Sizepv = 2/24 = adjusted = doc 400 5:2 he llock o	at 1 1 1 1 1 1 1 1 1 1 1 1 1	alum	Ai- (sl/m)
Table 4 M Hx low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N Core check: All cores a	ess Flow 1 Ci ir 8:25 am ne bubbli	2eadings 02 (scc/ 0300 7.681 5.111 5.111 5.111 5.111 0.600	in) = adjusted D 0-100 at S=26pv = z/24 => adjusted => do 0-400 5:2 he flock o	at 1 3.700 0.750 	alum	Air (sl/m)
Table 4 M Hx low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N Core check: All cores a	ess Flow 1 Ci ir 8:25 am ne bubbli	2eadings 02 (scc/ 0300 7.681 5.111 5.111 5.111 5.111 0.600	in) = adjusted D 0-100 at S=26pv = z/24 => adjusted => do 0-400 5:2 he flock o	at 1 1 1 1 1 1 1 1 1 1 1 1 1	alum	Air (sl/m)
Table 4 M Hx low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N Core check: All cores a	ess Flow 1 Ci ir 8:25 am ne bubbli	2eadings 02 (scc/ 0300 7.681 5.111 5.111 5.111 5.111 0.600	in) = adjusted D 0-100 at S=26pv = z/24 => adjusted => do 0-400 5:2 he flock o	at 1 1 1 1 1 1 1 1 1 1 1 1 1	alum	Air (5 L/m)
Table 4 M +x low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 low CO2/N2 Core check: All cores a asces 13,1 NIM All agluman,	455 Flow 1 Ci Ci Ci Ci Ci Ci Ci Ci Ci Ci	2eadings D2 (scc/ D 300 7.681 5.111 5.111 5.111 5.111 0.600 ing. Th 15, 11, 15, 11, 15, 11, 15, 11, 15, 11, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	in) = adjusted D 0-100 at Sizepr = = = = = = = = = = = = =	n Hu 8 as settled be bottom 6 cm	alum so the of the	Ai- (SL/m)
Table 4 M HX Iw CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N2 Core check: All cores a ares 13,1 with all alumn, of water	125 stlow 1 Clark	2eadings 2eadings 2 (scc/ 0 300 7.681 5 111 5 1111 5 1111 5 111 5 111	in) = adjusted D 0-100 at S=21pv = = = = = = = = = = = = =	n the 8 as settled he bottom of cur	alum so the of the a hell a hell	Air (52/m) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Table 4 M Hx low CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jugh CO2/N2 Jow CO2/N Core check: All cores a	125 stlow 1 Clark	2eadings 2eadings 2 (scc/ 0 300 7.681 5 111 5 1111 5 1111 5 111 5 111	in) = adjusted D 0-100 at S=21pv = = = = = = = = = = = = =	n the 8 as settled he bottom of cur	alum so the of the a hell a hell	Air (SL/m)

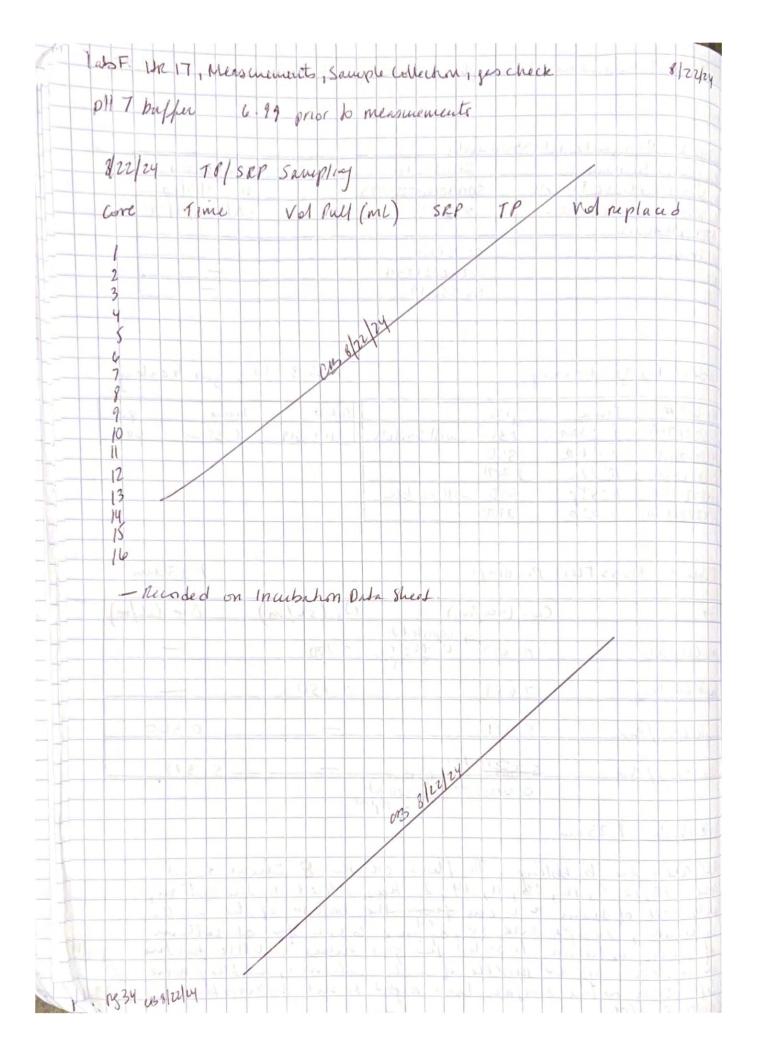
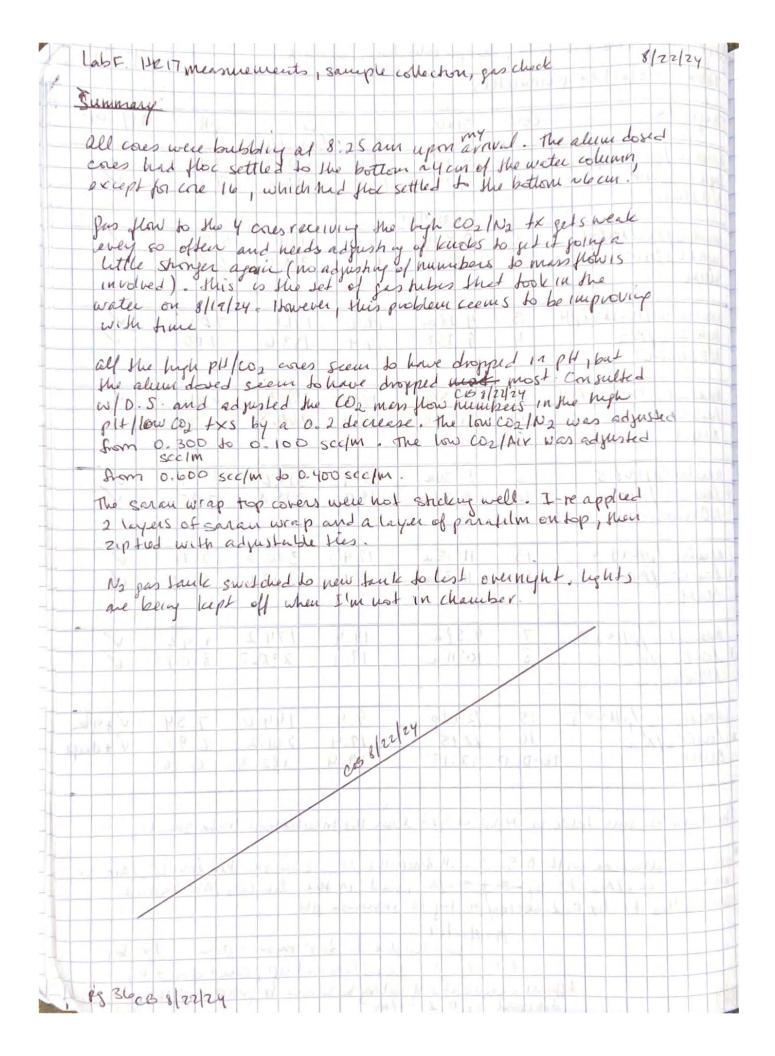


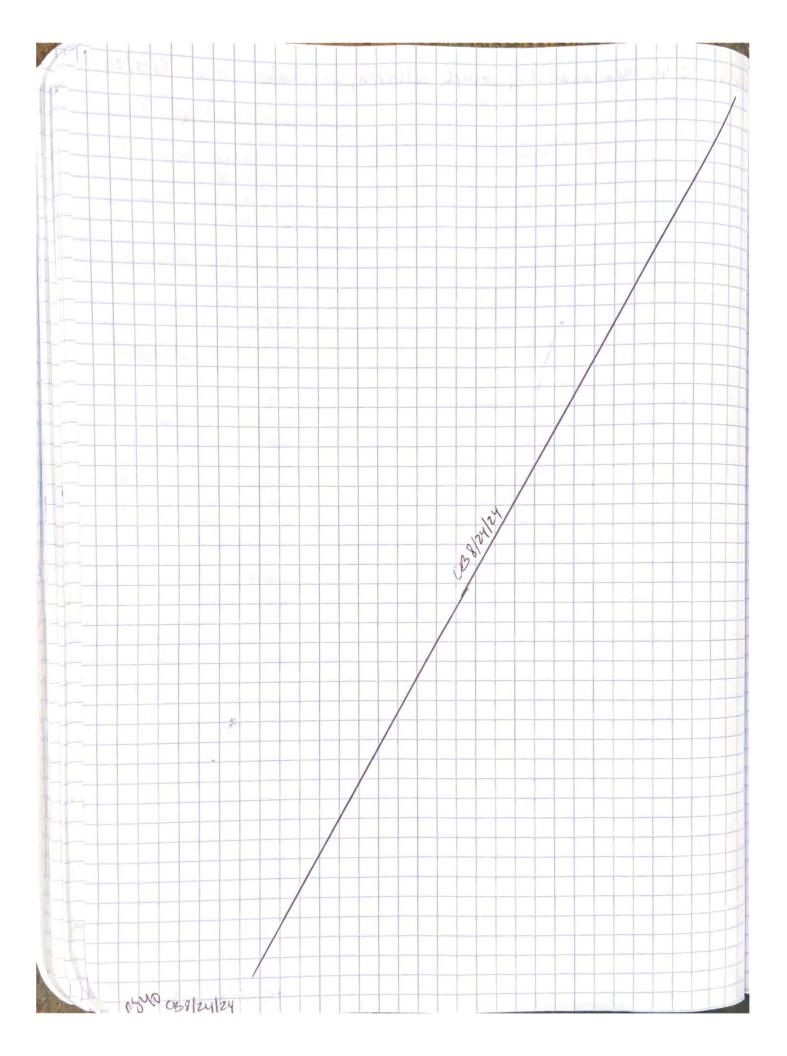
Table 5. 8 22 24 pc						-
auget tx	Core	Time	(°C) 1	unalle)	PH	TPSP
renobic IneutralpH	2	9:22a	19.4	322.3	7.12	
No alum	1	9:150	19.4	322.6	7-11	
aeropic/neutralpH	9	10/2.290	19.4	317.1	6.93	1
high CO2/Air ALUM	10	10: 450	19.4	318.0	6.99	J
anaeropic/neubalpH	3	9:28a	19.4	191.1	7.04	/
high log /N2 No alum	4	9:33a	19.4	153.6	7.00	
anaerobic/neutralpt	+ 11	10:58a	19.4	189-3	6-86	1
high CO2/N2 Alum	/2	11:052	19-4	260.8	6.98	
aerobulpHr8.5	S	9:362	19.4	314.6	8.24	1
NOalun	6	9:512	19.4	315.8	7.95	
aerobic/pltn 8.5	13	11/15a	19.4	320.0	7.71	/
* Low O2/Air AUM	14	11:332	19.4	322.6	8.05	
anaerobic/plt~ 8.5	7	9.59a	19.4	174.2	8.42	V
Vo alum	8	10:11 a	19.4			
anaerobic/pHn 8.5	- 15	12:010	9.4	144.0	7.54	Vtspk
+ Low CO2/N2	16	12-15	19.4		6.98	V+dup
AUM	16-DUP	12:15	19.0	4 182.3	6.96	
The data on this ta	ble is tre	uscribed	Scan the	Incubation	Date She	ets.
* per consultation in and low co2/N2	ty by -0	+ scc/m	, and in	the low C	the low c 02/Air +x	OzlAir tx and
low co2/N2 +x by	0.2 sec/n	1 122/24		drop these		



