SENT VIA DOH-CWB E-PERMITTING PORTAL (#HQ1-DHS2-A88JE)

2023 ANNUAL RECEIVING WATER MONITORING REPORT
KAILUA REGIONAL WWTP
NPDES PERMIT NO. HI 0021296

GENERAL

This Receiving Water Monitoring Report is submitted in accordance with Part E.4 of the Kailua Regional Wastewater Treatment Plant (WWTP) NPDES Permit No. HI 0021296, effective May 1, 2020. Water quality sampling was implemented in 2023 in accordance with the Kailua Regional WWTP's Receiving Water Monitoring Program in accordance with Part E.1 and 2 of the permit.

GENERAL DESCRIPTION OF MONITORING

STATION LOCATIONS

Shoreline and offshore water quality monitoring were conducted at the stations shown in Attachment 1: Kailua Regional WWTP Ocean Monitoring Stations. The longitude and latitude coordinates of the shoreline and offshore monitoring stations are shown in the following tables. The coordinates were taken with a global positioning device (GPS) receiver, a Garmin GPS 72H.

Shoreline Stations	Coordinates (Latitude; Longitude)
North Beach	21º 27' 11.8" N; 157º 44' 33.5" W
MS1 (Fort Hase Beach)	21º 26' 40.0" N; 157º 44' 10.6" W
MS2 (Kapoho Point)	21° 25' 30.8" N; 157º 44' 24.2" W
Oneawa Beach	21° 25' 06.0" N; 157º 44' 39.3" W
Kalama Beach	21° 24' 20.1" N; 157º 44' 19.9" W
MS3 (Kailua Beach)	21° 23' 55.8" N; 157º 43' 43.8" W
MS4 (Lanikai Boat Ramp)	21° 23' 44.8" N; 157º 43' 19.7" W

Offshore Stations	Coordinates (Latitude; Longitude)
M1	21° 28' 13.4" N; 157º 43' 55.9" W
M2	21° 27' 18.4" N; 157º 42' 54.9" W
M3	21° 27' 17.0" N; 157º 42' 44.1" W
M4	21° 27' 03.3" N; 157º 42' 54.7" W
M5	21° 27' 08.7" N; 157º 43' 06.2" W
M6	21° 26' 35.6" N; 157º 42' 55.1" W

Stations M2, M3, M4, and M5 are positioned along the Zone of Mixing (ZOM) boundary. Stations M1 and M6 are the control stations.

DESCRIPTION OF CLIMATIC AND RECEIVING WATER CHARACTERISTICS

In accordance with the permit, Part E.4.a., the Annual Receiving Water Monitoring Report shall include:

> *"A description of climatic and receiving water characteristics at the time of sampling (weather observations, floating debris, discoloration, wind speed and direction, swell or wave action, time of sampling, tide height, etc.)"*

The 2023 receiving water observations and data generated from the shoreline and offshore water quality monitoring were reported in the Discharge Monitoring Reports (DMRs).

Descriptions of climatic and receiving water characteristics in the DMRs include: time of sampling, depth, tide height, tide stage, a description of odors or floatables, wind speed, wind direction, water color, a description of weather conditions at the time of sampling, a description of the state of the sea at the time of sampling, and a description and estimate of wave height at the time of sampling. Additionally, enterococcus monitoring results are summarized by station identification, date and time of sampling, and number of colony-forming units (CFU) per 100 milliliters (mL).

DESCRIPTION OF SAMPLING STATIONS

In accordance with the permit, Part E.4.b., the Annual Receiving Water Monitoring Report shall include:

> *"A description of sampling stations, including differences unique to each station (e.g. station location, sediment grain size, distribution of bottom sediment, rocks, and shell litter, calcareous worm tubes, etc.). This ocean bottom information shall be recorded at least once per calendar year at the permit designated stations."*

On February 2, 2023, each sampling station was videoed using two "GoPro" cameras, which were mounted onto a bracket and sent down to the sea floor on a nylon line. Written descriptions of the ocean bottom at each sampling station are provided below:

<u>STATION M1</u>:

Depth 98-100 feet

The sea floor consisted of a hard substrate bottom with a light layer of sand and shell fragments. There were also scattered coral patches in the area and a very slight growth of algae.

<u>STATION M2</u>:

Depth 88 - 89 feet

A distribution of coral, sand and larger rocks made up the bottom at this station. Shell fragments were present mixed throughout the sand. A variety of coral species were affixed

to the larger rocks and sea floor. The larger rocks at this station are rounder in shape and more abundant than other stations.

STATION M3:

Depth 111-113 feet

The sea floor consisted of a hard substrate bottom with a light layer of sand and shell fragments. Scattered coral patches were observed in the area.

STATION M4:

Depth 98-100 feet

This station consisted of a hard substrate sea floor with rubble and a light layer of sand. Shell fragments and coral were observed nearby.

STATION M5:

Depth 74-75 feet

This station is located alongside the outfall. The outfall rocks were covered with various coral species making the outfall unnoticeable. Smaller rocks and sand were present along the side of the outfall.

STATION M6:

Depth 104-106 feet

This station consisted of a hard substrate bottom with a dusting of shell fragments and very little sand. There were scattered low lying algae were found at this station.

RECORD OF INDIVIDUALS PERFORMING SAMPLING OR MEASUREMENTS

In accordance with the permit, Part E.4.c., the Annual Receiving Water Monitoring Report shall include:

> *"A record shall be kept of the individual(s) performing sampling or measurements. A description of the sample collection and preservation procedures used in the survey shall be included in the report."*

1. Record of individuals performing sampling or measurements

The City's Oceanographic Team performs sampling, and the City's Water Quality Laboratory (WQLAB) performs testing and measurements as required under the permit. Records of the individuals performing sampling and measurements are maintained by the City and can be made available upon request.

2. Description of the sample collection and preservation procedures used in the survey

Shoreline Sample Collection and Preservation Procedures

The shoreline stations were monitored for enterococci levels to determine compliance with water quality criteria associated with marine recreational waters, as specified in Part C.1.a. of the permit.

Samples were collected at a minimum of five times per calendar month and were as equally spaced as possible throughout the calendar month. A grab sample was taken at the water surface from each shoreline monitoring station.

Enterococci sample collection, handling, and storage was conducted in accordance with the provisions of EPA-821-R-14-011, Method 1600: *Enterococci in Water by Membrane Filtration Using Membrane-Enterococcus Indoxyl-Beta-D-Glucoside Agar (mEI),* September 2014. Water quality sample collection and preservation were performed in accordance with the Oceanographic Standard Operation Procedures (SOP). During transport to the WQLAB, water quality samples were chilled with ice. Water quality samples maintained at <10^{o}C in accordance with 40 CFR Part 136 during transport to the WQLAB were considered acceptable. A chain of custody (COC) form completed by the Oceanographic Team serves as a checklist ensuring sample integrity from collection to data reporting.

Offshore Sample Collection and Preservation Procedures

Offshore stations were monitored for compliance with the state water quality standards based on the water quality parameters shown in the following table.

Parameter	Units	Sample Type	Monitoring Frequency
Total Nitrogen	µg/L	Grab	1/ Month
Ammonia Nitrogen	µg/L	Grab	1/ Month
Total Phosphorus	µg/L	Grab	1/ Month
Turbidity	NTU	Grab	1/ Month
pH	s.u.	CDP	1/ Month
Dissolved Oxygen	mg/L	CDP	1/ Month
Temperature	^{o}C	CDP	1/ Month
Salinity	ppt	CDP	1/ Month

µg/L = Micrograms per Liter
s.u. = standard unit
CDP = Continuous Depth Profile
NTU = Nephelometric Turbidity Units
°C = Degrees Celsius
ppt = parts per thousand

Grab samples were collected at each offshore station at each of the following three depths: within 1 meter below the surface, mid-depth, and within 2 meters above the ocean bottom.

