Literature Review and Comparative Analysis of Existing Certification and Training Programs Applicable to Clean Water Project Operations and Maintenance

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Stormwater Management through Green Infrastructure and the Maintenance Dilemma

Stormwater runoff that carries sediments and nutrients is a primary pollutant entering surface waters in the State of Vermont. Phosphorus pollution is driving cyanobacteria blooms in many of our lakes including Lake Champlain, Lake Carmi, and Lake Memphremagog, especially in the warmer months. Warmer weather patterns and an increased frequency of extreme storms are predicted with climate change. As such, there is critical need to take action on the land to minimize and treat stormwater runoff on-site.

The State adopted a Clean Water Act in 2015, which was swiftly followed by a Total Maximum Daily Load (TMDL) for Lakes Champlain and Memphremagog, and that was preceded by a TMDL for Lake Carmi. Each TMDL has an associated implementation and/or tactical basin plan that defines actions to address phosphorus transport in these watershed drainage areas. Other watersheds of the state also have land use practices guided by tactical basin plans.

Green infrastructure practices are commonly recommended to address phosphorus pollution. Green infrastructure practices are nature-based solutions that clean and minimize stormwater runoff on-site. They include rain gardens and other types of bioretention basins, permeable pavers, green roofs, bioswales, and infiltration basins, among a variety of other systems that mimic nature to infiltrate, store and/or treat stormwater runoff to reduce its volume and clean it before it enters surface waters.

While green infrastructure practices and other nature-based stormwater management solutions have become more and more commonplace in the state since the 1990s, understanding and awareness of the need for maintenance of these systems has grown overtime. Some installations have lost capacity to sustain their stormwater treatment and mitigation capabilities as a result of insufficient maintenance. In fact, long-term performance of green infrastructure practices is distinctly related to successful long-term maintenance.

Act 76, Vermont's Clean Water Service Delivery Act of 2019 sets forth requirements for the creation of an operation and maintenance (O&M) program for non-regulatory clean water projects funded through Clean Water Service Providers (CWSPs). The program will be complex, replete with new funding mechanisms, new policy and procedural guidelines, and a community of practice comprised of a myriad of stakeholders. In addition, it will include comprehensive training on the contents of a new *Operations and Maintenance Standards Manual* that was developed in 2020 by Hoyle, Tanner and Associates. This manual standardizes operations and maintenance procedures across land use types – from agriculture to developed lands and natural resources. This manual was nearing completion as this literature review and comparative analysis was conducted.

The *Operations and Maintenance Standards* defined in the manual will need to be implemented by a capable and qualified suite of professionals who understand the general designs, functions, and required maintenance needs and timing for a variety of types of green infrastructure

practices over time. These individuals will require training and both the individuals and the State may benefit if they are required to become certified to carry out maintenance on green infrastructure installations, as formalizing the training may add a level of quality assurance and control over the maintenance practices implemented by the contractors. As the program and its methods are being developed, it is helpful to ask: how do we engender quality maintenance practices? This paper looks at one possible tool: a certification program.

Overview of This White Paper

To inform next steps the State will take in regard to such trainings, the goal of this research was to assess existing green infrastructure and other similar types of professional certification programs, identifying strengths and weaknesses along with such details as eligibility for certification, certification period, organizational home for certification providers, and content of certification training programs.

This literature review of existing programs identifies information such as: who is the certifying entity? Who is eligible to get certified? What is included in trainings? How are participant skills assessed to warrant certification? How long does certification last?

Certification Programs

First, let's define certification. It is a voluntary process by which an organization formally recognizes that an individual has attained certain predetermined knowledge, skills and/or competencies. These qualifications may be achieved through a variety of pathways, but typically are attained by completing one of more of the following: attendance in an approved training, performance on post-training assessments, and/or completion of some specified work experience.[1]

Certification programs have value for both those receiving the certification and those utilizing the services of the certified. According to Certiport,[2] those who become certified can become eligible for salary increases or promotions. They may also have increased credibility, confidence and performance due to enhanced confidence in their ability to carry out work tasks.[2] Likewise, the agency or organization utilizing services of the certified individual can expect work to be conducted more efficiently and competently, resulting in having more confidence in the work being performed. In regard to certification related to green infrastructure maintenance, the environment may benefit as systems are more adequately cared for, potentially increasing the

[1] Knapp, J.E. 2000. Designing Certification and Accreditation Programs In The Association Educator's Toolkit. American Society of Association Executives. Retrieved from: http://www.knappinternational.com/assets/uploads/pages/designing(1).pdf

[2] Certiport. 2020. The Value of Certification. Retrieved from: https://certiport.pearsonvue.com/About/The-value-of-certification.aspx

amount of stormwater that can be mitigated, maintaining performance over the design life, and sometimes expanding the lifespan of the practice and, in turn, reducing replacement/reinstallation costs.

