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RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM DRAWDOWN PERIOD MONITORING REPORT #9

SEPTEMBER 14, 2021

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, Adrienne Dunk

Reviewed by: Tom Jenkins, P.E.

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 ninth 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. During the winter drawdown period, dissolved oxygen monitoring will occur at a frequency of once every 2 months. From March through October, during the growing season, monitoring will occur monthly.

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 discussed 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 winter drawdown period, dissolved oxygen monitoring occurred at a frequency of once every 2 months. From March through October, during the growing season, dissolved oxygen and groundwater monitoring occurs monthly. Within the Pond, vertical profiles are being conducted at the three locations and Dissolved Oxygen (DO) and Temperature (°C) are measured at one-foot depth intervals. Secchi disk depth is recorded at each site. Vegetation community monitoring occurs twice per growing season, in late May and between August 15 and September 15. Groundwater and vegetation community monitoring is being conducted at the six stations located at the three BVWs identified during the pre-drawdown report and depicted on **Figures 2 through 4**. This report presents the results of the ninth 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.

The second 2021 growing-season vegetation community monitoring took place on September 8, 2021.

The current water quality monitoring event was conducted on September 14, 2021. Monitoring was repeated at the two locations selected during the first sampling event, conducted December 15, 2020, and at a third sampling location near the dam which was added on March 23, 2021, to take advantage of deeper residual pool depth for monitoring (see **Figure 1A** for data collection locations).

RESULTS

The Watershops Pond residual pool encompasses 23± acres upgradient of the dam where the water exits the pond basin through the sluice gates. At low water, the maximum pool depth observed was 4.5 feet, with most of the pool area less than 3 feet deep. However, pool depths tend to vary during monitoring dates due to slight variations in monitoring locations as well as variable head height at the dam outlet due to rainfall and stream flow variation. 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 141.3± which is approximately 0.65± feet lower than the water surface elevation that was measured in August 2021 and approximately 0.60± feet higher than measured in December 2020.

Based upon the Secchi Disk depth, the water within the pool basin was observed to be less turbid than the August sampling event which recorded Secchi Disk depths of 1.5 feet.

Watershops Pond had an average temperature of 21.2° C for locations measured. The measured temperatures ranged from 20.6° C to 23.2° C. The maximum DO observed was 9.1 at one location (**Table 1**).



Table 1. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 09/14/2021 2:30-3:30 PM

Date: 09-14-2021				Time: 2:40 PM				Surface Water Elevation: 141.30 (Note: chisel mark on pond side of pier made at 12.00' below bridge deck)			
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				Location: Main Body, Near Dam, 100'± West of Steel Bridge; 42°05.848 N; 072°33.735 W*			
Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C	Secchi Depth (ft)	Depth (ft)	DO (mg/l)	Temp °C
2.5	0	8.8	21.2	<1	0	8.6	23.2	2.25	0	8.8	21.1
	1	8.9	21.1		1.0 bottom	7.7	23.5		1	9.1	20.8
	2	8.8	21						2	9.1	20.7
	3	8.8	20.9						3	9.0	20.7
	4	8.8	20.6						4	8.9	20.6
	4.5 bottom	3.8	20.6						4.5 bottom	8.8	20.6

The average DO concentration at each depth range of the water column is shown in **Table 2**. Because the DO concentration changed little over depth, with the exception of one measurement, the average DO within the water column is above the action level of 5.0 mg/l. The depression of DO near the bottom surface at the sampling location east of the steel bridge is suggestive of the influence of the anoxic sediments and decomposition of benthic organic material.

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	22.5	860,941.9	44.7	44.7	8.7
1-2	17.2	623,461.9	32.3	77.0	8.6
2-3	11.6	335,447.7	17.4	94.4	9.0
3-4	4.3	96,265.6	4.99	99.39	8.9
4-5	0.63	11,608.4	0.60	99.99	8.9
5-6	0.03	435.0	0.02	100	6.3
Total		1,927,709.6			

Groundwater levels were measured at the six stations by auguring a 3-inch diameter hole to a depth of at least 24 inches and allowing time for equilibration. The observed depths to groundwater are shown in **Table 3**.