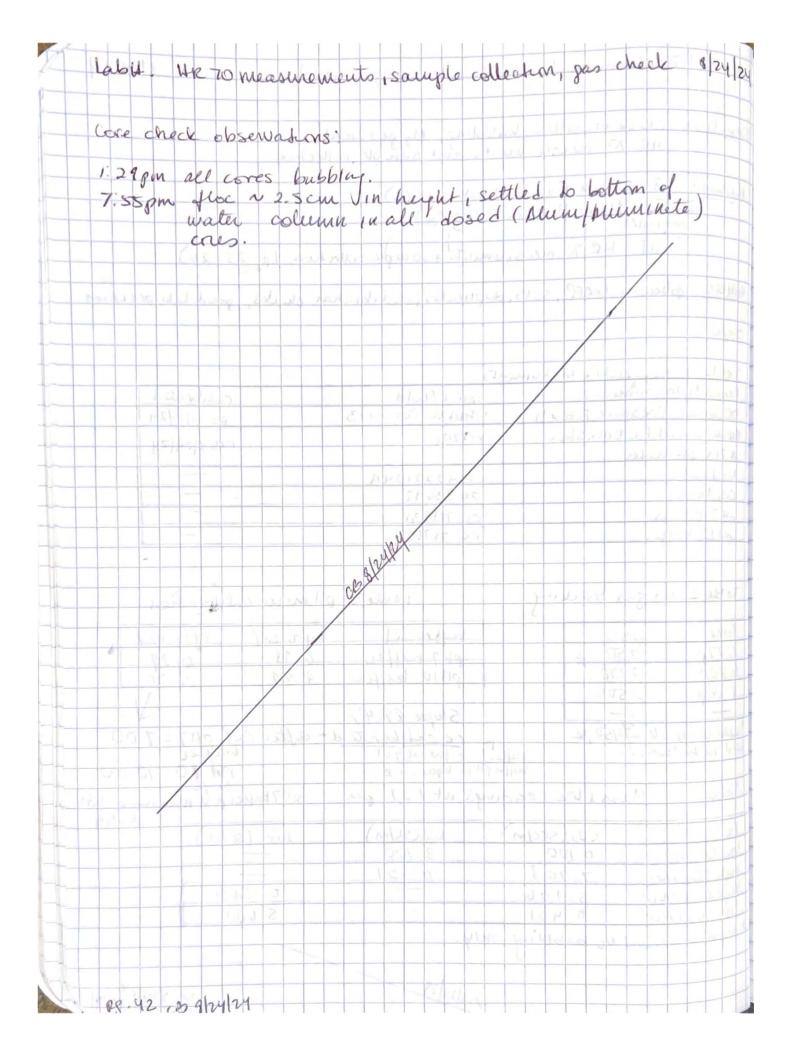
ab G. UR 46 mec	smemouls, sample coll	ector, gas check	8/2	23/24
objectus: 131	2 46 measurement hect on mess flow	its and same	ple collection	
C	heck on mass ylow	, bubblng, a	nd N2 pas Lank	k.
		, J,	0 0 0 0 0	
Methods	Partis and the			
I. LICYOME	2 gas Lank (og	uple collection	n (p; 25)	
L. Switch	" check (pg 26)	25).	1-1PS201	
III. Mass from	N CHECK (PS 26)			
DCB923124 0016	1C. following QAPP, good lab prach	she tinle 1	a libre tion ch	Solo S
pase delle	end lab acal	sors, aupricat	is carbinour co	in the second se
	good tele practi	(Les)		38
Data:			RE EL	
Table 1 Reagen	to + Instruments			-
8				
Respects / insh	ments Serial #	= Lot#	Calibrate d	
DO Sevisa Pre	Sense SAAADOO	8000073	0.5.8152	4
FIDOX 4			8123/24	
Thermo Scientifi			CA/CD 8/21	24
Chon Star AZ	14 elt meter		CB 8/23/24	
N2 tank	w242221			
CO2 Javie	2H33619			411
pH7 buffer	CC 7888		T	
pH 10 buffer	0 187 6	- 11 7	old meter celibrati	~
Table 2 No ga Hol# are same on	S macking		efore cal. after	in Cal.
		PH7 buffer	4:97 7.0	
1:33 pm 7	SD ranged y oppy	pH 10 buffer	4.97 7.0 9.48 10.0	
4:13 04 6	50	1 Dealler		
	OD	slope 99.41		
		offast measure	ement of beffer pl+7)	= 7.00
4	flow Readings (see	8/23/24	The second second	i i
Table \$ Mass	flow Readings (sect	at 1:30pm	E-11 - 124 - 22 - 10	
+×	CD2 (cc/m)	N2 (sl/m)	Ar (sym	
10.0011.	0.100	3.750		
100 CO2102	7.700	0.750		
high CO2/N2	1		0.500	9:20
high co2/Air	5.100 0000 11-5-400 1123 0.400		5.400 -	
how co2/Air	123 0.400			
Air increased to	5.600 skin at 9:200 sed on all N2 +x at	2M		23/24537

Taba. DRY4	mensurements, s	sample collect	in pasche	de	8/23/24 8/2
					11
J. Could	le observation	15:		The las	
1:15 pm	arrived. and	aleader 1 c	me hibb	ine All	ares
	bubblag e	checked c	Carel (the	on early	NO MUM).
	Turned die co	respective	und shy	ne eas f	on
	system a lit	the and the	blue wea	vertores	1. 1. 21 1
	system a lit	1	000	1	1 1 1 1 1
9:02pm	loc on set do	sed was la	lun) 9, 1	5,16,12,	13,14,10
	had selled y	e neight of	n L. D cm	A4 GOLOUN	a para
	oglumn. core	11 height a	1110c N2.5	- 3 cm as	botton
	ell higher co	hunn	1 10 Add 1	al Mary Mary	<u>a</u>
12345	- Pg. 39)	1-1-1-	13 1 2 2 2 2 2 2	1111	
-Surver Sig	- pg. 39) Summary				
1			1.14	-	
Lores rei	mained seale.	9 Hursepho	ul the n	ight - (ore I not
pusping	(no mass fle	unival rad	justed a	ubb and	puspies
restried	(no mass fu	x number	s changed	t at Mis	poivir).
Bullows	H7 aud pt 10	Paul and	hold the las	100 50	all mailes
recaliba	ated. An app	in maine s	C. Ata	column v	upp in pal
with to	ape on all a	pres to on	sine moet	4 in amount	alsounding
vas de	ape on all ci	he level of	one four	nd	Journhand
			and the second second second		manufacture and a second
Nonced	the type atta	thed to the	e syringe	pulls on	+ an extra
5 mL c	from the core:	s yesterda	1. This e	ktra am	1 was
replace	1 for HR 12-	18 (17) al	d today	HR46.	The extra
amit wa	is not replan	ced for HF	20, where	a shate	n syringe way
used.	from the correst for HR 12- is not replan Will check w	w marry	ml it hol	ds.	State Barries
					and the second s
had so	es measured a	Scienter	lit al	hser [mi	cker. Ha
colum	ttled to 22. n, with cre	11 22.504	igni and	allon of	Water +
of wat	a column.	1 m + 2 1	Juli	in neg	nt ras bou
0					
after co	nsulfation w	uh D.S.	increased	bulde a	to Chiano
knobs	only) in all	No tx to	declare	DO al	o advista
numbe	only) in all ous in mess f low CO2/Air	low system	1 by incr	easing a	ir b 02
IN VIO	Low CO2/Air	t of Xt	ry to inc	rease pt	L. 29 0.2
1. one	I. C. Dol	15150	0		
n. I		and for s	he maket	lights 1	off in cham
gas ta	IL (N2) QUIT	10111	11.0		01
gas ta	nk (N2) suit	12		3	01
gas ta	TIL (NQ) QUIT			3	201
gas ta				0-	

