FINAL REPORT

Lake Champlain Committee AHEAD OF THE STORM - SCHOOL STORMWATER ASSESSMENT PILOT PROJECT

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1. EXECUTIVE SUMMARY

The Ahead of the Storm School Stormwater Reduction Implementation Project (AOTS SSRP) had dual goals of stormwater reduction and education. In 2019, the Lake Champlain Basin Program (LCBP) awarded the Lake Champlain Committee (LCC) an education and outreach grant to help reduce stormwater runoff at Plattsburgh High School (PHS) in Plattsburgh, New York. The project was intended to help implement some of the recommendations from LCC's 2018 Stormwater Assessment and further educate and engage students and the school community in an on-site stormwater reduction program. We worked with lead PHS teachers, students, and the facilities manager and Lake Champlain Sea Grant (LCSG) staff to identify optimal site-work to reduce stormwater flows. Locations were identified for a bioswale and rain gardens and an implementation plan and schedule developed.

However, shortly before the bioswale work was to begin the school administration requested a delay until 2023/2024 due to their securing funding for sports field renovations that would affect the entire campus. That timeframe would not work for the grant funding and LCBP approved LCC looking for another school partner in the Lake Champlain watershed. The COVID-19 pandemic further delayed project work since schools moved to remote operations and were not allowing non-school personnel on-site access. LCC partnered with Bellow's Free Academy (BFA) in St. Albans, VT for the Stormwater Reduction Implementation Project in the winter of 2022/23.

Working with a team of science teachers at BFA St. Albans, LCC engaged students in environmental science and outdoor education classes to discuss stormwater runoff at BFA's campus, its impact on nearby waterways and St. Albans Bay in Lake Champlain, and ways to reduce runoff on campus. Teachers and students identified areas on campus that were high-priority for stormwater reduction due to slope, impervious surfaces, lack of gutters, and other site issues. Working with the school community and the LCSG Green Infrastructure Collaborative Coordinator we identified locations for infiltration trenches and native plantings as well as outside contractors to assist with the project work. The educators and students from the participating classes were involved in on-site work to remove sod for the infiltration trenches, move gravel, and participated in plantings. LCC hired a local excavator to dig and fill three infiltration trenches in the high-priority areas on campus according to the Blue BTV Basis of Design guidance document. Two 88-foot long infiltration trenches were built on the west side of BFA's Connector hallway and main entrance, and one 13-foot long infiltration trench was built on the east side. LCC also worked with a local landscape designer to install plantings of native clethra, echinacea, rudbeckia, cinquefoil, ninebark, switchgrass, and hydrangea in high-priority areas. LCC led class discussions on stormwater reduction with native plants, and facilitated in class participation in the plantings themselves. LCC worked with students involved in BFA's student-run newspaper The Mercury to share information about the project with the school and St. Albans community. The project reinforced the value of and opportunities associated with doing stormwater reduction work at school and helped LCC create a test a general methodology for conducting on-site stormwater reduction projects at other schools in the Lake Champlain watershed

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1. PROJECT SYNOPSIS

Project Background and Goals

Stormwater runoff poses a major challenge for water quality in Lake Champlain. When rain falls on impervious surfaces, it does not have the chance to infiltrate into the ground and instead flows over roofs, parking lots, and roads—collecting pollutants and nutrients along the way—until it eventually reaches the lake, untreated. According to the Lake Champlain Basin Program, runoff from developed land contributes more phosphorus to waterways than any other land use type per area. As the intensity and frequency of heavy precipitation events increases with climate change, efforts to mitigate stormwater runoff are increasingly critical.

Schools provide ideal locations for this education given their central role within communities and that many of them also have extensive areas of impervious surface from large buildings and parking lots.

BFA St. Albans was a particularly apt setting for AOTS SSRP because of its proximity to Stevens Brook, a stream designated by the state of Vermont as an impaired waterway, and St. Albans Bay, an area with high frequency of cyanobacteria blooms. In 2019, BFA St. Albans built a new hallway connecting the North and South buildings of campus—the Connector—which we identified early on as an area of concern for stormwater runoff. The Connector was built on a slope and has no gutters so stormwater flows directly from the roof to grass. The grassed area surrounding the Connector was on highly compacted and eroded soil, so it did little to retain stormwater. During precipitation events, runoff would collect sediments from the soil and flow over sidewalks and parking lots on both sides of the Connector. The slope of the land around the Connector shed water away from the building at high velocity. On the west side of the Connector, the closest storm drain was at the end of the Connector, so all stormwater that flowed to the west side had a large area to collect pollutants before reaching a nearby stream.