A “Sea-Bird SBE 19,” “Sea-Bird SBE 19 Plus,” or similar device was used to obtain the CDP data.

In accordance with the 2020 Permit, samples are collected at a minimum of once per month, except where inclement weather or hazardous conditions which may endanger the lives of the facility’s personnel are present. Sampling for January 2023 was cancelled due to adverse weather conditions on January 1, 2023 and January 31, 2023 as reported in the January 2023 DMR. Sampling for July 2023 was cancelled due to adverse weather conditions on July 17, July 25, July 28, and July 31, 2023 as reported in the July 2023 DMR. Sampling for August 2023 was cancelled due to adverse weather conditions on August 10, August 17, August 25, August 29, and August 31, 2023 as reported in the August 2023 DMR.

Water quality sample collection and preservation were performed in accordance with the Oceanographic Standard Operation Procedures (SOP). During transport to the WQLAB, water quality samples were chilled with ice. Water quality samples maintained at $\leq 6^{o}$ C in accordance with 40 CFR Part 136 during transport to the WQLAB were considered acceptable. A COC form completed by the Oceanographic Team serves as a checklist ensuring sample integrity from collection to data reporting.

ANALYSIS METHODS

In accordance with the permit, Part E.4.d., the Annual Receiving Water Monitoring Report shall include:

> *“A description of methods used for laboratory analyses. Variations in procedure may be acceptable, but any such changes shall be reported to the EPA and DOH, before implementation. All such variations must be reported with the analytical results.”*

All samples analyzed for compliance with the Kailua Regional Receiving Water Monitoring Program were conducted in accordance with the methods referenced in the Hawaii Administrative Rules (HAR) Title 11, Chapter 54, Subsection 11-54-10. The methods used by the WQLAB in analyzing the water quality parameters are summarized in the table below.

Parameter	Reference for Analysis
Total Nitrogen	SM 4500-N C. Nitrogen-Persulfate Method / SM 4500-NO_3^- F. Nitrogen (Nitrate)-Automated Cadmium Reduction
Ammonia Nitrogen	FIAlab100 Automated Gas Diffusion followed by Fluorescence Detector Analysis
Total Phosphorus	SM 4500-P B.5. Phosphorus Sample Preparation-Persulfate Digestion / SM 4500-P F. Phosphorus-Automated Ascorbic Acid Reduction Method

Parameter	Reference for Analysis
Turbidity	EPA 180.1, Rev. 2.0
pH	Sea-Bird SBE 19 or SBE 19 Plus (Reference SM 4500-H^+ B)
Dissolved Oxygen	Sea-Bird SBE 19 or SBE 19 Plus (Reference SM 4500-O G)
Temperature	Sea-Bird SBE 19 or SBE 19 Plus (Reference SM 2550 B)
Salinity	Sea-Bird SBE 19 or SBE 19 Plus (Reference EPA Method 120.1)
Enterococcus	EPA 1600 (2014)

IN-DEPTH DISCUSSION OF MONITORING RESULTS

In accordance with the Permit, Part E.5.e., the Annual Receiving Water Monitoring Report shall include:

> *"An in-depth discussion of monitoring results. All tabulations and computations shall be explained."*

1. ENTEROCCOCUS

Shoreline Station Results

In accordance with the permit, Part E.1., enterococcus receiving water monitoring was conducted at the shoreline stations a minimum of five times per month, and the results were reported as single sample maximum (SSM) values. An SSM value is recorded for each sampling date at each shoreline station. A geometric mean (geomean) for each station for the calendar month was then calculated from the SSM values. The SSM values and geomean values for 2023 are summarized in the following table.

2023 Shoreline Station Enterococcus Results (CFU/100 mL)

STATION:	MS4	MS3 (Kailua Beach)	Kalama Beach	Oneawa Beach	MS2	MS1	North Beach
January							
Geomean	11.01	5.21	3.19	2.30	28.72	1.15	1.24
SSM	20	20	29	5	310/2	3	5
February							
Geomean	11.19	5.53	4.54	17.26	25.86	2.24	0.92
SSM	30	41	17	28	230/1	7	1
March							
Geomean	9.91	3.04	2.96	18.02	144.23	1.49	1.94
SSM	32	8	35	89	980/3	5	42
April							
Geomean	10.37	5.68	11.39	31.18	63.82	4.08	1.55
SSM	560/1	260/1	500/2	1,700/3	2,300/5	540/1	18
May							
Geomean	5.55	4.35	4.43	21.05	10.27	1.80	1.26
SSM	22	15	48	40	80	7	9
June							
Geomean	3.00	1.94	3.25	10.09	8.70	1.48	0.92
SSM	9	19	10	39	17	11	1
July							
Geomean	3.20	1.83	2.85	2.08	2.13	1.42	1.01
SSM	23	14	13	8	6	4	1
August							
Geomean	2.11	1.32	1.88	1.34	3.27	2.56	1.37
SSM	10	4	5	3	14	12	4
September							
Geomean	6.08	9.45	2.25	0.90	4.59	3.59	0.99
SSM	64	29	4	0.9	72	5	1
October							
Geomean	5.95	3.51	1.61	2.05	19.73	2.43	1.17
SSM	96	55	5	10	110	7	3
November							
Geomean	20.09	17.64	6.72	17.69	19.16	2.79	2.05
SSM	87	89	29	230/1	430/2	14	8
December							
Geomean	26.08	23.03	16.87	47.14	46.36	2.82	1.63
SSM	150/1	67	39	240/1	93	27	7

Notes: 1. SSM/No. = The first figure is the highest SSM value for the month. The second figure is the number of values that are greater than 130 CFU/100 mL.

Instances where the monthly geomean of 35 CFU/100 mL or the Statistical Threshold Value (STV) of 130 CFU/100 mL were exceeded typically occurred at stations near the Kawainui Canal (Stations MS2 and Oneawa Beach) and Kaelepulu Stream (Stations MS3 and MS4) discharge points shortly after localized rainfall events, and were likely attributed to runoff reported in the January, February, March, April, November, and December 2023 DMR shoreline notes. In addition, the KRWWTP effluent enterococcus monitoring results

sampled on the respective dates of the shoreline enterococcus STV exceedances were below the NPDES Permit maximum daily discharge limitation of 57,850 CFU/100 mL. Thus, the outfall does not appear to be the source of any of these elevated levels.

Offshore Station Results

Although not a requirement of the permit, offshore station monitoring for enterococcus was conducted during offshore sample collection on February 2, April 20, April 24, and May 2, 2023 and the results submitted with the respective monthly 2023 DMRs. The results of the offshore enterococcus monitoring are shown in the table below.

2023 Mokapu Offshore Station Enterococci Results (CFU/100 mL)

	Control Stations		ZOM Stations			
	M1	**M6**	**M2**	**M3**	**M4**	**M5**
February 2						
Surface	<0.9	<0.9	0.9	<0.9	<0.9	<0.9
Mid-depth	<0.9	<0.9	0.9	8	3	3
Bottom	2	<0.9	<0.9	<0.9	<0.9	<0.9
April 20						
Surface	14	19	26	<0.9	9	23
Mid-Depth	50	30	14	48	140	180
Bottom	0.9	12	52	25	4	13
April 24						
Surface	0.9	0.9	7	<0.9	<0.9	2
Mid-Depth	0.9	<0.9	<0.9	<0.9	<0.9	0.9
Bottom	0.9	2	<0.9	0.9	11.5	2
May 2						
Surface	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Mid-Depth	0.9	<0.9	71	3	6	10
Bottom	<0.9	<0.9	77	2	<0.9	2

The results from the offshore stations were typically low and ranged from <0.9 CFU/100 mL to 180 CFU/100 mL at ZOM stations and <0.9 CFU/100 mL to 50 CFU/100 mL at the control stations.

