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RESILIENCY IMPROVEMENTS AT WATERSHOPS POND DAM
DRAWDOWN PERIOD MONITORING REPORT #17

November 1, 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 seventeenth 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 primarily 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.

GZA began monitoring dissolved oxygen at a frequency of once every 2 months from February to March 2021. During the growing season, GZA monitored dissolved oxygen monthly from April to October 2021. With the end of the growing season, GZA returned to monitoring every 2 months from November 2021 until March 2022. As the pond refilling process began, GZA conducted dissolved oxygen monitoring monthly from April to June and August to October 2022. 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. In September and October 2022, the furthest downstream sampling point was not accessible given the water surface elevation under the private bridge and lack of vertical clearance for the passage of the sampling boat beneath this bridge. 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 October 24, 2022 (see **Figure 1C** for data collection locations).

RESULTS

During the October 24, 2022 sampling event, the maximum pool depth observed was 15.5 feet, with the pond at or near normal pre-drawdown pool levels. During the sampling event, it was raining; however, less than a tenth of an inch of rain had accumulated. Compared to the September sampling when the Bascule gate was in the fully upright position, the water surface elevation had decreased slightly. Pool depths may also have varied from previous observations due to slight variations in monitoring locations. 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 154.40± which is approximately 1.0± feet lower than the water surface elevation that was measured in September 2022 and 4.2± feet higher than the August 2022 measurement. The 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 observed Secchi Disk depths which ranged from 3.5 to 4.5 feet, the water was observed to be similarly turbid to the September 2022 sampling event.

Watershops Pond had an average temperature of 12.1° C for locations measured. The measured temperatures ranged from a low of 10.1° C in the West Branch Cove to a high of 13.0° C in the main body of the pond east of the steel bridge. DO levels measured ranged from 3.4 at the pond bottom to a maximum of 8.4 mg/l near the water surface (**Table 1**).

Table 1. Watershops Pond Drawdown Pool Dissolved Oxygen, Temperature, and Secchi Depth Measurements
Date of Data Collection: 10/24/2022 10:30 AM – 12:30 PM

Surface Water Elevation: 154.40							
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**
3.5	0	5.6	13.0	4.0	0	6.1	12.6
	1	5.4	12.6		1	6.0	12.6
	2	5.3	12.6		2	6.0	12.6
	3	5.3	12.6		3	5.9	12.6
	4	5.2	12.6		4	5.8	12.6
	5	5.2	12.6		5	5.8	12.6
	6	5.2	12.6		6	5.7	12.6
	7	5.2	12.6		7	5.7	12.6
	8	5.1	12.6		8	5.7	12.6
	9	5.1	12.6		9	5.7	12.6
	10	5.1	12.6		10	5.6	12.6
	11	5.1	12.6		11	5.0	12.5
	12	5.1	12.6		12	4.4	12.3
	13	5.1	12.6		13	3.7	12.0
	14	5.1	12.6		14	3.4	11.8
	15	5.0	12.6				
	15.5	4.6	12.6				
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	5.7	12.5
					1	5.5	12.5
					2	5.4	12.5
					3	5.3	12.5
					4	5.3	12.5
					5	5.2	12.5
					6	5.1	12.5
					7	5.0	12.4
					8	4.7	12.3
					9	4.2	12.2
					10	4.0	12.1
					11	4.3	11.5
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**
4.5	0	6.8	12.1	4.5	0	8.4	12.4
	1	6.6	12.1		1	8.1	12.1
	2	6.5	12.0		2	8.2	12.0
	3	6.4	12.0		3	8.2	11.9
	4	6.4	12.0		4	8.1	11.6
	5	6.3	11.9		5	7.5	10.8
	6	5.8	11.0		6	7.3	10.4
	7	6.6	10.3		7	7.1	10.3
	8	6.7	10.2		8	7.1	10.3
	9	6.9	10.1				
	10	6.9	10.1				