One of the project goals was to pilot an on-site stormwater reduction project with a school community and assess ways to most efficiently replicate the process at other schools in the Lake Champlain Basin.

Figure 1 - The northeast side of the Connector before and after building the infiltration trench and adding native shrubs to hold soil and reduce stormwater flows. The lawn did little to retain water during rain events and most of the stormwater would runoff into the adjacent sidewalk and parking lot. With the infiltration trench and planting, stormwater will have the chance to soak into the ground.

Timetable

The original project work began at Plattsburgh High School in Plattsburgh, New York in 2019 but the school had to pull out of the program due to county-wide funding to upgrade sports fields which would have interfered with the stormwater reduction work and delayed the project beyond the grant deadline for use of funds. The COVID-19 pandemic further delayed work since schools did not have the capacity to take on a project of this scope during that time. Most schools were not allowing non-school personnel on campus and were not in a position to entertain new projects in the midst of the pandemic. LCC secured approval from LCBP to work with another school in the Lake Champlain Basin, where we had done preliminary stormwater reduction assessment work. We moved the project to Bellows Free Academy in St. Albans (BFA St. Albans) Vermont in the fall and winter of 2022 after receiving enthusiastic support from school administrators and a team of environmental science teachers. Coordination and planning occurred during the winter of 2022 and winter and spring of 2023 with education work taking place from winter 2023 through June 2023, and on-site work including infiltration trenches and native plantings undertaken in the spring of 2023. All project work was completed in June 2023.

Project Partners

LCC collaborated closely with three BFA science teachers who involved their environmental science and outdoor education classes in the project work and also served as key liaisons with

the school administration and leadership and helped involve building and maintenance personnel. LCSG's Green Infrastructure Collaborative Coordinator provided ongoing technical support on green stormwater infrastructure (GSI) design and implementation for all stormwater reduction projects. LCC also invited the participation of VT Northwest Regional Planning Commission and the City of St. Albans to gain further information about stormwater issues specific to St. Albans and to ensure that none of the site projects would require permits.

2. TASKS COMPLETED AND METHODOLOGY

Task 1 – Coordinate Ahead of the Storm Implementation Pilot Project

LCC established a team of science teachers at BFA St. Albans with whom to implement AOTS SSRP and met with them regularly via Zoom and on-site visits to ensure a smooth project roll-out. The teachers took responsibility for contacting school leadership and securing approval from the principal and superintendent to conduct the project. Initially through regular Zoom meetings and phone calls, LCC coordinated details on stormwater issues on campus—particularly those around the newly built Connector hallway that was added after LCC's 2018 School Stormwater Assessment at BFA –as well as education needs, outreach strategies, and options for on-site stormwater reduction work. In March 2023, LCC and LCSG staff made a site visit to work with the teachers and students in an outdoor education class to discuss stormwater runoff at BFA and brainstorm solutions including an infiltration trench and plantings in strategic areas around the Connector.

Task 2 – Implement Ahead of the Storm Pilot Project

Infiltration Trenches

The roof of the Connector has no gutters and was the source of heavy stormwater flow during precipitation events. The soil along the dripline of the Connector was heavily compacted and would readily shed water onto the adjacent sidewalk and parking lot. A clear solution came from LCC and LCSG's initial site visit with the outdoor education class in March—infiltration trenches.

First, we had to determine if the soils were suitable for infiltration trenches. Soils must be well-drained in order for infiltration trenches to work as they are designed. The soil around the Connector is fill with a sandy composition that was added to the site when the Connector was originally built. LCC and BFA teachers conducted percolation tests following the VT Guide to Stormwater for Homeowners and determined that the soils were well drained and suited for infiltration trenches. The team marked off where the infiltration trenches were to be built and contacted Dig Safe for gas, electric, and communication line locations. Once all Dig Safe representatives gave the go-ahead, work began with students cutting the sod along the infiltration trench lines in preparation for digging.