To better understand what's involved with operating some form of certification program, here are some questions to ask ourselves. They are adapted from "Designing Certification and Accreditation Programs" by Joan Knapp.[1]

- Why offer a certification program? What is the need for such a program? What are the benefits and disadvantages for both the managing entity and for those certified?

- What type of certification program model is most appropriate and what ongoing commitment would it require?

- Who will develop the certification program and how much will that cost?

- Who will administer the program and how will those costs be covered in the short and long term? Will the program ever be self-sustaining?

To help assess if some form of O&M certification program will help promote quality maintenance of green infrastructure, below are just a few benefits and disadvantages.

Some Benefits

- Certification can elevate the quality of O&M services delivered by certified individuals.
- It establishes a pool of qualified professionals.
- It provides an on-going engagement between those overseeing water quality investments (e.g., DEC and CWSPs) and the practitioners visiting BMP sites regularly over the life span of each installation. This can be an opportunity for learning and the refinement of O&M programming in general.
- Certification recognizes the expertise of those certified, which can help build a workforce in O&M.

Some Disadvantages

- The effort to develop and administer a certification program can be significant, especially if a more elaborate model is used, like, for example, one that requires renewal and CEUs (Continuing Education Units).
- Cost and funding are likely to be an issue, certainly for developing the program. Financial support continues if the program isn't financially sustainable – which is quite common.
- The branding and marketing of the program require regular attention over its life. So does the preservation of the certificate's value and benefit to those certified.

The Spectrum of Certification Programs

Certification programs vary in complexity, from the very simple where someone attends a training and receives a paper certificate at the end of class, to one with features, requirements and fees that approach those of a professional license. Most are somewhere in the middle and are comprised of one or more of the following elements.

Training: Some form of knowledge is conveyed to the participant via either remote, in-person classroom, in-person field-based, or some combination of these. Remote instruction can be self-paced. One challenge is "how can the certification organization recognize the richness of knowledge, skills, and abilities that a worker must develop as new experiences are added to his or her repertoire? Mere recertification of initial skills could encourage mediocrity. "[1]

Assessment of trainee's understanding of the material: most often these "tests" are administered through an in-person, proctored written exam. Assessment may also be given through online checkpoint quizzes or similar.

Recertification: for programs that require periodic recertification, it most often includes attaining a minimum number of continuing education credits (CEUs) to be completed prior to recertification. A renewal fee is often assessed. VTDEC's Natural Shoreland Erosion Control Certification program provides four options for recertification, either: attend a 4-hour relevant training or conference, or complete a bioengineering project installation, or prepare a presentation about your Shoreland work, or complete the Shoreland online tutorial.

Eligibility requirement: Is a minimum amount of schooling required to be eligible? Do participants need some kind of professional status, such as experience in a relevant field? Is the person seeking certification required to be a resident of the region? Some certification programs include information on permitting/native plants that are specific to a region and therefore require participants to be from the area.

Tiered approach: Some programs have different levels, or tiers, of certification so that too much training information is not squeezed into a one-level certification. Tiers or levels may be sequential, where a lower level of certification is a prerequisite for attaining a higher level. Alternatively, levels can be assigned by function or task, such as "bioretention system" or "constructed wetlands."

Target audience: is the certification geared towards entry-level workers? Who will benefit the most from these trainings? Some examples of relevant fields may include landscape contractors and technicians, GI/LID Professionals, engineers, urban planners and grounds managers.

Cost to participants: how much will it cost for the initial certification and for any recertification in subsequent years? "Fees for certification range from $15 for automotive mechanics to $1,900 for skin cancer surgeons."[1] Will certification include examination fee? These questions are

particularly relevant to consider to help ensure that the program is accessible to a broad spectrum of people. If the goal is to enable participation by a diversity of experience, abilities, ages, cultures, etc. exorbitant costs may reduce access to certain populations.

Comparative Analysis of Existing Certification Programs

To build upon our existing knowledge of Vermont-based certification programs and to identify other programs that could be used as models for O&M certification, a web search was conducted of certification programs across the nation related to green infrastructure. Nine certification programs were identified. For each, a brief overview, web address, and key aspects are described. Table 1 provides a means to see a side-by-side comparison of the programs, including costs, eligibility, and certification process and recertification timing.

