STATE:	Michigan
GRANT TITLE:	Integrated Invasive Aquatic Plant Management: Evaluating, Refining and Expanding the Management Toolbox (IS14-2009)
REPORT TYPE:	Final Performance Report
DATE:	July 28, 2017

Final Summary

The project developed an integrated, adaptive weed management framework to provide MDNR/MDEQ and lake managers with a better understanding of the mechanisms behind successful and failed herbicide treatments, provide additional treatment options, and inform best management practices. Field trials were conducted to test the efficacy of a suite of management strategies on Eurasian watermilfoil (EWM), Carolina fanwort (CFW), and starry stonewort (SSW). Management strategies included herbicide application, mechanical harvesting, and biodegradable benthic barriers. For EWM, a season long management strategy using a combination of granular and liquid triclopyr, and 2, 4-D for EWM was conducted on two lakes. Field observations indicated initial plant mortality with eventual regrowth from shoots of surviving plants or vegetative fragments that settled. No regrowth was observed from seed. Tissue samples of EWM from three Michigan lakes were used to describe genetic diversity within and among herbicide treated lakes and changes (random or non-random) in genetic composition over time. Data was used to evaluate evolution of invasive populations, and potential herbicide resistance for Eurasian and hybridwater milfoil. For SSW control and managment, two treatments of chelated copper and one mechanical harvesting were evaluated separately and as part of a season-long management strategy. Pre- and post-treatment biomass and SSW mat height data demonstrate that the treatments as implemented did not effectively control SSW when compared to untreated control plots. Flumioxazin treatment was evaluated as a method to control CFW. Pre- and post-treatment biomass data indicate that flumioxazin treatment provided effective single season CFW control when compared to untreated control plots. Benthic barriers were evaluated as a method to control for EWM, CFW, and SSW. Biomass pre- and post-treatment dry weight biomass, photoquadrat/SCUBA monitoring, underwater video capture, macroinvertebrate sampling were evaluated at benthic barrier test and control sites. Pre- and post-treatment biomass data indicate that biodegradable benthic barriers provided effective single season CFW and EWM control when compared to untreated control plots. A pilot project to optimize benthic barrier protocols and invertebrate sampling was conducted for SSW. Preliminary results indicate that burlap benthic barriers have potential for invasive aquatic plant control over more than one year, but treatment efficacy may depend on the relationship between plant stem size and barrier density (i.e. Thick stemmed Cabomba and EWM appear more susceptible to control with medium weight barriers and narrow stemmed SSW has potential for effective control with heavy weight (dense) barriers). Computer-simulation management models were created for EWM, CFW, and SSW. Project results have been disseminated and shared with stakeholders through multiple presentations, trainings, newsletters and online platforms. The completion of several additional technical documents, manuscripts and presentations are submitted or in preparation.

Discussion of Accomplishments

Objective 1 — Improve efficacy of herbicide applications for hybrid Eurasian watermilfoil (EWM) by understanding mechanisms behind variable treatment success.

- The treatment sites on Gun Lake were treated on 5/18/15 with granular triclopyr over a 24 acre area, liquid triclopyr over a 4.25 acre area, and 2, 4-D over a 12 acre area.
- The treatment sites on Long Lake were treated on 5/20/15 with granular triclopyr over a 5.5 acre area, and 2, 4-D over a 42.5 acre area.
- Pre- and post-treatment sampling was conducted via point-intercept surveys to quantify distribution and abundance of Eurasian and Hybrid Watermilfoil at both Gun and Long Lake.

- 9 sites within Gun Lake were sampled weekly.
- Although initial observations indicated plant mortality, there was eventual regrowth from shoots of surviving plants or vegetative fragments that settled. There was no observed regrowth from seeds.
- Pre- and post-herbicide treatment survey samples were collected from Gun and Long Lake in 2015. These samples had DNA extracted and basic genetic identifications performed (EWM vs hybrid).
- DNA fingerprinting data collection and analysis were completed.