The infiltration trenches were constructed following specifications from Blue BTV's Basis of Design guidance. That guidance dictated infiltration trenches with a flat, unlined bottom at 30" depth and 24" width, filled with washed stone of at least 1" aggregate, lined on the side further from the building with a non-woven geotextile filter fabric and on the side closer to the building

with an impermeable liner. LCC sought input from the school community to find a local excavator and source for stones and all contractors were asked to review and follow the Blue BTV Basis of Design guidance. LCC worked closely with the local excavator to source the correct materials and follow the exact trench dimensions and site requirements. With LCC's oversight, the excavator dug two 88-foot long infiltration trenches along the entire length of the Connector on the west side, as well as one 13-foot infiltration trench on the northeast side of the Connector. Soil removed for the infiltration trenches was stored on-site for future use by the school as per request of BFA Facilities Management. Silt fencing was placed wherever excavation work was taking place to prevent exacerbating the runoff problem. Capped perforated PVC pipes were added perpendicular inside of the infiltration trenches per recommendation from LCSG, to allow for the ongoing supervision of water levels within the trench in the future. This will help with managing any potential drainage issues and provide a hands-on learning opportunity for future students to check the trench during and after precipitation events. The infiltration trenches were completed by late May 2023.

Site cleanup was a requirement of the excavation contract. LCC worked with the local excavator as well as BFA Facilities Management to identify areas in need of topsoil, seeding, and straw to mitigate site disturbance after the infiltration trenches were completed. Site mitigation materials were locally sourced and organic where possible.

Figure 2 - The infiltration trench on the southwest side of the Connector. This section of trench is 88 feet long, running the length of the Connector under the roof's dripline. It is filled to a depth of 30 inches with washed 1" stone.

Plantings

During the site visit in March of 2023, LCC, LCSG, and BFA teachers and students all agreed that plants around the Connector would be a good strategy for stormwater reduction. Native plants would stabilize the soil between the infiltration trenches and the sidewalk, retain stormwater, and provide the added values of aesthetic improvements and pollinator support. To source plants and for technical work on building plant beds, LCC reached out to a landscaper from BLUE BTV's contractor list as provided by LCSG. The contractor was local, had experience in stormwater reduction work, was recommended by University of Vermont personnel with GSI expertise, and was very excited to work with the school and engage students in the project work.

LCC worked closely with the landscaper to develop planting designs to best address stormwater issues while being responsive to limitations imposed by BFA St. Albans Facilities Management staff. The plants that were chosen fit the requirements of LCC as salt tolerant, native, low-maintenance, pollinator-friendly perennials that are good for stormwater reduction. BFA Facilities Management also specified the need to avoid trees and plants that shed annual fruits. With LCC's oversight and the involvement of LCC and the participating educators and students, the landscaper planted:

- *Panicum virgatum,* a native switchgrass, in clumps on the southeast side of the Connector and near the entrance of the west side of the Connector;
- *Potentilla fruticose,* or shrubby cinquefoil, between the infiltration trench and the sidewalk on the west side of the Connector;
- *Physocarpus opulifolius,* or ninebark, a flowering shrub, on the ends of the planting beds on the west side of the Connector;
- *Hydrangea arborescens,* a native hydrangea, on the southeast side of the Connector;
- *Clethra alnifolia,* sometimes called pepperbush or summersweet, on the southeast side of the Connector;
- *Echinacea*, purple coneflower, in clumps near the entrance to the school on the west side of the Connector; and
- *Rudbeckia*, black-eyed Susan, in clumps near the entrance to the school on the west side of the Connector.

LCC collaborated with the local landscaper to implement low-impact landscaping, so the project plantings were done almost exclusively with hand tools. All materials used in the plantings were locally-sourced, and organic where possible.

Figure 3 - Landscapers add the finishing touches to the planting on the southwest side of the Connector.

Student Involvement, Education, and Outreach

LCC endeavored to involve students from the BFA science teachers' classes as much as possible in the project. This included a site visit with the outdoor education class where we discussed stormwater challenges and possible solutions at BFA, and also walked to Stevens Brook and discussed surface water flow to St. Albans Bay and why the stream is classified as an impaired waterway.