Certification programs vary in complexity from a simple free workshop to a multi-tiered program that may require recertification and tracking CEUs. To help the reader understand the spectrum of how different programs are organized, below are program descriptions followed by a matrix breaking down how each program works. The descriptions are based on a review of each program's website and linked promotional material. The nine cases are:

1. National Green Infrastructure Certification Program (NGICP)
2. Michigan Certified Natural Shoreline Professional (CNSP)
3. Chesapeake Bay Landscape Professional (CBLP) with certification Levels 1 & 2
4. Natural Shoreland Erosion Control Certification (VTDEC Lakes & Ponds)
5. Master Gardener Program- UVM Extension (certification Tracks 1, 2 & 3)
6. Master Rain Gardener Class, Washington Co, Michigan
7. UNH Stormwater Management Certificate
8. Custom Applicator Certification Program through VAAFM [manure]
9. UVM graduate certificate programs

I. National Green Infrastructure Certification Program (NGICP)

Key aspects:

- National recognition – valid across the United States
- Certification carries more weight
- Ability for host agencies/organizations to become partners

The National Green Infrastructure Certification Program (https://ngicp.org/about/) was founded in 2016 as a way to establish national standards for green infrastructure projects. The program quickly gained momentum as universities began to offer trainings and organizations decided to partner with NGICP in lieu of creating their own certification program. The Water Environment

Federation (WEF) is the certifying body for this program and there are three distinct governing bodies to this program: (1) Strategic Advisory Council (SAC) that oversees business operations including fundraising, promotion, etc., (2) Certification Committee (CC) that oversees the maintenance of the program and reports to the SAC, and (3) Technical Advisory Group (TAG) that is in charge of the technical aspects of the program and reports to the CC. The material covered in the trainings focuses on six different types of GI- bioretention, permeable pavements, rainwater harvesting, rooftop detection practices, dry wells, and stormwater wetlands.

Compared to other certification programs, this one requires a higher time commitment and is more formalized, with a proctored written final exam and a recertification period of two years to maintain certification. To be eligible for this program, an applicant must first attend a training course in their region (often offered through a university or partner organization of NGICP) and possess a high school degree. Following the training course, the applicant would then fill out a certification application with a fee of $200 and schedule a date to take the exam.

As this program gains traction, an individual may benefit from the name-recognition value of the certification but may lack the regional-specific knowledge needed in addressing green infrastructure maintenance in Vermont or the Lake Champlain Basin. This program is the first of its kind and marks a shift in recognizing the need for a larger consensus on the maintenance of green infrastructure systems.

II. Michigan Certified Natural Shoreline Professional (CNSP)

Key aspects:

- Highly specialized field of study
- Easy to recertify

The Michigan Certified Natural Shoreline Professional (https://www.mishorelinepartnership.org/contractor-training.html) training is targeted towards contractors and landscape professionals in Michigan. This program focuses on erosion control for the protection of Michigan's inland lakes and is comprised of two consecutive days of classroom training and a one-day field session which involves installing a natural shoreline landscape. An exam is given on the field day, although limited detail is given on the scope of the material covered in the exam. Classroom topics include problems associated with shoreline development, soils and native plants, water law and shoreline development permits, case studies, and the designing of bioengineered shoreline control. After three years there is a $25 recertification fee.

III. Chesapeake Bay Landscape Professional (CBLP)

Key aspects:

- Currently expanding program across Bay watershed
- Two-level approach to encourage advancement in field
- Choice of a design or installation certification (or both) for Level 2
- Includes a classroom training and field practicum
- Participants have unlimited access to an ongoing online webinar series about sustainable landscaping

The Chesapeake Bay Landscape Professional (https://cblpro.org/) program began in 2016 and is now offered in Virginia, Maryland, Pennsylvania, and the District of Columbia. Eventually, this certification will be available throughout the Bay Watershed. This certification emphasizes stormwater BMPs and conservation landscaping with native plants. There are two levels to this certification: Level 1 (baseline credential) and Level 2 (advanced credential). Level 1 certification involves two interactive online days vis Zoom (9 a.m.-12:00 p.m.) followed by a full day field-based practicum. Classroom topics include conservation landscaping (invasive plants, soils, natural communities, etc.) and stormwater BMPs.

To qualify for Level 1 certification, an applicant must have professional work experience in landscaping or a related field, possess a degree/certificate from an accredited institution in a related field, or have a professional certification which requires continuing education to maintain the credential. The $450 cost for Level 1 certification includes the written exam cost at the end of the training.

Level 2 involves three online days (8:30 a.m.-2:00 p.m.) with interactive sessions, HW assignments, and individual and group assignments. There is also a field-based practicum following classroom instruction (11 a.m.-3 p.m.) in which participants complete a residential design/implementation that incorporates vegetation and soil protection, stormwater planning, and using native plant communities as a reference for planting design. Certification is awarded based on the completion of the residential project and an online open-book test. To qualify for Level 2, applicants must have Level 1 certification and demonstrate previous experience in design/installation of sustainable landscapes. For Level 2, applicants have the option of paying for one certification in either CBLP-D (design) or CBLP-I (installation) ($580) or both for $630.