Analysis of collected fragments from Gun and Long lake was completed and analysis was conducted to assess survival and vegetative regrowth of Eurasian and hybrid watermilfoil following operational treatment with auxinic herbicides (Thum et al 2017). We completed DNA fingerprinting data collection and analysis and identified unique genotypes (which we consider distinct clones) pre-treatment, and unique genotypes post-treatment, some found in both pre- and post-treatment. Molecular markers from three different molecular techniques were evaluated (microsatellite, AFLP, and GBS). All were congruent and the GBS data was used moving forward as it was determined to be more powerful. Our findings suggest the possibility of using GBS genotype data to test for significant changes in relative frequency over time in order to identify watermilfoil genotypes that are potentially "high-risk" for being "weedier" and/or tolerant to recent control tactics. We are continueing to add to our GBS dataset to 1) estimate the hybrid class of individuals (e.g., F1, F2, backcross, etc.) to determine whether there are any patterns with respect to whether individuals of particular hybrid classes or more common in different types of lakes, and 2) test for non-random patterns of introgression across the genome that might indicate selection for genomic regions that originate from one or the other parent (Eurasian versus northern).

Objective 2 — Apply and assess efficacy of herbicide treatment to control localized, high priority invasive aquatic plants (IAP): Carolina fanwort (CFW) and starry stonewort (SSW).

- Field trials were conducted to test the efficacy of:
    - Flumioxazin (200 ppb) application to control CFW.
        - Biomass (by genius) was sampled prior to and following the application of flumioxazin. Total and proportional percent cover were recorded monthly along with water chemistry variables (temp., DO, pH, conductivity).
        - Pre- and post-treatment biomass data demonstrate that flumioxazin (200 ppb) treatment provided effective single season CFW control when compared with untreated control plots.
        - Proportional percent cover data suggest that even though flumioxazin treatment reduced CFW biomass, CFW remained the dominant plant in the macrophyte community throughout the growing season.
        - A manuscript detailing these results is currently in preparation.

    - A multi-stage management strategy (2 applications of Komeen Krystal [1 ppm], 1 mechanical harvesting) to control SSW.
        - Biomass (by species) was sampled prior to and following the implementation of the multistage management strategy. Biomass and SSW mat height were assessed pre- and post- each treatment. Water chemistry variables (temp., DO, pH, conductivity) were measured at each visit.
        - Pre- and post-treatment biomass and mat height measurements demonstrate that the implemented management strategy did not effectively control SSW when compared with untreated control plots.
        - Non-significant reduction in biomass and mat height were noted post-herbicide treatment. There were no statistically significant differences in biomass or SSW mat height between treatment and control plots during any specific sampling date.
        - A manuscript detailing these results is currently in preparation.

An application of flumioxazin significantly reduced CFW biomass relative to untreated control plots. The CFW flumioxazin field trial results are detailed in a manuscript in preparation (Cahill et al. *in prep*) and summarized in Michigan's Status and Strategy for Carolina Fanwort Management (Hackett at al. 2017). The multi-stage management strategy consisting of 2 applications of Komeen Krystal and 1 mechanical harvesting did not significantly reduce biomass or SSW mat height when compared to untreated control plots. Results from the SSW herbicide and mechanical harvesting field trials are detailed in a manuscript in preparation (Cahill et al. *in prep*) and summarized in a SSW review manuscript (Larkin et al. *in review*). These results are also included in Michigan's Status and Strategy for Starry Stonewort Management (Hackett et al. 2017).

Objective 3 — Deploy and assess efficacy of biodegradable benthic barriers to control localized, high priority IAP: EWM hybrid, SSW and CFW.

