



Environmental Monitoring Report or Work Activities Associated with the Replacement of Tainter Gates 3 and 4

STS Hydropower
Morrow Dam
7000 East Michigan Avenue Consumers Power Drive
Comstock Township, Michigan

Project Number: 60644031

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
A	11/18/20	Draft Report to Client	Eagle Creek RE	David Fox	Director, Licensing and Compliance
B	2/18/21	Final Report to Client	Eagle Creek RE	David Fox	Director, Licensing and Compliance

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1. Introduction

1.1 Site Location

STS Hydropower, LLC (STS) owns and operates the Morrow Hydroelectric Project (Federal Energy Regulatory Commission (FERC) Project No. 9000) located on the Kalamazoo River in Comstock Township, Kalamazoo County, Michigan.

1.2 Purpose

The purpose of this environmental monitoring report is to document environmental monitoring activities observed during the dredging and flow reduction work in association with the Joint Permit and Mitigation Plan for the Tainter Gate Replacement Project at the STS Hydro Morrow Dam site in Comstock, Michigan.

This report is an update to the interim report issued on November 18, 2020.

1.3 Gate Replacement Activities

As stated in the Joint Permit Application for gates 3 and 4 replacement work: Work affecting the structures of the dam will be removed and replaced for existing Tainter gates #3 & #4. New Tainter gates of in-kind design will be installed into the existing gate bays.

Approximately 600 cubic yards of sediment was accumulated within and in front of Bays 1 & 2 prior to the drawdown of the Morrow Lake reservoir. To prepare for the installation of the temporary barrier and bulkhead slots, the sediment located on the existing concrete apron between the piers and upstream of the dam was both mechanically and hydraulically dredged, removed and placed into a sediment containment area located on a concrete pad directly south of the dam.

The dredged material is temporarily being stored and dewatered within the proposed temporary on-site sediment containment area in accordance with the EGLE Joint Permit requirements. The dredged material will be characterized and disposed of at a licensed waste disposal facility in the near future. Water from the hydraulic dredging was discharged upland of the sediment containment area in accordance with the EGLE Joint Permit.

1.4 Schedule of Work Activities

Table 1 below provides a timeline for the major work activities completed in association with the gate replacement project:

Table 1. Schedule of Major Work Activities

Task Description	Start Date	End Date
Sediment Containment Installation for Dredged Material	10/19/20	10/23/20
Shoreline Protection Installation – Upstream of Dam	10/22/20	10/23/20
Shoreline Protection Installation – Downstream of Dam	10/27/20	10/28/20
Dredging at Wingwall and Gates 1 & 2	10/23/20	11/2/20
Flow Reduction #1	11/3/20	11/4/20
Flow Reduction #2	11/19/20	11/19/20
Flow Reduction #3	12/07/20	12/08/20
Gate Replacement/Construction	10/5/20	12/14/20
Morrow Lake Re-Fill	12/16/20	1/12/21
Sediment Sampling/Characterization of the Dredged Material	12/2/20	12/2/20
Disposal of Dredged Material	TBD	TBD
Sediment Containment Removal	TBD	TBD

2. Mitigation Activities

As part of the Joint Permit's requirements, a Mitigation Plan was generated to document what mitigative controls would be performed during the Gate Replacement work. The Mitigation Plan required an environmental monitor to be present during key work activities associated with the Joint Permit requirements to observe, monitor and document changes in turbidity and to ensure compliance with the Joint Permit requirements.

2.1 Summary of Mitigation Controls

In accordance with the Mitigation Plan required by the EGLE Joint Permit, the following mitigation control measures were installed prior to dredging work starting on October 25, 2020:

- A silt curtain was installed at the upstream side of Gates 1 and 2 using a 10-foot impermeable containment that was affixed to the Dam between gates 2 and 3. This curtain was angled to the east southeast away from the dam. Four (4) - 21-foot pipes were anchored into the ground to help support the silt curtain. A group of Jersey Barriers were placed in the middle of the silt curtain on the Dam facing side to hold the curtain against the river flow and contain any sediment coming from the dredging activity (see **Attachment 1** for Containment Above Morrow Dam); and
- A silt curtain approximately 135 feet long was installed at the entrance of the downstream tailrace south "thumb" area to minimize/eliminate scour and remobilization of sediment previously deposited in this area especially during the flow change from gate 3 to gates 1 and 2 (see **Attachment 2** for Containment below Morrow Dam).

In accordance with Section 2.4 of the Mitigation Plan, turbidity readings during the gate replacement work did not exceed the action level of 100 NTUs for an extended period of time, and therefore a rock dike/wall was not constructed at the downstream tailrace side near the Consumers Power Street Bridge on the right descending bank. As discussed with EGLE (Water Quality Division) prior to the issuance of the Joint Permit, EGLE deemed the rock dike/wall structure to be too obtrusive to install, and to only consider installation if turbidity readings indicated exceedances of 100 NTUs for a longer sustained period. Since turbidity readings were stable throughout the work conducted and were well below 100 NTU, other than four very short spikes (as described in **Section 2.3**), the rock

dike wall and/or other additional control measures outlined in the Mitigation Plan were not deemed necessary for installation.

2.2 Summary of Environmental Monitoring Observations

Table 2 provides a summary of environmental monitoring observations noted by the on-site environmental monitors during the dredging activities at Gates 1 and 2, during the three water flow reduction/flow changes, and during boom removal activities. During the environmental monitoring activities, turbidity spot measurements were taken in accordance with Mitigation Plan and those observations are included in **Section 2.3**. Photographs taken during the environmental monitoring activities are provided in a photolog, see **Attachment 3**.

Table 2. Environmental Monitoring Observations

Date	Environmental Monitoring Observations
10/23/20	<p>1245-1330: MJ VanDamme (MJVD) preparing for dredge activities. SWAT deploying silt curtain and boom along upstream side of dam in front of Gates 1 and 2.</p> <p>1330-1430: Lightning stand down.</p> <p>1430-1700: MJVD continues dredging preparation activities.</p> <p>1700-1800: Containment boom is set and deployed upstream in front of Gates 1 & 2.</p> <p>Summary: Work preparation is on-going. No issues to note. No spot turbidity readings taken yet as dredging has not commenced.</p>
10/24/20	<p>0900: Calibrate EXO3 (turbidity monitor).</p> <p>1000-1430: Dredging activities not started. MJVD prepping pipe and sediment containment area. Gates 1 & 2 closed in preparation of dredging.</p> <p>1430-1500: Confirmed no dredging will occur today.</p> <p>Summary: Work preparation is on-going. No issues to note. No spot turbidity readings taken yet as dredging has not commenced.</p>
10/25/20	<p>0800-0900: Dredging not started, MJVD preparing and finalizing piping connection to the dredge area. Calibrated Sonde unit.</p> <p>0845: Spot turbidity readings commence at Consumers Bridge and River Street Bridge per the Mitigation Plan.</p> <p>0900: SWAT informs AECOM employee a SWAT employee tested positive for Covid-19. AECOM incident hotline contacted to log incident and determine next steps.</p> <p>1000: AECOM Health & Safety cleared AECOM monitor to continue to work on-site as outdoor work was occurring, no symptoms observed and more than 6-feet social distancing from SWAT employee was observed.</p> <p>1300-1645: Mechanical dredging begins at Gate 1.</p> <p>1645: Dredging activities halted due to water infiltration into Gate 1 occurring. Issues with dewatering process from the sediment containment area.</p> <p>1800: Dredging activities ceased.</p> <p>Summary: Mechanical dredging technique being re-evaluated. Hydraulic dredging may be utilized or a combination of both. No turbidity issues to note.</p>
10/26/20	<p>0815-0900: Calibrate EXO3 (turbidity monitor) and take Turbidity readings.</p> <p>1000: Dredging activities begin.</p> <p>1030: Dredging suspended, as gates will not close/seal. Too much sediment present to be able to close gates.</p> <p>1100-1300: Water is coming into Gate 1 faster than can be pumped out. Sediment containment area not big enough to contain all the water being hydraulically pumped.</p> <p>1330-1700: Sediment being cleared in front of gate 1.</p> <p>Summary: Gate closure issues to resolve. No turbidity issues to note.</p>
10/27/20	<p>0800-0840: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings. Dredging activities not started yet, gate 1 still not sealing properly.</p> <p>0900-1300: Flow in gate 4 to be lowered to Morrow Lake level.</p> <p>1340-1700: Dredging operations re-start and continues in front of Gate 1.</p> <p>1700-1800: Dredging in front of Gate 1 is about 60% complete.</p> <p>Summary: No turbidity issues to note.</p>
10/28/20	<p>0800-1500: No dredging work occurred today, too much water entering Gate 1.</p>