A benefit to this type of program is the ability to advance to the next level and become more marketable in the workforce, although the steep upfront cost of Level 2 may bar Level 1 certification recipients from pursuing this next level.

IV. Natural Shoreline Erosion Control Certification (NSECC)

Key aspects:

- Accessible to a larger audience (low fees with smaller time commitment)
- Preference given for grants and contracts through Vermont Clean Water Initiative

The Natural Shoreline Erosion Control Certification (https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/nsecc) course is offered through Vermont DEC and is a one-day, six-hour training course that is typically offered once a year. This course is intended for landscapers, contractors, and site workers that are interested in developing their knowledge about shoreland BMPs. Topics included in this course are: techniques for erosion control, stormwater management, bioengineering, and wildlife habitat protection. The course is taught entirely indoors, and while there are hands-on activities, there are no field-based components. There is no assessment of material at the culmination of the course.

For recertification, workers have the option of a 4-hour relevant training or conference, completing a bioengineering project installation, preparing a presentation about their shoreland work, or complete the shoreland online tutorial (in-development).

There is a $20 registration fee. As a one-day course with a low cost and technical level that does not required lengthy certification process it is much more accessible to a broad audience. Certain types of practices might be well-suited to this level of training whereas others might be more suited to lengthier and more technical trainings. Aside from being economical and accessible to many, a unique benefit associated with this certification is that applicants are given preference for grants and contracts through the Vermont Clean Water Initiative.

V. Master Gardener Program – UVM Extension

Key aspects:

- Three tracks based on time availability and commitment level
- Structured as more of a traditional college class
- Track 1 includes a 40-hour volunteer internship requirement over 2 years
- Online

The Master Gardener Program (https://www.uvm.edu/extension/mastergardener/master-gardener-program) is offered through UVM Extension and covers the key aspects of home gardening focused on plant and soil sciences. Vermont horticulture professionals along with UVM faculty and staff teach this course and it is open to everyone although content is specific to Vermont. For in-state residents, there is a $400 fee while out-of-state residents are required to pay a $550 fee. Prior to beginning the course, the Penn State Master Gardener Manual must be purchased for $75. There are three tracks that are available: (1) Master Gardener Volunteer Certification, (2) Home Horticulture Certificate of Completion, or (3) Self-Paced Course Only.

Track 1 is the most involved of the three and involves completing an online course, a 3-to-5-hour time commitment each week (to complete assignments, quizzes, watch lectures, participate in Q&A sessions over video), and completing a 40-hour volunteer internship during the 2 years after the course. After the completion of Track 1, participants receive a Vermont Master Gardener badge and certificate and are expected to pay a $25 annual membership fee.

Track 2, the Home Horticulture Certificate of Completion, has the same requirements as Track 1 but without the 40-hour volunteer internship. Participants receive a certificate at the end of the course.

Track 3, the Self-Paced Course, is the least involved of the three and allows for access to the online course but without the assignments or associated due dates. This track is intended for people who are interested in learning more about home horticulture who may not have as much time on their hands.

One notable aspect of this Master Gardener program is the 40-hour volunteer internship for Track 1, which was not common among other certification programs. In encouraging certified individuals to give back to the community, this may foster future relationships while increasing awareness of the program throughout the state.

VI. Master Rain Gardener Class – Michigan

Key aspects:

- Self-paced
- Free
- Designed to increase the average homeowner's knowledge about rain gardens

The Master Rain Gardener Class in Washtenaw County, Michigan (https://www.washtenaw.org/675/Master-Rain-Gardener-Class) is a self-paced, online class followed by building a rain garden. There are five classes total and the cost was waived since the start of COVID-19. Anyone interested in rain gardens can take the class and the certificate is valid for life. A registration form is required so that the location of the constructed rain garden is recorded, and participants receive a Master Rain Gardener t-shirt. This class is targeted to anyone interested in eco-friendly stormwater management but may lack the knowledge required to implement a rain garden. As a program on the lower end of the spectrum of certification (requiring minimal time and effort), this certificate is more arbitrary in that it is not intended to increase competitiveness in the workforce but rather provide a new skillset for personal use.

VII. UNH Stormwater Management Certificate

Key aspects:

- Series of seven workshops that culminates in earning a certificate of Stormwater Management
- Students required to attend 5 of the 7 workshops in 2-years to earn the certificate.