- Six 10m x 10m benthic barriers were deployed in Barton Lake, Michigan to test efficacy for control of CFW and EWM.
    - Two biomass and 5 percent cover/species composition surveys were completed on all benthic barrier plots in Barton Lake. Total and proportional percent cover were recorded monthly along with water chemistry variables (temp., DO, pH, conductivity).
    - Pre- and post-deployment biomass data indicate that biodegradable benthic barriers provided effective single season CFW and EWM control when compared with untreated control plots.
    - Inspection of the barriers at Barton Lake (including collection of plant abundance, species composition, and barrier integrity data) was also conducted in May 2017.
- Three 6m x 6m benthic barriers were monitored in Gun Lake, Michigan to assess efficacy of benthic mats deployed to control SSW in 2015.
    - Four biomass and 5 percent cover/species composition surveys were completed on all benthic barrier plots in Gun Lake. Total and proportional percent cover were recorded monthly along with water chemistry variables (temp., DO, pH, conductivity).
    - Analysis and interpretation of this data is ongoing.

Pre- and post-treatment biomass data indicate that biodegradable benthic barriers provided effective single season CFW and EWM control when compared to untreated control plots. A pilot project to optimize benthic barrier protocols and invertebrate sampling was conducted for SSW. Preliminary observations indicate treatment efficacy is variable among the three taxa used in the study and potential control application of benthic mats may depend on the relationship between the target plant stem size and barrier density (i.e. Thick stemmed Cabomba and EWM appear more susceptible to control with medium weight barriers and narrow stemmed SSW has potential for effective control with heavy weight (dense) barriers). Our initial results support the potential for burlap benthic barriers to aid in invasive aquatic plant control and we recommend continued longer-term monitoring, assessment of differential mat materials and weights, and investigation of impacts on non-target species. We did encounter some challenges related to reaching our proposed project outputs for SSW (see answer to question #2).

Objective 4 — Integrate, refine, optimize and communicate best management practices.

- We identified several deficiencies in statistical methods commonly employed in the literature for comparing pre-treatment and post-treatment estimates of cover by invasive aquatic plants, based on data from point-intercept surveys.
- We found an exact version of McNemar's matched-pair test of homogeneity that permits testing the null hypothesis of homogeneity against a one-sided alternative, and we found a widely-used statistic (Moran's I) that allows one to estimate spatial autocorrelation and test the null hypothesis of no autocorrelation. However, it appears that no version of McNemar's test has been developed to date that is appropriate for spatially autocorrelated data.
- We interested two statisticians from Grand Valley State University's Department of Statistics in this problem and have collaborated with them on it.
- Computer-simulation management models were created for Eurasian watermilfoil, Carolina fanwort, and starry stonewort.
- Data from the Gun Lake herbicide experiment were analyzed statistically.
- Project results have been disseminated and shared with stakeholders through multiple presentations, trainings, newsletters and online platforms. The completion of several additional

technical documents, manuscripts and presentations are planned in the coming months. Products and events since 10/15/16, the date of the previous progress report submitted, include:

Publications/communications:

- Benthic mat slideshow story hosted on The Nature Conservancy's website: https://www.nature.org/ourinitiatives/regions/northamerica/areas/greatlakes/explore/benthic-mat-slideshow.xml?redirect=https-301. To date this online story has been viewed over 100 times.
- Update in *Long Lake Improvement Board Newsletter*, Spring 2017. This newsletter is distributed to at least 250 people.
- Tucker, A., L. Chadderton, A. K. Monfils, B. C. Cahill. 2017. Benthic barriers for invasive aquatic plant management. A technical document submitted to MDEQ that summarizes experimental results and provides recommendations for the acquisition, deployment, and monitoring of burlap benthic barriers.
- Thum, R.A., S. Parks, J.N. McNair, P.J. Tyning, P.J. Hausler, W.L. Chadderton, A.J. Tucker and A.K. Monfils. 2017. Survival and vegetative regrowth of Eurasian and hybrid watermilfoil following operational treatment with auxinic herbicides in Gun Lake, Michigan, USA. Journal of Aquatic Plant Management. 55: 103–107.
- Larkin D.J., A.K. Monfils, A. Boissezon, R.S. Sleith, P.M. Skawinski, C.H. Welling, B.C. Cahill and K.G. Karol. (*In review in Hydrobiologia*) Biology, ecology, and management of starry stonewort (*Nitellopsis obtusa*; Characeae): A Red-listed Eurasian green alga invasive in North America.
- Cahill B.C., M.J. Monfils, R.A. Hackett, P. Tyning, A.J. Tucker, R.A. Thum, J.N. McNair, W.L. Chadderton, A.K. Monfils. (*In prep*) Efficacy of chemical treatments and mechanical harvesting for starry stonewort control in an inland Michigan lake.
- Cahill B.C., M.J. Monfils, R.A. Hackett, P. Tyning, A.J. Tucker, R.A. Thum, J.N. McNair, W.L. Chadderton, A.K. Monfils. (*In prep*) Efficacy of flumioxazin for Carolina fanwort control in an inland Michigan lake.
- Suggested updates to Status and Strategy for Eurasian Watermilfoil Management. Michigan Department of Environmental Quality, Lansing, Michigan.
- Hackett R.A., B.C. Cahill and A.K. Monfils (*In prep*) 2017 Status and Strategy for Starry Stonewort (*Nitellopsis obtusa* (Desv. in Loisel.) J. Groves) Management. Michigan Department of Environmental Quality, Lansing, Michigan.
- Hackett R.A., B.C. Cahill and A.K. Monfils (*In prep*) 2017 Status and Strategy for Carolina Fanwort (*Cabomba carolinianna* A. Gray) Management. Michigan Department of Environmental Quality, Lansing, Michigan.
- Experimental results for benthic mats will not be published in a peer-reviewed journal before the end of the project period. However, we anticipate producing a manuscript at some time in the future that will combine the present data with data from continuing observations of established experimental plots (planned for 2017 and beyond) and data from experimental plots that we hope to establish for SSW control (see response for question #8).
- Another manuscript in progress is tentatively titled "Some nonparametric statistical methods useful for adaptive-management studies of invasive plants." It reviews, corrects, and extends methods commonly used in studies where control measures for invasive plants (e.g., herbicide application, manual removal) are quantitatively assessed, and it includes worked examples with real data using R.

Presentations:

- Monfils, A.K., B.C. Cahill, M. Monfils, L. Chadderton, A. Tucker, P. Tyning, P. Hausler, R. Thum, and J. McNair. 2016. Starry Stonewort (Nitellopsis obtusa): Research Efforts Towards an Integrated Management Plan. 2016 Upper Midwest Invasive Species Conference, La Crosse, WI.
- Cahill, B.C., A.K. Monfils, M. Monfils, L. Chadderton, A. Tucker, P. Tyning, P. Hausler, R. Thum, and J. McNair. 2016. Carolina Fanwort (Cabomba caroliniana): Research Efforts Towards an Integrated Management Plan. 2016 Upper Midwest Invasive Species Conference, La Crosse, WI.
- Tucker, A., L. Chadderton, A. K. Monfils, B. C. Cahill, H. Dame, P. Tyning, P. Hausler, R. Thum, and J. McNair. 2016. Going to the Mat: Biodegradable Benthic Mats for Invasive Aquatic Plant Control. 2016 Upper Midwest Invasive Species Conference, La Crosse, WI.
- Cahill, B.C., M. Monfils, A.M. Clare, L. Chadderton, A. Tucker, P. Tyning, P. Hausler, R. Thum, J. McNair, and A.K. Monfils. 2017. Carolina Fanwort (*Cabomba caroliniana*): Research Efforts