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 DO value for at least 75% of the pond water volume 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	144.90	6,099,351.9	15.95	15.95	6.5
1-2	135.19	5,675,736.8	14.84	30.79	6.3
2-3	125.46	5,178,393.9	13.54	44.33	6.2
3-4	112.41	4,469,620.2	11.69	56.02	6.2
4-5	93.11	3,593,650.4	9.40	65.42	6.2
5-6	72.33	2,850,450.2	7.45	72.87	6.0
6-7	58.78	2,321,613.8	6.07	78.94	5.8
7-8	48.00	1,930,250.4	5.05	83.99	5.9
8-9	37.88	1,650,247.5	4.31	88.30	5.9
9-10	32.42	1,412,099.0	3.69	91.99	5.5
10-11	26.06	1,135,237.4	2.97	94.96	5.4
11-12	22.50	860,941.9	2.25	97.21	4.8
12-13	17.20	623,461.9	1.63	98.84	4.8
13-14	11.60	335,447.7	0.88	99.72	4.4
14-15	4.30	96,265.6	0.25	99.97	4.3
15-16	0.63	11,608.4	0.03	100.00	5.0
16-17	0.03	435.0	0.00	100.00	4.6
Total				100.00	

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**. Station 3 at Gunnery Sergeant J. Sullivan Park was not accessible during the observation event due to the depth of surface water.

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

	Springfield College	Springfield College East Campus		GYSGT J. Sullivan Park		
Date	**Station 1**	**Station 1**	**Station 2**	**Station 1**	**Station 2**	**Station 3**
10/24/2022	-20	-3	-4	-16	+4	>16
Note: Depths denoted with a ">" indicate the station could not be safely accessed given water inundation depth.						

DISCUSSION

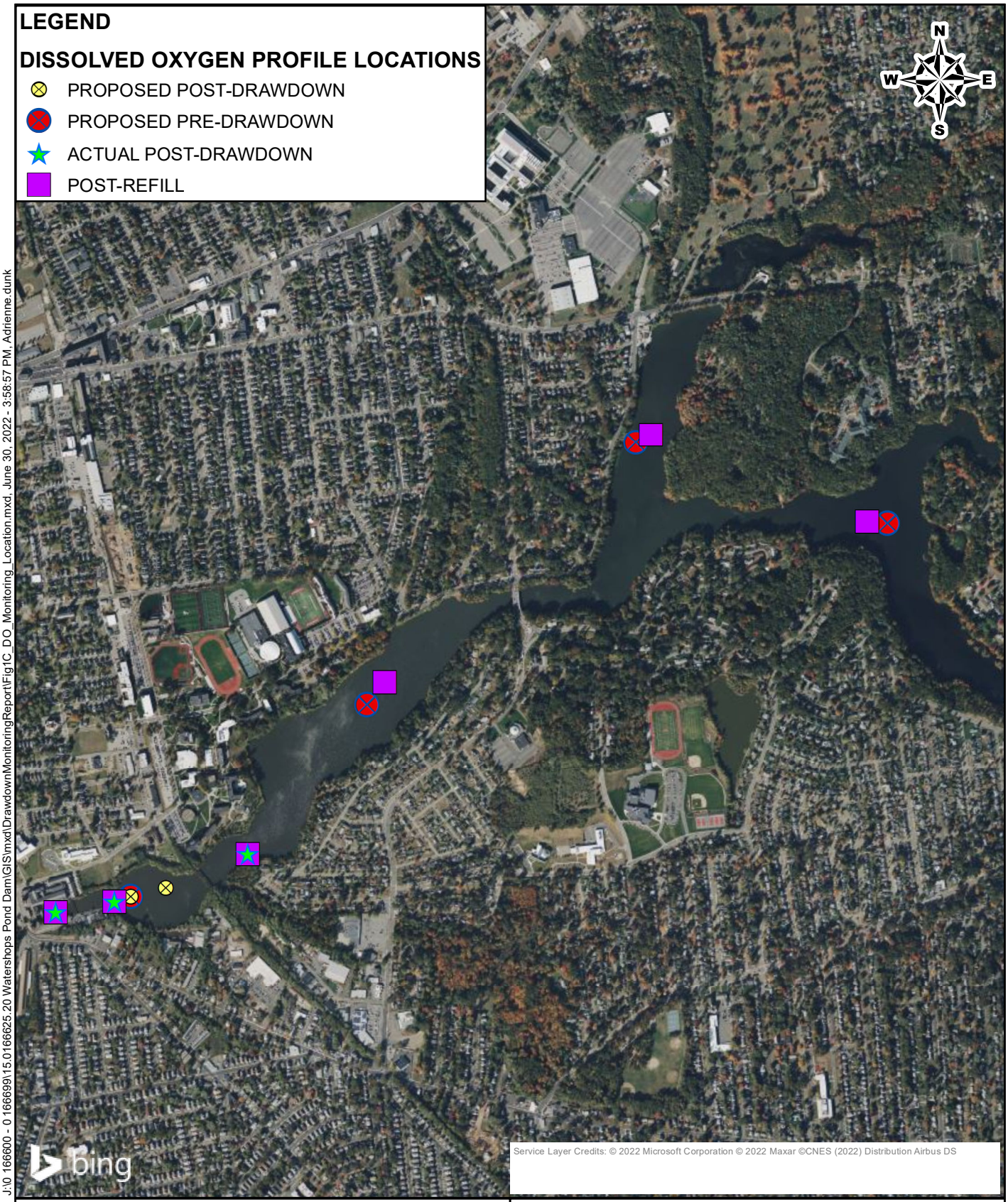
The Plan suggested an action level for DO of 5 mg/l for at least 75% of the surface waters in the residual pool, with lesser values potentially triggering mitigation action. During the October 2022 monitoring event, this action level was not exceeded, and no further action was required. This result demonstrates somewhat increased DO levels from September 2022 which could represent a slowdown in the die-off and decomposition of emergent vegetation within the formerly