Table 3. Watershops Pond Drawdown Groundwater Monitoring Measurements (inches below ground surface)
Date of Data Collection: 09/08/2021 11:00 AM – 1:00 PM

Date	Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
09/08/2021	-24+	-24+	-24+	-13	-6	0

Note: Depths denoted with a "+" indicate that groundwater was not observed at this depth



Vegetation was also inventoried with percent cover estimated for each observed species at the six stations. No change in species or percent composition was observed in the tree canopy, shrub/sapling, or vine layers since the initial inventor in September 2020. Changes in the herbaceous layer are shown in **Table 4**.

Table 4. Watershops Pond Drawdown Wetland Vegetation Monitoring Herbaceous Vegetation Change
Date of Data Collection: 09/08/2021 11:00AM – 1:00PM

Species		Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
Common Name	Scientific Name	Station 1	Station 1	Station 2	Station 1	Station 2	Station 3
Fleabane Daisy	<i>Erigeron annuus</i>	-trace					
Purple Loosestrife*	<i>Lythrum salicaria</i>				+trace	-9%	
Thistle	<i>Cirsium sp.</i>	+5%					
Glossy Buckthorn*	<i>Frangula alnus</i>		+8%				
Clearweed	<i>Pilea pumila</i>		-15%		-5%	+30%	
Barberpole Sedge	<i>Scirpus rubrotinctus</i>		-15%**				
Skunk cabbage	<i>Symplocarpus foetidus</i>		+5%	+5%			
Fringed Sedge	<i>Carex crinita</i>		+trace			+5%	
Swamp Beggar's Tick	<i>Bidens discoidea</i>		+2%			-trace	
Awl-fruit sedge	<i>Carex stipata</i>		+3%				
Arrowwood	<i>Viburnum dentatum</i>		-1%	+trace			
Red Oak	<i>Quercus rubra</i>			+trace			
Spinulose Wood Fern	<i>Dryopteris carthusiana</i>			-4%			
Pennsylvania Sedge	<i>Carex Pennsylvanica</i>			-4%**			
Swamp Azalea	<i>Rhododendron viscosum</i>			-5%**			
Princess Pine	<i>Lycopodium obscurum</i>		+2%	+2%			
Jewelweed	<i>Impatiens capensis</i>				+5%	+40%	
Sensitive Fern	<i>Onoclea sensibilis</i>				+20%	-7%	
Duckweed	<i>Lemna minor</i>						-85%
Highbush Blueberry	<i>Vaccinium corymbosum</i>			+3%			
Bindweed	<i>Convolvulus spp.</i>			+5%		+5%	
Arrow-leaf Tear-thumb	<i>Persicaria sagittata</i>					+45%	
American Bur-reed	<i>Sparganium Americanum</i>					-3%	
Broadleaf Cattail	<i>Typha latifolia</i>					-15%	
Smartweed	<i>Polygonum spp.</i>					+10%	
Water Horehound	<i>Lycopus americanus</i>		+3%				

Note:
 "+" indicates an increase in percent cover from pre-drawdown conditions
 "-" indicates a decrease in percent cover from pre-drawdown conditions
 * indicates the species is considered invasive in Massachusetts
 ** indicates that the species may have previously been misidentified



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 2021 monitoring event, this standard was met as the average DO concentration exceeded 6.3 mg/l at all contour elevations, and was 8.6 mg/l or greater for most elevations. This result demonstrates a similar DO level from August and may be reflective of continued flow through the pond given recent rain events.

As temperatures remain stable and then begin to lower, it is likely that the DO will continue to increase as the fall season approaches. Due to short-term low DO concentrations experienced in May 2021, a fountain aerator was installed in the lower pool area above the dam as a mitigation measure. While mitigation requirements have not been triggered since that time, the aerator has been in near continuous operation except during occasional periods of operational failure to due power outage.