Towards an Integrated Management Plan. Poster presentation at the 2017 Institute for Great Lakes Research Symposium, Mount Pleasant, MI.
- Tucker, A., L. Chadderton, A. K. Monfils, B. C. Cahill, H. Dame, P. Tyning, P. Hausler, R. Thum, and J. McNair. 2017. Starry Stonewort (Nitellopsis obtusa): Research Efforts Towards an Integrated Management Plan. Binational Great Lakes Aquatic Invasive Species Forum, Erie, PA.
- Shared benthic mat results with MDNR and MDEQ staff (i.e. the "Benthic Mat Workgroup") via webinar in February 2017.
- Project team members joined a number of calls with MDNR/DEQ staff to discuss potential for benthic mats to control water clover.
- Project results were shared with the "New York State Benthic Mat Working Group" in December 2016.
- Project team members participated in a Great Lakes Restoration Initiative (GLRI) Aquatic Invasive Plant Management Collaborative Webinar held on November 1, 2016. Goals of the meeting were to 1) share information among states about new invasive plants or management techniques of concern, 2) compare state aquatic invasive plant management evaluation monitoring protocols and determine if data can be collated and for which purposes and 3) develop group goals/terms of reference.

1. Discuss problems encountered during the grant period and how that interfered with meeting program/project objectives. [List N/A if no problem exists.]

Objective 1 — Improve efficacy of herbicide applications for hybrid Eurasian watermilfoil (EWM) by understanding mechanisms behind variable treatment success.

- The Work Plan included watermilfoil regrowth studies employing SCUBA sampling in both Long Lake and Gun Lake. However, it was not feasible to conduct the regrowth study in Long Lake, due to dense mats of calcareous algae on the bottom.
- While analyzing the pilot GBS data from Houghton Lake we found that our current bioinformatics pipeline filters out any stacks of sequence data for which an individual has more than two alleles, and watermilfoil is hexaploidy.
- In analyzing the Gun and Long Lakes pre- and post-treatment distribution and abundance data for pure versus hybrid Eurasian watermilfoil there was very low power to detect differences using the standard fixed-grid sampling scheme and currently available statistical methods. The sample sizes required to detect differences in the reduction of occurrence using point-intercept data are very high; most likely higher than the number of survey points that could reasonably be included in routine point-intercept monitoring.

Objective 3 — Deploy and assess efficacy of biodegradable benthic barriers to control localized, high priority IAP: EWM hybrid, SSW and CFW.

- Deployment had been proposed for SSW and EWM in year 1. However, project sites identified in the permit application were determined based on past presence of IAP, and in year 1 EWM did not occur in any of the three project sites; SSW was present in only two of the three sites.
- Deployment of the benthic mats in 2015 resulted in a large amount of sediment and vegetative material being suspended into the water column and deposited on the mats.
- Based on numerous conversations with MDEQ and MDNR staff it is evident that the potential for non-target impacts resulting from benthic barrier deployment is a significant concern (especially impacts to threatened or endangered fish, mollusks, or invertebrates) and hence there appears to be a preference for a more cautious and or deliberate process to quantify these impacts before the use of benthic mats is promoted.

Objective 4 — Integrate, refine, optimize and communicate best management practices.

- The planned purchase of a new high-performance computer system (not funded by this project) was delayed by several months due to a change in Grand Valley State University's computer vendor, and this slowed progress on development of the management simulation model somewhat.

- We had proposed “learning by doing” benthic mat activities with up to four lake associations. A delay in execution of the grant agreement (which pushed back the timeline for barrier deployments) and the withdrawal of a permit application at one of the candidate treatment lakes hampered implementation of these activities.

2. List remedies of the problem(s) indicated in item 2 and how they may be avoided in the future. [List N/A if not applicable]

Objective 1 — Improve efficacy of herbicide applications for hybrid Eurasian watermilfoil (EWM) by understanding mechanisms behind variable treatment success.