2. TEMPERATURE

Temperature was measured at offshore stations once per calendar month. Temperature was measured on a CDP basis, from within one meter below the surface to within two meters above the bottom at one meter intervals. Sea-Bird conductivity, temperature, depth

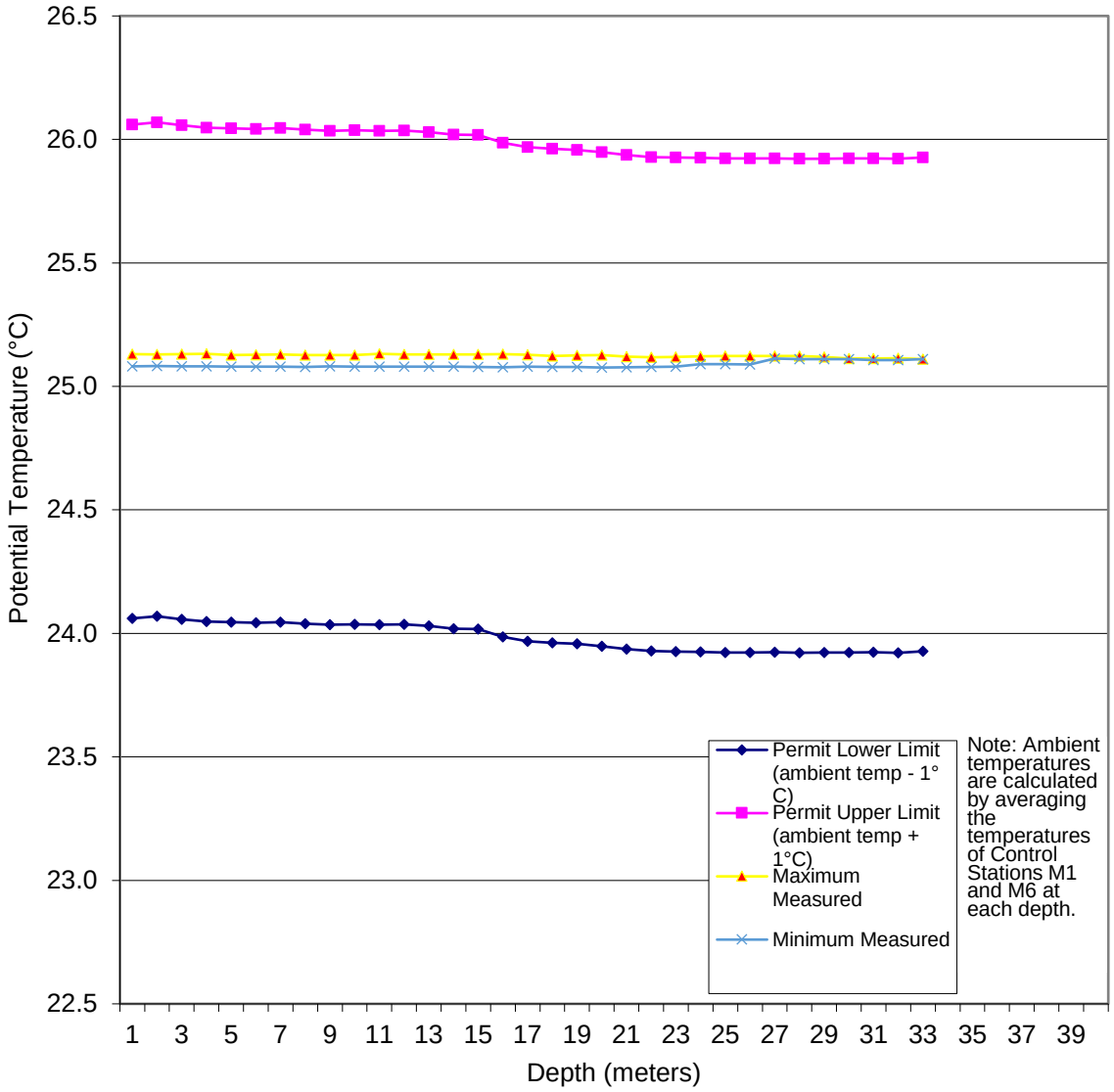
(CTD) instrumentation measured temperatures from which it calculates and records potential temperature.

HAR Chapter 11-54-6(b)(3), Water Quality Standards, dated October 22, 2021 provides that temperatures beyond the ZOM shall not vary more than one degree Celsius (1° C) from the ambient conditions, where ambient conditions for each monitoring event are calculated by averaging the temperatures of control stations M1 and M6 for each depth. At depths where only one control station was measured, the measured potential temperature is used as the ambient potential temperature. At each depth, maximum and minimum measured potential temperatures at the ZOM are compared with the ambient conditions.

All of the 2023 potential temperatures measured at the ZOM stations were within the acceptable range. See graphs below.

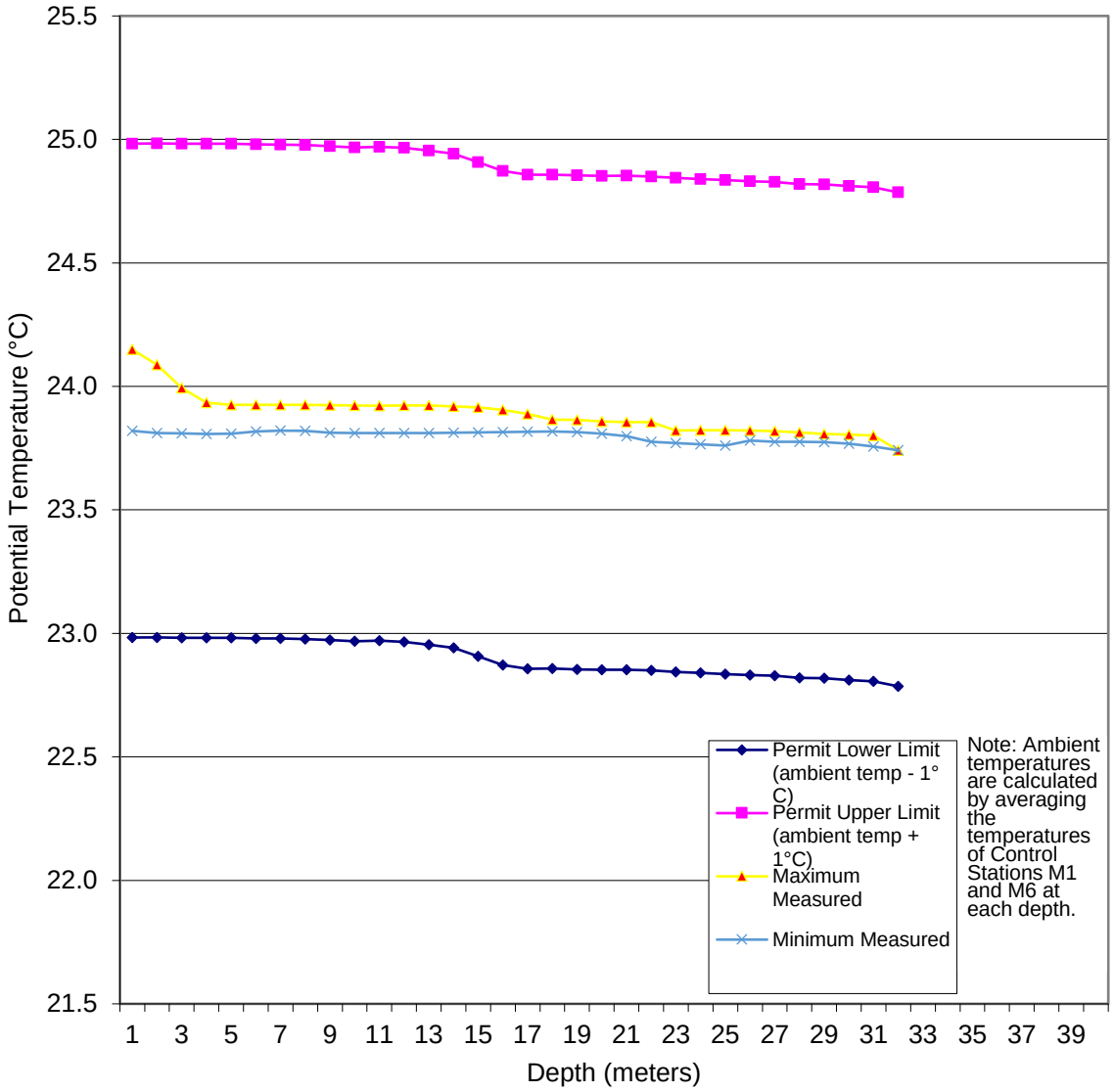
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