The groundwater levels in the wetlands were expected to drop with the Watershops Pond drawdown. Given recent rain events, including Hurricane Henri and Tropical Storm Ida, the depths to groundwater decreased from August and were similar to the seasonal high water observed in July. Groundwater depths will continue to be monitored throughout the growing season and there may be a short-term shift in some herbaceous vegetation. More permanent vegetation in the tree canopy, shrub/sapling, and vine layers are not anticipated to change from the drawdown.

Most observed changes in herbaceous vegetation composition were not significant with the exception of duckweed. The percentage of duckweed coverage at Sullivan Park Station 3 decreased by 85%. Duckweed is an aquatic plant which floats at the top of the water column; however, there is no standing or ponded water at this sample station currently. The duckweed is anticipated to return when the pond is refilled. Other herbaceous vegetation which shifted over 20% included an increase of clearweed, sensitive fern, jewelweed, and arrow-leaf tear-thumb at Sullivan Park. These increases indicate that the wetland is receiving sufficient surface inundation and groundwater inputs to sustain a wetland habitat despite the drawdown. These data will be discussed and analyzed further in the annual wetland monitoring report. Following the refilling of the pool, wetland impacts, and potential mitigation measures will be discussed.

LEGEND

DISSOLVED OXYGEN PROFILE LOCATIONS

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



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

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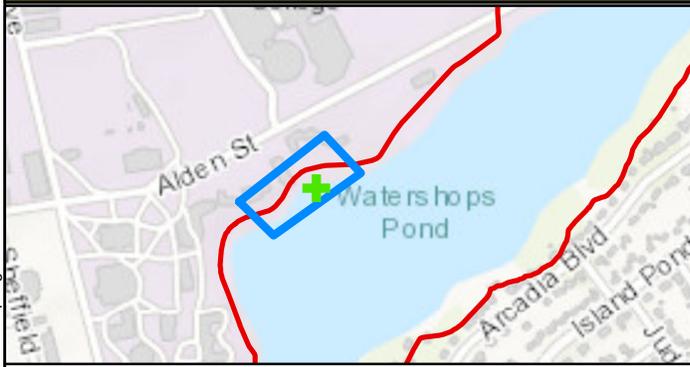
DISSOLVED OXYGEN PROFILE MONITORING LOCATIONS

PROJ MGR:	JRB	REVIEWED BY:	TEJ	CHECKED BY:	SLL
DESIGNED BY:	ARD	DRAWN BY:	ARD	SCALE:	1 in = 350 ft
DATE:	03/25/2021	PROJECT NO:	15.0166625.20	REVISION NO:	

FIG.
1A



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LEGEND

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



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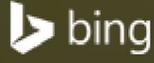
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SPRINGFIELD COLLEGE BVW

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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- PROJECT AREA



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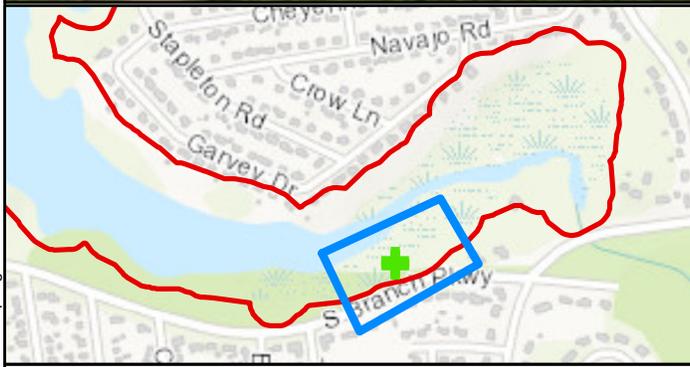
SPRINGFIELD COLLEGE
EAST CAMPUS BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 3
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GYSGT. J. SULLIVAN PARK BVW

PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG. 4
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DATE: 11/24/2020	PROJECT NO: 15.0166625.20	REVISION NO:	