- We focused our study of watermilfoil regrowth on Gun Lake, where the bottom was accessible. This does not seriously compromise the usefulness of our assessment of the sources of regrowth following herbicide treatment.
- We identified ~300 SNPs that behave as diploid loci, and these are the markers we are currently focusing our analyses on. However, ideally, we would develop a bioinformatics pipeline that retains polyploid loci. We will be working on this issue over the next several months. The bioinformatics pipeline that we are currently using is called STACKS, and only works for diploid loci. There are other pipelines that we can modify that will retain polyploid loci. One pipeline we have been working on is called iPYRAD. While this pipeline should be able to retain polyploid loci, we have been troubleshooting getting it to run correctly through the supercomputer cluster at Montana State University. We will continue to work with the IT personnel to troubleshoot the hang-ups. If that doesn’t work, we will explore other options, including customized scripts. Our fall-back plan is to continue to use the diploid-filtered data, as these still provide more information than previous markers.
- Project collaborators Thum, McNair, and Parks have been discussing whether it is feasible to develop alternative statistical methods that have greater power to detect differences in the relative changes in distribution and abundance among taxa using point-intercept data. In addition, project collaborators are discussing alternative methods for conducting pre- and post-treatment monitoring of distribution and abundance. It is possible that alternative sampling strategies are required for higher statistical power to detect disproportional changes in distribution and abundance of different taxa over time. For example, biomass sampling in representative areas of a water body may provide more powerful data than lake-wide frequency of occurrence data that form the basis of current point-intercept methods. Thum’s lab may pilot this idea on a separate project this summer.

Objective 3 — Deploy and assess efficacy of biodegradable benthic barriers to control localized, high priority IAP: EWM hybrid, SSW and CFW.

- Since stands of SSW were less extensive than anticipated in 2015, we deployed benthic mats with dimensions 6m x 6m, instead of the larger 10m x 30m mats proposed in the grant.
- New strategies for mat deployment were used in 2016 to limit plant disturbance and sedimentation during deployment (e.g. deploying mats earlier in the season when plant growth was minimal and deploying mats by boat).
- We have and will continue to engage with MDEQ and MDNR to determine how best to minimize the potential for non-target impacts and how to monitor for such impacts. We recently participated in two “workgroup” planning calls with MDEQ and MDNR staff to discuss candidate locations for deployment of benthic barriers that were originally purchased for Long Lake. One of the first steps in that process was to identify and rule out any lake with T&E species. We are also considering possible monitoring activities that may help us to clarify whether or to what extent benthic barrier deployment impacts native animal species.

Objective 4 — Integrate, refine, optimize and communicate best management practices.

- The computer system was acquired in October 2016 and was used to facilitate model development for this project.

- "Learning by doing" was limited to two MDEQ staff, who assisted with deployment at Barton Lake in May 2016. Informal summaries of results were provided to riparian owners at Gun Lake, Barton Lake, and Long Lake (via personal email or newsletters to lake association members).

3. Discuss the rate of expenditure versus progress on project. Did your original budget allow you to accomplish the goals of the project? Please describe any budgetary problems you encountered and how those could be alleviated in the future.

The original budget was adequate to accomplish project goals.

4. Provide information on equipment purchased for the grant and how it was utilized to meet project goals. [List N/A if no equipment was purchased for the project]

Professional Plus Multiparameter Instrument
Quatro cable - Dual ISE/DO/Cond/Temp 10-m for Pro Plus instruments
Model 1001 pH Sensor for ProSeries
Model 2003 Polarographic DO Sensor for ProSeries

Total: $2,497.95

A YSI meter is a multi-parameter device used to quantity water quality parameters. We used it to measure physical (temperature, conductivity) and chemical properties (pH, dissolved oxygen) at the surface and bottom of the water column at all herbicide treatment and benthic barrier deployment sites.

5. Discuss steps taken to ensure activities conducted did not contribute to the spread of invasive species. *Example: A decontamination policy was implemented and decontamination language and instructions were included in RPF's and contracts.*

Equipment decontamination procedures were developed based on the Medium Risk Category of the MDEQ/MDNR Policy and Procedures for Invasive Species Decontamination for Field Operations in Michigan. The Medium Risk Category was selected because our equipment came into contact with multiple infested lakes in a single week. Prior to leaving a site all sediment, plants, and debris on any piece of equipment were removed and all water was drained from the boat, snorkel/SCUBA equipment and any other equipment which could hold water. The boat, trailer and all non-sensitive or snorkel/SCUBA equipment was power washed, sprayed with a bleach solution (1/4 cup bleach to 5 gallons water) and allowed to stand for at least 10 minutes after which time it was power washed a second time and allowed to dry. Sensitive equipment such as the YSI was rinsed thoroughly between sampling sessions and snorkel/SCUBA equipment was rinsed.