February 2, 2023



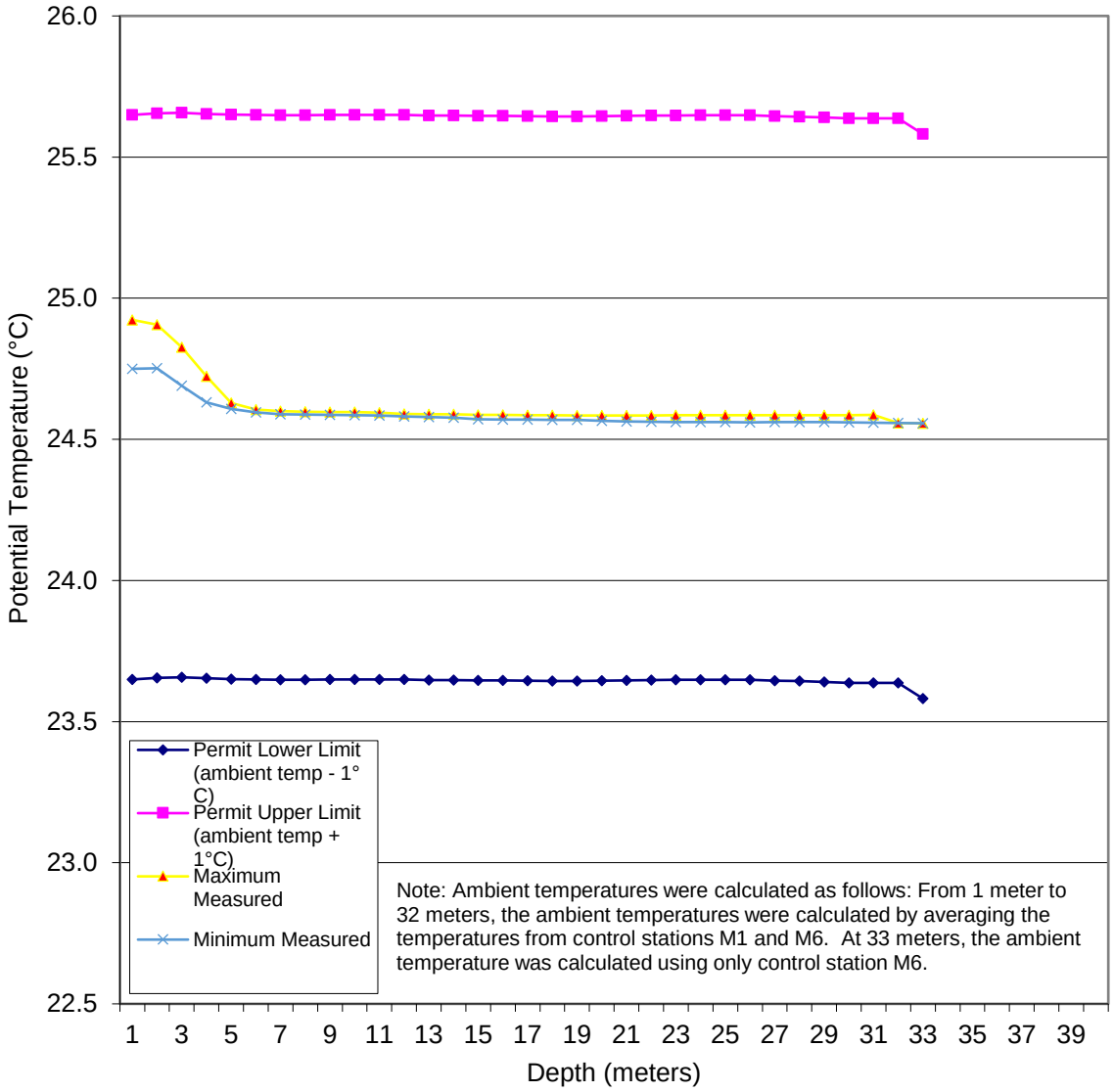
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

March 14, 2023



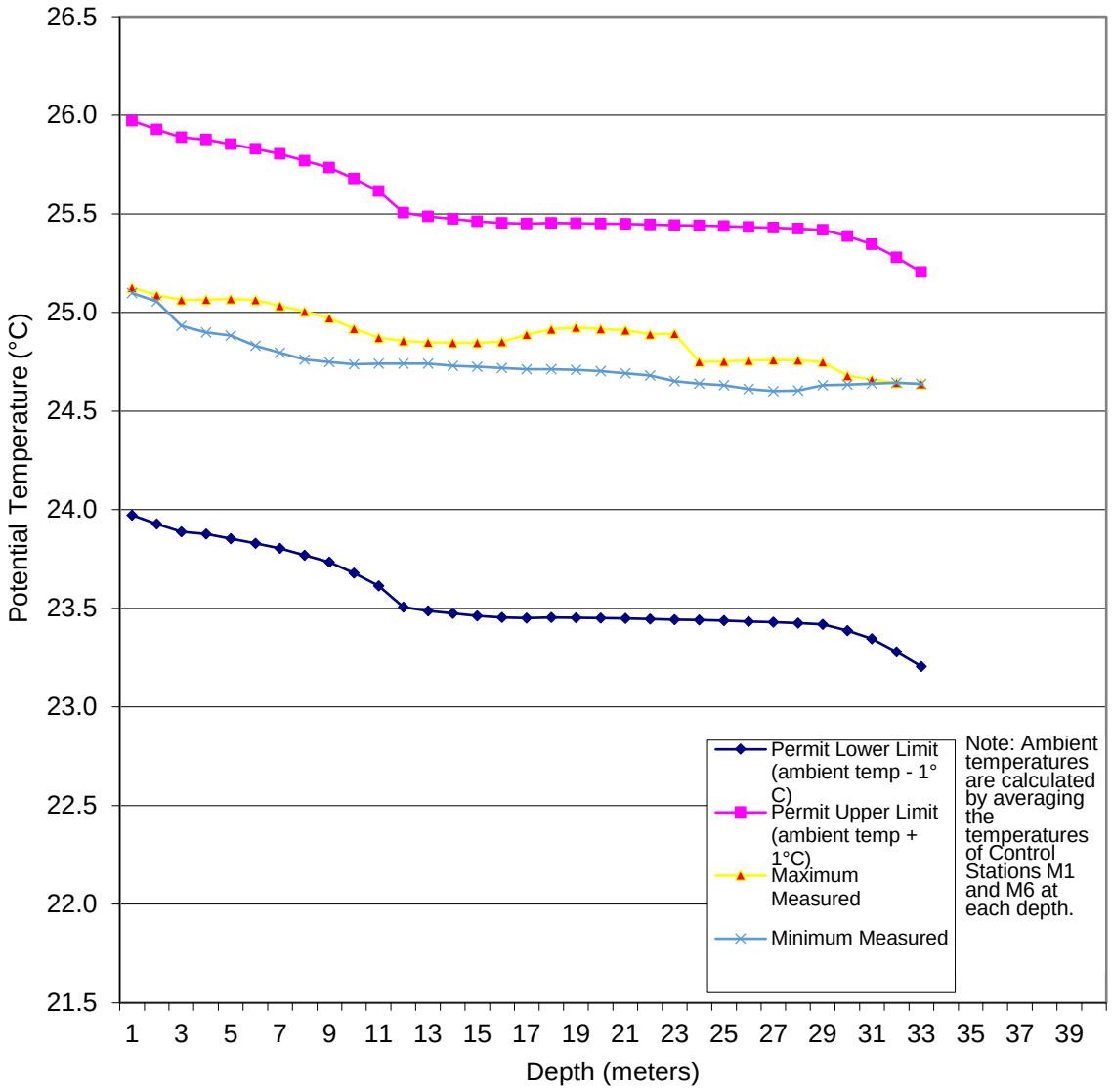
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

