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F: 413.732.1249
www.gza.com

RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM DRAWDOWN PERIOD MONITORING REPORT #16

September 16, 2022

For Compliance with:

Order of Conditions, DEP File No. 294-0607, issued 09/17/2020

Section 401 Water Quality Certification, BRP WW 08, DEP Transmittal No. X286704, issued 07/23/2021

Section 404 Permit, File No. NAE-2020-02301, issued 10/21/2020

Certificate on the SEIR, Secretary of Energy and Environmental Affairs, EOEEA No. 16234, issued 07/31/2020

Prepared by: Paul G. Davis, PhD, and Adrienne Dunk, WPIT

Reviewed by: Guy Dalton, LSP, Associate Principal

INTRODUCTION AND METHODOLOGY

In compliance with authorized procedures approved under the above-referenced permits and authorizations, GZA is monitoring dissolved oxygen levels, temperature, and transparency during the period of drawdown associated with the Resiliency Improvements at Watershops Pond Dam Project. This report presents the results of the sixteenth monitoring event conducted during the period of drawdown, which commenced with the opening of the low-level outlets at the dam on October 26, 2020. At this time, the dam repairs are largely completed and the pool levels are at or near normal.

Ecological resource monitoring was initially identified as a means to gauge the environmental impacts associated with a partial or full drawdown of Watershops Pond that may occur during the Project. The monitoring was described conceptually in the Alternatives Analysis included in the Expanded Environmental Notification Form (EENF) for the Project (EOEEA No. 16234, EENF dated June 15, 2020). On July 31, 2020, the Secretary of Energy and Environmental Affairs issued the Certificate on the EENF requiring the preparation of a Single Environmental Impact Report (SEIR). In response to comments received on the EENF and in response to the Secretary's Certificate on the EENF, a detailed draft "Aquatic and Wetland Resource Monitoring and Mitigation Plan" (the "Plan") was developed in coordination with regulatory agencies and was submitted as an integral mitigation commitment detailed within the SEIR dated August 28, 2020. The Plan was referenced in the Secretary's Certificate on the SEIR (October 16, 2020) and became a mitigation requirement associated with the City of Springfield's Preferred Alternative of full pond drawdown during the Project. The basic elements of the Plan were developed based upon prior studies of the pond and consultations with the Springfield Conservation Commission and State and Federal regulatory officials.



A copy of the Plan was provided in **Appendix 1** to the “Pre-Drawdown Ecological Monitoring Report,” GZA, September 2020.

During the 2022 spring drawdown, dissolved oxygen monitoring occurred monthly from April to June and will occur between August and November. During the winter drawdown period, dissolved oxygen monitoring occurred at a frequency of once every 2 months. During the 2021 drawdown period, from March through October, dissolved oxygen monitoring occurred monthly. After the pond refilling process began in May 2022, vertical profiles were conducted at four locations and Dissolved Oxygen (DO) and Temperature (°C) were measured at one-foot depth intervals, incorporating one of the pre-drawdown sampling locations, with the other two locations being unavailable due to lack of water depth at those locations. Beginning in June 2022, the two additional pre-drawdown sample profile locations were added as water depths allowed access (**Figure 1C**) for a total of six monitoring locations. Secchi disk depth was recorded at each monitoring location. During the 2021 and 2022 growing season, April through October, groundwater monitoring occurred monthly at the six stations located within the three bordering vegetated wetlands (BVWs) identified during the pre-drawdown report and depicted on **Figures 2 through 4**. Vegetation community monitoring occurs twice per growing season, in late May and between August 15 and September 15 at the same six stations as the groundwater monitoring.

The most recent water quality monitoring event was conducted on September 15, 2022 (see **Figure 1C** for data collection locations).

