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Progressive Solutions, Traditional Values

PROPOSED LEAK DETECTION PLAN FOR THE KENYON-ZERO FOOD STORAGE PLANT, 100 BENITZ ROAD, PROSSER, WA

Prepared for:

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INTRODUCTION

This 2-acre evaporation pond began operations in CIRCA 1998. It receives industrial wastewater from the following operations:

1. Cooling water from the thermal condensers (capacity increased in 2008).
2. Defrost water from the in-plant de-humidifying units (capacity increased in 2008).

The pond has a single liner and was designed by Orren Fricke, White Shield, and installed by Alba Construction. The Washington State Department of Ecology (WSDOE) has provided the following, current, documents regarding the evaporation pond operations:

1. **Reference 1**: *Fact Sheet for State Waste Discharge Permit ST0009213; KENYON ZERO STORAGE-PROSSER*
2. **Reference 2**: Bowen, David, *State Waste Discharge Permit Number ST0009213,* WSDOE, November 12, 2021 and effective January 1, 2021.

SCOPE-OF-WORK

White Shield, Inc. has been retained to provide a *"Leak Detection Plan"* for the evaporation pond. This requirement is stated on page 15/32, Reference 1, and page 19/37 in Reference 2. The plan must be submitted by no later than September 15, 2021.

FINDINGS

I visited the site on July 20, 2021 and met with Scott Wingert, President, and Buford Baze, Chief Engineer, Kenyon Zero Storage. WSDOE ref. 2: provides the following outfall limits:

- Flow- maximum 12,000 gal/day
- pH: 6.0 to 9.0

Note: The 12,000 gal/day flow maximum is based on 212,000 ft^2 of cold storage space in 1998 when the plant began operations. In 2008, a 75,000 ft^2 cold storage addition was added increasing the demand for condenser cooling. The flow maximum has not been reviewed or increased and is discussed further in this report.

WSDOE ref. 2, page 8/32, Table 2 shows the water chemistry results with pH values running from 6.9 to 9.1. The 9.1 pH occurs rarely.

A necessary description of process discharging waste to the pond (cooling and defrost water) is lacking. This report describes the necessary detail for analysis and recommendations.

<u>Evaporation Pond</u>

The evaporation pond runs west by northwest along its long axis parallel to the Yakima River (see Google Earth aerial photo in Appendix). The following visual findings are provided below with the appropriate photo figures in the Appendix:

1. There is an accumulation of sediment from settled particles from the air, the waste stream and bird population that inhabit the pond. Figures 1, 2, 3, 4, and 5.
2. The industrial wastewater from the coolant discharges to the Southwest End of the pond (fig. 8. The Southwest end of the pond has developed cattails and sawgrass growing from the deposited sediment (fig. 7).

Defrost water waste stream

Much like a residential freezer, ice accumulates on the defrost units and the melt is discharge to the evaporation pond. Four, 6-inch diameter pipes discharger to the pond. Normal operations discharge 120 to 200 gallons every 3 days and large seasonal demands may produce up to 1,000 gallons every 3 days. Once again, this is ice melt from vapor condensate upon melting and is quite benign relative to contaminants. Figure 6 (photo) in the Appendix shows a typical discharge pipe.

Condenser Cooling Water waste stream

The condenser unit is located on the west end of the plant on the roof (see Google Earth and fig. 9). The aboveground sump (fig. 11) is located in the building below the condenser where the water is chemically processed (fig. 10) for conductivity ($\leq$ 1,000 µS/cm) using a chemical additive provided by CH_2O, Tumwater, WA. When the conductivity exceeds 1,000 µS/cm, it is discharged. The discharge temperature is normally 78-80°F.

As the outfall limits are maximum flow and a pH range, I examined the flow from 7/1/2020 to 7/25/2021 with the following findings:

- Average= 5,595 gal/day
- Maximum= 25,800 gal/day
- Minimum= 0 gal/day
- Maximum monthly average daily flow (June)= 16,183 gal/day
- Standard Deviation= 4,997 gal/day
- Total= 2,115,070 gal/yr.