64	- F-	12	46	m			ine	vi	ell		1	sa		p		40	ue		אנ	1)							73		
			1		TD/CRD	done	dono	dono		done+dup	N/A	done	done	done	done	done+ spike	done	done	done	done	done	done	done						
					11-	LID	01.7	/.04	6.93	6.97	6.96	6.98	6.99	6.86	6.83	8.30	7.73	8.10	8.10	8.57	8.48	8.46	7.83						
						DO (umoVL)	328.0	324.7	317.1	318.1	320.1	169.8	140.2	189.3	201.8	320.2	312.7	317.3	320.3	203.1	98.4	211.6	165.3						
	1					T (°C)	19.5	19.5	19.4	19.4	19.4	19.5	19.5	19.4	19.4	19.5	19.5	19.4	19.4	19.5	19.5	19.4	19.4						
						Time	2:50 PM	3:18 PM	5:20 PM	5:30 PM	5-30 PM	2.33 PM	MO VV C	3:44 PM	D.43 LT	MU ST-1	4.30 PM	MG PM	6-24 PM	N-15 PM	5-00 PM	6:38 PM	6:46 PM						
	1					Core	1	2	σ	0 01	01	dnp-01	ŋ,	4	11	71	n u	0 (5	1 <u>1</u>	- 0	α u	64	2					
					and a state of the second states of the second stat	23/ 2024 TIN40 Latanta	Idiget IX		aerobic/ph/-filgit COZ/Air-190 amin	aerobic/pH7-high CO2/Alr-ALUM	aerobic/pH7-high CO2/Air-ALUM	aerobic/pH7-high CO2/Air-ALUM	anaerobic/pH7-high CO2/N2-NO alum	anaerobic/pH7-high CO2/N2-NO alum	anaerobic/pH7-high CO2/N2-ALUM	anaerobic/pH7-high CO2/N2-ALUM	aerobic/pH8.5/low CO2/Air-NO alum	aerobic/pH8.5/low CO2/Air-NO alum	aerobic/pH8.5/low CO2/Air-ALUM	aerobic/pH8.5/low CO2/Air-ALUM	anaerobic/pH8.5-low CO2/N2-NO Alum	anaerobic/pH8.5-low CO2/N2-NO Alum	anaerobic/pH8.5-low CO2/N2-ALUM	anaerobic/pH8.5-low CO2/NZ-ALUM					



Lab H. HR 70 measurements, S	ample collection, gas che	UK = 14 (14 8	124/22
Objectives: Check mass flow, 1 HR 70 mecsure	bubbling, N2 gestant	china	
Methods. I. Switch No go II The Mass flow cl 000/174/22			
amac: following DAPP, sop		, i i i i i i i i i i i i i i i i i i i	prechas.
Dete			
Table Reagents + Instrum	nontr		
Pergents/Instruments	servel/Lot#	albrete	2
Do sensa presense Fibox 4	SAMA 0008000073	DS 8/15/2	
ThermoScientific Drionstan A 214 pH meter	x18241	CB 8/24/7	
No Jank	W24222124A		
Cos tank	2433619		
oH7 buffer	CC 788831		
old 10 buller	CC 787687	-	
Table 2 N2 gas bracking		Il meter calibrate	
Time psl 1:27p 750 # 6:30p 2700	pH7 buffer pH10 buffer	petre cel after 6 98 6. 9 99 10	29 29
8:18°p 250D	Slope 99.41.		Y
* used gas tank 27450 psi hered in between.	buffer 7 before al 7.01 buffer 7 before al 7.01 buffer PH 10 bytas al 10.05	- after cal off 7 buffer no 10	= 10.00
Table Massflowr	eadings at 1.27 pm.	247 buffer post ni	econers Nts 6.99
Tx CO2(see		Air (sl/m)	
100 CO21N2 0.100	3-700		
men co2/N2 7.708			
high cos/hir 5-10		0.500	
Low CostAir 0.40		5.600	2
8:20pm increased No bubbl	ing only.		
	03 2124129	0.	5 924124 pg 41