Date	Environmental Monitoring Observations
10/29/20	<p>0800-0900: Calibrated EXO3 (turbidity monitor) and took initial turbidity readings. SWAT deployed containment boom on downstream side LDB but did not drop curtain yet. Curtain will remain up until water transfer is completed to Gates 1 & 2.</p> <p>0900: Mechanical dredging started in front of Gates 1 & 2 until pumps arrive. Placing of mechanically dredged material in front of Gate 1 until hydraulic dredge setup is in place.</p> <p>0900-1200: Train environmental monitoring replacement with Mitigation Plan and Joint Permit requirements.</p> <p>1200-1750: Setup for hydraulic dredging being worked on by MJVD, no dredging activities occurring.</p> <p>Summary: Hydraulic dredging will be utilized going forward. No turbidity issues to note.</p>
10/30/20	<p>0750: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.</p> <p>0800-1815: Hydraulic dredging and maintenance activities continuing. Water from containment area is being discharged to an upland location in accordance with the Joint Permit.</p> <p>1410-1815: MJVD begins maintenance to remove excess water from downstream area.</p> <p>Summary: Hydraulic dredging continuing. No turbidity issues to note.</p>
10/31/20	<p>0640: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.</p> <p>0730-1615: Hydraulic dredging and maintenance activities continuing at Gate 1, wingwall and Gate 2. Water from containment area is being discharge to an upland location in accordance with the Joint Permit.</p> <p>1200: Pulled and cleaned Sonde at Buoy 3.</p> <p>1230: SWAT drops curtain on containment boom on downstream side LDB.</p> <p>1800: SWAT removes upstream sediment controls in anticipation of the first water flow reduction event since the dredging work at Gate 1 is complete.</p> <p>Summary: Hydraulic dredging continuing. No turbidity issues to note.</p>
11/1/20	<p>0650: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.</p> <p>0700: Hydraulic dredging continues in Gate 2 in a contained area.</p> <p>0730: High wind gusts, rain and snow, work stopped at 0800.</p> <p>0800: New geotechnical bag added to sediment containment area as not enough space to place dredged material.</p> <p>0815-1015: MJVD begins maintenance to remove excess water from downstream area.</p> <p>1030: Due to bad weather conditions work is stopped for the day.</p> <p>Summary: Hydraulic dredging continued briefly at Gate 2. Space at sediment containment needed to be increased as a lot of water from hydraulic dredging was generated. Two turbidity spikes were attributed due to bad weather conditions and debris.</p>
11/2/20	<p>0650: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.</p> <p>0720-1230: Dredging activities continue at Gate 1, several stops occurred during this time due to water management issues from dredging activities.</p> <p>0720-1236: MJVD begins maintenance to remove excess water from downstream area.</p> <p>1220-1405: Sediment containment leaking water and leaking onto roadway near drain that leads out to downstream river. Dredging activities stopped until containment system could be fixed.</p> <p>1315: Informed by SWAT they are working upstream of the Dam and may cause some turbidity fluctuations.</p> <p>1405-1800: Dredging continues at Gate 2 and dredging is finished. First waterflow reduction scheduled to commence 11/3/20.</p> <p>Summary: Hydraulic dredging completed today. No turbidity issues to note. Water flow reductions planned for tomorrow.</p>
11/3/20	<p>0630: Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.</p> <p>0715: Sonde at Buoy 3 was pulled and cleaned.</p> <p>0730-1800: Gate 1 opened. 25% shutting of Gate 3, with 25% additional closure every 30 minutes until closed.</p> <p>0830: Units 1 & 2 opened. Flow is 50 to >125 cfs on unit 1 and unit 2 is at 50 cfs. Gates 2, 3 & 4 closed.</p> <p>0830: Gate 1 & 2 closure slowly proceeding.</p> <p>1000: Gate 2 closed.</p> <p>1045: Soft boom placed right outside of Gate 1 downstream as precautionary measure.</p> <p>1230: Unit 2 opened and has water flow.</p> <p>Summary: Gate replacement activities took longer than anticipated and flow reduction to continue tomorrow. No turbidity issues to note.</p>

Date	Environmental Monitoring Observations	
11/4/20	0320:	Open Gate 3 @ 25%.
	0345:	Open Gate 3 @ 50% and left there overnight as Morrow Lake levels are so high. Gates 1 & 2 closed. Deflector containment downstream LDB broke free when opening Gate 3.
	0650:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.
	0900-1500:	Gate 3 was opened 50% all night due to high water level in Morrow Lake. Gates 1 & 2 were open, but not running water through the powerhouse units. Turbidity readings taken, no issues.
	Summary:	First flow reduction completed at 3:45am. Opening of Gate 3 took longer than anticipated. Deflector containment downstream broke free, however, no turbidity issues to note.
11/19/20	0930:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.
	1000:	Water flow reduction has begun for continued work on the gate replacement
	1000-1500:	Gate 4 expected to be closed for a few more hours per ECRE
	1000-1700:	No turbidity issues noted for the day
	1700-1730:	Photograph oxbow
	1730:	Off-site – Gate 4 is still closed and ECRE will notify when the gate opens
	1900:	Open Gate 4 @ 25%
	Summary:	No turbidity issues or concerns observed with flow change activities. Second flow reduction completed at 19:00pm.
12/7/20	1100:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings. There were elevated turbidity levels at Buoy 3 between 5:45 am and 9:00 am. AECOM spoke with SWAT and they could see the river bottom during these elevated readings. The spot check readings were normal and the elevated readings from the real-time sondes was likely due to an obstruction of the sensor.
	1400:	Arrive at Consumers Bridge for turbidity spot check
	1430:	Off-site
	Summary:	No turbidity issues or concerns observed with the flow change activities. Third flow reduction started at 6am.
12/8/20	0900:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.
	0900-1200:	Collect spot check readings at Consumers Bridge and River Street Bridge
	1200:	Off-site
	Summary:	No turbidity issues or concerns observed with the flow change activities. Third flow reduction completed at 3:00pm.
12/14/20	0930:	Arrive on-site. SWAT plans to pull boom and anchors, some boom will be staged upstream in the channel to free-float until the water level in the lake rises. Other boom will be staged along the wall on the south side of the lake.
	1100:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.
	1300:	Turbidity levels are increasing to around 50 NTUs due to the excavator buggy being in the channel to move the boom and anchors.
	1500:	Turbidity levels receding.
	1630:	Boom removal/staging activities completed for the day.
	Summary:	No turbidity issues or concerns observed with the boom staging activities.
12/15/20	0900:	Arrive on-site. SWAT plans to continue boom removal/staging activities.
	0920:	EGLE on-site to perform drone flyover of Morrow Lake area.
	1000:	Remove Buoy 2 so the boom can be moved and staged up-river.
	1200:	Calibrate EXO3 (turbidity monitor) and take initial spot turbidity readings.
	1210:	Take photos of oxbow and park area.
	1500:	Place Buoy 2 back in the water.
	1600:	Boom removal/staging activities completed for the day.
	Summary:	No turbidity issues or concerns observed with the boom staging activities.