The University of New Hampshire's Stormwater Management Certificate (https://training.unh.edu/Stormwater) is set up in a manner that students can earn their certificate in one calendar year. Each student must participate in five workshops of the seven offered. These include stormwater hydrology, stormwater site design, treatment system design and post construction performance estimates, treatment system design and post construction performance estimates Part II, stormwater construction erosion and sediment controls, stormwater modeling, and stormwater management overview. These are all available online. The cost is $99/workshop plus a $50 fee to be issued the certificate.

VIII. Custom Applicator Certification Program – VT Agency of Agriculture, Food & Markets (VAAFM)

Key aspects:

- Certification is required to be a custom manure applicator in VT
- Program enacted due to requirements arising from Act 64
- Two educational credits can be gained

The Custom Applicator Certification Program is run by the Vermont Agency of Agriculture, Food, & Markets (https://agriculture.vermont.gov/custom-applicator). It was enacted in response to new requirements from Act 64. Custom manure applicators, or people that apply manure/nutrients to land for profit, are now required to receive training and certification through VAAFM. The Required Agricultural Practices (RAPs) passed in December 2016 support this certification program by requiring custom applicators to be certified, possess knowledge of RAPs and other agricultural rules, train seasonal and part-time employees in techniques to minimize runoff, and keep records of the amount of manure applied to the land.

To become certified, individuals must complete a two-hour training course through UVM and certifying exam (either in-person or online), email the certificate of completion, fill out a contact form (available here: https://agriculture.vermont.gov/custom-applicator), and pay the $30 certification fee. Although recertification is required every five years with eight hours of training, an annual fee of $30 must be paid by Jan. 31st to remain certified. Two educational credits can be gained from the online course for custom applicators and/or training purposes.

IX. UVM Graduate Certificate Programs

Key aspects:

- Available for current graduate students to enhance learning or new post baccalaureate/non-matriculating students to gain professional skills to expand the career opportunities
- Two options: 9 (up to 14) credits for a micro-certificate or 15 credits for a certificate
- For a certificate, credits must be completed within 5 years; for a micro-certificate, credits must be completed within 3 years
- Option to create a new certificate or micro-certificate with existing or new courses at UVM

The University of Vermont offers both certificate and micro-certificates (http://catalogue.uvm.edu/graduate/degreerequirements/requirementsforthecertificatesofgraduatestudy/) that are intended to enhance career options for enrolled graduate students or to provide professional skills to those preparing to attend graduate school or for non-matriculating students. The certificate program requires students to take at least 15 credits in a specified area of study determined for that particular certificate. Of those, at least 9 of the credits are considered to be part of a core curriculum for the certificate, while the others are able to be selected from a varied suite of elective courses from a defined list for that certificate. Students completing a certificate must complete all coursework within 5 years. For a micro-certificate, 9 credits are required at a minimum to complete requirements, but micro-certificates can have up to 14 credits required. Of those, 6 must be within a core curriculum for the micro-certificate while the others can be selected from a list of elective courses. These must be completed within 3 years. In both programs, credits from other colleges or universities may not be transferred into the certificate program, but if a student has taken 300+ level courses at UVM as a non-degree student, those credits are transferable into the certificate or micro-certificate program.

In both programs, a minimum grade point average of 3.0 must be maintained. Credits earned through the micro-certificate and certificate programs are able to be counted towards a master's or doctoral degree, though students in a master's or doctoral degree program must choose a certificate in a different discipline than their degree. Credits earned in a micro-certificate program can be applied towards a certificate program, but cannot overlap with a second micro-certificate. Similarly, credits earned in a certificate program cannot be used to fulfill another certificate's requirements.

Table 1. Comparison among green infrastructure and similar types of certification programs.

		Classroom training	Field-based training	Assessment of material	Recertification Timeline	Eligibility Requirement	Target Audience	Cost (2020)
NGICP		N/A	Yes	Exam, formal setting; only two pencils allowed	Every 2 years; 14 hours of continuing education training	HS degree	Entry-level workers	Certification application: $200
Michigan CNSP		Yes, two consecutive days	Yes, one day field session	Exam	Every 3 years	Contractor in the state of Michigan	Contractors	$25 recertification fee
CBLP	Level 1	Yes, two consecutive days (9 a.m.-noon)	Yes, one day field session (9:30 a.m.-5 p.m.)	Written examination	Every 2 years; 20 continuing education units to maintain credential	• Professional work experience in landscaping/related field OR • Possess a degree/certificate from accredited institution in a related field OR • Possess a professional certification that requires continuing education to maintain the credential	Landscape professionals, engineers, stormwater planners, environmental scientists, local gov't, etc.	$450 (includes training and materials, lunch, webinars, and exam cost)
	Level 2	Yes, 3 online days (8:30 a.m.-2:00 p.m.)	Yes, one day field session (11 a.m.-3 p.m.)	Completion of a project and an online open-book test	Not mentioned	Level 1 certification and demonstrate previous experience in design/installation of sustainable landscapes (need letter of recommendation from past employer)	Highly driven/ experienced professionals in a relevant field	One certification (CBLP-D (design) or CBLP-I (installation) is $580 while both cost $630

Table 1. Comparison among green infrastructure and similar types of certification programs.