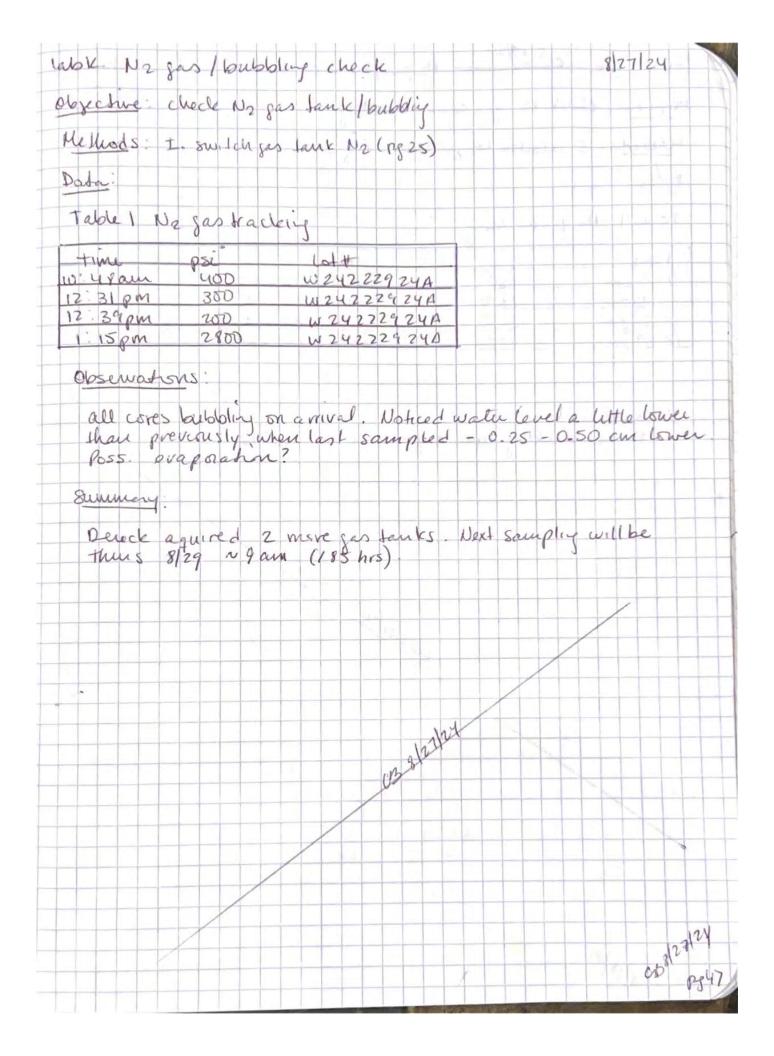


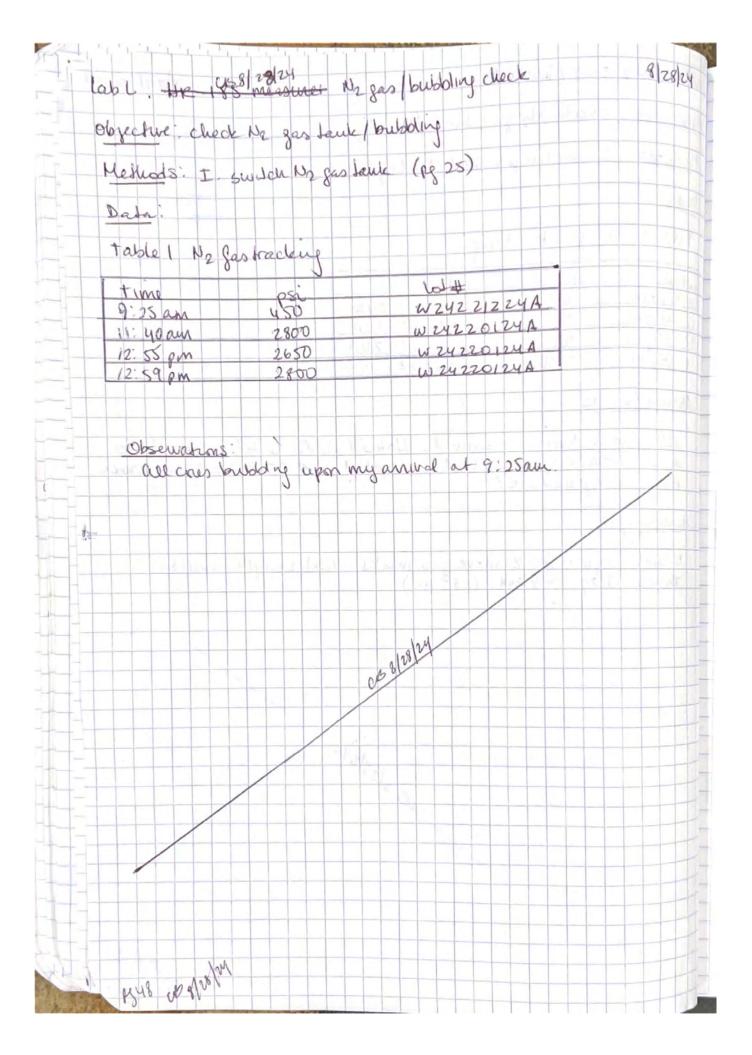
	1						+
		A.2			10		
		5400	1-1-		1		
8/24/2024 HR70 Parameters							
Target Tx	Core	Time	T (°C)	DO (umol/L)	Hd	TP/SRP	1
aerobic/pH7-high CO2/Air-NO alum	1	2:28 PM	19.5	321.7	7.05	done	
aerobic/pH7-high CO2/Air-NO alum	2	2:59 PM	19.5	327.9	7.01	done	
aerobic/pH7-high CO2/Air-ALUM	6	4:51 PM	19.4	324.9	6.96	done+spike	
aerobic/pH7-high CO2/Air-ALUM	10	5:16 PM	19.4	326.2	6.96	done	
anaerobic/pH7-high CO2/N2-NO alum	с,	3:15 PM	19.5	160.7	6.99	done+dup	
anaerobic/pH7-high CO2/N2-NO alum	3-dup	3:15 PM	19.5	171.4	7.12	N/A	
anaerobic/pH7-high CO2/N2-NO alum	4	3:41 PM	19.4	186.3	7.01	done	
anaerobic/pH7-high CO2/N2-ALUM	11	5:26 PM	19.4	194.4	6.82	done	
anaerobic/pH7-high CO2/N2-ALUM	12	6:03 PM	19.4	188.9	6.97	done	
aerobic/pH8.5/low CO2/Air-NO alum	Q	3:53 PM	19.4	325.6	8.33	done	
aerobic/pH8.5/low CO2/Air-NO alum	9	4:11 PM	19.4	323.5	7.88	done	
aerobic/pH8.5/low CO2/Air-ALUM	13	6:14 PM	19.4	321	8.27	done	
aerobic/pH8.5/low CO2/Air-ALUM	14	6:22 PM	19.4	324.2	8.55	done	
anaerobic/pH8.5-low CO2/N2-NO Alum	7	4:24 PM	19.4	216.2	8.83	done	
anaerobic/pH8.5-low CO2/N2-NO Alum	80	4:40 PM	19.4	196.2	8.65	done	
anaerobic/pH8.5-low CO2/N2-ALUM	15	6:46 PM	19.4	215	8,59	done	
anaerobic/pH8.5-low CO2/N2-ALUM	16	6:57 PM	19.4	184.1	8.59	done	
		4	1				
					4.1		-
	-		1				1
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													-		1	Last	
	all	core	6	udde	up .	at	an	val	1:3	300	m.	pU	mes	er r	call	Brau	20.
	00:	seus	sil.	asta	Sel	cbro	ete-	1 8/	15/2	46	1 D.	5.	Tha	ven	or r	bret ecal	vora
	Sin	ce -1	mus	Com	217	asi	fre	cili	bra	hn	p th	115	cnsl	vm	in		+
	-11			confi	den	1	1	-		1		L e		1110	nde	uch	reite
	914	level	s h	ave	im	nah	ed,	clos	us.	0 1	aye	640	0 no	els	to	decu	2000
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	0	yosle	RY	que	VI L	J	100	t ru		an	200						
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	in	had	uced	1 th	or	ph :	sam	plu	m	in	ods	0	r le	chni	que	. 11	S
	- IV	and the class of	24	VL2 C	- ward	~ v ~		1000	100	and VY		-					
	O	1151	- bil	ity	du	140	15+	ju-	ek	d	ince	Low	tim	asi	epor	lean	1
	2	ovan	(05t	824	24	anp	et a	1.,2	0(4)	m	esu	as	- +-	su	su l	20381	-
		0 200	180	heed	S	re-c	all	ba	non		1						
	t		-1.05	loo d	~7		0	ma	el	103	es o	end	he	ight	of	Aloc	
	0	ac	no	\times 2	.50	im	Se	TIL	do	1 to	201	m	off	wat	er y	Sun	nn.
	T	dos	ene	1 au	d	com	pare	ed (ore	12	Cla	000	211	2 4	UM.) and	
	C	Se T	111	n Ci	10	Val	nho	Peru	1) 9	Ual	ilat	uel	yau	ia n	9414	ed al	ipae-
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	l	insu	re il	core	1	LOOK	sa	u	e d	ype	ens	m	an	one	IS TO	of de Howe	Decer
	6	show	dij	- on	fre	1	- 30			au	e s	6 4		everes	v-	NOWE	vert
	T	ro G	DC-	inc	Sax												
		12 +0	inks	SUI	1 de	ed	14	phis	di	in	cha	ub	er.				
									-01						/		
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								1.1	24	1				_			
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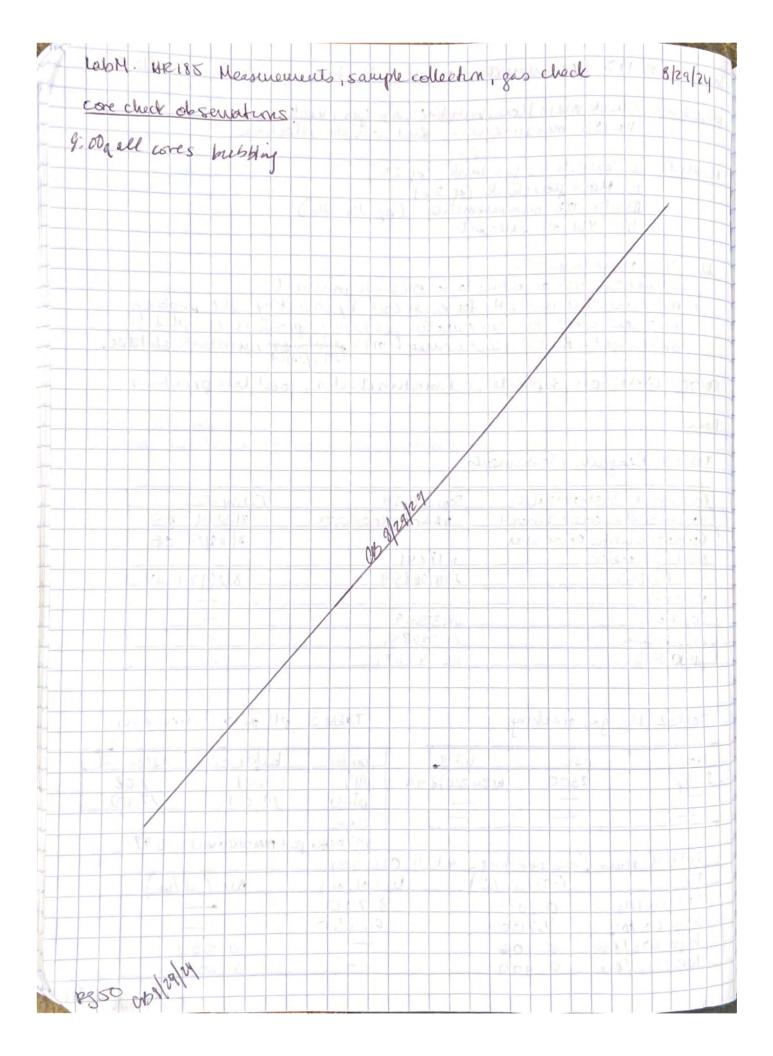
ab I. No gas	I bubbling chec	k		5	125/24
Objectives: Ch	uck N2 jastante	and buddolin	(e : 1213	1. 12Y
	switch gas tank		2		
Date:				1 5- 1	
Tablel Nor Time 2:57pm 3.02pm	280D	N2 lot#w2			
Summary:	gas sauk (N2) u were busbling	vas switched	to a new ta	uk. Al	cores
		CE \$ 125/24		0	08/25/24 88.45
ab J. Nz gas	I buldding check	k, YSI DO M	easurements		8/26/24
objectives: C	check Nz gas Jan	and bubble	g	J.	
Methods: T.	switch No ges 1	lauk			
Dada:	1 4 1 1 1 1 1				
Tablel N2 time	ges trecking	lott	+	-	
10:08 an	600 surlike	d to W242	22124A	-	
12:40 au	300 50100	1 W 242	22124A	-	
12 10 pm	450 0	al in wzu-	22124A		
3:06pm	370 switch 2750 W	W2422	2924A Wt 4	Ŧ	
Changes to 1	Procedures:				
Per consu anaerobic being used tx. 80551	l Latin with (tx using DO for the shidy bly into ducing with instrument	Clark, also probe to con due to high DO with syr	measure Do mpare to D Do reading inge pulling	o in shi o sensor in ane methid	erobic
					c6 8125124 68 83 45

+1-	Labs. No se	s I buldding	check, YSI DO		3/20
-			easurements 8		
-	Core	The	DO mg/L	DO1.	ty
1	3	1.34p	1. 51	16-7	high CO2/N2
	4	1:49p	1 5 0 40	4.5	high CO2/N2
	7	1:57p	0.84	9.3	low CO2/N2
	8	2:070	0.67	7.3	how CO2/N2
_	15	2:050	0.60	6.7	buce IN2 AWM
_	16	2:09	0.34	3-8	Ew CO2/No AWM
	11	2:13	0.44	4.8	high CO2/N2 AUM
	12 22224	2:17	2.85	31.4	high CO2/N2 Allen
		ation ins		3/20/24	
	ivill n 3 ann a t le	- n Sam. - n Sam.	eurigh N2 % Dereck will 1 nore.	ry to aqu	nrough wed 8/28/21 ire more No Jank
	481	confirmed	bower DO Jest both m	measuremen	its than Dosens
-	heve	vec win te	SCIT COSVI IN	chucas at n	eer sampling
+-			0/2 8/21	124	
1-		1011-201	Ub		
	157				





	5 Measuremen	to, sample	Collection	1 gascheck	8/29/24
preceives: Cho	de man lla	1 110100 1		.1.	
byectures: Che He	185 meaning	, busony r	2 yas che	lacha	
	news many many	ana ana	samper	mechan	
lethods. I. S	Suritch No an	lande las 1	E		
T	Mars flow cher	L (00 21)	3)		
	Hr 185 measu	noments 1	25-210		
IV.	YSI measure	ments	12 - 2	,	
I. YSI Mec					
1. calibrat	e ystaccade	up to instruct	non man	val	
2 measure	DO and of	1 for each 1	ne by ins	estine the a	robe
into the	cores over	ying water,	ensuring	probe is com	pletely
submerg	cc. record m	easurent	once proc	probe is compensations	Stabilize.
and certer,	aurs, duplicat	es, culibratu	mchecks,	good lab pro	chies
Dola.					
table 1 Re .	d lader	e et			
Table Reag	curs + MISROW	eus			
Reagents + 11	astromotes	Seriel/lot	#	Cubrated	
	Souse Fiboxy		8000073	8/15/24	
Thermascient		SARBILL	80000 B	8/29/24	
AZIY OH Me!		× 18241			
VSI PODSS		2214/0685		829120	VL I
No Jank					
Co, tank		2433619		_	
		CC 78883		-	
pH7 buller		CC 7876	87		
		<u>cc 7876</u>	87		-
pH 7 buffer pH 10 buffer					
pH7 buller	gas tracking	<u> </u>	87 Table 3	pH meter culi	brahon
pH 7 buffer pH 10 buffer table 2 Nz			Table 3		
Table 2 Nz Time	psi	Lot ##	Table 3	before al	aftercal
pH 7 buffer pH 10 buffer table 2 Nz	psi		Table 3 buffer pH7		
Table 2 Nz Time	psi	Lot ##	Table 3 buffer pH7 pH10 slape	before cil 7.01 10.07	after c.l. 7.02 10.00
Table 2 Nz Time	psi	Lot ##	Table 3 buffer pH7 pH10 slape	before cil 7.01 10.07	after c.l. 7.02 10.00
Tablez Nz Time 2:19p	2300 k	1 24 22072 4A	Table 3 buffer pH7 pH10 slage pH7buffer	before al 7.01	after cl. 7.02 10.00
Tablez Nz Time 2:19p	2300 k	101 #= 124 22012 4A 	Table 3 buffer pH7 pH10 slope pH7buffer pH7buffer	Defou al 7.01 10.07 post measurements	after c.l. 7.02 10-00 c68)24124 6.77 7.02
Table 2 Nz Table 2 Nz Time Z:19p Table 4 Mas Tx	psi 2300 k Jlow readi CO2 (scc	124 22012 4A	Table 3 buffer pH7 pH10 slope pH7buffer 0 am	before cil 7.01 10.07	after c.l. 7.02 10-00 c68)24124 6.77 7.02
Table 2 NZ Table 2 NZ Time 2:19p Table 4 Mas Tx Iow Co2 /W2	psi 2300 k 	1,24,220)2 4A 	Table 3 buffer pH7 pH10 slope pH7buffer pH7buffer pH7buffer o ann c sl(m) 3.700	Defou al 7.01 10.07 post measurements	after c.l. 7.02 10-00 c63)22124 6.77 7.02
Table 2 N2 Table 2 N2 Time 2:19p Table 4 Mas Tx Iow Co2 1W2 high Co2 1N2	psi 2300 k 2300 k 2300 k 200 (scc 0.100 7.700	124 22072 4A 	Table 3 buffer pH7 pH10 slope pH7buffer 0 am	before al 7.01 10.07 post measurements Arr (sl,	after col 7.02 10-00 6.17 7.02
Table 2 NZ Table 2 NZ Time 2:19p Table 4 Mas Tx Iow Co2 /W2	psi 2300 k 2300 k 200 k	124 22072 4A 124 22072 4A 125 at 9:0 (m) N;	Table 3 buffer pH7 pH10 slope pH7buffer pH7buffer pH7buffer o ann c sl(m) 3.700	Defou al 7.01 10.07 post measurements	after col 7.02 10-00 668)22124 6.17 7.02