2.3 Summary of Turbidity Monitoring Results

During the dredging activities and the waterflow reduction activities, remote staff accessed the real-time turbidity monitoring system for Buoys 1, 2 and 3 and worked with on-site personnel to inform them of any spikes in turbidity readings.

The on-site environmental monitor performed a daily calibration of the handheld turbidity meter used for spot measurements, and for permit compliance purposes during the dredging and flow change activities. The frequency of the spot measurements was taken approximately every two (2) hours at the River Street Bridge location, and approximately every hour at the on-site Consumers Power Drive Bridge location.

Based on the observations from the first flow change and due to the amount of the time it was taking to complete the water flow-reduction from start to finish, an on-site environmental monitor was not taking spot measurements throughout the entirety of the flow changes. It was determined the real-time turbidity monitoring system from Buoys 1, 2, and 3 could supplement some of the on-site observations as an effective monitoring tool.

Baseline turbidity readings from Buoys 1, 2, and 3 prior to and during work activities were used to monitor turbidity and to determine if permit compliance readings were indicative of background conditions or caused by the permitted work.

The following table is a summary of spot measurements taken during the dredging activity, the three water flow reductions, and the boom removal activities (October 25, 2020 through December 15, 2020):

Table 3. Turbidity Spot Measurement Results

Date	Location	Time	Turbidity (NTU)
10/25/2020	Consumers Bridge	1315	8.31
		1415	9.06
		1515	8.83
		1615	9.64
		1715	8.09
	River Street Bridge	1330	8.93
		1530	9.15
		1730	9.16
10/26/2020	Consumers Bridge	1000	12.08
		1100	6.86
		1200	6.77
		1300	5.71
		1400	8.86
	River Street Bridge	1015	13.43
		1215	6.54
		1415	8.88
10/27/2020	Consumers Bridge	1400	19.61
		1500	19.6
		1600	10.45
		1700	8.52
	River Street Bridge	1415	13.65
		1615	13.04
		1715	9.02

Date	Location	Time	Turbidity (NTU)
10/29/2020	Consumers Bridge	920	10.91
		1019	16.19
		1122	12.87
		1219	13.6
		1318	9.68
		1417	14.84
		1519	14.55
		1620	16.18
		1720	10.35
	River Street	930	13.19
		1132	15.19
		1330	13.11
		1533	13.83
		1732	14.16
10/30/2020	Consumers	807	10.45
		917	9.19
		1012	8.12
		1113	6.61
		1213	6.3
		1321	6.07
		1417	6.72
		1511	6.95
		1609	6.27
		1711	6.87
		1828	7.85
	River Street Bridge	757	9.1
		1024	8.38
		1227	6.74
		1524	6.61
		1730	6.54
		1836	7
10/31/2020	Consumers Bridge	654	9.96
		756	13.75
		854	9.62
		953	10.42
		1055	8.28
		1201	8.6
		1255	8.43

Date	Location	Time	Turbidity (NTU)
		1353	8.95
		1451	9.95
		1604	15.2
	River Street Bridge	643	11.07
		906	9.59
		1110	9.07
		1307	8.64
		1509	10.08
		1553	10.01
11/1/2020	Consumers Bridge	703	21.28
		805	21.9
		921	28.22
		1005	29.7
	River Street Bridge	720	20.33
		936	24.05
		1014	17.43
11/2/2020	Consumers Bridge	701	8.63
		806	10.31
		902	9.55
		1001	14.68
		1100	21.04
		1202	35.6
		1259	18.32
		1409	34.4
		1448	19.29
		1601	36.66
		1654	25.94
		1747	25.25
	River Street Bridge	720	9.19
		911	11.35
		1112	23.25
		1309	36.5
		1457	31.04
		1704	29.89
11/3/2020	Consumers Bridge	719	7.62
		810	10.71
		919	11.8
		1019	5.1

Date	Location	Time	Turbidity (NTU)
		1113	3.36
		1343	3.88
		1517	3.76
		1618	3.86
		1717	3.85
		1816	3.96
		1917	4.15
		2016	3.92
		2113	4.76
		2218	3.17
		2310	2.64
	River Street Bridge	943	8.25
		1123	6.13
		1357	6.73
		1526	4.34
		1727	4.54
		1928	4.61
		2124	6.91
11/4/2020	Consumer Bridge	704	6.47
		807	4.99
		902	5.25
		1003	4.16
		1103	4.64
		1225	5.82
	River Street Bridge	715	10.19
		911	8.2
		1117	6.87
		1243	7.27
11/19/2020	Consumers Bridge	1000	3.29
		1100	2.49
		1200	2.40
		1300	2.39
		1400	2.30
		1500	2.32
		1600	3.00
		1700	2.76
	River Street Bridge	1010	4.20
		1210	2.77

Date	Location	Time	Turbidity (NTU)
		1415	2.95
		1615	3.14
12/7/2020	Consumers Bridge	1120	3.05
		1405	2.01
	River Street Bridge	1135	3.19
		1415	2.45
12/8/2020	Consumers Bridge	930	4.16
		1030	2.96
		1135	2.33
	River Street Bridge	940	5.34
		1150	3.11
12/14/2020	Consumers Bridge	1100	13.53
		1210	15.46
		1300	51.29
		1500	27.11
	River Street Bridge	1110	12.31
		1310	54.90
		1515	31.12
12/15/2020	Consumers Bridge	1205	74.08
		1400	44.98
	River Street Bridge	1215	23.96
		1415	38.26

Dredging activities commenced on October 25, 2020 and continued through November 2, 2020. While active dredge operations occurred, environmental monitoring of turbidity downstream of Morrow Dam continued on an hourly basis at the Consumers Bridge location and every two hours at the River Street Bridge location, along with real-time water quality monitoring. Please refer to the Bi-weekly Turbidity Monitoring Reports for data associated with the real-time monitoring during this timeframe. To summarize, the turbidity spot measurements had no turbidity exceedances of 100 NTU and the real-time data collected during this period only included one period of exceedance of 100 NTU associated with work being conducted at Gate 1 on October 31. This was due to a short duration trend of increased turbidity lasting approximately 1.5 hours related to the removal of an upstream sediment control boom in preparation for the first water flow reduction event, see **Exhibits 1 & 2**. Other exceedances observed are likely attributable to debris or other environmental conditions related to changes in weather and not associated with work activities.