Students prepared the infiltration trenches by cutting sod prior to excavation. Students also had hands-on participation in the plantings. The plantings were preceded by collaborative, dialectical class discussions on runoff, benefits of the planting, the importance of native plants, and water quality in Lake Champlain facilitated by LCC staff and the landscaper.

LCC collaborated with the staff advisor and student editors for the BFA Mercury—the online student newspaper for BFA St. Albans. Two student editors conducted interviews with BFA teachers and interviewed LCC staff about the project for school outreach. Due to schedule constraints, the team at BFA Mercury had not finished the piece at the time of the Final Report (6/15/2023) but intended to publish it in June.

LCC also worked with BFA personnel who head the school's online blog (Growing Green and Gold Pride at BFA) and Facebook account to share a short educational blurb and photos of students working on the plantings with the broader school community. LCC posted three Facebook write-ups on AOTS SSRP to promote the work and broaden educational efforts to LCC followers.

Task 3 – Produce Draft Final Report & Maintenance Plan

The Final Report and Maintenance Plan were completed in June 2023.

3. DELIVERABLES COMPLETED

- Meetings
  - 12/5/2023 – LCC Preliminary meeting in person at BFA.
  - 12/4/2023 – Zoom with LCC and BFA team.
  - 2/6/2023 – Zoom with LCC and BFA team.
  - 3/9/2023 – Zoom with LCC and BFA team.
  - 3/13/2023 – Zoom with LCC and LCSG.
  - 3/23/2023 Zoom with LCC, LCSG, and BFA team.
  - 3/31/2023 – In-person walk and talk with 15 students on stormwater solutions at BFA.
  - 4/18/2023 – Zoom with LCC and BFA team.
  - 4/21/2023 – In-person DigSafe mark-up and brainstorm with LCC and BFA team.
  - 4/24/2023 – In-person tour of BFA and brainstorm with LCC and landscaper.
  - 4/27/2023 – In-person infiltration trench discussion at BFA with excavator.
  - 5/1/2023 – Zoom with LCC, LCSG, and BFA team.
  - 5/16/2023-5/19/2023 – Infiltration trench building, LCC checking in throughout day with excavator.
  - 5/19/2023, 5/22/2023, 5/23/2023 – Plantings - three classes, two planting and class discussion sessions each. LCC checking in with landscaper in-between.
  - 6/1/2023 – Final in-person check-in with BFA team and LCSG Green Infrastructure Collaborative Coordinator.

- Three infiltration trenches (two 88-foot long and one 13-foot long) following specifications from Blue BTV.

- 55 native plants spanning seven species installed in beds on the west side of the Connector (between the infiltration trenches and sidewalk), the southeast side of the Connector (along the dripline of the roof), and surrounding the stormwater drain adjacent the infiltration trench in the northeast corner side of the Connector.

- One stormwater “walk and talk” with 16 students; six class discussions on stormwater and planting with 22 students (three classes, two sessions per class).

- Two original educational Facebook posts on LCC’s page (and one shared from BFA’s page).

- One educational Facebook post on BFA St. Albans’ page.

- One blog post on BFA St. Albans’ “Growing Green and Gold” school blog.

- One editorial in BFA St. Albans’ student newspaper The Mercury.

- One E-Newsletter article for distribution to LCC membership and list-serve.

- Maintenance plan for the plantings as provided by the landscaper.

4. CONCLUSIONS

Project Accomplishments

The project provided on-site stormwater reduction measures on the school campus, engaged the school community in the project, developed a broad methodology for replicating the approach at other schools in the Lake Champlain watershed, and fostered relationships to continue collaborations on stormwater reduction in future years. Infiltration trenches and native plantings on campus will help reduce stormwater flows and the maintenance work provides ongoing opportunities to educate and engage educators and students in stormwater remediation in the future. The Connector posed a major challenge for runoff due to a lack of greenspace surrounding the building and a parking lot between the building and the closest storm drain on the west side. Precipitation that falls on the Connector will now have the opportunity to soak into the ground through the infiltration trenches. Excess stormwater and water that rolls from the southeast side of the Connector will be slowed down and soaked up by the new native plants. On the education front, all classes participated in identifying ways to slow down, spread out, and soak up stormwater. By the end of the project, students showed an ability to connect the runoff problems on their school's campus to water quality issues in local waterways and St. Albans Bay. This project helped foster a sense of stewardship for Lake Champlain's water quality among students through hands-on digging and planting.