	Pro DDS	DO measurem	outs	48/2012	4		
ore	Time	DO myll mid-way	DO 7. midway	pH P midway	DO mill	tom battom	pH
1	12:170	9.53	104.9	-	9.50	104.6	-
2	12:239	9.45	104.4	-	9.41	104.0	-
3	11:44a	1.98	21.9	7.10	1.84	20.3	7.09
Y	12:250	0,52	5.7		0-50	5.8	-
5	11:5Da	9.41	104.3	1.24	. 9.42	104.2	3.27
6	11:590	9.23	101.8	7.99	4.23	101.7	7.96
7	12:429	0-86	9.5		0.81	8.9	
8	12:450	1.34	14.7		1.23	13.5	-
9	12:10p	9.58	185.700	4.58	- 105.7	- 105.7	
10	12:20p	. 9.32	102.8		9.20	101-2	-
11	12:308	0.52	5-7	-	0.46	5.1	-
12	12:340	0-38	4.2		0,21	2.3	
13		9.57	105.9	8.47	49:59	105.9	5.47
14	12:029	9.,59	105-9	8.41	9.60	106.0	8.4
15	12:380	0,93	10.2	-	0-89	9.8	
10	12:490	0,57	6.3		0,56	6.1	
in	helly also	recorded pld, b ever taking long.	towever since	e only DO schween c	was neces	any and much with	DD

030/29/24

CB 8/29/24 - 19551

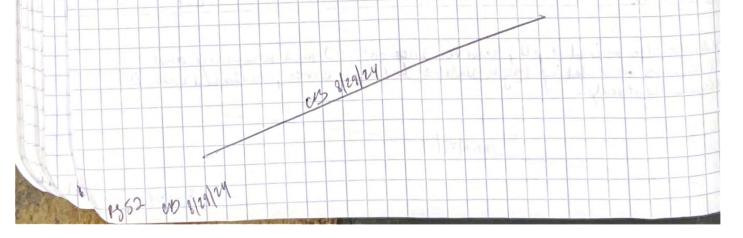
	LODH. DE 195 Neasurement	1.1					1	Time	DO (mg/L)	DO (%)	00/	
1	8/29/2024 HR185 Parameters				DO (umoVL)	pH	TP/SRP		YSI ProDSS	VCID	DO (mg/L)	DO (%)
13-1		ore	Time		DO sensor				mid-water column i 9.53	nid-water column	TSI ProDSS	YSI ProDS
1 1					DO sense.			12:17 PM	9.53	104.9	inch from bottor	inch from bo
+-1					318	7.01	done	12:23 PM	9.45	104.4	9.5	104.6
+++	aerobic/pH7-high CO2/Air-NO alum	1	9:26 AM	19.5	323.7	7.11	done	12:20 PM	9.58	105.7	9.41	104
	aerobic/pH7-high CO2/Air-NO alum	2	9:34 AM	19.5	323.7	7.08				102.8	9.58	105,7
-	aerobic/pH7-high CO2/Air-ALUM	9	10:25 AM	19.4		7.14		12:20 PM			9.2	101.2
-11	aerobic/pH7-high CO2/Air-ALUM	10	10:31 AM		316.4 139.6	7.02		11:44 AM		21.9	1.84	20.3
-	anaerobic/pH7-high CO2/N2-NO alun	з	9:42 AM	19.5	139.6	7.02		12:25 AM	0.50	5.7	0.52	5.8
	anaerobic/pH7-high CO2/N2-NO alun	4	9:52 AM	19.5	149	6.87		12:30 PM		5.7	0.46	5.1
	anaerobic/pH7-high CO2/N2-ALUM	11	10:40 AM			7.02	done+dup	12:34 PM	N/A	4.2	0.21	2.3
-	anaerobic/pH7-high CO2/N2-ALUM	12	10:55 AM			7.04	N/A	N/A	0.44	N/A	N/A	N/A
4	anaerobic/pH7-high CO2/N2-ALUM					8.26	done	11:50 AM	0.22	104.3	9.42	104.2
-	aerobic/pH8.5/low CO2/Air-NO alum		9:58 AM			7.99	done	11:59 AM	0.57	101,8	9.23	101.7
-	aerobic/pH8.5/low CO2/Air-NO alum		10:00 AM			8.4	done	12:07 PM	0.50	105.9	9.59	105.9
-	aerobic/pH8.5/low CO2/Air-ALUM aerobic/pH8.5/low CO2/Air-ALUM	13				8.46	done	12:02 PM		105.9	9.6	105.9
1	anaerobic/pH8.5-low CO2/NI-ALOH anaerobic/pH8.5-low CO2/N2-NO A		10:15 A			8.7	done	12:42 AM		9.5	0.81	8.9
1	anaerobic/pH8.5-low CO2/N2-NO A					8.93	done	12:45 PM		14.7	1.23	13.5
han	anaerobic/pH8.5-low CO2/N2-ALUI				.3 149.4	9.02	done	12:38 PM		10.2	0.89	9.8
4	anaerobic/pH8.5-low CO2/N2-ALU		6 11:20/	AM 19	.3 118	8.84	done+spike	12:49 PM	0.57	6.3	0.56	6.1

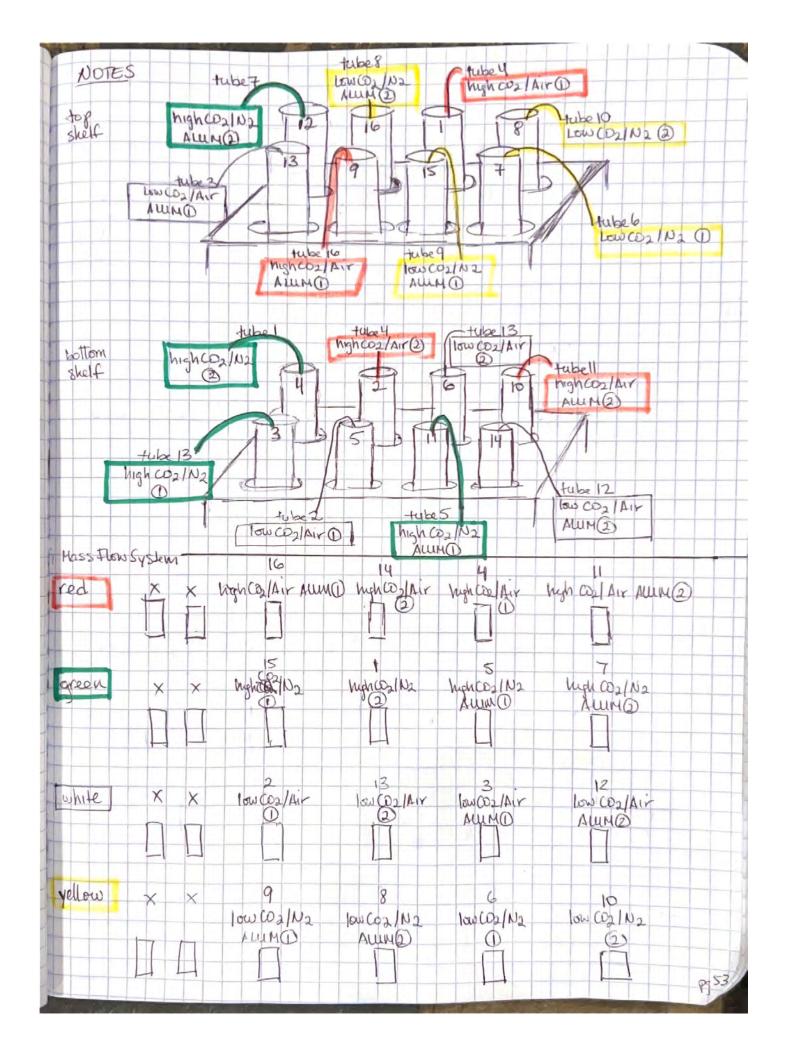
8/29/2024 HR185 Parameters				10.1	pH	TP/SRP	Time	DO (
	ore	Time	T (°C)	DO (umoVL) DO sensor	pro		n	YSI Pi
					7.01	done	12:17 PM	9.
aerobic/pH7-high CO2/Air-NO alum	1	9:26 AM	19.5	318	7.11		12:23 PM	9.
aerobic/pH7-high CO2/Air-NO alum	2	9:34 AM	19.5	323.7 316.2	7.08	uone	12:10 PM	9.
aerobic/pH7-high CO2/Air-ALUM	9	10:25 AM	19.4	316.4	7.14	done	12:20 PM	9.
aerobic/pH7-high CO2/Air-ALUM	10	10:31 AM	19.3 19.5	139.6	7.02	done	11:44 AM	0
anaerobic/pH7-high CO2/N2-NO alun	3	9:42 AM 9:52 AM	19.5	186.6	7.02	done	12:25 AM	0
anaerobic/pH7-high CO2/N2-NO alun	4	10:40 AM	19.3	149	6.87	done	12:30 PM 12:34 PM	0
anaerobic/pH7-high CO2/N2-ALUM	12	10:55 AM		196.6	7.02	done+dup	12:34 PM	1
anaerobic/pH7-high CO2/N2-ALUM anaerobic/pH7-high CO2/N2-ALUM				162.7	7.04	N/A	11:50 AM	g
aerobic/pH8.5/low CO2/Air-NO alum	5	9:58 AM	19.5	322.1	8.26	done done	11:59 AM	9
aerobic/pH8.5/low CO2/Air-NO alum	6	10:00 AM	19.4		7.99	done	12:07 PM	5
aerobic/pH8.5/low CO2/Air-ALUM	13	11:02 AM			8.4 8.46	done	12:02 PM	-
aerobic/pH8.5/low CO2/Air-ALUM	14	11:10 AM			8.7	done	12:42 AM	
anaerobic/pH8.5-low CO2/N2-NO Alu	J 7	10:15 AM			8.93	done	12:45 PM	
anaerobic/pH8.5-low CO2/N2-NO Ali	8	10:20 AN			9.02	done	12:38 PM	
anaerobic/pH8.5-low CO2/N2-ALUM	15	11:11 AM 11:20 AM			8.84	done+spik	e 12:49 PM	