Exhibit 1. Graphical Representation of Real-time Turbidity Monitoring Data during the Period of Dredging

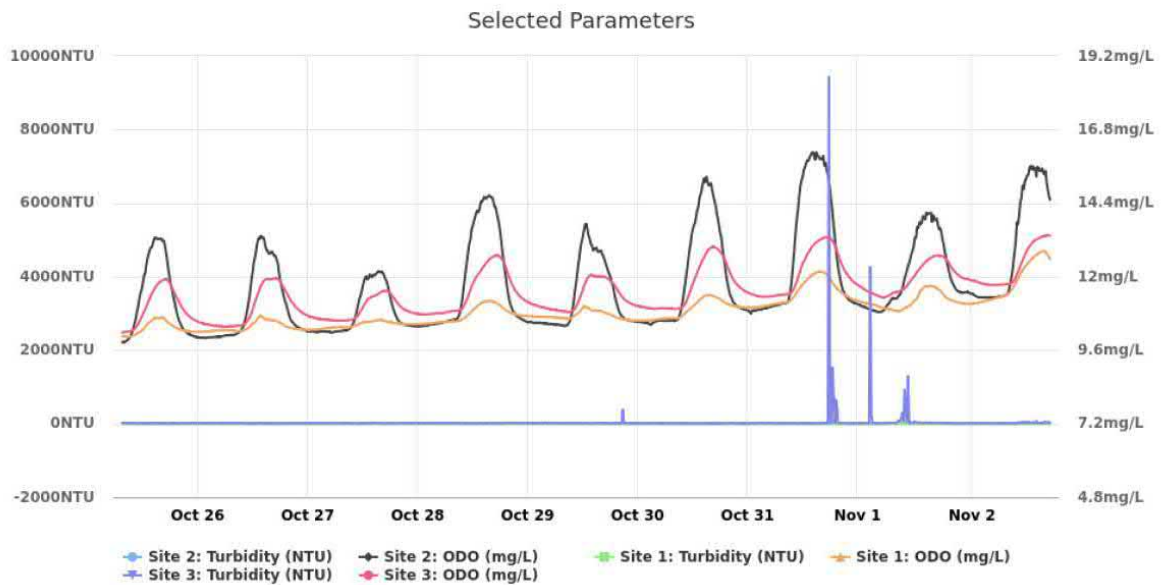
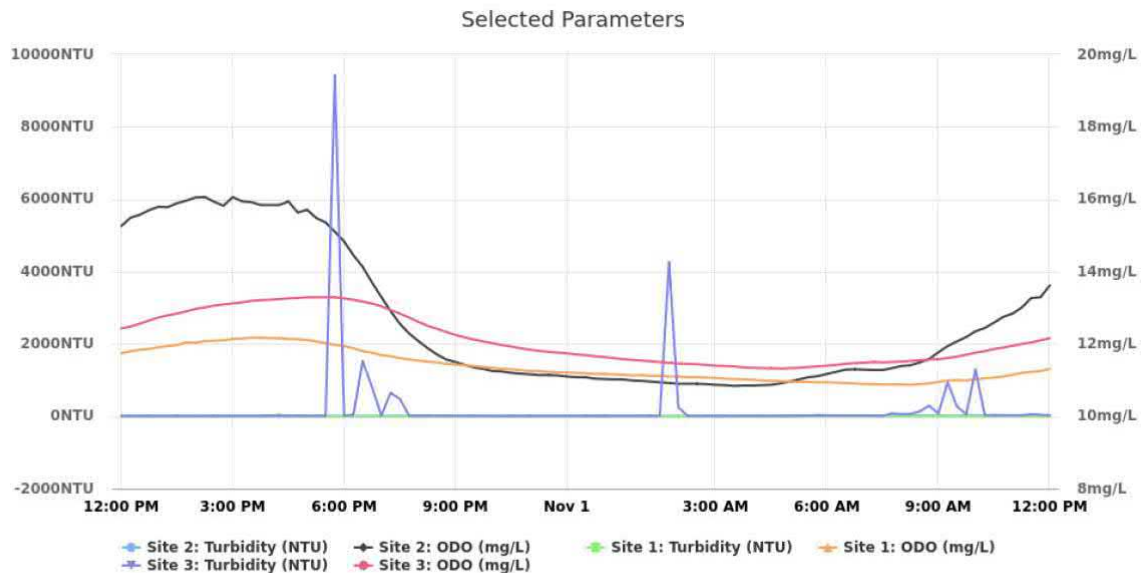


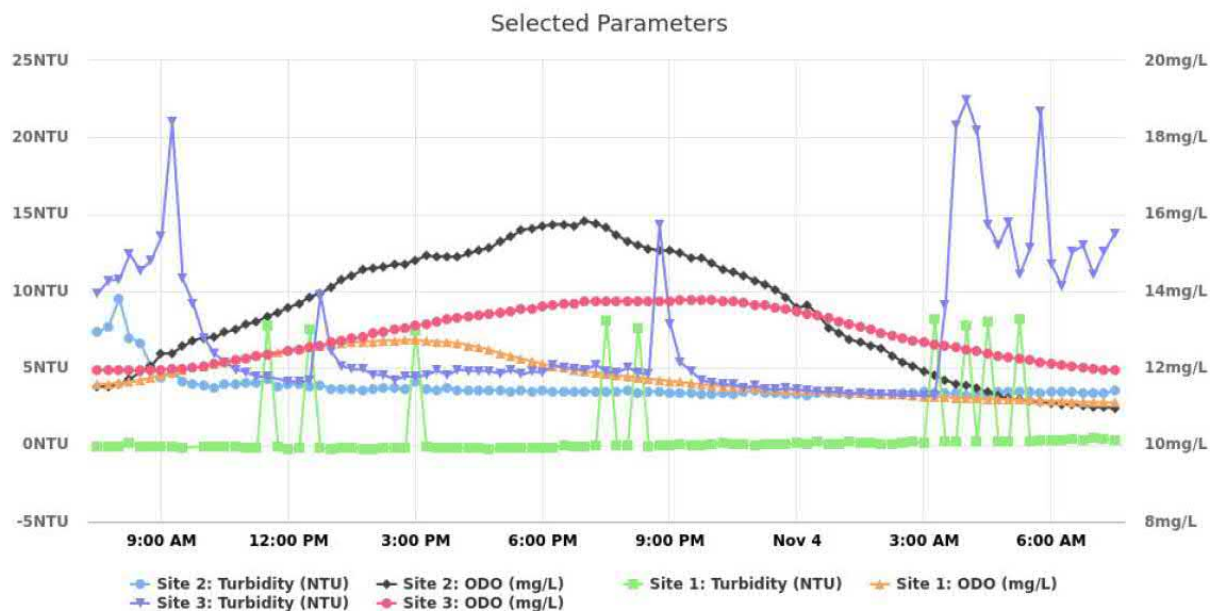
Exhibit 2. Graphical Representation of Real-time Turbidity Monitoring Data during a Period of Increased Turbidity Readings



The first flow reduction activity began November 3, 2020 at 7:30am and continued until November 4, 2020 at 3:45am. Due to the extended duration and unanticipated overnight hours, spot measurements were not collected through the entire duration. However, real-time monitoring continued, and a graphical representation is provided in **Exhibit 3**. Please refer to the Bi-weekly

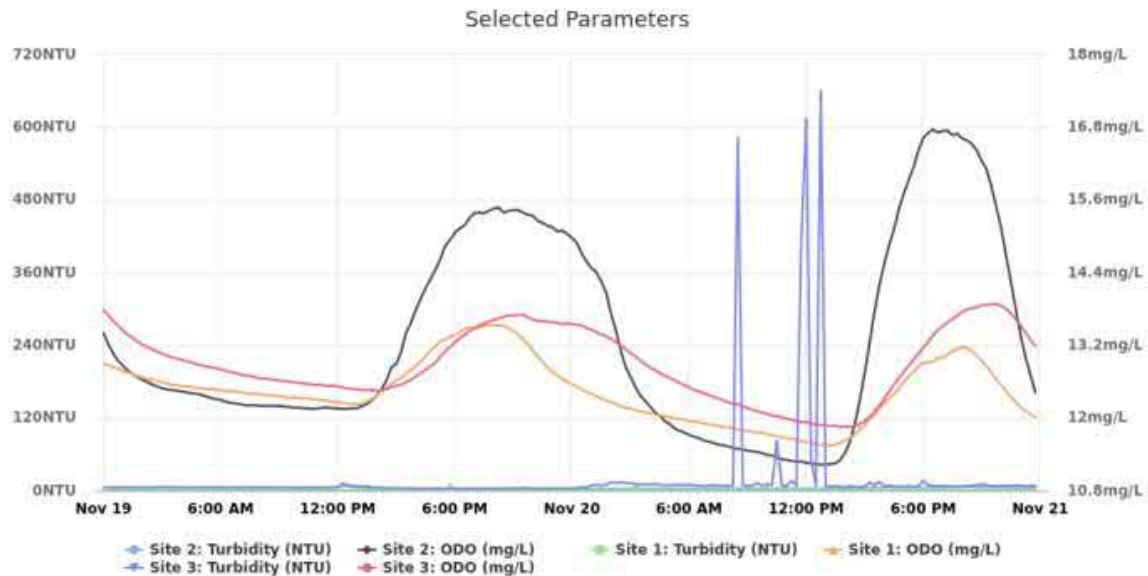
Turbidity Monitoring Reports for detailed data summary associated with the real-time monitoring during this timeframe. To summarize, both the turbidity spot measurements and the real-time data taken during these work activities indicated no turbidity exceedances of 100 NTU.