		Classroom training	Field-based training	Assessment of material	Recertification Timeline	Eligibility Requirement	Target Audience	Cost (2020)
Natural Shoreland Erosion Control (VT)		6-hour training course, once a year in November (typically)	N/A	None mentioned	Every 3 years; must attend a 4-hour relevant training or conference, complete a bioengineering project installation, prepare a presentation, or complete the online tutorial	Designed for Landscapers, Contractors, and Site Workers	Contractors	$20 registration fee
Master Gardener Program- UVM Extension	Track 1	Online course w/ assignments and due dates	Must complete 40 hours of service work over 2 years	Online course assignments	$25 annual membership fee	None	VT residents with more time	In-state: $400 Out of state: $550 Penn State Gardener's Manual: $75
	Track 2	Online course w/ assignments and due dates	N/A	Online course assignments	None	None	Out of state/VT residents with less time	
	Track 3	Online course w/o assignments	N/A	None	None	None	Anyone looking to gain knowledge about gardening	
Master Rain Gardener Class		5 online classes- self-paced	None	None	None	None	Anyone interested in rain gardens	Free

Table 1. Comparison among green infrastructure and similar types of certification programs.

	Classroom training	Field-based training	Assessment of material	Recertification Timeline	Eligibility Requirement	Target Audience	Cost (2020)
UNH Stormwater Management Certificate	Must attend 5 of 7 available online 8-hour workshops	None	Must maintain 80% class attendance and complete all assignments	None	None	Designed for landscape architects, engineers, surveyors, project managers, and those who design, build and maintain stormwater management systems	$99 plus a one-time $50 administrative fee for the certificate
VAAFM	Must attend a 2-hour training course	None	Must take a certifying exam	Every 5 years, plus 8 hours of training, and must train all staff in how to minimize runoff to surface waters	None	Anyone who, in their business, applies manure or nutrients to land and charges for this service.	$30 each year
UVM Certificate/Micro-certificate	9 to 14 credits micro-certificate; 15+ credits for a certificate	Varies	Must maintain a 3.0 GPA	Must complete coursework within 3 years (micro-certificate) or 5 years (certificate). Once earned, maintain certification.	Bachelor's degree	Anyone with a bachelor's degree with interest	Tuition-based (varies in vs. out of state)

Aspects of a Certification Program for Vermont to Consider

There are a variety of characteristics of certification programs that Vermont must consider when making a determination about whether to pursue this type of formal process for training contractors in maintenance practices.

- Classroom training
  - Can be adapted for remote or in-person instruction
  - Includes background knowledge about the system/how it works
  - Training modules would comprise this aspect of the certification program
  - Self-paced vs person-to-person instruction or a combo of both
  - Could include case studies, problems associated with unmaintained systems, native plants, permitting laws, etc.

- Field-based training
  - Practicum
  - Hands-on skills to demonstrate when out in the field
    - For example, the Michigan CNSP certification involves installing a natural shoreline landscape on an inland lake property for their field-based practicum

- Assessment of material
  - Most often administered through an in-person, proctored written exam
  - Potential pitfalls: people only study the material necessary to pass the final examination and may not have field-based skills suitable to implement required practices
  - Offering the certification examination through a separate organization than the training materials offers a barrier between the two so that knowledge isn't solely gained for the purpose of passing the certification exam
  - Assessment could also be given through online checkpoint quizzes (more of a hybrid approach to certification)

- Recertification timeline
  - Does the program have a recertification fee associated with it? Who pays?
  - Most often includes a minimum number of continuing education credits
  - Different approach from Natural Shoreland Erosion Control (4 options for recertification) and a form to indicate recertification
    1. 4-hour relevant training or conference
    2. Complete a bioengineering project installation
    3. Prepare a presentation about your Shoreland work
    4. Complete the Shoreland online tutorial

- "how can the certification organization recognize the richness of knowledge, skills, and abilities that a worker must develop as new experiences are added to his or her repertoire? Mere recertification of initial skills could encourage mediocrity." (http://www.knappinternational.com/assets/uploads/pages/designing(1).pdf) In addition, how can the current workforce keep up with the latest science and best practices for operations and maintenance, or designing with operations and maintenance in mind over time?
- NGICP: every two years
  - 14 hours of professional development training
    - Online programming/E-learning/Mentoring/Publication options to fulfill the 14 hours