RESULTS

During the September 15, 2022 sampling event, the maximum pool depth observed was 18.0 feet, with the pond slightly exceeding normal pre-drawdown pool levels. Approximately a half-inch of rainfall occurred on September 13, 2022, and the Bascule gate was in an elevated position as part of the last stages of rehabilitation work and testing, both of which may have contributed to the observed pond levels. Pool depths may also have varied from previous observations due to slight variations in monitoring locations as well as the partial closure of the low-level dam outlet on May 16, 2022, and subsequent refilling and full closure of the low-level dam outlets. The height of the pool was determined by measuring the surface water elevation below the deck of the privately-owned steel bridge located approximately 200 feet upstream of the dam. The measured surface water elevation was at Elevation 155.40± which is approximately 3.45± feet higher than the water surface elevation that was measured in August 2022 and 5.2± feet higher than the June 2022 measurement. The increased water surface elevation prohibited access to the sampling location nearest the dam given the limited vertical distance between the steel bridge and the water surface which did not allow for boat access under the bridge. With the return of normal pool elevations of the pond, the additional sampling location closest to the dam was eliminated from sampling due to insufficient clearance for access by kayak beneath the bridge. This sampling site was originally added after the initial monitoring event because it had a somewhat deeper pool depth (in relation to other portions of the pond during that period), which was important during the maximum drawdown period.

Based upon the Secchi Disk depths which ranged from 3.5 to 4.5 feet, the water was observed to be less turbid than the August 2022 sampling event which recorded Secchi Disk depths of 2.0 to 4.0 feet

Watershops Pond had an average temperature of 20.8° C for locations measured. The measured temperatures ranged from a low of 18.9° C in the West Branch Cove to a high of 22.1° C observed both in the east branch of the Mill River near Pease Cove and in the main body of the pond near the Roosevelt Street Bridge. DO levels measured ranged from 0.1 at the pond bottom to a maximum of 7.2 mg/l within the water column (**Table 1**).



Table 1. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 09/15/2022 11:00 AM – 1:00 PM

Surface Water Elevation: 155.40							
Location: Main Body, Near Dam, East of Steel Bridge; 42°05.861 N; 072°33.624 W				Location: Main Body, Central Pond, East of RR Bridge; 42°05.940 N; 072°33.345 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
4.5	0	4.6	22.0	4.5	0	6.2	21.8
	1	4.6	22.0		1	6.0	21.8
	2	4.6	21.7		2	5.9	21.8
	3	4.6	21.5		3	5.8	21.7
	4	4.6	21.4		4	5.7	21.6
	5	4.5	21.3		5	5.6	21.4
	6	4.3	21.2		6	5.2	21.2
	7	4.0	21.1		7	4.8	21.1
	8	3.8	21.0		8	4.8	21.8
	9	3.5	21.0		9	4.8	21.0
	10	3.4	20.9		10	4.4	20.9
	11	0.4	20.2		11	1.8	19.9
	12	0.2	19.8		12	0.6	19.5
	13	0.1	19.5		13	0.3	19.4
	14	0.1	18.4		14	0.2	19.3
	15	0.1	19.3		15	0.2	19.3
	16	0.1	19.3				
	17	0.1	19.2				
	18	0.1	19.2				
Location: Main Body, Near Dam, 100'± West of Steel Bridge; 42°05.848 N; 072°33.735 W				Location: Main Body, Central Pond West of Roosevelt St. Bridge 42°06.212 N; 072°33.061 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
Location not accessible; No data collected				4.0	0	7.2	22.1
					1	7.2	22.1
					2	7.2	21.9
					3	6.0	21.3
					4	5.8	21.3
					5	5.5	21.1
					6	2.8	20.8
					7	1.0	20.4
					8	0.3	20.1
					9	0.2	19.8
					10	0.1	19.7
Location: West Branch Mill River Cove 42°06.606 N; 072°32.509 W				Location: East Branch Mill River Cove Near Pease Cove 42°06.473 N; 072°32.049 W			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
3.5	0	6.5	21.8	4.5	0	5.9	22.1
	1	6.4	21.8		1	6.1	22.1
	2	6.4	21.7		2	6.6	21.8
	3	6.5	21.5		3	6.3	21.6
	4	6.4	21.4		4	6.1	21.5
	5	6.2	21.2		5	6	21.4
	6	1.4	20.8		6	4.5	21.1
	7	0.7	20.2		7	3.2	20.1
	8	0.6	19.8		8	2.9	19.8
	9	1.0	18.9		9	2.8	19.8
					9.25	2.8	19.8



The average DO concentration at each depth range of the water column is shown in **Table 2**. Despite variation in the DO concentrations over depth, the weighted average DO value for at least 75% of the pond water volume is 5.2 mg/l, which exceeds the action level of 5.0 mg/l.

