



CHAMPLAIN
COLLEGE



FINAL REPORT

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**PROTECTING OUR WATERS - AN EXPERIENTIAL LEARNING
MODULE FOR ELEMENTARY STUDENTS THAT BENEFITS THE
WHOLE COMMUNITY**

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EXECUTIVE SUMMARY

Lake Champlain is facing a wide variety of environmental problems, namely phosphorus overloads, urban and agricultural runoff, and aging wastewater and stormwater infrastructure. This summer was a very important reminder of the devastation that flooding and stormwater can cause for our community and the need for mitigation efforts as the weather is anticipated to be warmer and wetter in the Northeast with climate change. Our education and outreach project sought to provide an engaging and enduring set of pedagogical tools that will help students learn about water quality issues facing their watershed and tangible solutions. Specifically, *Protecting our Waters* engaged and informed the public about water quality issues facing Lake Champlain in two ways.

First, a comprehensive learning module was developed for fourth graders to teach students about watershed science and the water quality challenges that Lake Champlain faces. The learning module met several Next Generation Science Standards for fourth grade, incorporated augmented reality, and provided an applied and experiential learning approach to understanding the solutions to water quality issues. The learning module was piloted in three fourth grade classrooms in Vermont in two different schools. The feedback from each pilot was used to improve the learning module.

Second, based on student feedback and subject matter experts, an enduring stormwater mitigation project (a rain garden at CP Smith Elementary) was built with elementary students, college students, and community members. The rain garden contains signs, created by Champlain College students, to teach students and community members about the native plants in the garden and how the rain garden works to improve Lake Champlain water quality. The whole project took place over a period of one year and 8 months. All project tasks were met and proposed deliverables were completed. In relation to the *Opportunities for Action Informing and Involving the Public* section of the LCBP management plan, our proposal specifically addressed strategy IV.A.1 by increasing K-12 classroom instruction that increases watershed science and IV.A.4 by engaging youth and adults in community service focused on water quality.

Protecting our Waters was a tremendous success. There has been so much positive feedback from the school district, CP Smith teachers, and community members. I am very excited to continue this work at other schools and to develop other stormwater mitigation projects at nearby schools in Burlington.

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1. PROJECT SYNOPSIS

In environmental education, among other important benefits, people with a strong sense of place may be more likely to engage in pro-environmental behaviors (Kudryavtsev et al., 2012), and a society that knows its natural environment is better able to understand and solve environmental problems. Lake Champlain, with a 435 square mile surface area and a very high ratio of drainage basin to lake surface area (17.6 acres of land:1 acre of lake), is facing a wide variety of environmental problems, namely phosphorus overloads, urban and agricultural runoff, and aging wastewater and stormwater infrastructure (LCBP, State of the Lake). The objective of our education and outreach grant was to create an engaging and enduring set of pedagogical tools and mitigation strategies that will help clean our waters by increasing stormwater retention and serving as teaching laboratories that can be used by schools and community members to learn more about what we can do to improve and protect our waters.

The project consisted of two parts: 1) Creating an engaging learning module about stormwater that helps elementary students learn and research about the water quality issues facing Lake Champlain and what they can do to help, and 2) Building an enduring stormwater mitigation project (informed by student research) constructed by students and community members.

The paper and web-based learning module was developed by Robin Collins and Champlain College students during the Spring and Fall of 2022. Robin Collins did research on inquiry-based models of elementary teaching and elementary approaches to teaching watershed science during the spring of 2022, which ultimately informed the creation of the paper-based learning module. Gin Ferrara was hired as a graphic designer during the of summer 2022 to determine a color palette, font, page layout, and character design for the paper-based learning module. Morgan Thibodeau, a Champlain College student, continued the graphic design work for the rest of the project and was part of a dynamic student team that designed a website for the augmented reality (AR) assets, surveys for teachers to get feedback, and the development of a teacher resource guide. The result was a very polished paper and web-based learning module that incorporates both inquiry and experiential-learning methodologies. We even have stickers for the students!

The pilot of the learning module occurred at C.P. Elementary school in Burlington, VT, during the Spring and Fall of 2022. We also did one additional pilot of the learning module at Founders Memorial Elementary School in Essex Junction, VT. Teachers were very positive about the learning module. The educational module met several of the next generation science standards for fourth grade (NGSS, 4-ESS2-1) and offered inquiry-based techniques and an AR component, two well documented teaching methods for increasing student engagement and retention (Chin et al. 2019a; Chin et al. 2019b; Radu 2014; Dresner et al. 2013; Gormally et al. 2009).

The culmination of the learning module was the construction of a rain garden (a best management practice (BMP) for stormwater) at the CP Smith school site. The design of the rain garden was done by Watershed Consulting and the landscape design was done by Holly Greenleaf Designs. The excavation work to prepare the site for planting was done by Bellavance Landworks, and the planting was done by elementary students, Champlain College students, and volunteers from the Vermont Nursery and Landscapers Association. Plant identification signs and an interpretive sign that discusses current environmental issues facing

Lake Champlain and how the rain garden addresses them was researched by Champlain College students, designed by Morgan Thibodeau, and printed by Generator.