- Eligibility Requirement
  - Amount of schooling
    - Do they have a Bachelor's, Master's, or certificate from an accredited university?
  - Professional status
    - What is their current job? Are they in a relevant field?
  - Regionally-specific
    - Some certification programs include information on permitting/native plants that are specific to that area. Certification programs can be national (NGICP), state-specific (Michigan CNSP), or over many states (CBLP).
  - Tiered approach
    - A potential pitfall of certification is trying to fit too much information into a one-level program (http://files.astd.org/LD-Blog-Images/2013/Creating%20a%20Certificate%20Program%20Final%20Slides.pdf)- would a tiered approach or one with a variety of modules be more effective?
      - Target Audience
  - Is the certification geared towards entry-level workers? Who will benefit the most from these trainings?
  - Examples of relevant fields may include (from https://cblpro.org/get-certified/):
    - Engineers
    - Landscape contractors and technicians
    - Urban Planners
    - Grounds managers
    - GI/LID Professionals
    - Wetland ecologists
    - Floodplain managers
    - River scientists

- Cost
  - What may the cost be dependent on?
  - Will it include examination fee?
  - Recertification fee often not included
  - Who pays? How to make cost accessible to all? Scholarship opportunities?
  - "Fees for certification range from $15 for automotive mechanics to $1,900 for skin cancer surgeons" (http://www.knappinternational.com/assets/uploads/pages/designing(1).pdf)

- Other Decisions to be Made About a Certification Program
  - What is the purpose of a certification program?
  - Might becoming a partner organization to provide certification in collaboration with the national GI certification program (NGICP) be the right option?
    - In lieu of creating a formal certification program, another pathway to certification is to become a partner organization for an organization like NGICP
    - Listed on their website as a partner, DEC receives more name-recognition

  - Timing of implementation
    - Consider rolling out a cert program over time. Lake Champlain basin & Lake Memphremagog first, then rest of VT later?
  - Who administers?
  - How much time/effort available to run a program?
  - How to (and who to) keep the O and M manual current over time? Is there a central hub to take on this role?
  - How to market to applicants?
  - Situations in which a certification program may not be right

Conclusions and Recommendations

A certification program may be a helpful tool for promoting quality O&M work conducted regularly at BMP installations around the State. Potential models range in complexity from the simple to the elaborate, and each will require effort and funding to develop and administer. Similarly, as DEC's Act 76 policy and guidance documents emerge, it may be determined that goals can be met without the creation of an O&M certification program. The discussion above is hopefully useful to DEC and its partners to decide if and how such a program could be designed and implemented.

In general, the certification programs identified and reviewed are organized and operated by single organizational entities, with the exception of the National Green Infrastructure Certification Program, which includes partner organizations that are using the program in parallel. Costs for certification range from $20 to $630, while training requirements range from online, self-paced learning to more stringent multi-day or multi-workshop programs with required exams. Most of the green infrastructure-focused programs require a field-based training, which seems critical for the type of work being conducted. For those that require recertification, this is required about every 2 to 3 years.

The State of Vermont has a multitude of decisions to make regarding whether to pursue a certification program for green infrastructure maintenance professionals. Existing programs such as the National Green Infrastructure Certification Program affords a tempting option as it provides standardized training that is aligned with international best practices, and would afford the State to employ professionals who have been certified in other locations that have already adopted the certification program. The option to become a partner organization is also advantageous as a training program and model already exists for sharing knowledge and resources across geographies. That said, further exploration to understand content and methodologies followed to provide the training is warranted. For instance, there is yet to be a northeastern partner in the certification and maintenance methods followed may differ slightly in other regions of the US or may not align with the *Operations and Maintenance Standards Manual* currently in development in Vermont. It may be worth exploring if a multi-state collaboration would be logical.

Alternatively, the State of Vermont may opt against a certification program entirely or may desire to develop a program unique to the State, ensuring it meets the precise specifications of the *Operations and Maintenance Standards Manual*. We recommend that a committee be convened to be presented with and consider findings of this report, and to discuss some of the key questions outlined on pages 12-14 of this document. The State might also consider developing and implementing a survey to assess perceived value of a certification program and current access to such a program by professionals who would be targeted to carry out the required green infrastructure maintenance. Such a survey could reveal barriers and motivations of this group to a certification program.