Table 2. Hypsometric Distribution of Lake Volume and Dissolved Oxygen by Depth

Depth (ft)	Acres Encompassed by Contour Depth	Water column volume by depth interval (CF)	% vol. of water column within depth interval	Cum. % vol. above interval depth	Average DO (mg/l)
0-1	180.6	7,865,357.8	7,865,357.8	15	6.1
1-2	153.0	6,487,711.4	14,353,069.2	27.3	6.1
2-3	144.9	6,099,351.9	20,452,421.1	38.9	6.1
3-4	135.19	5,675,736.8	26,128,157.9	49.7	5.8
4-5	125.46	5,178,393.9	31,306,551.8	59.5	5.7
5-6	112.41	4,469,620.2	35,776,172.0	68	5.6
6-7	93.11	3,593,650.4	39,369,822.4	74.9	3.6
7-8	72.33	2,850,450.2	42,220,272.6	80.3	2.7
8-9	58.78	2,321,613.8	44,541,886.4	84.7	2.5
9-10	48.00	1,930,250.4	46,472,136.8	88.4	2.5
10-11	37.88	1,650,247.5	48,122,384.3	91.5	2.7
11-12	32.42	1,412,099.0	49,534,483.3	94.2	1.1
12-13	26.06	1,135,237.4	50,669,720.7	96.3	0.4
13-14	22.5	860,941.9	51,530,662.6	98	0.2
14-15	17.2	623,461.9	52,154,124.5	99.2	0.2
15-16	11.6	335,447.7	52,489,572.2	99.8	0.2
16-17	4.3	96,265.6	52,585,837.8	100	0.1
17-18	0.63	11,608.4	52,597,446.2	100	0.1
18-19	0.03	435.0	52,597,881.2	100	0.1
Total				100	

Groundwater levels were measured at the six stations described above by auguring a 3-inch diameter hole to a depth of at least 24 inches and allowing time for equilibration of the groundwater level within the hole. The observed depths to groundwater are shown in **Table 3**. Due to the elevated water surface elevation, the groundwater monitoring stations were inundated, with the exception of Station 1 at GYSGT J. Sullivan Park.

Table 3. Watershops Pond Drawdown Groundwater Monitoring Measurements (inches below ground surface)

Date	Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
9/14/2022	6	12	6	-6	16	>16

Note: Depths denoted with a ">" indicate the site could not be safely accessed given water inundation depth.

Vegetation was also assessed at each of the six stations; however, due to the inundation, the ground cover vegetation could not be fully inventoried by species with accurate percent cover estimates. Despite this limitation, the observed vegetation appeared to be of similar species composition and densities as in previous observations. No change in the species or percent composition was observed in the tree canopy, shrub/sapling, or vine layers since the initial inventory in September 2020.



DISCUSSION

The Plan suggested an action level for DO of 5 mg/l for at least 75% of the surface waters in the residual pool, with lesser values potentially triggering mitigation action. During the September 2022 monitoring event, this action level was met as the average DO concentration exceeded 5 mg/l for 75% of the surface water volume. This result demonstrates somewhat decreased DO levels from August 2022 which could potentially be associated with the increasing submergence and die-off of emergent vegetation within the formerly exposed pond basin sediments, which may have contributed to Biochemical Oxygen Demand (BOD) and some oxygen depletion.

As the pond has reached its full refill, some areas of vegetation that developed on the exposed sediments will die-off, resulting in the decay of these plants within the water column, causing increased BOD. Such decomposition could result in localized DO depletion; therefore, continued water quality observations will be useful for the 2022 growing season to determine if DO mitigation is necessary. The areas of vegetation submergence appear relatively small compared to the entirety of Watershops Pond, so we remain optimistic that DO levels should remain above the action thresholds during this post-refill season. After the initial decomposition related oxygen demand and with the expectation of cooler periods with the onset of the fall climate, any such BOD will be expected to decrease with time and normal DO levels should be restored. Relative to the pond basin refilling efforts, we judge them to have been generally successful.





The groundwater levels in the wetlands were expected to drop with the Watershops Pond drawdown and to quickly rebound with the restoration of the pond water surface elevation. Due to the observed water surface elevation at the time of this monitoring event, five of the six groundwater monitoring stations were inundated with more than six inches of standing water. The only monitoring station that was not inundated was located at Gunnery Sergeant Park. This station reflected the higher water surface as groundwater was observed within six inches of the soil surface.