The 12,000-gallon, conductivity driven, condenser water requirement was exceeded 39 times during the last year. For perspective, this is a 2-acre pond and 12,000 gallons (1,604 ft^3) would raise the pond surface about 0.0184 ft. or about 0.2 in/day. The maximum flow of 25,800 gallons would raise to pond surface approximately 0.5 in/day. Given that the facility size has increased 35%, the industrial waste stream discharge has increased.

The daily effluent quantity may not be the appropriate standard for discharge. Using the same data, and determining the average daily flow, by month gives the following results:

- Average= 5,677 gal/day
- Maximum= 16,183 gal/day
- Minimum= 2,077 gal/day

- Standard deviation= 3,875 gal/day

Starting in April and ending in July, the daily averages (monthly basis) increased. The values are; April-6,921 gal/day, May-7,776 gal/day, June-16,183 gal/day, July-9,424. As can be observed, June of this year found the highest daily average of 16,183 gal/day. It is important to note that the evaporation must be considered in ascribing maximum daily flows. For example, the June flow of 16,183 gal/day over 30 days would raise the pond level by about 8.9 inches, but the average evaporation is 7.5 inches (see Evaporation table in Appendix) in June which provides an average pond rise of 1.4 inches.

All the above calculations *assume* a 2-acre surface area which has not been verified by survey.

ANALYSIS

<u>Evaporative pond liner</u>

Based on my visual inspection, I noted no visual defects in the liner. However, the sediment and limited vegetation precluded any further examination without the proper footgear and tools. However, I did note that the liner was present *under* the vegetation in several areas.

It is important to note that this industrial process waste water is relatively benign when compared to the toxicity of stormwater and stormwater ponds require no liner. However, the proximity of the Yakima River does require more caution.

Without removing the sediment and vegetation (limited area), one cannot determine with any certainty, if obvious structural defects (e.g., tears or weld seam failures) have occurred in the liner.

It is reasonable to assume that the 12,000 gallon/day discharge limit is not appropriate given the size of the pond. Also, examining water level staining on the pond walls shows little of the capacity of the pond has been used including the freeboard reserve.

<u>Defrost water waste stream</u>

No analysis is required given the source of the water and small quantity.

<u>Condenser Cooling Water waste stream</u>

The required pH is exceeded infrequently. As the plant operations use a maximum of 1,000 µS/cm for determining discharge of the coolant water to the evaporation pond, it is important that the chemical composition of the water be examined particularly if advantages can be obtained to lower pH and decrease conductivity.

Another measure of water quality is "total dissolved solids (TDS)". Conductivity is a measurement of the waters ability to conduct electricity via the dissolved salts. TDS is the concentration of dissolved solids in the water usually in mg/L. While the two are related *they* *are not the same.* The normal TDS standard for “fair” drinking water is 500 mg/L. The WSDOE uses TDS, not conductivity, to assess water quality.

Another important parameter is that pH is inversely proportional to temperature (i.e, the higher the temperature the lower the pH along with the inverse). Therefore, when the discharge temperature is at the normal 78-80°F and the outside temperatures are, say, 40°F, the pH will increase.

While the relationships between conductivity, pH and temperature can be calculated using different reagents, lab-scale tests provide the most accurate, inexpensive, and rapid process to make these determinations. These tests must also consider TDS for discharge as well.

Last, the “maximum daily discharge” is an improper metric for control. Rather the limit should be the *average daily discharge over one month.* Using the 12,000 gal/day metric, a 35% increase in facility operations would increase the maximum flow to 16,200 gal/day. The maximum monthly average based daily flow of 16,183 gal/day reflects this value.

PROPOSED PLAN

This plan has three principal elements as follows:

1. Perform a survey of the pond to determine volumetric storage at different elevations and set-up referances for a 30 by 30 ft. grid.
2. Perform a visual, annual inspection of the liner on approximately a 30 by 30 ft. centers on the base and continuous on the exposed sidewalls. Remove vegetation, debris, sediment as necessary to exposed a 2 ft. by 2 ft. area. If water is present, use the hand to feel the base. If required, the vegetation and sediment can be removed from the area and maintained.
3. Perform necessary bench scale lab tests to determine if pH can be reduced to 7.5 at 50°F by amending the sump treatment chemicals. If so, install the equipment to perform the new conditioning. TDS should not exceed 1,000 mg/L in the pond. This testing may be accomplished by either CH_2O or another accredited lab.
4. Once the survey data is available, calculate the industrial waste stream effluent flow vs. evaporation vs. pond volume through the year on a monthly basis.
5. Provide an operating manual for the water chemistry control and liner monitoring. The operating manual should include the following items and need not be complicated:
   a. Requirements for the annual liner inspection including reporting elements. To perform this inspection, a survey should be provided to detail the horizontal and vertical dimensions of the pond along with showing discharge ports for the pond. As to inspection requirements, the first inspection should be a stratified sample (inspection) as discussed above (i.e., 30 ft. centers at base and continuous on sides- ~97 locations in base). Following inspections should include a random sampling of

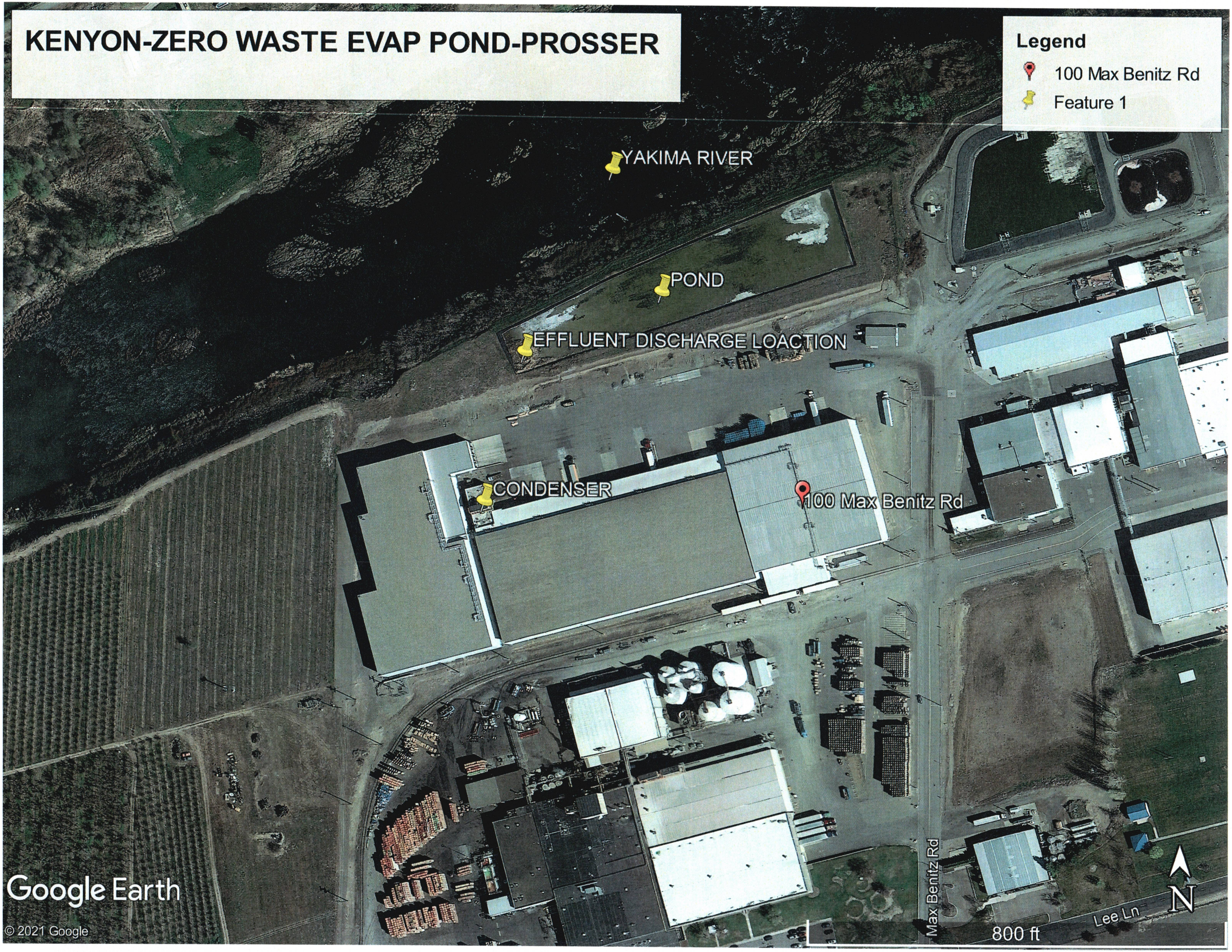
the pond base using random inspections at a least 50 locations (about 5.7% of the area) based on a 10 by 10 ft. grid using a random number generator. Any defects encountered should be immediately reported for additional characterization and repair.

