APPENDIX C

MONITORING PROTOCOL

this page is left intentionally blank

Connecticut River Hydrilla R&D Project
2025 Post-Treatment Monitoring Plan

Submersed Vegetation Mapping using Hydroacoustic Surveys

Pre- and post-treatment hydroacoustic surveys will be conducted to determine changes in submersed aquatic vegetation (SAV) cover and biovolume. These surveys will allow for the estimation of SAV response to treatment both spatially and temporally. This survey method alone will only detect whole plant community changes (not species-specific). Surveys will be conducted monthly for at least one year using the following methods:

Lowrance HDS Unit Settings (Recommended by BioBase):

- Ensure the Lowrance unit software/firmware is up to date (http://www.lowrance.com/en-US/Software-Updates/) and check for clear signals (Sonar and GPS) before and during surveys. Always monitor the 200 kHz Sonar page.
- Transducers will be installed to Lowrance units and appropriate depth offset recorded at each survey.
- Lowrance units will be consist of the following settings: shallow water mode (<60 ft), a ping rate of 10 pps, Sonar range to Auto, traditional broadband sonar frequency of 200 KHz, StructureScan frequency of 455 KHz, Default 3200 bytes per sounding, and WAAS differential correction enabled on GPS.
- Survey speed will not exceed 6 mph and Sonar pages will be monitored for interruptions.

Transects/Point-Intercepts for Mapping:

- Survey transects and point-intercepts will be created using ArcGIS and saved as a .gpx file and preloaded onto an SD card and imported to Lowrance units.
- Transect/point-intercept spacing for each plot is a function of size, vegetation coverage (patchy, entire area, littoral zone only), desired resolution of the data, and logistical constraints. Spacing will be determined initial based on time constraints and available resources.
- For larger sized plots we utilize 1 point per 3, 5, 10, and 15 acres, which are equivalent to 110, 142, 201, 246 meter transect spacing. For smaller plots we utilize 1 point per 0.5, 1, and 2 acres, which are equivalent to 45, 64, 90 meter transect spacing.

Recording Sonar (Recommended by BioBase):

- Two 8 to 32 GB SD cards will be kept with survey crews to mitigate lost, damaged, corrupted, or full cards. Lowrance units are not compatible with 64GB SD cards. No more than one hour per transect file will be logged. Ensure SD card compatibility and function prior to recording sonar by ensuring the card is recognized in the Log Sonar menu dialog (if compatible it will automatically recognize or allow you to select the card). Sonar will not be logged to the small internal memory of the Lowrance unit.

Data Upload to BioBase:

- Transect files will be uploaded directly from a team member's local computer or uploaded from the SD card.

- Files will be uploaded using the BioBase Client Tool that is downloaded from the user's BioBase homepage.

Point-Intercept Vegetation Sampling

In conjunction with monthly hydroacoustic surveys, point-intercept vegetation sampling will be conducted concurrently. These surveys allow for presence/absence, speciation, and abundance. The following methods will be employed:

- Survey crews will consist of at least two people per boat [a driver (running the sonar and recording data) and a vegetation raker].
- Vegetation samples will be collected by frotus rake or twist rake.
- The typical twist rake consists of an 8 – 16' extendable painter's pole, with four 5 – 6" bolts attached to the end of the pole in opposite directions.

- At each sampling point, the twist rake will be placed at the bottom, spun three times, and pulled to the surface for the SAV sample. Emergent and floating vegetation will be evaluated visually within a 10 ft radius of the sample point.
- The following data will be recorded: 1) All vegetation species present. 2) An abundance/density rank for each species present on the rake (submersed) and visually (emergent) using rank 1 = sparse, rank 2 = moderate, rank 3 = dense.
- To assist with vegetation identification, reference preexisting point-intercept data from the last time that plot was mapped.
- If there is uncertainty of a plant species, a picture and sample will be collected for later identification.
- See Madsen 1999, Hauxwell et al. 2010, Netherland and Jones 2015, and Valley et al. 2015 for further description.