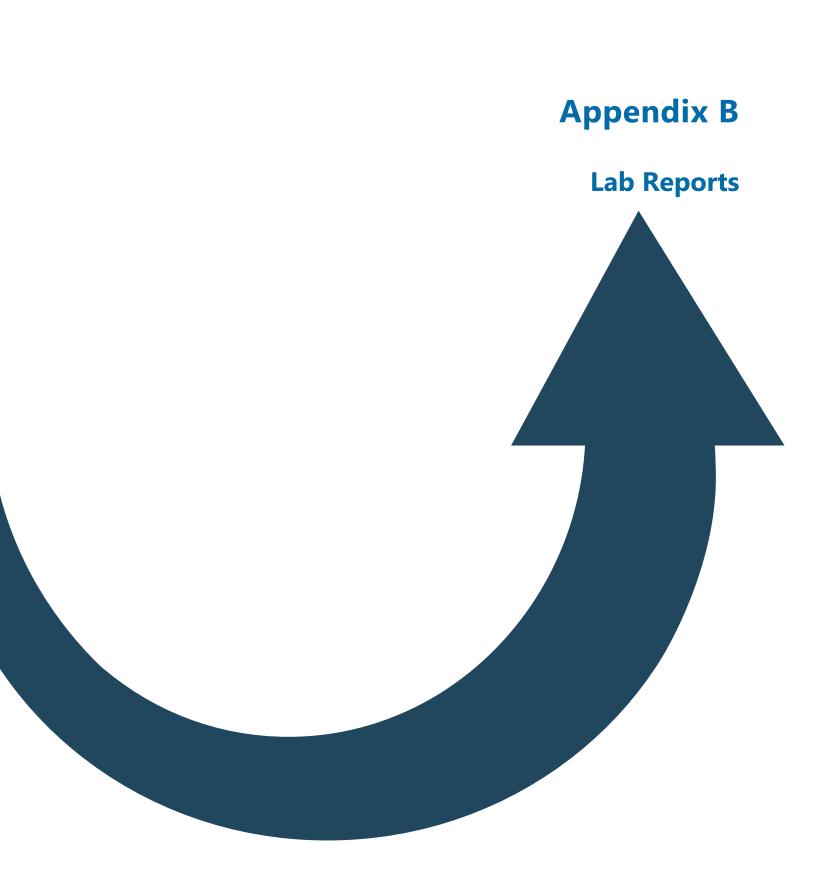
Summary:

all crees were bubbling upon my arrival of gam. pH, DD, and sample collection were done per previous methods. Then DO was measured with YSI Pro DSS

DO sensor measurements have been the initial number provided by sensor, as numbers did not seen to stabilize the experiment, I re-tessed randomly, 138/29/24 At the end of the experiment, I re-sessed, randomly, cores to and it to see if there could be a gossibility not enough time was allowed for DO sensor to stabilize initial reading for core lowes 319.0 went down to 318, then back up to 340.2 (after Smin) and consinued to go up. Gove II started at 179.) and a ster Comin was at 71.7 and continued to slowly go down. Results reported to t.C









KR.	IEH
	Laboratories & Consulting Group

CERTIFICATE OF ANALYSIS

Contact:Rob Zisette 200 6th Ave Seattle, WA 98121 Phone:206 441 9080 Fax:206 441 9108 IEH Laboratories & Consulting Group IEH Analytical Laboratories 3927 Aurora Avenue North Seattle, WA 98103 Phone: (206) 632 2715 Far: (206) 632 2417

Phone:(206) 632-2715 Fax:(206) 632-2417 www.iehinc.com

		TRADE SECRET	/ CONFIDENTIAL COMMERCIAL	INFORMATION	
WO: 1750468		Rec.	Date: 9/3/2024 6:51	Report Date: 12/31/2024	Report No: IAL-67241
Lab Sample ID	Client Sample ID	Analysis Date		Aluminum (mg/L)	
1750468-161194	ALUM	9/10/2024		60100	
1750468-161195	LAS	9/10/2024		108000	
Test Method: Aluminur	n = Aluminum EPA 200.8				

UNLESS OTHERWISE NOTED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. THE RESULT(S) IN THIS REPORT RELATE ONLY TO THE PORTION OF THE SAMPLE(S) TESTED. THIS REPORT DOES NOT CONSTITUTE A RELEASE OF PRODUCT FOR CONSUMPTION. THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT WRITTEN APPROVAL OF THE LABORATORY. THIS DOCUMENT CONTAINS CONFIDENTIAL COMMERCIAL INFORMATION PURSUANT TO 5 U.S.C. SEC. 552(b)(4).

amen Hademsh"

Laboratory Director: Damien Gadomski

Bell Sediment Study Policit winner: Comp Tic. Carter Transition Stagt County Corp Tic. Cartel@herrerailnc.com Requesta Completion Date: Stagt Transition Hazardous Materials Caution Hazardous Materials Stagt Transition Hazardous Materials Caution Hazardous Materials Stagt Transition Hazardous Materials Caution Hazardous Materials Stagt Transition Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials Stagt Transition Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials Caution Hazardous Materials (Signapsi Stagt Freeson Stagt	HERRERA Provincial States I and						Ampluson Dogulart	Š.	
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track/@herrerainc.com Rob Ziette, risette@herrerainc.com e Hand: Caution Haardous Materials ic Research Std Std Time Viset de Viset Terai No. of Caution Face Viset de Viset Total No. of Caution Face Std Time Viset de Viset Total No. of Caution Face Viset de Viset Total No. of Caution Face Viset de Viset Viset de Viset Sample ID 1 Viset de Viset Viset de Viset Sample ID 9/2/2/024 9/2/2/024 1030 6 N 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1030 9/2/2/024 1040 1 X 1 <td>Report To:</td> <td></td> <td>Сору То:</td> <td><u>}</u></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Report To:		Сору То:	<u>}</u>					
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9/2/2024 1030 G N M 1 X	ALUM	9/2/2024						16/1/14	
c-Composite Matrix Codes: A-A/r GW-Groundwater SE-Sediment SU-Surface Water W-Material C-Other (Specify)	LAS	9/2/2024	-		1-3			6M015	
c-composite Matrix Codes: A-Alir CW-croundwater SE-Sediment SD-Soil SW-Surface Water W-Water (blanks) M-Material C-Other (specify)									
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e/CO/ , Herrera /////////////////////////////////	LSA = Sodium aluminate (20.1% AL2O3) = strong causic base	Date/Time	Received By (Vame/CO)	Signatur	e	Date/	Time 2,40
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	Sample Type: G=Grab C=Composite						ALA MANAtoria	O-Othor (engeify)	

					Runner on one of an and the second	Check with lah for specific holding times and sample containers.	*Keep samples refrigerated or on ice.	Special Notes:	CORES-HRO SPK+QC	CORET-HRO	CORE6-HRO	CORES-HRO-DUP .	CORES-HRO	CORE4-HRO	CORE3-HRO		CORFLERO	CAM-DEEP-08192024	2	Laboratory WWU Institute for Watershed Studies Environmental Studies Building Contact: Phone:	CHAIN OF CUSTODY RECORD Client Information Name: Skagit County Address: 1800 Continental PI. Mount Vernon, WA 98273 Contact Leanne Ingman Phone: 360-899-6758 Email: leanne@co.skagit.wa.us	SNI SNI
					the site output of the	mes and sample contai			CTP/TN)											ig	RECORD 8273	WATERSH STUD
						ners.			8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	R/19/24	8/19/24	8/19/24	Date Collected			
Deterring.	Channel	Signature:	Received by:			Company:	Signature:	Relinquished by:	14:53	14:49	14:04	13:57	13:57	13:55	13:45	13:40	14:22	-	Time Collected		Project and Billing Information Project Name: Lake Campbell Sediment Incubation Study Contact: Tim Clark Email: tclark@herrerainc.com Granu/Fast Index: (<i>WWU Internal only</i>) Samples collected by: Claudia Basso	
					8/29/24	Herrera Environmental Consultants. Inc.	0	Claudia Basso	1-60ml, 1-10ml	1-60ml 1-10ml	1-60ml. 1-10ml	1-60ml, 1-10ml	# and type of	-	illing Informs : Lake Camp Slark Sherrerainc.cc ex: ex: cted by: Clau	WES: WASHI UNIVE						
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								and the post of the second sec	frozen and trasported on ice	frozen and trasnoted on ice	ten and trasported on ice	frozen and trasported on ice	Preservation (eg. HCl, ice,		0 <u>ent Incu</u> bation Study	CORE 4 CORE 3 CORE 3-						
										d on ice			on ice	on ice	on ice	nn ice	onice	on ice	1. ice,		54	CORE 3 -070 - DUP CORE 3 - MRO - DUP CORE 8 - MRO - DUP