April 20, 2023



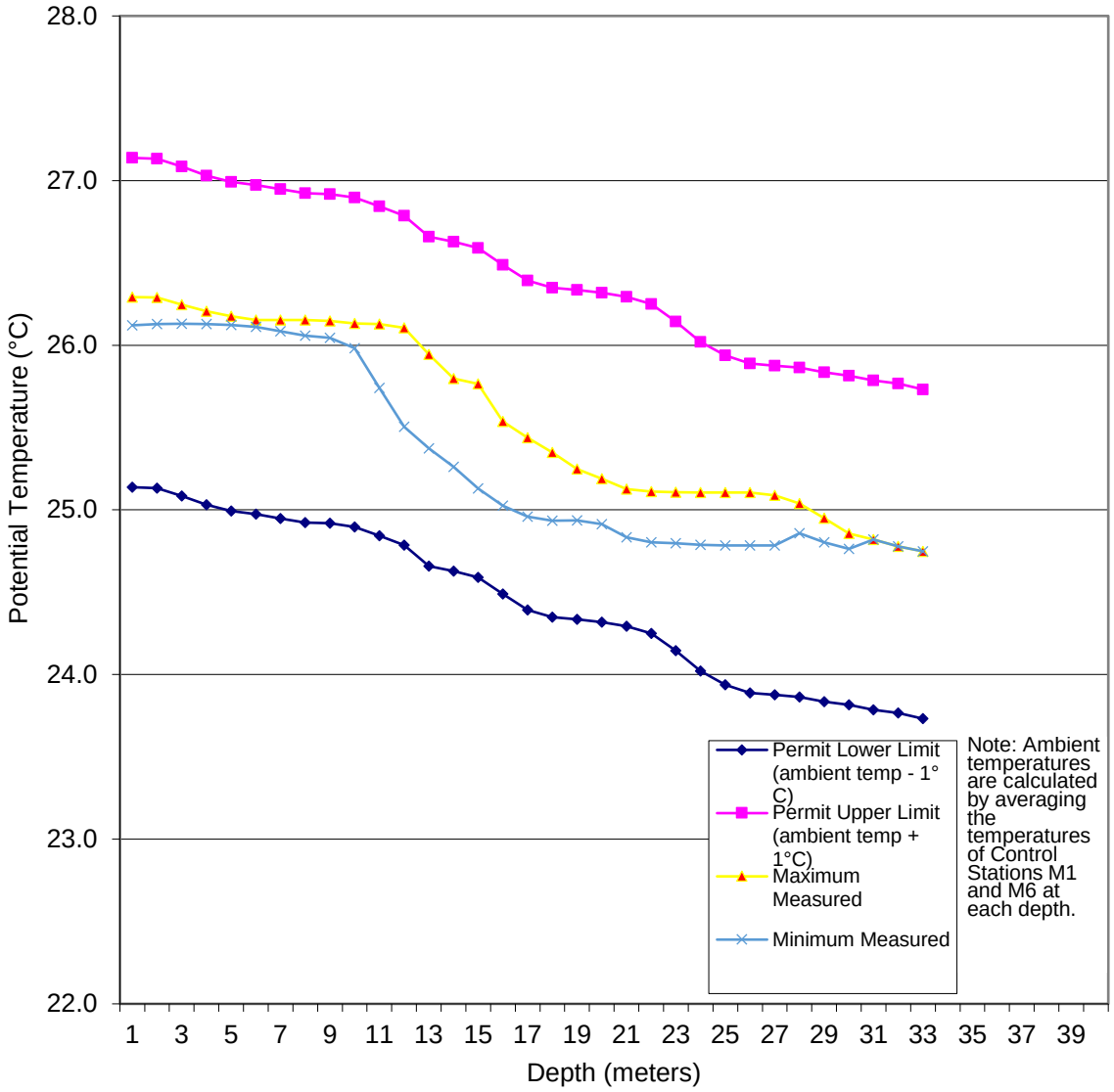
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

May 2, 2023



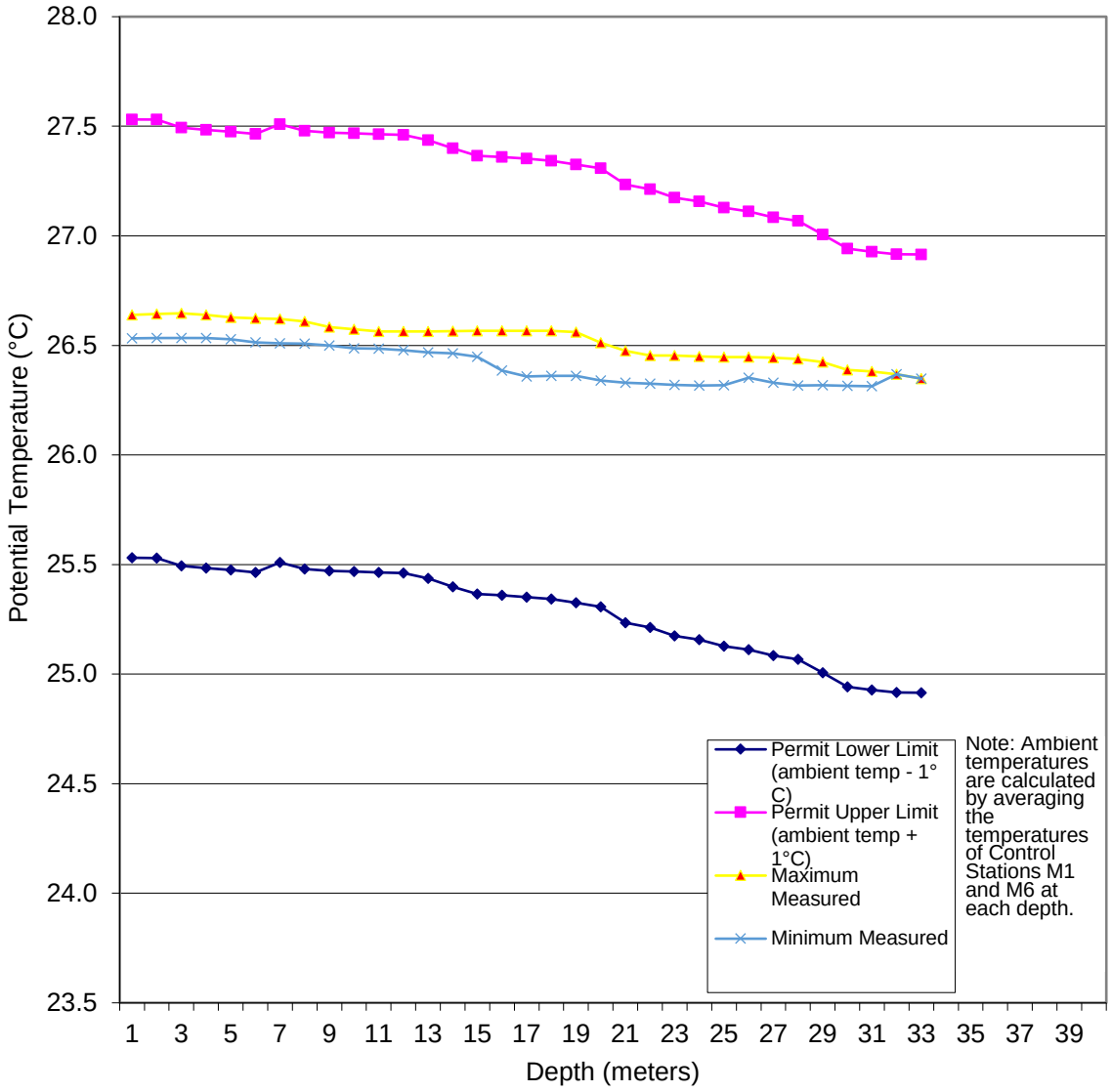
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