b. The salient quality control for the sump water will be a data logger that records the pH and conductivity on no more than an hourly basis. The process should be alarmed to ensure immediate action if the operating band of chemistry is breached.
c. Continue to record daily blowdown (pond discharge) flows. The flows should be examined monthly to ensure the *maximum average monthly flows* have not been exceeded. If significant breaches of the recommended flows occur, a pond level monitoring system may be required.

I recommend changing the daily *maximum* discharge limit to an *average* monthly limit of 17,000 gal/day average. Once the Proposed Plan is approved by the WSDOE, the work should be implemented in 60 days.

APPENDIX

APPENDIX


KENYON-ZERO WASTE EVAP POND-PROSSER
Legend
100 Max Benitz Rd
Feature 1
YAKIMA RIVER
POND
EFFLUENT DISCHARGE LOACTION
CONDENSER
100 Max Benitz Rd
Max Benitz Rd
Lee Ln
800 ft
N
Google Earth
© 2021 Google

KENYON-ZERO STORAGE EVAPORATION POND PICUTURES AND PROCESSES

Figure 1-looking W by SW from SE corner of pond

Figure 2-looking N by NW from SE corner

Figure 3-looking W by SW from NE pond corner

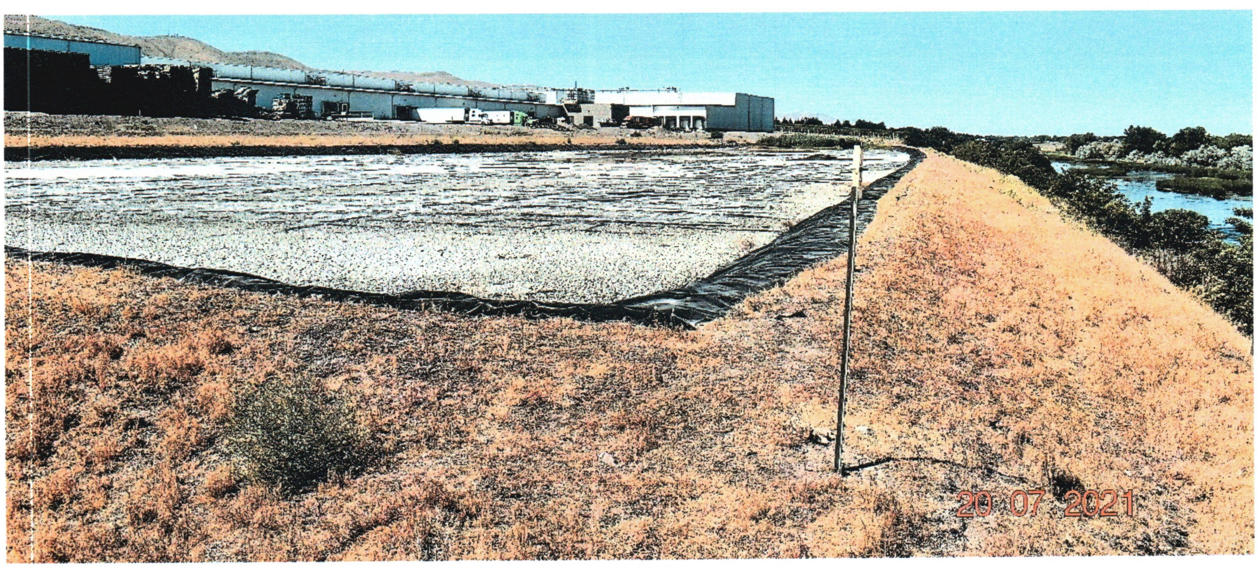


Figure 4- looking W by SW from NE corner. Near complete view of pond

Figure 5-NE corner sediment, bird feces and debris accumulation

Figure 6- typical discharge pipe from evaporative cooler ice defrost discharge

Figure 7-accumulated sediment and vegetation SW corner of pond

Figure 8-discharge pipes from condenser into pond; SW corner

Figure 9-condenser units with regulation sump below

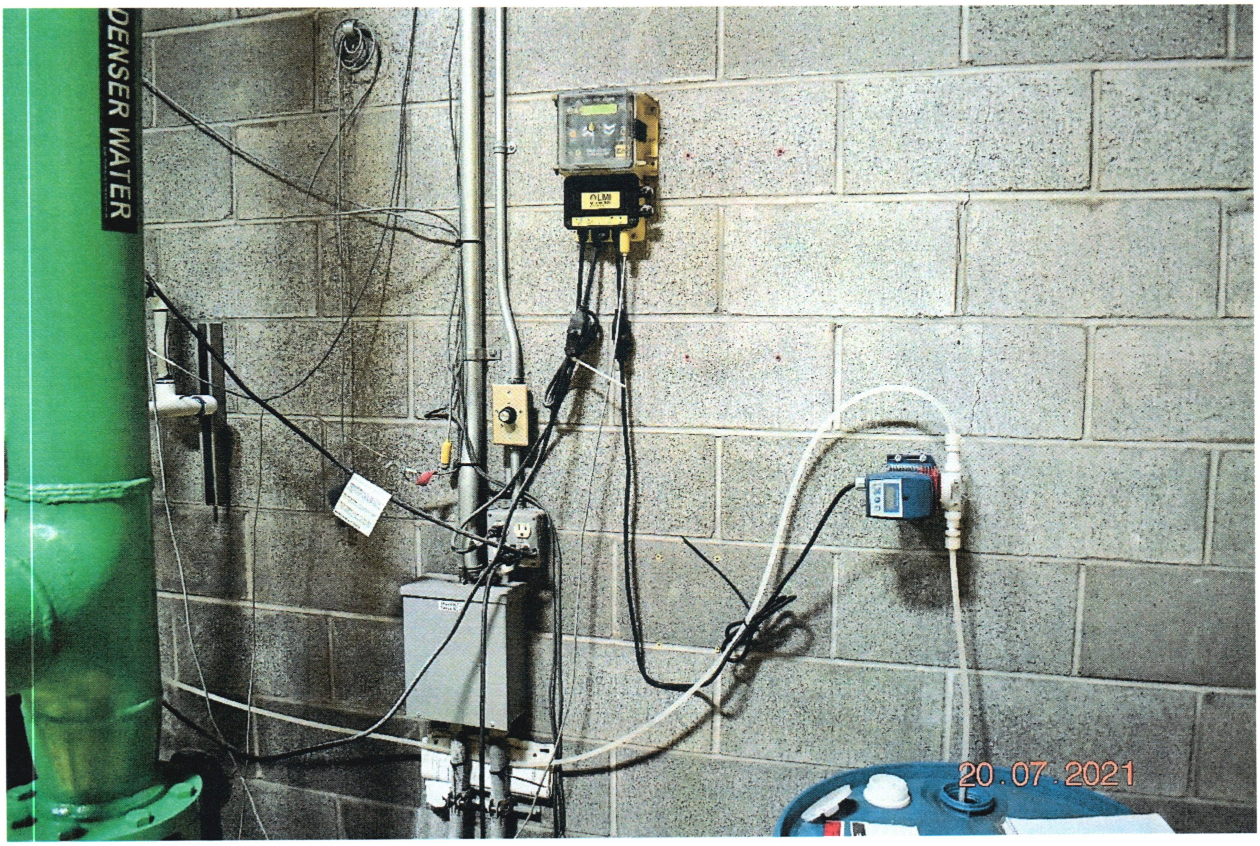


Figure 10-Regulation sump with process chemical feeds and intruments

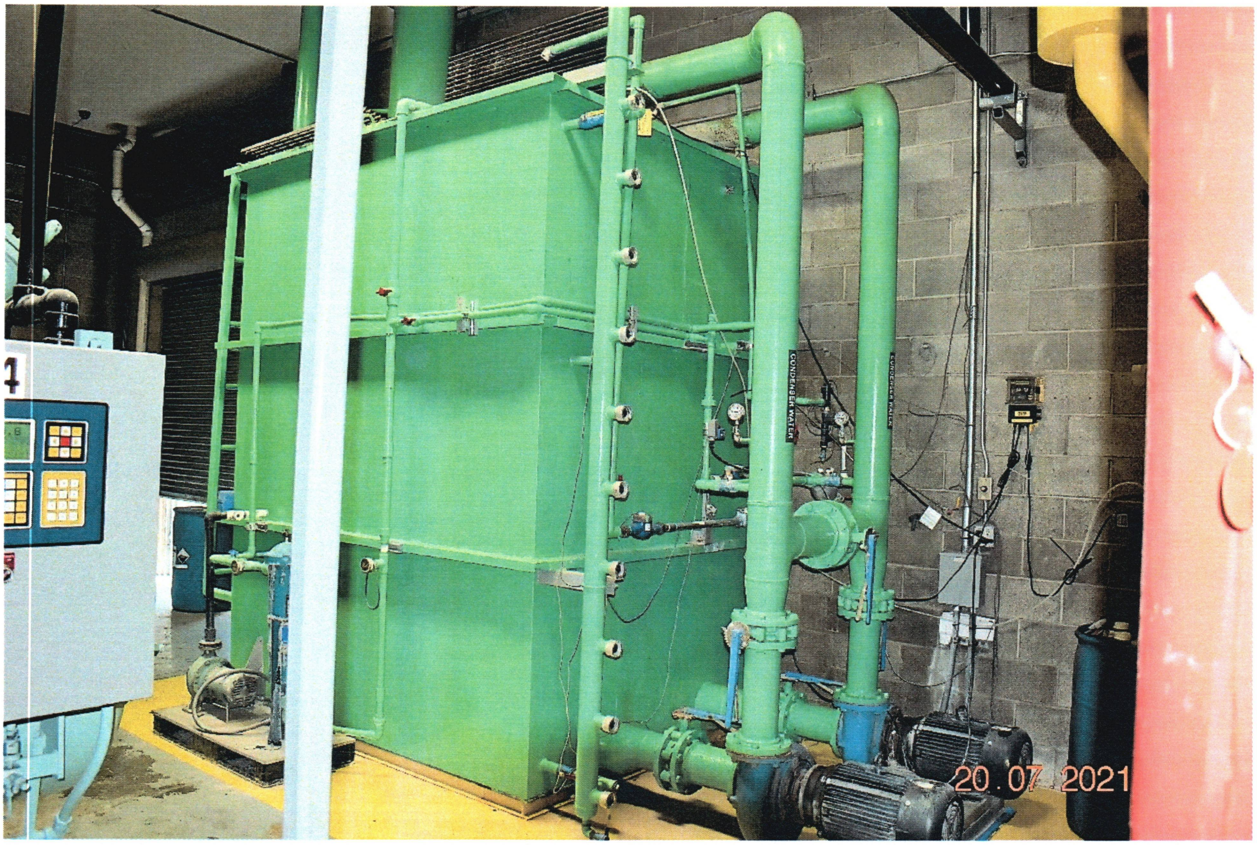


Figure 11-view of regulation sump for condenser cooling

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
BELLINGHAM 2 N	1948-1985	0.00	0.00	0.00	2.75	4.59	5.35	6.28	5.56	3.34	1.22	0.00	0.00	29.09
BELLINGHAM 3 SSW	1985-2005	0.00	0.00	0.00	0.00	3.77	4.69	5.31	4.50	2.65	1.39	0.00	0.00	22.31
BUMPING LAKE	1931-1967	0.00	0.00	0.00	0.00	4.01	4.13	5.58	4.63	3.19	2.34	0.00	0.00	23.88
CONNELL 1 W	1960-2003	0.00	0.00	0.00	5.43	8.35	9.89	11.90	10.77	6.88	3.00	0.00	0.00	56.22
ELTOPIA 6 W	1954-1973	0.00	0.00	3.23	5.46	6.61	7.73	9.36	7.56	4.93	2.45	0.83	0.00	48.16