Appendix A: Contact Information for Certification Programs

Program Name and Web Address	Contact
National Green Infrastructure Certification Program	wecare@envirocert.org
Michigan Certified Natural Shoreline Professional (CNSP) Training	Erick Elgin elgineri@anr.msu.edu (231) 928-1053
Green Infrastructure Certification with the Chesapeake Bay Landscape Professional Organization (CBLP)	Kory Kreiseder The Watershed Institute kkreiseder@thewatershed.org (609) 737-3755
Natural Shoreland Erosion Control Certification	Amy Picotte Amy.picotte@vermont.gov
Master Gardener	Beret Halverson Beret.halverson@uvm.edu (802) 656-1777
Master Rain Gardener	Susan Bryan bryans@washtenaw.org
UNH Stormwater Center	James Houle James.houle@unh.edu (603) 767-7091
LID Certification	Chris Navitsky Lake George Association cnavitsky@lakegeorgewaterkeeper.org (518) 668 9700 x301
VAAFM	Mary Montour mary.montour@vermont.gov (802) 461-6087

Appendix B: Resources for Certification Program Design

Bushman, S. and J. Llorens. 2013. Creating a Certificate Program. PowerPoint. Retrieved from: http://files.astd.org/LD-Blog-Images/2013/Creating%20a%20Certificate%20Program%20Final%20Slides.pdf

- Key points: Gives potential pitfalls of certification programs (e.g., miscalculating costs, trying to fit too much into a one-level program, not regular program maintenance)

Ennico, C. 2017. The Right Way to Set up a Certification Program. Creators (website). Retrieved from: https://www.creators.com/read/succeeding-in-your-business/04/17/the-right-way-to-set-up-a-certification-program

- Key point: Asks questions to consider when developing a certification program

Harvard Law School. 2014. Certifications for Green Infrastructure Professionals - The Current State, Recommended Best Practices, and What Governments Can Do to Help, Emmett Environmental Law & Policy Clinic and the Environmental Policy Initiative, Harvard Law School, Cambridge, Mass. Retrieved from: http://blogs.harvard.edu/environmentallawprogram/files/2014/08/GI-Certification-paper-FINAL_7-28-14.pdf

- Key points: Summarizes the current state of green infrastructure certification programs and makes recommendations for program design

Knapp, J.E. 2000. Designing Certification and Accreditation Programs *In* The Association Educator's Toolkit. American Society of Association Executives. Retrieved from: http://www.knappinternational.com/assets/uploads/pages/designing(1).pdf

- Key points: Discusses aspects of certification programs including eligibility, accessibility, and costs

Lonergan, K. 2017. The Issue with certification training. Project Management Informed Solutions. Retrieved from: https://www.pmis-consulting.com/issue-with-certification-training/

- Key point: Content is delivered in a way that is geared towards participants passing the program, and not developing valuable skills

Scivicque, C. 2017. Are Professional Certifications Worth it? Eat Your Career (website). Retrieved from: https://eatyourcareer.com/2017/06/professional-certifications-worth/

- Key point: Emphasizes the importance of *who* is giving out the certification- are they reputable? If so, a program is much more likely to gain traction.

Appendix C: Relevant Research Articles

Abell, S., Boone, W., Arbaugh, F. et al. 2006. Recruiting Future Science and Mathematics Teachers Into Alternative Certification Programs: Strategies Tried and Lessons Learned. J Sci Teacher Educ 17, 165–183. https://doi.org/10.1007/s10972-005-9001-4

- Key points: Challenges of recruiting teachers into a certification program. Is quite education-based but contains some useful information relevant to our work (e.g., Gatekeepers section)

Hall, T. J., Lopez, R. G., Marshall, M. I., & Dennis, J. H. 2010. Barriers to Adopting Sustainable Floriculture Certification, HortScience horts, 45(5), 778-783. Retrieved from: https://journals.ashs.org/hortsci/view/journals/hortsci/45/5/article-p778.xml

- Key points: Due to lack of knowledge about certification programs, growers are not interested. They have concerns that using sustainable practices will not have beneficial financial outcomes for them. Research that might suggest certification would be profitable to them may increase interest in such programs. They could find out such things as "Is becoming certified worth their time, energy, and resources?" Also, research is needed to understand if consumers are willing to pay more for sustainable production practices?

Prowant, B. F., Niebuhr, B., & Biel, M. (2007). Perceived value of nursing certification - summary of a national survey. Nephrology Nursing Journal, 34(4), 399-402. Retrieved from https://search.proquest.com/scholarly-journals/perceived-value-nursing-certification-summary/docview/216532515/se-2?accountid=14679

- Key points: Tables 2 through 4 offer some insights into motivations and barriers to practitioners signing up to be certified, and why they let their certifications lapse. Things such as cost, lack of relevance, lack of institutional support, lack of time, and lack of access were cited as barriers/reasons for lapsed certifications.