Tracer Dye Monitoring

Rhodamine WT tracer dye will be included in herbicide treatments (10 ppb) to aid in determining water exchange patterns, physical herbicide dissipation rates, and to inform extinction of herbicide sampling. Tracer dye and aqueous herbicide samples will be collected at the same points. One to three calibrated YSI EXO data sondes will be deployed across each treatment plot. Sondes will be equipped with rhodamine fluorometers that will automatically log tracer dye concentrations at least every hour until nondetectable levels are observed. Likewise, hand-held fluorometers (limit of detection ~ 0.1 ppb) will be used to quantify tracer dye concentrations at sampling points. Sufficient points will be included in the study to represent the entire treatment plot, unique bathymetric and flow characteristics, and any unique site features that may influence

herbicide dissipation. At each sampling point dye concentrations will be recorded at three sampling depths: 6-12" from the bottom, middle of the water column, and just below the surface. Sampling frequency after treatment will be at least twice daily until nondetectable levels are observed. All sensors will be calibrated on site with source water to account for background fluorescence or interference.

Herbicide Dissipation Sampling

Water samples will be collected at each treatment site and sent to an analytical laboratory to determine spatial and temporal dissipation patterns of aqueous herbicide concentrations. Predetermined sampling points will be arranged and georeferenced to cover the treatment area, just outside the treatment area, and at any specific points of interest (e.g., native plant stand of interest, unique water exchange feature such as a inflow and outflows, etc.). Samples will be collected at 30 cm depth in a volume of at 30 ml at pretreatment, immediately after treatment (0.25 to 3 hours), and twice daily (morning and evening) every day until tracer dye levels are nondetectable. Additionally, sampling at multiple depths will be conducted if unequal mixing of tracer dye is detected. Following collection, water samples will be appropriately preserved (acid fixed if necessary), stored on ice, frozen, and shipped overnight to the laboratory for analysis.

Monitoring Response of Specific Plants of Interest

Plants of specific interest, such as state-listed species of concern that are identified in pretreatment surveys (inside and outside treatment polygons), will be appropriately marked using GPS and manual marking with PVC. These species will be revisited for at least one year of monthly vegetation monitoring surveys during the growing season (May to November) for visual evaluation of herbicide injury, reduction, and/or expansion. Post-treatment monitoring will begin one month following treatment and may occur for up to three years if additional surveys are identified as necessary. Following post-treatment monitoring, if a net-reduction in state-listed plant species is observed and determined to be due to herbicide treatments, the CE will work with CT DEEP to develop a plan for restoration planting.

Water Quality Monitoring

YSI EXO data sondes (recording at least hourly) and handheld water quality sensors (at least twice daily) will be used to collect water quality data during tracer dye and herbicide dissipation surveys. Following this period, water quality information will be collected monthly during hydroacoustic and point-intercept surveys. Parameters of interest include but are not limited to: dissolved oxygen, temperature, pH, and turbidity.

Literature Cited

Hauxwell J, Knight S, Wagner K, Mikulyuk A, Nault M, Porzky M, Chase S (2010) Recommended baseline monitoring of aquatic plants in Wisconsin: Sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources PUB SS01068, Madison, WI. 27 pp.

Madsen JD (1999) Point intercept and line intercept methods for aquatic plant management. U.S. Army Engineer Research and Development Center, Technical Notes Collection IN APCRP MI-02, Vicksburg, MS. 16 pp.

Netherland MD, Jones KD (2015) A three-year evaluation of triclopyr for selective whole-bay management of Eurasian watermilfoil on Lake Minnetonka, Minnesota. Lake Reserve. Manag. 31:306-323.

Valley RD, Johnson MB, Dustin DL, Jones KD, Lauenstein MR, Nawrocki J (2015) Combining hydroacoustic and point-intercept survey methods to assess aquatic plant species abundance patterns and community dominance. J Aquat Plant Manage 53:121-129.