June 20, 2023



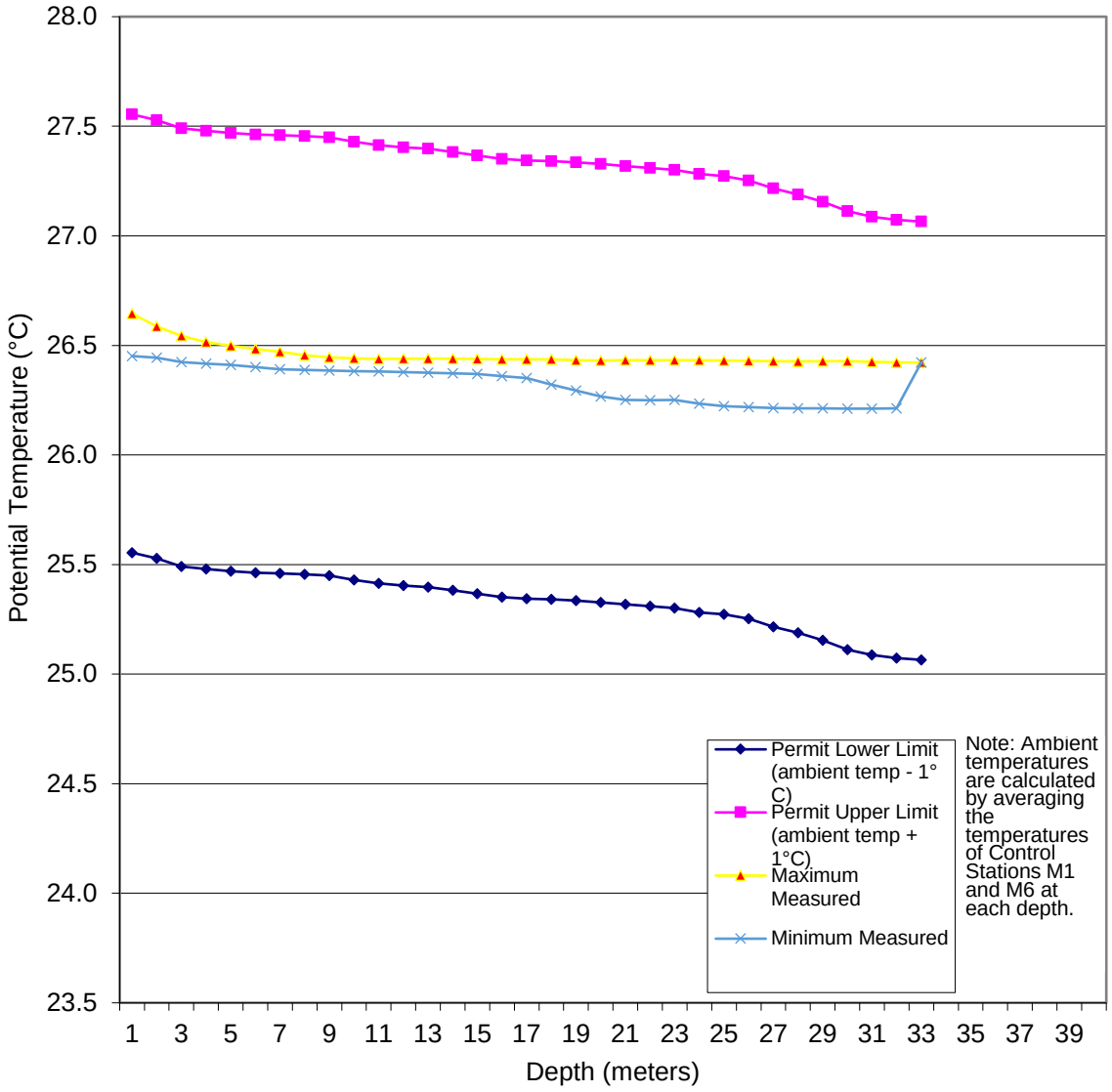
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

September 7, 2023



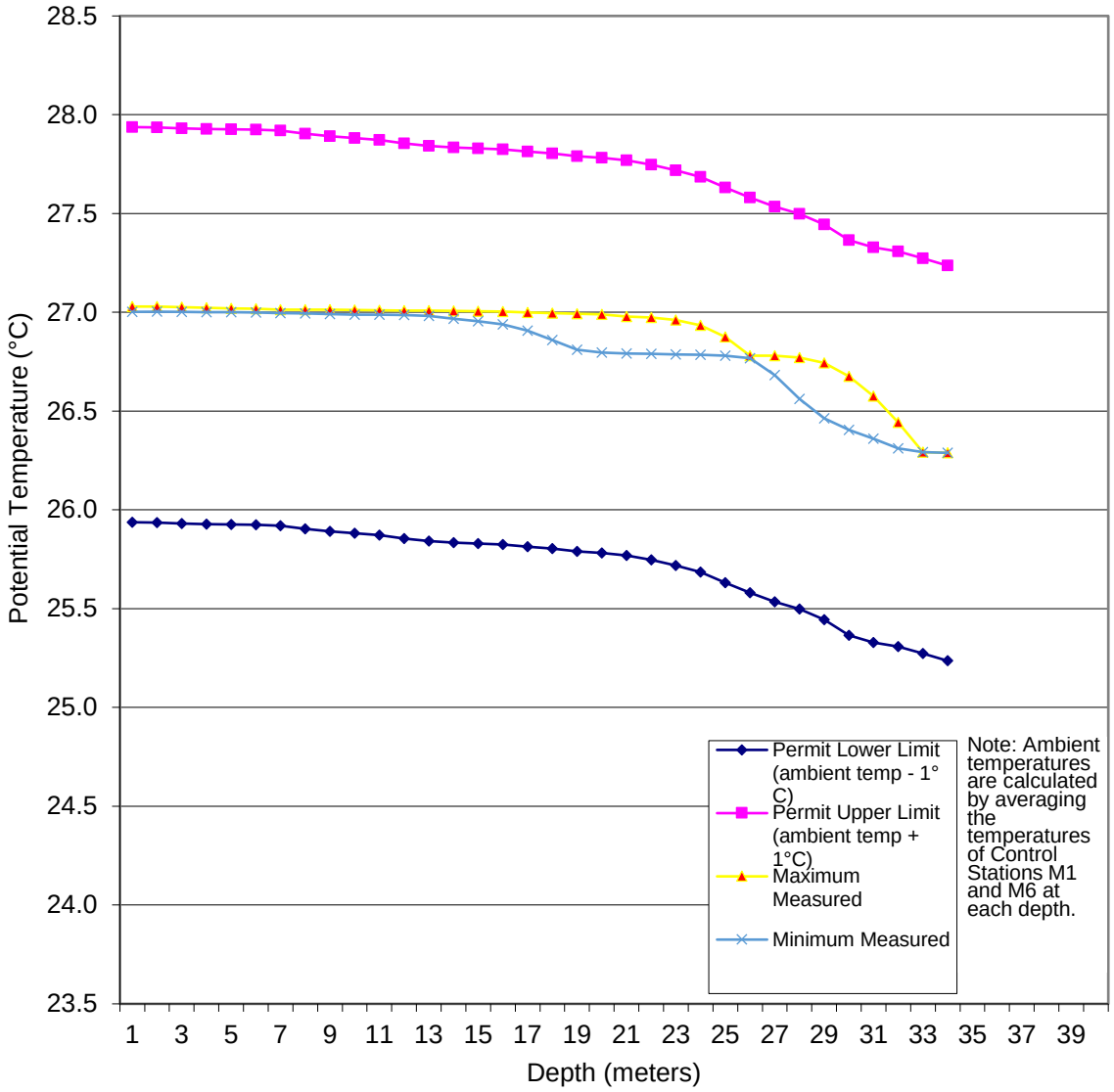
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