Comments/Special Notes: Rein *Keep samples refrigerated or on loe. Sign *Check with lab for specific holding times and sample containers. Date Reg Sign Comments/Specific holding times and sample containers. Date Reg Sign Comments Comments Comments Reg Sign Comments Comments Sign Comments Sign					COREIG-HRO-SPK + QC + CVC		CORE15-HR0	CORE14-HR0	ORE13-HRO	CORE12-HR0	CORE11-HRO	CORE10-HRO		Sample ID	Laboratory WWU Institute for Watershed Studies Environmental Studies Building Contact Phone:	Phone: 360-899-6758 Email: leanne@co.skagit.wa.us	Contact Leanne Ingman	Address: 1800 Continental PI. Mount Vernon WA 08273	Name: Skagit County	Client Information	CHAIN OF CUSTODY RECORD	INSTITUTE FC WATERSHE STUDIE					
				containers.			8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	8/19/24	Date Collected									E FOR UDIES		
Company:	Signature:	Received by:	Dopping by	Date/Time: 8/29/24 12:45p	Company:	Signature:	Delinguiched hv	14:17	14:17	14:49	14:45	14:39	14:34	14:31	14:26	13:30	Time Collected	Analy	(WWU internal o Samples collect	Project Name: Lake Campue Contact: Tim Clark Email: tclark@herrerainc.com Grant/Fast Index: (WWU internal only)	Project Name: Lake Campbell Sediment Incubation Study	Project and Billing Information					
				/24 12:45p	Herrera Environmental Consultants, Inc.	1	Claudia Basso	1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	# and type of containers		(WWU Internal only) Samples collected by: Claudia Basso	ake Campbe rk merainc.com		ng Informatic		VESTE			
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				containers.			8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	Date Collected				UDIES UDIES
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			Date/ Little, 0/	Herrera Enviro	Car	Claudia Basso	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	1-60ml, 1-10ml	# and type of			Ing Informati Lake Campbe ark errerainc.com errerainc.com x: only) ted by: Claudi	VEST JNIVE
			rater Fille, 0/23/24 12,430	Herrera Environmental Consultants, Inc.					W	W	W	W	W	W	W		Total Organic Carbon (as NPOC) Dissolved Organic Carbon (as NPOC) Total Nitrogen Nitrate + Nitrite	Analysis Requested		Project and Billing Information Project Name: Lake Campbell Sediment Incubation Study Contact: Tim Clark Email: tclark@herrerainc.com Grant/Fast Index: (WWU internal only) Samples collected by: Claudia Basso	TERN NGTON RSITY
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				*Check with lab for specific holding times and sample containers	*Keep samples refrigerated or on ice.	Comments/Special Notes:		CORE16+112-50- HC12-13-DU1		143		HR	1	1	Hei			Laboratory WWU Institute for Watershed Studies Environmental Studies Building Contact Phone:	Mount vernon, WA 98273 Contact Leanne Ingman Phone: 360-899-6758 Email: leanne@co.skaglt.wa.us	Client Information Name: Skagit County Address: 1800 Continental PI,	CHAIN OF CUSTODY RECORD	WATERSHE
				tainers.				8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	8/22/24	Date Collected						DIES
Company: Date/Time:	Signature:	Received by:	Date/Time:	Company:	Signature: 4	Relinguished by:		12:15p	12:15p	12:01p	12:01p	11:33a	11:15a	11:05a	10:58a	Tim			Email: tclark@herrerainc.com Grant/Fast Index: (WMU internal only) Samples collected by: Claudia Basso	Project and Billing Information Project Name: Lake Campbell Sediment Incubation Study Contact: Tim Clark		002
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					containers.			8/23/24	8/23/24	8/23/24	8/23/24	8/23/24	8/23/24	0120124	0/23/24	0/20/24	0/20/24	Date Collected		TUDIE RSHE
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				9/24 12:45p	Herrera Environmental Consultants, Inc.			W :	W	W	W	W	W	W	W	W	W	Total Organic Carbon (as NPOC) Dissolved Organic Carbon (as NPOC) Total Nitrogen Nitrate + Nitrite	Bass	NG TON RSITY
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Client Information								
Client Information Name: Skagit County Address: 1800 Continental PI. Mount Vernon, WA 98273 Contact Leanne Ingman Phone: 360-899-6758 Email: Ieanne@co.skagit.wa.us		Project and Billing Information Project Name: Lake Campbell Sedin Contact: Tim Clark Email: tclark@herrerainc.com Grant/Fast Index: (WWU internal only) Samples collected by: Claudia Basso	lling Informat Lake Campb lark lark nerrerainc.cor nerrerainc.cor v: v: v:	ell Sedir	Project and Billing Information Project Name: Lake Campbell Sediment Incubation Study Contact: Tim Clark Email: tclark@herrerainc.com Grant/Fast Index: (WWU internal only) Samples collected by: Claudia Basso	udy	Page:6_ Project Name: Lake Camp	Page:6 of10 Project Name: <u>Lake Campbell Sediment Incu</u> bation Study
Laboratory								
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Sample ID	Date Collected	Time Collected	# and type of containers	matrix Total	Orga Diss olve Total Nitro Nitra te + Total	Pho Amm onia	Solu ble Chlo roph TP spik SRP spik	Preservation (eg. HCl, ice,
CORE10-HR46	8/23/24	5:30p	1-60ml, 1-10ml	_		~ .		e(c.) frozen and trasnorted on ice
CORE10-HR46-DUP	8/23/24	5:30p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
CORE11-HR46	8/23/24	5:43p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
CORE12-HR46 SPKJ QC	8/23/24	5:55p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
	8/23/24	d6:09p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
CORE14-HR46	8/23/24	6:24p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
CORE15-HR46 SPK+QC	8/23/24	6:38p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
CORE16-HR46	8/23/24	6;46p	1-60ml, 1-10ml	W		×	×	frozen and trasported on ice
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	a a a a a a a		
-	Total Orga Diss olve Total Nitro Nitra te + Total	Amm onia Solu	Preservation (eg. HCl, ice, elc.)
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Name: Skagit County Address: 1800 Continental PI. Mount Vernon, WA 98273 Contact Leanne Ingman Phone: 360-899-6758 Email: leanne@co.skagit.wa.us		Project Name: Lake Campbell Sedir Contact: Tim Clark Email: tclark@herrerainc.com Grant/Fast Index: (WWU internal only) Samples collected by: Claudia Basso	Lake Camp Jark herrerainc.co ex: cted by: Clau	inn im dia Basso	ent Incubatio	n Study	Project Na	me: Lake Q
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CORE9-HR70-SPK	8/24/24	4:51p	1-10ml	H			Η	
CORE10-HR70	8/24/24	5:16p	1-60ml, 1-10ml	W		×	×	
CORE11-HR70	8/24/24	5:26p	1-60ml, 1-10ml	W		×	×	
CORE12-HR70	8/24/24	6:03p	1-60ml, 1-10ml	W		×	×	
CORE13-HR70	8/24/24	6:14p	1-60ml, 1-10ml	W		×	×	
CORE14-HR70 SPK+ QC	8/24/24	6:22p	1-60ml, 1-10ml	W		×	×	
	8/24/24	6:46p	1-60ml, 1-10ml	W		×	×	
CORE16-HR70	8/24/24	6:57p	1-60ml, 1-10ml	W		×	×	
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Comments/Special Notes:		Relinquished by:	Claudia Basso			Relinquished by:	ed by:	
*Keep samples refrigerated or on ice.		Signature:	Y			Signature:		
*Check with lab for specific holding times and sample containers.	ntainers.	Company:	Herrera Environmental Consultants, Inc.	imental Consu	ultants, Inc.	Company:		
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WATERSHED STUDIES



Institute for Watershed Studies Western Washington University 516 High St ES501 Bellingham, WA 98225 (360) 650-3510

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frozen and trasported on ice				×	F	×	F	F	F	F	W	1-60ml, 1-10ml	10:25a	8/29/24	CORE9-HR185
frozen and trasported on ice	E	F	t	×	t	×	t	t	t	+	N	1-60ml, 1-10ml	10:20a	8/29/24	CORE8-HR185
frozen and trasported on ice	E	t	t	×	t	×	t	t	t	-	W	1-60ml, 1-10ml	10:15a	8/29/24	CORE7-HR185
frozen and trasported on ice	t	t	t	×	t	×	t	t	t	+	Г	1-60ml, 1-10ml	10:00a	8/29/24	CORE6-HR185
frozen and trasported on ice	t	t	t	×	t	×	t	t	t	+	t	1-60ml, 1-10mi	9:58a	8/29/24	CORES-HR185
frozen and trasported on ice	t	t	t	×	t	×	t	t	t	+	F	1-60ml, 1-10ml	9:52a	8/29/24	CORE4-HR185
frozen and trasported on ice	t	F	t	×	F	×	t	t	t	+	T	1-60ml, 1-10ml	9:42a	8/29/24	CORE3-HR185
frozen and trasported on ice	t	t	t	×	f	×	t	t	t	+	Г	1-60ml, 1-10ml	9:34a	8/29/24	CORE2-HR185
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Preservation (eg. HCl. ice.	SRP spike	TP spike	Chlorophyll a	Soluble Reactive Phosphorus	Ammonia	Total Phosphous	Nitrate + Nitrite	Total Nitrogen	Dissolved Organic Carbon (as NPOC)	로 Total Organic Carbon (as NPOC)	2	# and type of	Time Collected	Date Collected	Sample ID
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ala Campball Codiment Insubstan Study	Namo- I	N POOL	P		tudy	on s	ubafi	tinc	imen	Sed	mobel	: Lake Car	Project Name: Lake Campbell Sediment Incubation Study		Name: Skagit County
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CORE12-HR185-DUP	8/29/24	10:55a	1-60ml, 1-10ml	W	× ;	< >		trozen and trasported on ice
CORE13-HR185	8/29/24	11:02a	1-60ml, 1-10ml	W	×	× >		Trozen and trasported on ice
CORE14-HR185	8/29/24	11:10a	1-60ml, 1-10ml	W	×	×		force and trasported on ice
CORE15-HR185	8/29/24	11:11a	1-60ml, 1-10ml	W	×	× :		frozen and trasported on ice
CORE16-HR185	8/29/24	11:20a	1-60ml, 1-10ml	W	×	×	<	force and trappited on ice
CORE16-HR185-SPK + QC	8/29/24	11:20a	1-60ml, 1-10ml	W	×	× :	×	frozen and trasported on ice
			1-60ml, 1-10ml	W			,	mozen and masported on ice
			1-60ml, 1-10ml	W				
Comments/Special Notes: *Keep samples refrigerated or on ice		Relinquished by:	Claudia Basso		Relin	Relinquished by:		
"Chack with lah for specific holding times and sample of		Company:	Loron Environ	montal Consulta		ature:		
Crisco with law for specific roughly times and satisfier containers		Date/Time:	Date/Time: 8/29/24 12:45p	Date/Time: 8/29/24 12:45p		Company: Date/Time:		
		Donotional her			2			
		Signature:			Sinn	Signature:		
		Company:			Com	Company:		
		company.						