6. Describe any post-completion activities that will be the responsibility of the GRANTEE.

Plan to submit manuscripts detailing the results from the SSW and CFW herbicide efficacy projects in peer reviewed journals.

A manuscript dealing with the management simulation models is in preparation. We plan to submit it to a peer-reviewed journal later in 2017. Two additional manuscripts are planned, one employing simulation models to compare evolutionary responses to management of successful invasive plant species that employ radically different life-history strategies, and another dealing with species that reproduce mainly vegetatively, focusing on the question of how much sexual reproduction is required in order for such species to exhibit rapid evolutionary responses to management activities like herbicide application.

7. Describe any plans for continuing activities funded under this grant in the future.

A second set of GBS data have been prepared, and will be submitted and analyzed over the next several months in order to address issues related to introgression and detection of putative genomic regions under selection. Research will continue regarding pre- and post-treatment distribution and abundance of EWM/hybrids, including genetic studies to identify specific genotypes for laboratory research on growth and herbicide response properties, and ultimately, genetic signatures of herbicide tolerance and resistance. In addition, where possible, research will continue on quantifying the sources of watermilfoil regrowth following herbicide treatment (or other management techniques).

Continued monitoring of existing experimental plots is planned and The Nature Conservancy hopes to secure funding that would allow additional quantitative data and potential non-target impacts to be measured from these plots, and additional Starry stonewort plots referenced below, after the project period ends (for up to 4 years).

Benthic barriers and sandbags were purchased for deployment at Long Lake but never used because a permit was not granted. A new permit was applied for and granted for deployment of these barriers in Messenger Lake (Branch County) to test efficacy for Starry stonewort control. Deployment of 2 of the 3 experimental barrier plots was completed at the end of July. The Nature Conservancy proposes to monitor plant growth and barrier integrity for up to 5 years following deployment.

Final Report Checklist

Review the following checklist of required documents for the grant program, noting which files need to be submitted with the final report and which must be kept on file for audit.

Required Documents	Submit	Keep in File
Progress Report Template	X	
Progress Report Tracking Workbook.xls	X	
5-10 Publishable Photos	X	
Outreach materials, including press releases, maps, or web links, etc.	X	
Meeting, Training, or Event sign-in sheets		X
Landowner Agreements		X
Permits		X
Survey and Treatment records		X
Survey and Treatment records		X

Financial Status Report:

Include an itemized list of all the expenditures and donations made during the entire project period and a list of the payments (advances and reimbursements) received by the GRANTEE.

Financial report will be submitted separately. CMU was granted an extension until August 18 to submit the financials as approved by Kammy Frayre.

Final Reimbursement Request:

Include a final reimbursement request with a tabulation of the total project costs and documentation of expenditures not already submitted to the DEPARTMENT.

Final reimbursement request will be submitted separately. CMU was granted an extension until August 18 to submit the financials as approved by Kammy Frayre.

GRANTEE Statement of Project Completion

Statement	Signature of GRANTEE
All relevant data uploaded to MISIN	Anne H. Moxfield
All other required documents attached or located in project file	Anne H. Moxfield
Project completed in accordance with the DEPARTMENT-approved Budget and Work Plan	Anne H. Moxfield

DEPARTMENT Statement of Project Completion

Statement	Signature of DEPARTMENT representative(s)
I have received and approved the GRANTEE's Final Report Documents, including the Final Performance Report, Financial Status Report, and Final Reimbursement Request. I certify that the project has been completed within the project period and as described in the executed grant agreement (including any amendments executed between the DNR and the grantee).	*Technical: Signature, Division, Department (Final Report)* *Date* *Grants Management (Financial Status/Final Reimbursement)* *Date*