exposed pond basin sediments as the vegetation has been inundated for over a month at the time of sampling, which would be expected with both the passage of time and the decreased water temperatures.

We expect there will be some continued decay of emergent plants and increased Biochemical Oxygen Demand (BOD) due to the pond refill that will extend into winter months and early 2023 growing season. However, this effect should be significantly less than observed in 2022. Given that the 5 mg/l action level was not achieved in 2022, we have some confidence that the action level will not be reached in 2023 due to emergent plant decomposition.

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. Based on the observed groundwater depths this monitoring event, the groundwater appears to have returned to normal pre-drawdown depths.

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.



0 650 1,300 2,600

SCALE IN FEET

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

DISSOLVED OXYGEN PROFILE MONITORING LOCATIONS

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Engineers and Scientists
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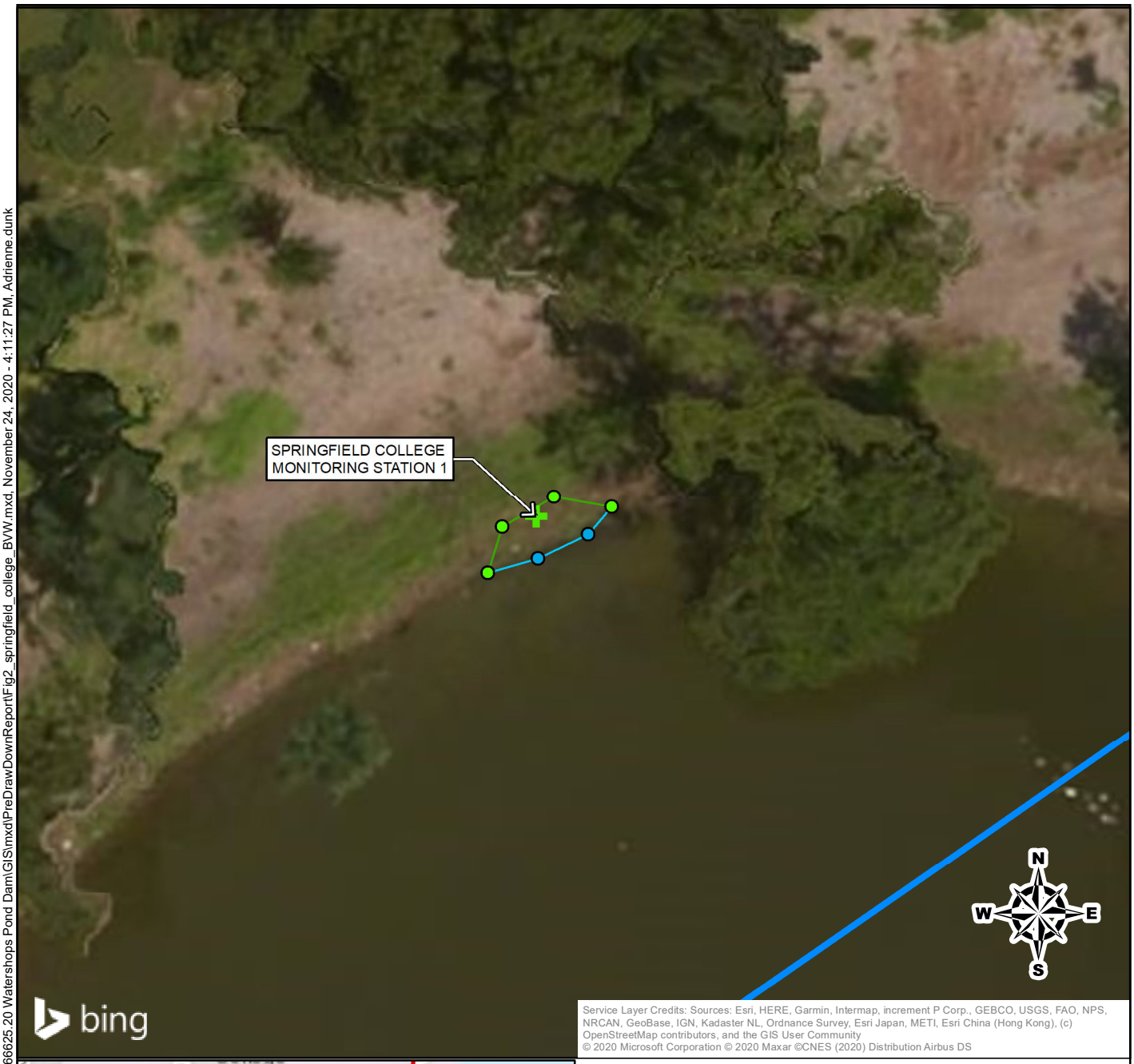
NATIONAL DISASTER RESILIENCY PROGRAM