2. TASKS COMPLETED

Task	Task Title	Description
1	Assemble learning materials and inquiry-based lab activities for students	Completed a thorough literature search and two separate reports on elementary inquiry-based learning and watershed science (see link in Deliverables Completed section).
2	Write learning module for 4th grade students	Designed and wrote a paper-based learning module for 4 th graders to learn about watershed science that was informed by teacher interviews and research reports generated in Task 1 (see link in Deliverables Completed section).
3	Integrate the gathered learning materials into an augmented reality (AR) experience that students can engage with outdoors	A website was developed that incorporated an augmented reality map of the Lake Champlain Watershed and 360° photos for students to investigate sources of pollution (see link in Deliverables Completed section).
4	Pilot 4th grade AR learning module with students at CP Smith Elementary School in Burlington. Meet with 4th grade teachers to discuss teaching module and class time needed	The learning module was completed by three 4 th grade classes and feedback was collected from the teachers of those classes to allow for improvement with each iteration of instruction.
5	Design stormwater retention project on school property or other high impact site in walking distance to school	A landscape architecture firm, excavation company, and landscape designer were brought on to plan and design the rain garden at CP Smith Elementary school in Burlington (see link in Deliverables Completed section).
6	Pilot 4th grade AR learning module with students at CP Smith Elementary School in Burlington and procure materials to build stormwater retention project (e.g. bioswale, rain garden, French drain, etc.)	Plants and materials for the rain garden were purchased and donated.
7	Build stormwater retention project and finalize maintenance plan	On July 8 th , 2023 the rain garden was built with elementary students, college students, and community members (many from the Vermont Nursery and Landscape Association) (see link in Deliverables Completed section).
8	Quarterly and Final Report(s)	Quarterly and Final reports were written.

3. METHODOLOGY

N/A

4. QUALITY ASSURANCE TASKS COMPLETED

N/A

5. DELIVERABLES COMPLETED

Task	Task Title (Timeframe of Completion)	Deliverable	Links to Photos and Documents
1	Assemble learning materials and inquiry-based lab activities for students (January 2022)	Paper-based educational document that will provide guidance for learning module design	Reports
2	Write learning module for 4th grade students (February 2022)	Paper-based educational document that can be used by 4th grade teachers to meet NGSS	Learning module Handouts
3	Integrate the gathered learning materials into an augmented reality (AR) experience that students can engage with outdoors (April 2022)	Website that incorporates the AR component of the project. One problem encountered was the AR component was a distraction to many 4 th graders, so we made the assets Chromebook based rather than tablet based.	Website
4	Pilot 4th grade AR learning module with students at CP Smith Elementary School in Burlington. Meet with 4th grade teachers to discuss teaching module and class time needed (May 2022)	Detailed notes, teacher interviews, and revisions to module, were made based on pilot feedback.	Teacher Survey
5	Design stormwater retention project on school property or other high impact site in walking distance to school (August 2022)	Clear design documents were created by engineers and a landscape designer. Meetings were held with the City of Burlington Stormwater Manager, James Sherrard, to make sure appropriate zoning, permits, and land permission were obtained. Permission	Design documents

		was also sought from CP Smith Principal and Physical Plant Director.	
6	Pilot 4th grade AR learning module with students at CP Smith Elementary School in Burlington and procure materials to build stormwater retention project (e.g. bioswale, rain garden, French drain, etc.) (June 2023)	Materials were purchased and stored by Holly Greenleaf.	Photos of excavation work
7	Build stormwater retention project and finalize maintenance plan (July 2023)	Installation of the rain garden with interpretive signs was completed, and a detailed maintenance plan was provided by Watershed.	Photos of rain garden planting and rain events
8	Quarterly and Final Report(s)	<p>Wrote quarterly reports and final reports for the project.</p> <p>Quarterly reports were submitted: March 2022 June 2022 September 2022 December 2022 March 2023 June 2023 Final report will be submitted in August 2023</p>	

6. CONCLUSIONS

This project was a tremendous success, and I am so grateful to the LCBP and NEIWPC for funding this work. What makes this project innovative is that we combined effective environmental education about stormwater issues and stewardship practices with an amazing experiential learning opportunity for students (both elementary and college aged), enhancing their sense of place and willingness to engage in projects that improve the environment. Two Champlain College classes were involved in the design of the rain garden signage, and four Champlain College students were part of a team that spent a semester working with me on developing the website, refining the graphic design, and creating a robust teacher manual so the learning module can be used by fourth grade teachers in the future. Morgan Thibodeau has since graduated and is actively pursuing graphic design jobs with an environmental focus. Their involvement in this project has had a huge impact on their life and really shaped the direction of their career. Two Champlain College students, Morgan Thibodeau and Madison Mueller, traveled to Atlanta, GA, with me in March 2023 to present our work at the National Science Teachers Association meeting. The response from the two fourth grade teachers we worked with has been overwhelmingly positive. Both teachers said that the students talked about the

learning module all year. I can't wait to see the students at CP Smith interact with the beautiful rain garden on their campus!

In the future I would like to partner with Flynn Elementary School and Hunt Middle School to see if we can envision future stormwater BMPs at those schools. Flynn, Hunt, and CP Smith are all in walking distance to one another and could provide a great outdoor learning opportunity for students to travel between schools and have a hands-on approach to learning about different BMPs. I am also excited to explore how the rain garden at CP Smith can be incorporated into the curriculum of other grades. For example, sitting at the garden to monitor pollinator visits on different types of flowers or measuring how long it takes for the water to drain from the garden after rain events. Finally, I am interested in how middle school students can become more involved in teaching and maintaining the stormwater management projects through curricular work or service-learning projects. I'm excited to talk with administrators at those schools to explore the possibilities.

7. REFERENCES

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8. APPENDICES

Appended Documents:

Attach any articles, press releases (which should acknowledge NEIWPC, EPA, and partnership with LCBP), a list of acronyms and published documents pertaining to this project.

[The Dirt article \(see page 7-8\)](#)

Photos:

[Photos of rain garden planting and later rain events](#)

Electronic Data:

Email your Project Officer with any electronic datasets you have generated through your project.

N/A