The wetland vegetation appeared similar to previous observations and, with the return of the normal pond water surface elevation, the wetland vegetation is anticipated to remain healthy. In areas where invasive or upland species were documented, the reintroduction of high groundwater and occasional inundation is anticipated to deter future growth and establishment.

The groundwater and vegetation data will be discussed and analyzed further in the 2022 year-end wetland monitoring report. This report will include wetland impacts and proposed wetland mitigation measures, if warranted.

LEGEND

DISSOLVED OXYGEN PROFILE LOCATIONS

-  PROPOSED POST-DRAWDOWN
-  PROPOSED PRE-DRAWDOWN
-  ACTUAL POST-DRAWDOWN
-  POST-REFILL

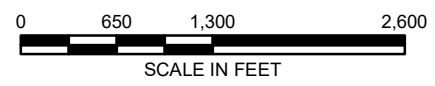


© 2022 - GZA GeoEnvironmental, Inc. J:\0 166600 - 0 166699\15.0166625.20 Watershops Pond Dam\GIS\mxd\DrawdownMonitoringReport\Fig1C_DO_Monitoring_Location.mxd, June 30, 2022 - 3:58:57 PM, Adrienne.dunk



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 1 ALLEN STREET
 SPRINGFIELD, MASSACHUSETTS

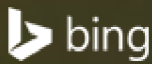
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**DISSOLVED OXYGEN PROFILE
 MONITORING LOCATIONS**

PROJ MGR: JRB	REVIEWED BY: GPD	CHECKED BY: SLL
DESIGNED BY: ARD	DRAWN BY: ARD	SCALE: 1 in = 1,300 ft
DATE: 06/30/2022	PROJECT NO: 15.0166625.20	REVISION NO:

FIG.
1C

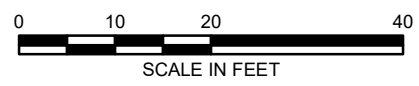


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LEGEND

- + MONITORING STATION
- WETLAND BOUNDARY POINT
- OBSERVED MEAN HIGH WATER
- WETLAND BOUNDARY
- BVW SURVEY AREAS
- PROJECT AREA



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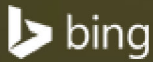
**RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM
1 ALLEN STREET
SPRINGFIELD, MASSACHUSETTS**

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SPRINGFIELD COLLEGE BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 2
DESIGNED BY: JRB	DRAWN BY: ARD	SCALE: 1 in = 20 ft	
DATE: 11/24/2020	PROJECT NO: 15.0166625.20	REVISION NO:	



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LEGEND

- + MONITORING STATION
- WETLAND BOUNDARY POINT
- WETLAND TRANSECT
- OBSERVED MEAN HIGH WATER
- WETLAND BOUNDARY
- BVW SURVEY AREAS
- PROJECT AREA



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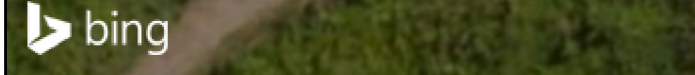
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1 ALLEN STREET
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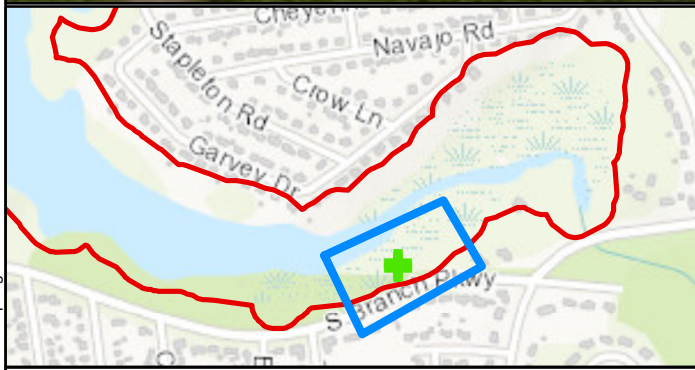
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SPRINGFIELD COLLEGE
EAST CAMPUS BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 3
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LEGEND

- + MONITORING STATION
- WETLAND BOUNDARY POINT
- WETLAND TRANSECT
- OBSERVED MEAN HIGH WATER
- WETLAND BOUNDARY
- BWW SURVEY AREAS
- PROJECT AREA

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GYSGT. J. SULLIVAN PARK BWW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 4
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