Project: S16-06417

	Analysis Date	Method	MDL
T Phosphorus	9/5/2024	SM 4500-P J	5 ug/L
Ortho Phosphorus	9/4/2024	SM 4500-P G	3 ug/L

Core	Batch	Date	Time	TP(ug P/L)	OrthoP(ug P/L) notes
LC-CAM DEEP-081924	Lake	8/19/2024	10:53 AM	31.8	14.1
1	HRO	8/21/2024	10:06 AM	54.1	<det< td=""></det<>
1	HR12-18	8/22/2024	9:15 AM	54.1	<det< td=""></det<>
1	HR46	8/23/2024	2:50 PM	41.5	<det< td=""></det<>
1	HR70	8/26/2024	2:28 PM	37.0	<det< td=""></det<>
1	HR185	8/29/2024	9:26 AM	22.1	3.5
2	HRO	8/21/2024	10:11 AM	67.5	<det< td=""></det<>
2	HR12-18	8/22/2024	9:22 AM	48.6	<det< td=""></det<>
2	HR46	8/23/2024	3:18 PM	45.0	10.4
2	HR70	8/26/2024	2:59 PM	51.9	21.8
2	HR185	8/29/2024	9:34 AM	46.7	33.0
3	HRO	8/21/2024	10:16 AM	79.5	3.6
3	HR12-18	8/22/2024	9:28 AM	83.0	5.7
3	HR46	8/23/2024	3:33 PM	93.8	10.8
3	HR70	8/26/2024	3:15 PM	87.1	13.2
3	HR185	8/29/2024	9:42 AM	55.0	23.7
4	HRO	8/21/2024	10:21 AM	54.6	3.2
4	HR12-18	8/22/2024	9:33 AM	69.2	12.3
4	HR46	8/23/2024	3:44 PM	96.2	27.0
4	HR70	8/26/2024	3:41 PM	101.8	32.0
4	HR185	8/29/2024	9:52 AM	96.0	52.1
5	HRO	8/21/2024	10:26 AM	51.8	<det< td=""></det<>
5	HR12-18	8/22/2024	9:36 AM	46.5	<det< td=""></det<>
5	HR46	8/23/2024	4:16 PM	35.0	<det< td=""></det<>
5	HR70	8/26/2024	3:53 PM	27.7	<det< td=""></det<>

5	HR185	8/29/2024	9:58 AM	31.8	7.4	
6	HRO	8/21/2024	10:31 AM	75.8	10.5	
6	HR12-18	8/22/2024	9:51AM	103.4	51.5	
6	HR46	8/23/2024	4:30 PM	217.2	185.2	
6	HR70	8/26/2024	4:11 PM	250.3	215.9	
6	HR185	8/29/2024	10:00 AM	474.0	491.4	
7	HRO	8/21/2024	10:36 AM	459.1	6.8	C
7	HR12-18	8/22/2024	9:59 AM	87.6	10.1	
7	HR46	8/23/2024	4:45 PM	113.9	41.1	
7	HR70	8/26/2024	4:24 PM	149.4	81.6	
7	HR185	8/29/2024	10:15 AM	203.7	180.4	
8	HRO	8/21/2024	10:46 AM	48.7	<det< td=""><td></td></det<>	
8	HR12-18	8/22/2024	10:11 AM	51.7	<det< td=""><td></td></det<>	
8	HR46	8/23/2024	5:00 PM	55.1	3.1	
8	HR70	8/26/2024	4:40 PM	59.9	8.7	
8	HR185	8/29/2024	10:20 AM	95.0	67.8	
9	HRO	8/21/2024	10:51 AM	48.6	<det< td=""><td></td></det<>	
9	HR12-18	8/22/2024	10:29 AM	<det< td=""><td><det< td=""><td></td></det<></td></det<>	<det< td=""><td></td></det<>	
9	HR46	8/23/2024	5:20 PM	<det< td=""><td><det< td=""><td></td></det<></td></det<>	<det< td=""><td></td></det<>	
9	HR70	8/26/2024	4:51 PM	6.0	<det< td=""><td></td></det<>	
9	HR185	8/29/2024	10:25 AM	5.9	<det< td=""><td></td></det<>	
10	HRO	8/21/2024	10:56 AM	39.4	<det< td=""><td></td></det<>	
10	HR12-18	8/22/2024	10:45 AM	<det< td=""><td><det< td=""><td></td></det<></td></det<>	<det< td=""><td></td></det<>	
10	HR46	8/23/2024	5:30 PM	11.1	<det< td=""><td></td></det<>	
10	HR70	8/26/2024	5:16 PM	9.1	<det< td=""><td></td></det<>	
10	HR185	8/29/2024	10:31 AM	7.8	<det< td=""><td></td></det<>	
11	HRO	8/21/2024	11:01 AM	63.7	<det< td=""><td></td></det<>	
11	HR12-18	8/22/2024	10:58 AM	<det< td=""><td><det< td=""><td></td></det<></td></det<>	<det< td=""><td></td></det<>	
11	HR46	8/23/2024	5:43 PM	5.9	<det< td=""><td></td></det<>	
11	HR70	8/26/2024	5:26 PM	6.9	<det< td=""><td></td></det<>	
11	HR185	8/29/2024	10:40 AM	6.5	<det< td=""><td></td></det<>	
12	HRO	8/21/2024	11:06 AM	188.8	133.8	

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ecked both values

12	HR12-18	8/22/2024	11:05 AM	8.1	<det< td=""></det<>
12	HR46	8/23/2024	5:55 PM	14.5	<det< td=""></det<>
12	HR70	8/26/2024	6:03 PM	19.2	22.9
12	HR185	8/29/2024	10:55 AM	20.5	8.3
13	HRO	8/21/2024	11:11 AM	20.8	<det< td=""></det<>
13	HR12-18	8/22/2024	11:15 AM	<det< td=""><td><det< td=""></det<></td></det<>	<det< td=""></det<>
13	HR46	8/23/2024	6:09 PM	6.6	<det< td=""></det<>
13	HR70	8/26/2024	6:14 PM	8.9	<det< td=""></det<>
13	HR185	8/29/2024	11:02 AM	8.9	<det< td=""></det<>
14	HRO	8/21/2024	11:16 AM	84.2	11.5
14	HR12-18	8/22/2024	11:33 AM	9.5	<det< td=""></det<>
14	HR46	8/23/2024	6:24 PM	11.7	<det< td=""></det<>
14	HR70	8/26/2024	6:22 PM	11.3	<det< td=""></det<>
14	HR185	8/29/2024	11:10 AM	17.5	3.1
15	HRO	8/21/2024	11:21 AM	76.8	11.7
15	HR12-18	8/22/2024	12:01 PM	10.2	<det< td=""></det<>
15	HR46	8/23/2024	6:38 PM	9.4	<det< td=""></det<>
15	HR70	8/26/2024	6:46 PM	16.3	<det< td=""></det<>
15	HR185	8/29/2024	11:11 AM	24.6	6.7
16	HRO	8/21/2024	11:26 AM	64.9	<det< td=""></det<>
16	HR12-18	8/22/2024	12:15 PM	<det< td=""><td><det< td=""></det<></td></det<>	<det< td=""></det<>
16	HR46	8/23/2024	6:46 PM	6.9	<det< td=""></det<>
16	HR70	8/26/2024	6:57 PM	7.9	<det< td=""></det<>
16	HR185	8/29/2024	11:20 AM	8.9	<det< td=""></det<>
5-DUP	HRO	8/19/2024	1:57 PM	58.1	<det< td=""></det<>
16-DUP	HR12-18	8/22/2024	12:15 PM	<det< td=""><td><det< td=""></det<></td></det<>	<det< td=""></det<>
10-DUP	HR46	8/23/2024	5:30 PM	<det< td=""><td><det< td=""></det<></td></det<>	<det< td=""></det<>
3-DUP	HR70	8/24/2024	2:48PM	92.3	13.8
12-DUP	HR185	8/29/2024	10:55 AM	20.7	8.2

Orthophosphate Lab Rep					Orthophosphate Spike Recovery						
Coll. Date	Run Date	Sample ID	Result	Lab Rep	Coll. Date	Run Date	Sample ID	pre-spike	post-spike	spike (ug)	% Recovery
8/23/2024	9/4/2024	C4 HR46	27.0	26.6	8/23/2024	9/4/2024	C4 HR46	27.0	57.7	25	123%
8/21/2024	9/4/2024	C8 HR0	<det< td=""><td><det< td=""><td>8/26/2024</td><td>9/4/2024</td><td>C9 HR70</td><td>0.7</td><td>24.7</td><td>25</td><td>96%</td></det<></td></det<>	<det< td=""><td>8/26/2024</td><td>9/4/2024</td><td>C9 HR70</td><td>0.7</td><td>24.7</td><td>25</td><td>96%</td></det<>	8/26/2024	9/4/2024	C9 HR70	0.7	24.7	25	96%
8/26/2024	9/4/2024	C9 HR70	<det< td=""><td><det< td=""><td>8/22/2024</td><td>9/4/2024</td><td>C15 HR12-18</td><td>0.8</td><td>24.8</td><td>25</td><td>96%</td></det<></td></det<>	<det< td=""><td>8/22/2024</td><td>9/4/2024</td><td>C15 HR12-18</td><td>0.8</td><td>24.8</td><td>25</td><td>96%</td></det<>	8/22/2024	9/4/2024	C15 HR12-18	0.8	24.8	25	96%
8/21/2024	9/4/2024	C12 HR0	133.8	130.1	8/21/2024	9/4/2024	C16 HR0	0.6	24.2	25	94%
8/21/2024	9/4/2024	C14 HR0	11.5	12.0	8/29/2024	9/4/2024	C16 HR185	0.2	21.6	25	86%
8/22/2024	9/4/2024	C15 HR12-18	<det< td=""><td><det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<></td></det<>	<det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<>							
8/21/2024	9/4/2024	C16 HR0	<det< td=""><td><det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<></td></det<>	<det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<>							
8/29/2024	9/4/2024	C16 HR185	<det< td=""><td><det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<></td></det<>	<det< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></det<>							
TP Lab Rep					TP Spike Recov	ery					
Coll. Date	Run Date	Sample ID	Result	Lab Rep	Coll. Date	Run Date	Sample ID	pre-spike	post-spike	spike (ug)	% Recovery
8/23/2024	9/4/2024	C4 HR46	96.7	96.2	8/21/2024	9/4/2024	C4 HR0	96.7	119.4	25	91%
8/21/2024	9/4/2024	C8 HR0	48.7	48.0	8/21/2024	9/4/2024	C8 HR0	48.0	92.1	25	176%
8/26/2024	9/4/2024	C9 HR70	5.9	6.0	8/26/2024	9/4/2024	C9 HR70	5.9	29.2	25	93%
8/23/2024	9/4/2024	C12 HR46	14.1	14.5	8/23/2024	9/4/2024	C12 HR46	14.1	33.2	25	76%
8/26/2024	9/4/2024	C14 HR70	13.1	11.3	8/26/2024	9/4/2024	C14 HR70	13.1	31.1	25	72%
8/22/2024	9/4/2024	C15 HR12-18	10.0	10.2	8/22/2024	9/4/2024	C15 HR12-18	10.0	34.1	25	96%
8/23/2024	9/4/2024	C15 HR46	8.9	9.4	8/23/2024	9/4/2024	C15 HR46	8.9	31.7	25	91%
8/21/2024	9/4/2024	C16 HR0	63.7	64.9	8/21/2024	9/4/2024	C16 HR0	63.7	88.7	25	100%
8/29/2024	9/4/2024	C16 HR185	8.7	8.9	8/29/2024	9/4/2024	C16 HR185	8.7	32.9	25	97%
Method Blank											
Run Date		Analyte	Blank 1	Blank 2	Blank3	Blank4	Blank5				
9/4/2024		OP	<det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<>	<det< td=""><td></td><td></td><td></td><td></td></det<>				
9/5/2025		ТР	<det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<></td></det<>	<det< td=""><td><det< td=""><td></td><td></td><td></td><td></td></det<></td></det<>	<det< td=""><td></td><td></td><td></td><td></td></det<>				