Exhibit 3. Graphical Representation of Real-time Turbidity Monitoring Data during the First Water Flow Reduction



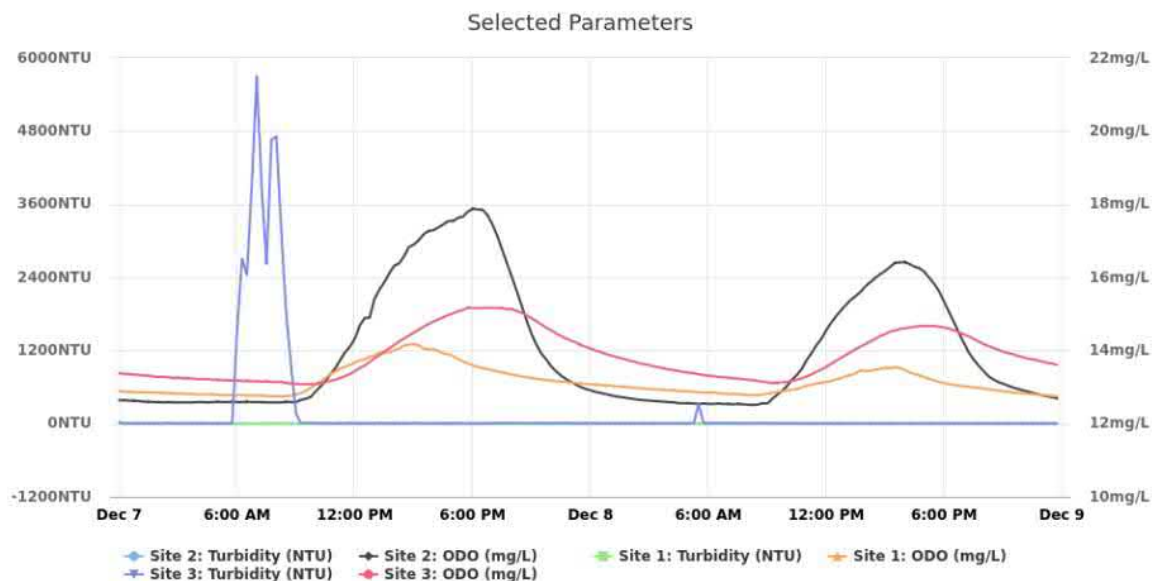
The second flow reduction activity began November 19, 2020 at 12:00pm and continued until 7:00pm. Spot measurements were not collected through the entire duration, however, real-time monitoring continued, and a graphical representation is provided in **Exhibit 4**. Please refer to the Bi-weekly Turbidity Monitoring Reports for detailed data summary associated with the real-time monitoring during this timeframe. To summarize, the turbidity spot measurements indicated no exceedances while there was a short duration trend of increased turbidity on November 20, 2020 in the morning. The event was an aggregate of turbidity spikes that may be related to a turbidity curtain downstream of the dam that became loose and was quickly fixed.

Exhibit 4. Graphical Representation of Real-time Turbidity Monitoring Data during the Second Water Flow Reduction



The third flow reduction activity began December 7, 2020 at 6:00am and continued until December 8, 2020 at 3:00pm. Spot measurements were not collected through the entire duration, however, real-time monitoring continued, and a graphical representation is provided in **Exhibit 5**. Please refer to the Bi-weekly Turbidity Monitoring Reports for detailed data summary associated with the real-time monitoring during this timeframe. To summarize, the turbidity spot measurements indicated no turbidity exceedances. The real-time data taken during these work activities indicated a short trend of increased turbidity prior to the start of the flow change that was likely related to debris on the sensor as there was no visual observations of turbid conditions by onsite personnel.

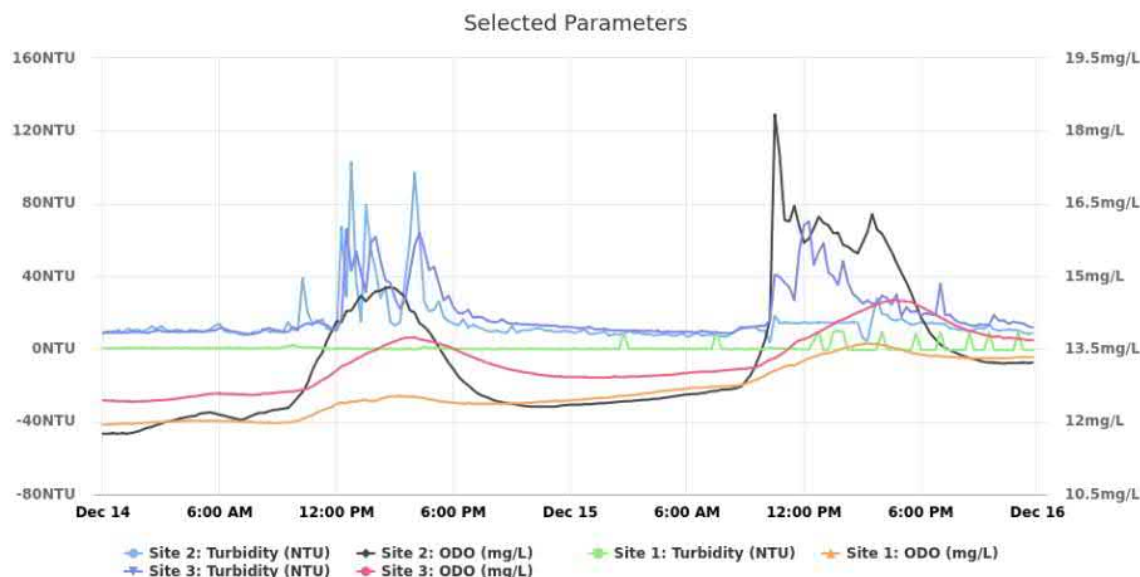
Exhibit 5. Graphical Representation of Real-time Turbidity Monitoring Data during the Third Water Flow Reduction



Upstream turbidity curtain and boom removal activities began on December 14, 2020 and continued until December 15, 2020. Spot measurements were collected during active work activities during

each day and real-time monitoring continued throughout. A graphical representation is provided in **Exhibit 6**. Please refer to the Bi-weekly Turbidity Monitoring Reports for detailed data summary associated with the real-time monitoring during this timeframe. To summarize, the turbidity spot measurements and real-time monitoring location downstream of Morrow Lake indicated no turbidity exceedances of 100 NTU.