CDBG-NDR GRANT#B-13-MS-25-0002

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



LEGEND

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

0 10 20 40
SCALE IN FEET

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

SPRINGFIELD COLLEGE BVW

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Engineers and Scientists
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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

0 10 20 40
SCALE IN FEET

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

SPRINGFIELD COLLEGE
EAST CAMPUS BVW

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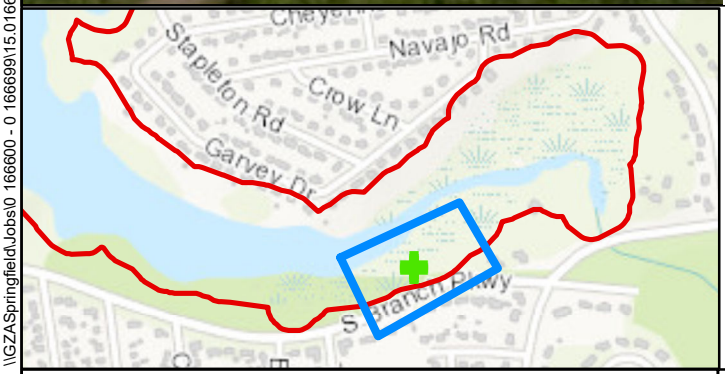
PROJ MGR: TEJ	REVIEWED BY: TEJ	CHECKED BY: SLL	FIG.
DESIGNED BY: JRB	DRAWN BY: ARD	SCALE: 1 in = 20 ft	3
DATE: 11/25/2020	PROJECT NO: 15.0166625.20	REVISION NO:	



LEGEND

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

0 15 30 60
SCALE IN FEET

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

GYSGT. J. SULLIVAN PARK BVW

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PROJ MGR:	TEJ	REVIEWED BY:	TEJ	CHECKED BY:	SLL
DESIGNED BY:	JRB	DRAWN BY:	ARD	SCALE:	1 in = 30 ft
DATE:	11/24/2020	PROJECT NO:	15.0166625.20	REVISION NO:	

FIG. 4