ELTOPIA 8 WSW	1974-2005	0.00	0.00	0.00	4.44	6.10	7.05	8.07	7.04	4.44	2.06	0.62	0.00	39.82
LAKE KACHESS	1931-1977	0.00	0.00	0.00	2.37	3.78	4.82	6.12	5.12	3.20	0.00	0.00	0.00	25.41
LIND 3 NE EXP STN	1931-2005	0.00	0.00	0.00	5.35	8.02	9.40	12.02	10.44	6.87	2.59	0.00	0.00	54.69
MOSES LAKE 3 E	1943-1979	0.00	0.00	0.00	5.51	7.50	8.78	10.29	8.10	5.53	2.79	0.00	0.00	48.50
OROVILLE 1 S	1960-1970	0.00	0.00	0.00	4.49	5.82	6.36	7.42	6.22	4.28	1.99	0.00	0.00	36.58
OTHELLO 6 ESE	1941-2002	0.00	0.00	0.00	5.40	7.60	9.00	10.77	9.14	6.12	2.92	0.00	0.00	50.95
PROSSER 4 NE	1931-2005	0.00	0.00	2.49	4.86	6.57	7.50	8.61	7.09	4.73	2.48	0.80	0.69	45.82
PUYALLUP 2 W EXP STN	1931-1995	0.00	0.71	1.58	2.46	3.97	4.63	5.61	4.97	2.92	1.28	0.61	0.00	28.74
QUINCY 1 S	1941-2005	0.00	0.00	0.00	5.76	8.05	9.00	10.20	8.52	5.52	2.60	0.00	0.00	49.65
RIMROCK TIETON DAM	1947-1977	0.00	0.00	0.00	0.00	5.35	7.08	15.41	6.71	3.70	1.63	0.00	0.00	39.88
SEATTLE MAPLE LEAF R	1941-1960	0.61	0.82	1.80	3.26	4.64	5.12	6.70	5.19	3.49	1.62	0.74	0.53	34.52
SPOKANE WSO AIRPORT	1889-2005	0.00	0.00	0.00	4.66	7.27	8.57	11.28	10.22	6.41	0.00	0.00	0.00	48.41