Exhibit 6. Graphical Representation of Real-time Turbidity Monitoring Data during the Upstream Turbidity Curtain and Boom Removal Activities



2.4 Conclusions

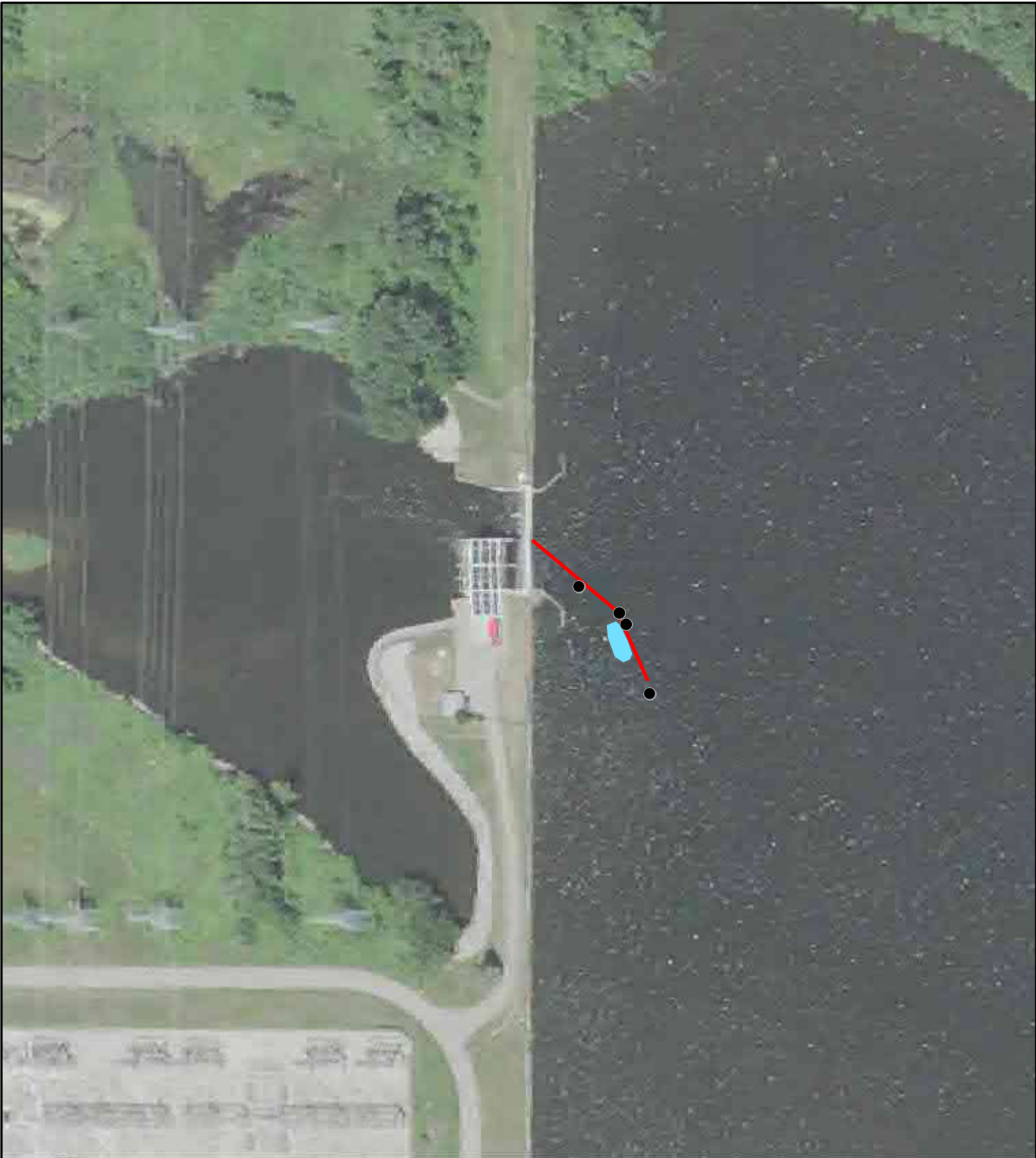
Environmental Monitoring in accordance with the Mitigation Plan has been completed for the dredging activities and water flow reductions for the Morrow Dam Gate Replacement Project.



During the environmental monitoring activities, only one deviation/exceedance in the turbidity action level of 100 NTU was noted for a short period of time on October 31, 2020. This was attributable to remove of upstream booms in preparation for the first water flow reduction event and only lasted approximately 1.5 hours. On November 1, November 20, and December 7, turbidity spikes above the action levels were observed likely attributable to debris or other environmental conditions not associated with work activities.

No turbidity measurements exceeded the 100 NTU action level during spot measurements while dredging activities were being performed and therefore no additional controls were implemented on-site. No turbidity measurements exceeded the 100 NTU action level during spot measurements or real-time monitoring data during the three water flow reduction events performed and therefore no additional controls were implemented on-site.

Attachment 1

Containment Above Morrow Dam





	<p>Map Location</p> 	<p>Legend</p> <ul style="list-style-type: none"> ● 21 ft pipes anchored into ground — 10 ft impermeable containment (affixed to the dam) ● Jersey block deflectors <p>0 0.025 0.05 Miles</p> <p>N</p>	<p>ATTACHMENT 1 CONTAINMENT ABOVE MORROW DAM</p> <p>EAGLE CREEK RE MORROW DAM</p>
<p>Project: 60644031</p>			
<p>Prepared: 10/20/2020</p>			

Attachment 2

Containment Below Morrow Dam



	<p>Map Location</p> 	<p>Legend</p> <ul style="list-style-type: none"> Installed containment curtain 135' silt curtain Proposed rock wall <p>0 125 250 Feet</p>	<p>ATTACHMENT 2 CONTAINMENT BELOW MORROW DAM</p> <p>EAGLE CREEK RE MORROW DAM</p>
<p>Project: 60644031</p>			
<p>Prepared: 10/20/2020</p>			

Attachment 3

Photolog

Site Number/Name: 60644031 – Morrow Dam

Date: 10/23/2020

Photo No.

1

Description:

Sediment containment area for dredging being set up.



Photo No.

2

Description:

Containment boom and curtain in place upstream of dam along wing wall.



Site Number/Name: 60644031 – Morrow Dam

Date: 10/24/2020

Photo No.
3

Description:
Hydraulic dredge attachment.



Photo No.
4

Description:
Pumps for hydraulic dredging.



Site Number/Name:

Date: 10/25/2020

Photo No.

5

Description:

Containment pad and sediment bag.



Photo No.

6

Description:

Sediment exposed in Bay 1 after dewatering.



Site Number/Name:

Date:10/26/2020

Photo No.
7

Description:
Consumers bridge
turbidity check.
(10/26/2020)



Photo No.
8

Description:
River street bridge
turbidity check.
(10/26/2020)



Site Number/Name:

Date:10/27/2020

Photo No.
9

Description:
Bay 1 sediment
being dredged.

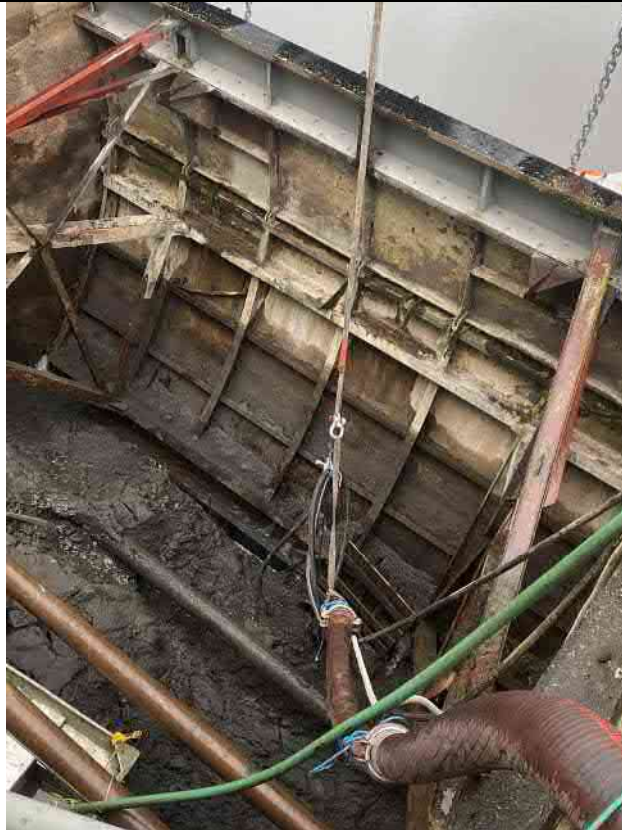


Photo No.
10

Description:
Water overflow in
dredge
containment.