October 5, 2023



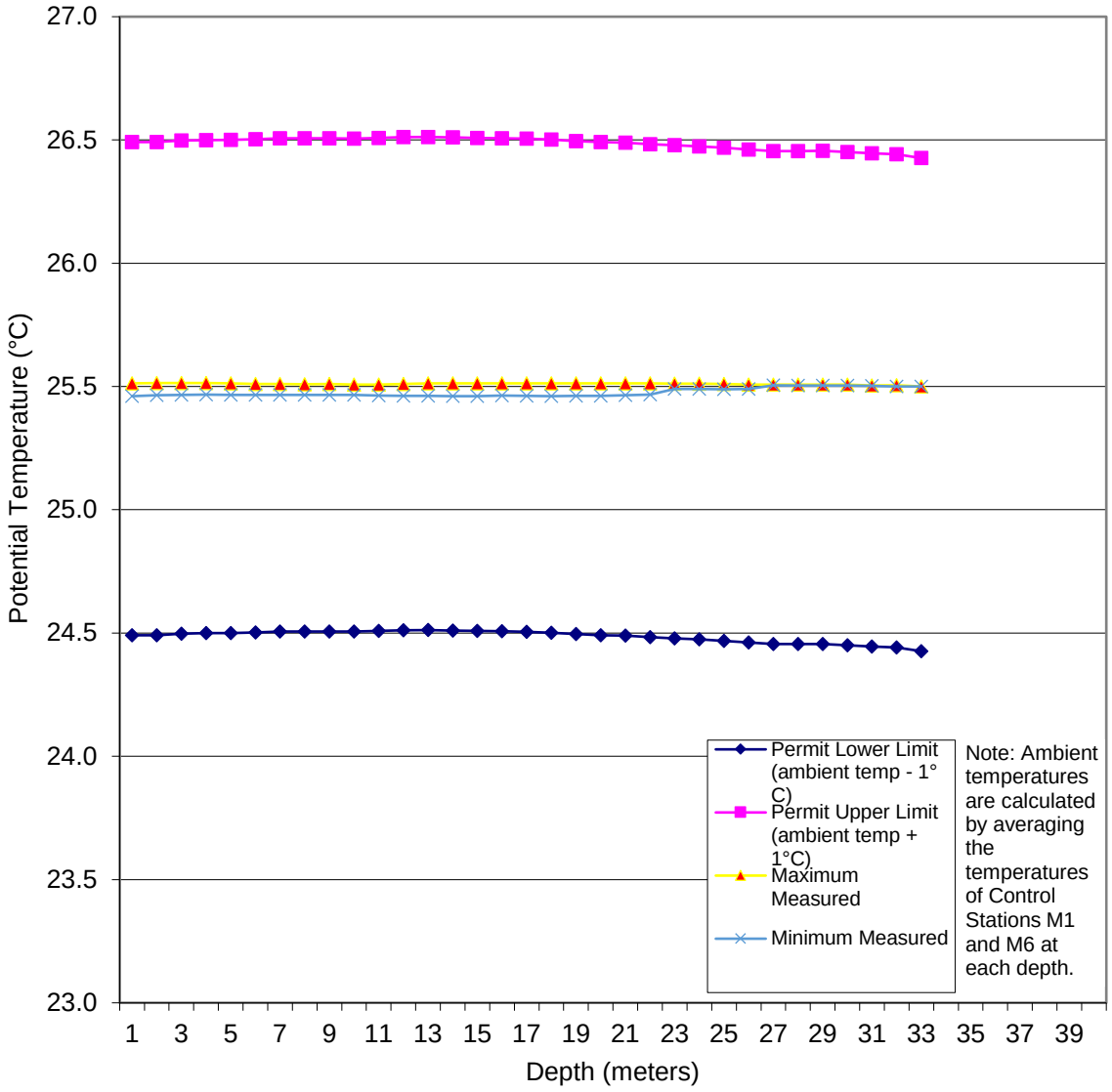
Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

November 2, 2023



Kailua Regional WWTP
Temperature Evaluation at ZOM Stations
Potential Temperature versus Depth

December 8, 2023



3. SALINITY

In accordance with the permit, salinity was measured at the offshore stations once per calendar month. Salinity was measured on a Continuous Depth Profile (CDP) basis, from within one meter below the surface to within two meters above the bottom at one meter intervals.

HAR Chapter 11-54-6(b)(3), Water Quality Standards, dated October 22, 2021 provides that salinity beyond the ZOM must not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

Salinity measurements at each depth (SAL_d) for each ZOM Station were compared with the ambient salinity ($AMBSAL_d$) at each corresponding depth. The $AMBSAL_d$ for each depth, d, was obtained by averaging salinity measurements from control stations M1 and M6. In cases where salinity was measured at only one control station, the measurements at that control station were used to represent the $AMBSAL_d$. The maximum percent difference from ambient salinity at each depth was computed using the following equation:

$$\text{Maximum Percent Difference from Ambient Salinity} = (1\text{-}SAL_d/AMBSAL_d) \times 100$$

Salinity beyond the ZOM did not vary more than ten percent from natural or seasonal changes considering hydrologic input and oceanographic factors. Results of the salinity analysis at the ZOM stations for 2023 are shown in the following table.

Monitoring Event	Maximum Percent Difference from Ambient Salinity Measurement	Permit Limit (Max Percent Difference from Ambient)
2/2/2023	0.21%	10%
3/14/2023	0.26%	
4/20/2023	0.49%	
5/2/2023	0.50%	
6/20/2023	0.56%	
9/7/2023	0.13%	
10/5/2023	0.13%	
11/2/2023	0.21%	
12/8/2023	0.05%	

4. pH

In accordance with the permit, pH is measured at the offshore stations once per calendar month. pH is measured on a CDP basis, from within one meter below the surface to within two meters above the bottom at one meter intervals.

HAR Chapter 11-54-6(b)(3), Water Quality Standards, dated October 22, 2021 provides that pH beyond the ZOM shall not deviate more than 0.5 units from a value of 8.1 (i.e., 7.6 to 8.6), except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0.