WALLA WALLA 3 W ENT LA	1931-1962	0.00	0.00	0.00	4.79	6.26	7.61	9.72	7.95	4.78	2.58	0.00	0.00	43.69
WENATCHEE EXP STN	1950-1997	0.00	0.00	0.00	4.74	6.87	7.87	9.38	7.83	4.19	0.00	0.00	0.00	40.88
WHITMAN MISSION	1962-2005	0.00	0.00	0.00	4.58	6.58	8.17	10.34	9.08	5.52	2.84	0.00	0.00	47.11
WIND RIVER	1901-1977	0.00	0.00	0.00	2.91	4.19	4.64	6.15	4.97	3.31	1.62	0.00	0.00	27.79
YAKIMA WSO AP	1946-2005	0.00	0.00	0.00	5.27	7.62	8.71	10.42	9.29	5.90	0.00	0.00	0.00	47.21

WRCC: Comparative Table (dri.edu)

GIVEN

1. 2-acre pond (surface area)
2. Daily flows of 12,000 gal/day
   16,183 gal/day & 25,800 gal/day

FIND

1. Rise/day for each flow
2. Monthly rise for 16,183 gal/day (30 days)

SOLUTION:

1 acre = 43,560 ft^3
1 ft^3 = 7.48 gal.

(1) $12{,}000 \frac{gal}{day} \cdot \frac{1\,ft^3}{7.48\,gal} \cdot \frac{1}{2(43{,}560\,ft^2)} =$

$0.0184\,ft \cdot \frac{12\,in}{1\,ft} = \underline{0.22}\ in/day$

$16{,}183 \cdot \frac{1}{7.48} \cdot \frac{1}{2(43{,}560)} = 0.0248\,ft = \underline{0.298}\ \frac{in}{day}$

$25{,}800 \cdot \frac{1}{7.48} \cdot \frac{1}{2(43{,}560)} = 0.0396\,ft = \underline{0.475}\ \frac{in}{day}$

(2) $0.298 \frac{in}{day} \cdot 30\,day = 8.94\ in.$