Site Number/Name:

Date 10/28/2020

Photo No.
11

Description:
Turbidity meter
calibration.
(10/28/2020)

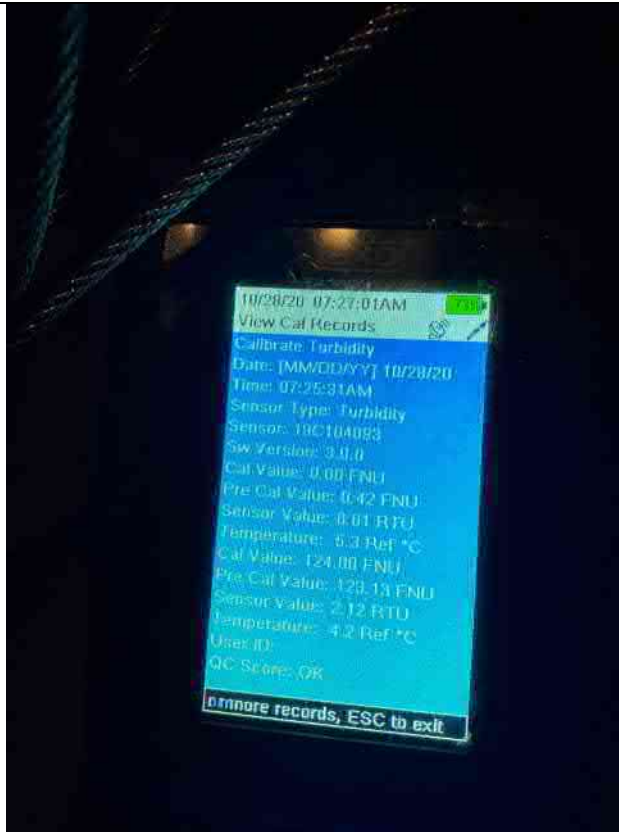
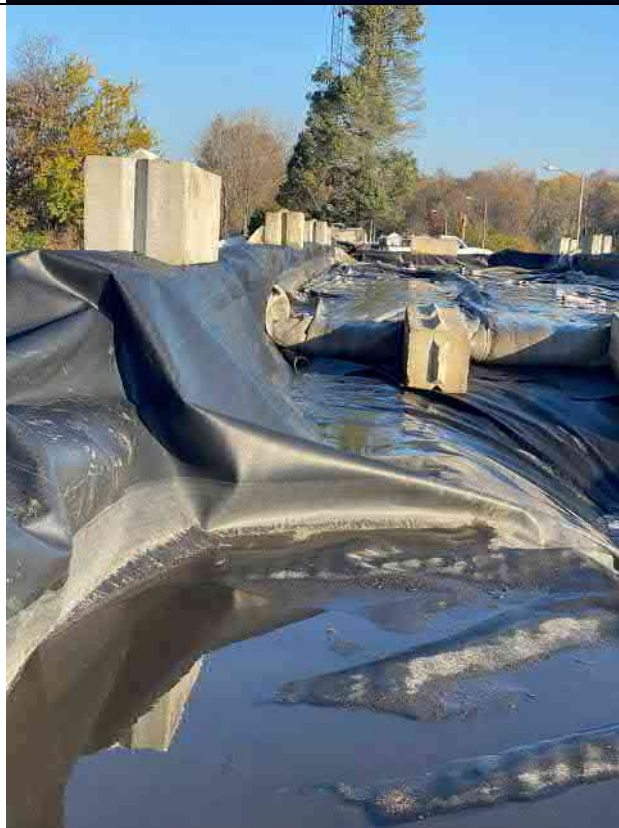


Photo No.
12

Description:
Piping to move
water from the front
of the containment
to the sump in the
back of the
containment that
was being dammed
up by the sediment
bag.



Site Number/Name: 60644031 – Morrow Dam

Date: 10-29-2020

Photo No.
13

Description:
Turbidity reading at
Consumers Bridge
(10/29/2020)



Photo No.
14

Description:
Turbidity reading at
River Street Bridge
(10/29/2020)



Site Number/Name: 60644031 – Morrow Dam

Date: 10-30-2020

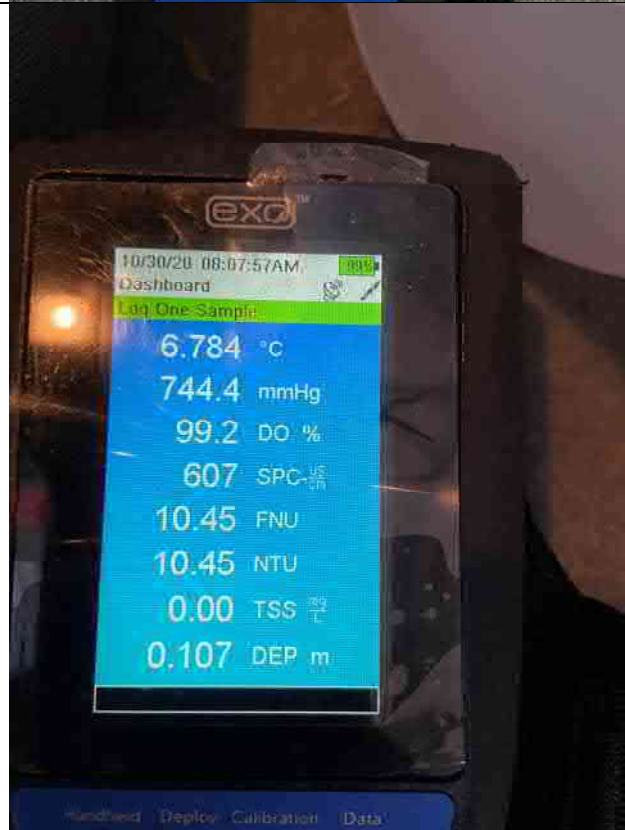
Photo No.
15

Description:
Initial turbidity
reading at River
Street Bridge
(10/30/2020)



Photo No.
16

Description:
Initial turbidity
reading at
Consumers Bridge
(10/30/2020)



Site Number/Name: 60644031 – Morrow Dam

Date: 10-31-2020

Photo No.
17

Description:
Sonde 3 before
cleaning.



Photo No.
18

Description:
Sonde 3 after
cleaning.



Site Number/Name: 60644031 – Morrow Dam

Date: 11-01-2020

Photo No.
19

Description:
Initial turbidity
reading at
Consumers Bridge
(11/1/2020)



Photo No.
20

Description:
Initial turbidity
reading at River
Street Bridge
(11/1/2020)



Site Number/Name: 60644031 – Morrow Dam

Date: 11-02-2020

Photo No.
21

Description:
Sediment bag leak



Photo No.
22

Description:
Sediment bag leak



Site Number/Name: 60644031 – Morrow Dam

Date: 11-03-2020

Photo No.
23

Description:
Sonde 3 before
cleaning.