Challenges

The construction schedule at Plattsburgh High School, which was not known by the lead school personnel when they signed onto the project, was a challenge and came about after LCC had already devoted extensive time to meeting with a team of educators, students, and the facilities manager to identify and plan project work. Since the construction work would be campus-wide there wasn't an option to undertake any on-site stormwater remediation until after the work was completed which wasn't anticipated to be until 2024. Also, the construction work was also going to include other schools in Clinton County where we had previously conducted stormwater assessments so we didn't have another New York school to partner with. The COVID-19 pandemic caused a further delay in project execution because most schools in the watershed were not allowing on-site visits by non-school personnel and they were under so much pressure that it was not a time when they could engage in planning for future project work when site restrictions eased. We are grateful for the support, understanding, flexibility of our LCBP project officer throughout this process.

Lessons Learned

As a pilot project, the AOTS SSRP helped LCC staff understand how to most effectively approach on-site stormwater reduction at schools throughout the Lake Champlain Basin.

Changes to the original proposed schedule as outlined in the initial workplan were beyond LCC's control. However, the shortened timeframe meant we had to adapt the project to what could be implemented in one school year. Flexibility is required to adapt an on-site project to each individual school and to be responsive to school culture, the teaching style of participating educators, maintenance and facility managers' approach to the project, students' knowledge about stormwater, and school's maintenance plans and needs.

LCC was prepared to conduct classroom lessons and activities with students prior to project implementation at BFA. The teachers initially embraced this idea but as we got closer to setting dates for in-classroom presentations they altered the approach to have their students "learn by doing", so we adapted to this need and instead incorporated stormwater education into on-site tours, sod removal for the infiltration trenches, and hands-on work with plantings. The landscaper enthusiastically engaged with the students helping to teach them about native vegetation as they were digging and planting. In contrast, previous stormwater assessment work at St. Albans City School incorporated a considerable amount of classroom workshops and presentations from LCC at the behest of educators. This is an exemplifies the to meet teachers where they are and work with them on what is best for their classes, and recognize that this will vary from school to school.

The variance in schools applies not only to classroom education but also to on-site stormwater reduction work. Stormwater remediation needs to be site specific and responsive to the physical aspects of each school campus including soils, stormwater flow, and site restrictions and limitations. This project reinforcedkey elements of successful stormwater reduction work at schools.

Possible Future Work

This project was intended to pilot stormwater reduction implementation at a single school as a model to learn from and replicate at other schools in the Lake Champlain Basin.

LCC has done extensive work on stormwater reduction at schools over the years including producing a stormwater education manual, conducting stormdrain stenciling projects with schools and municipalities, doing "Ahead of the Storm" stormwater assessments, collaborating with LCSG on the development of Soaking Up Stormwater curricula.

LCC wants to continue to work with BFA St. Albans on additional stormwater remediation actions as there are other places on campus that provide opportunities to further reduce stormwater flows and also expand the on-site work to other schools in the Lake Champlain Basin. Future work that would build off the AOTS SSRP at BFA St. Albans includes expanding plantings to additional areas on campus beyond the Connector area, as the marginal greenspace on campus is dominated by eroding grassed areas that lack a diversity of species and don't hold soil or allow for enough infiltration. LCC has also discussed designing signage and conducting more class lessons with some of the teachers involved in the project. As for expanding the stormwater reduction project to other schools, the landscaper that we worked with at BFA St. Albans has expressed interest in LCC conducting a similar project at BFA Fairfax, where he is a substitute teacher. We plan to meet with him and school leadership to explore options for a future grant application.

Figure 4 - Environmental science students pose after prepping the southeast side of the Connector for planting.

5. REFERENCES

Blue BTV (2022). Basis of Design: Design Guidance for Small-Scale Green Stormwater Infrastructure Projects in Burlington, Vermont. https://www.uvm.edu/seagrant/sites/default/files/files/publication/BLUE_BTV_BasisOfDesign_Standards_VersionV_Complete.pdf

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6. APPENDIX

Appended Documents:

LCC E-News article

Maintenance plan

Meeting notes

Photo folder