The results were within the appropriate pH range of 7.6 to 8.6 at all station depths. The 2023 results are presented in the following table.

Monitoring Event	Station M2		Station M3		Station M4		Station M5	
	Min	Max	Min	Max	Min	Max	Min	Max
2/2/2023	8.322	8.338	8.335	8.355	8.328	8.349	8.337	8.347
3/14/2023	8.536	8.547	8.541	8.560	8.534	8.548	8.550	8.561
4/20/2023	8.060	8.098	8.063	8.108	8.078	8.106	8.060	8.103
5/02/2023	8.090	8.114	8.098	8.117	8.097	8.118	8.104	8.120
6/20/2023	8.434	8.444	8.441	8.449	8.440	8.445	8.405	8.462
9/7/2023	8.250	8.328	8.256	8.339	8.247	8.327	8.246	8.320
10/5/2023	8.157	8.225	8.174	8.223	8.182	8.261	8.177	8.261
11/2/2023	8.097	8.152	8.194	8.252	8.138	8.206	8.133	8.187
12/8/2023	8.149	8.179	8.275	8.304	8.196	8.218	8.185	8.211

5. DISSOLVED OXYGEN

In accordance with the permit, DO is measured at the offshore stations once per calendar month. DO was measured on a CDP basis, from within one meter below the surface to within two meters above the bottom at one meter intervals.

HAR Chapter 11-54-6(b)(3), Water Quality Standards, dated October 22, 2021 provides that Dissolved Oxygen (DO) concentration of waters beyond the ZID must remain at values not less than 75 percent saturation.

The DO concentration at one hundred percent (100%) saturation is a function of the ambient water temperature and salinity. The ambient values were the calculated average of the values of Control Stations M1 and M6 at each depth. If measurements were available for only one control station, then only those measurements were used as the ambient values. The DO saturation value for the temperature and salinity at each depth was determined using a DO saturation table. The measured DO values at each monitoring station and depth were then compared to the corresponding DO saturation values at the corresponding depths. All measured values were equal to or greater than 75 percent of the corresponding DO saturation values and are shown in the following table.

Monitoring Event	Minimum Dissolved Oxygen (Percent of Saturation)	Permit Minimum
2/2/2023	95%	75.00%
3/14/2023	96%	
4/20/2023	88%	
5/2/2023	92%	
6/20/2023	88%	
9/7/2023	89%	
10/5/2023	82%	
11/2/2023	85%	
12/8/2023	85%	

6. NUTRIENT ANALYSIS

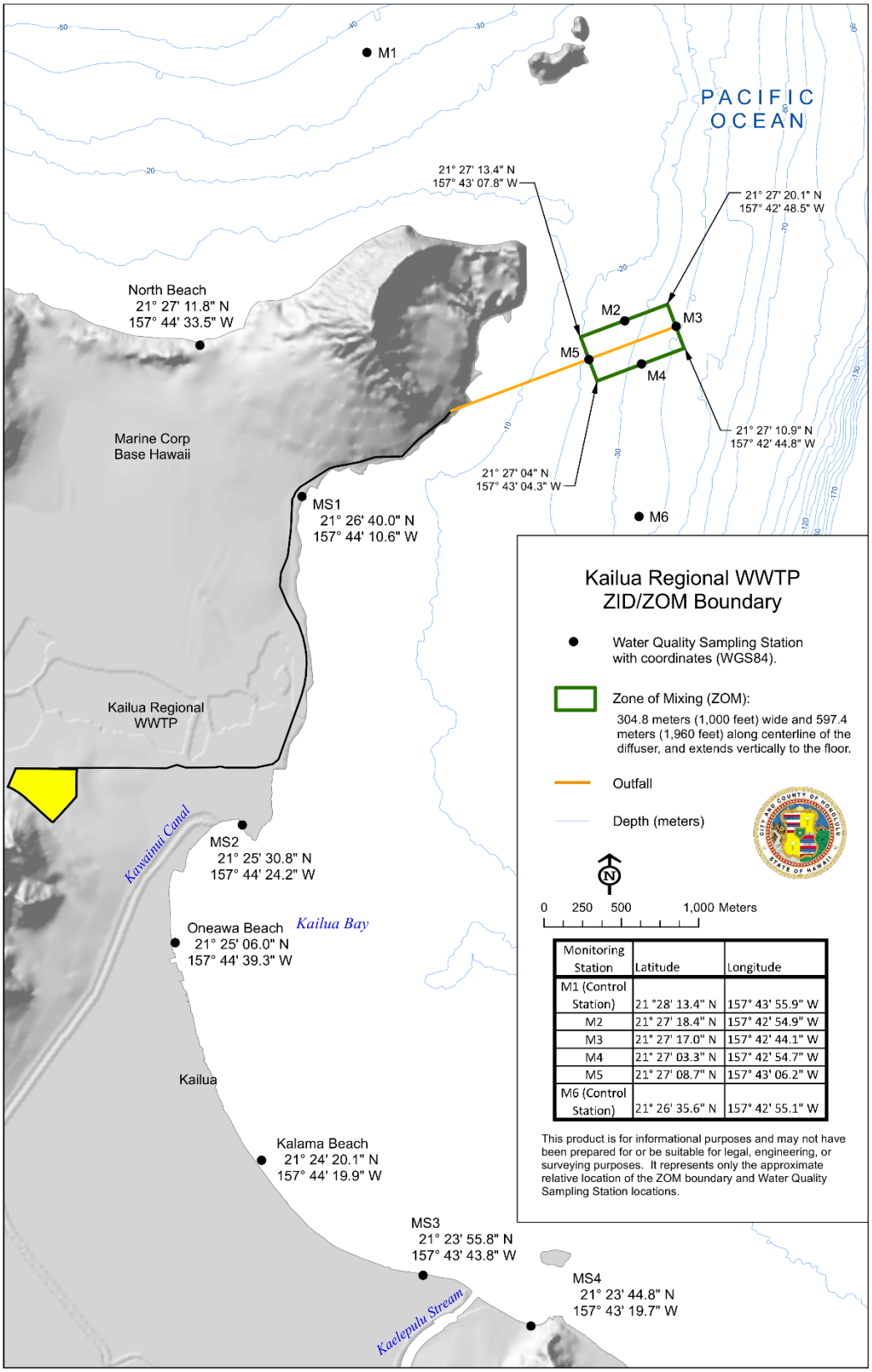
Nutrients are monitored monthly at the four ZOM stations (M2, M3, M4 and M5) at three different depths.

For each nutrient, the annual geometric mean (GM) was calculated by combining all data from all depths for the ZOM stations and then compared to the applicable water quality standard. For the analyses, any values below the nutrient's specific method detection limit (MDL) were substituted with one quarter of the MDL, consistent with DOH methodology.

The analysis resulted in a determination that all nutrient monitoring results were in compliance with HAR 11-54 State Water Quality Standards as shown in the below table:

	Maximum Annual GM Across all ZOM Stations	Geometric mean not to exceed the given value
Total Nitrogen (ug/L)	66.9	110
Ammonia Nitrogen (ug/L)	1.0	2
Total Phosphorus (ug/L)	4.3	16
Turbidity (NTU)	0.14	0.2

Attachment 1: Kailua Regional WWTP Ocean Monitoring Stations



Monitoring Station	Latitude	Longitude
M1 (Control Station)	21 °28' 13.4" N	157° 43' 55.9" W
M2	21° 27' 18.4" N	157° 42' 54.9" W
M3	21° 27' 17.0" N	157° 42' 44.1" W
M4	21° 27' 03.3" N	157° 42' 54.7" W
M5	21° 27' 08.7" N	157° 43' 06.2" W
M6 (Control Station)	21° 26' 35.6" N	157° 42' 55.1" W