Photo No.
24

Description:
Sonde 3 after
cleaning.



Site Number/Name: 60644031 – Morrow Dam

Date: 11-03-2020

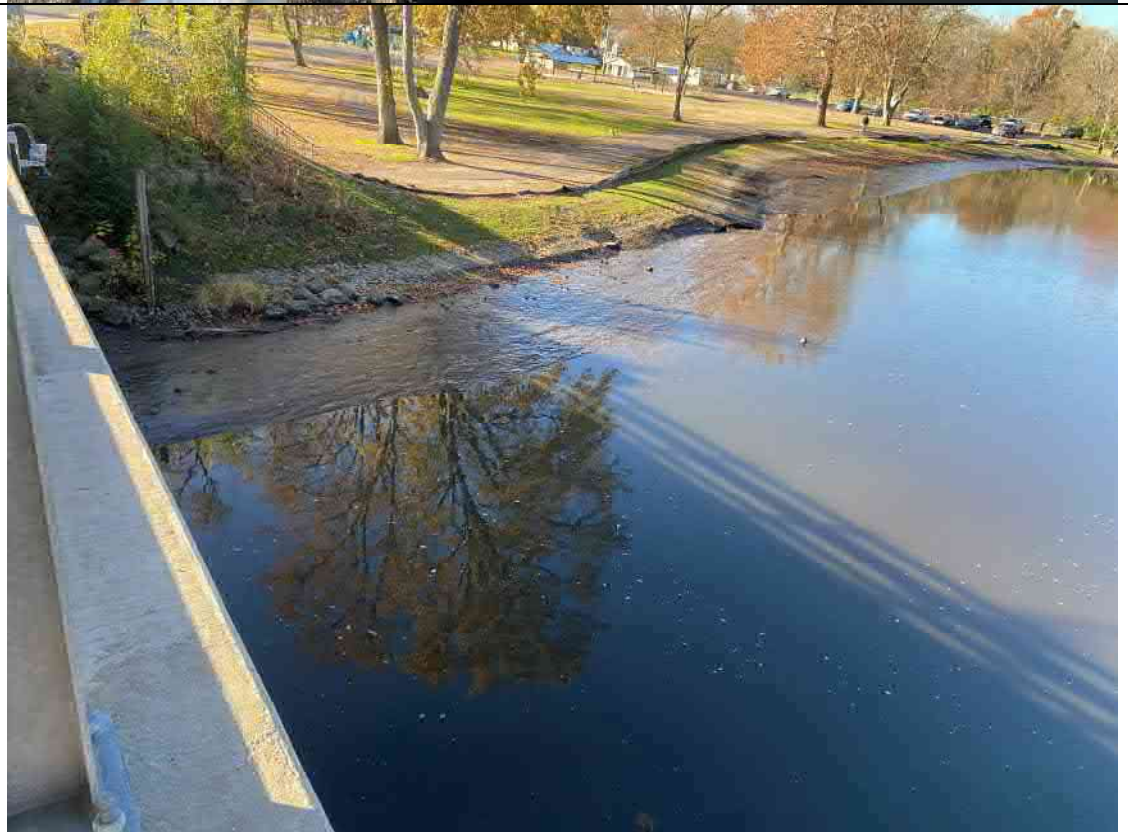
Photo No.
25

Description:
River after flow change initiated,
from Consumers
Bridge



Photo No.
26

Description:
River after flow change initiated,
from River Street
Bridge



Site Number/Name: 60644031 – Morrow Dam

Date: 11-04-2020

Photo No.
27

Description:
Initial turbidity
reading at
Consumers Bridge
(11/4/2020)



Photo No.
28

Description:
Initial turbidity
reading at River
Street Bridge
(11/4/2020)



Site Number/Name: 60644031 – Morrow Dam

Date: 11/19/2020

Photo No.
29

Description:
Flow reduction on
11/19/2020. From
Consumers Bridge
looking east



Photo No.
30

Description:
Flow reduction on
11/19/2020. From
Morrow Lake Dam
looking east



Site Number/Name: 60644031 – Morrow Dam

Date: 11/19/2020

Photo No.
31

Description:
Flow reduction on
11/19/2020. From
Morrow Lake Dam
looking north over the
thumb area



Photo No.
32

Description:
Turbidity reading at
Consumers bridge
during water flow
reduction on
11/19/2020



Site Number/Name: 60644031 – Morrow Dam

Date: 12/7/2020

Photo No.
33

Description:
Flow reduction on
12/7/2020. From
Consumers Bridge
looking east

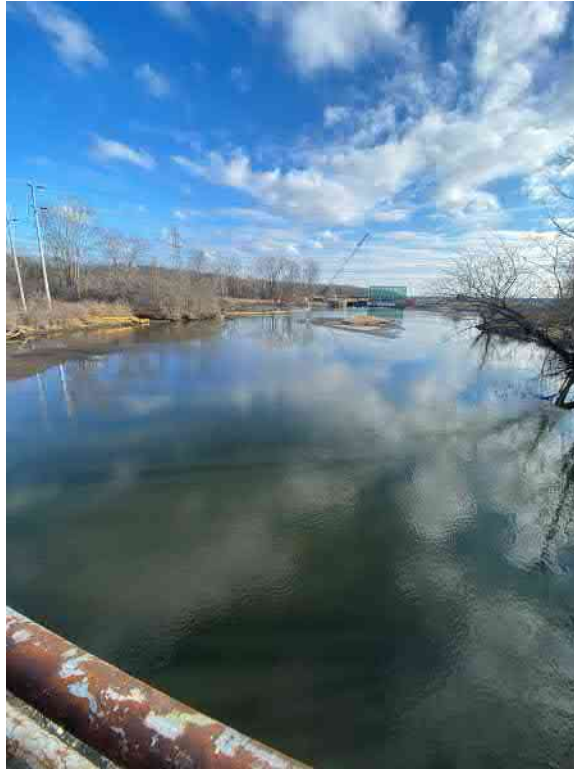


Photo No.
34

Description:
Flow reduction on
12/7/2020. From
Consumers Bridge
looking north at buoy 3
location



Site Number/Name: 60644031 – Morrow Dam

Date: 12/7/2020

Photo No.
35

Description:
Flow reduction on
12/7/2020. From
Morrow Lake Dam
looking north over the
thumb area



Photo No.
36

Description:
Turbidity reading at
River Street bridge
during water flow
reduction on 12/7/2020



Site Number/Name: 60644031 – Morrow Dam

Date: 12/8/2020

Photo No.
37

Description:
Flow change on
12/8/2020. From
Consumers Bridge
looking north at buoy 3
location



Photo No.
38

Description:
Turbidity reading at
Consumers bridge
during water flow
reduction on 12/8/2020



Site Number/Name: 60644031 – Morrow Dam

Date: 12/14/2020

Photo No.
39

Description:
Staging boom for
removal on 12/14/2020
at Morrow Lake Dam
looking north



Photo No.
40

Description:
Staging boom for
removal on 12/14/2020
at Morrow Lake Dam
looking north



Site Number/Name: 60644031 – Morrow Dam

Date: 12/14/2020

Photo No.
41

Description:
Turbidity reading at
Consumers bridge
during boom staging
activities on 12/14/2020



Photo No.
42

Description:
Staging boom for
removal on 12/14/2020
at Morrow Lake Dam
looking east



Site Number/Name: 60644031 – Morrow Dam

Date: 12/15/2020

Photo No.
43

Description:
Beginning Morrow Lake
refill and staging boom
for removal on
12/15/2020 at Morrow
Lake Dam looking north



Photo No.
44

Description:
Buoy 2 location during
Morrow Lake refill on
12/15/2020 at Morrow
Lake Dam looking north



