Education and Training Landscape:

Providing a Supply of Talent for Decentralized/Onsite Wastewater Occupations

EPA Office of Wastewater Management

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CONTENTS

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Introduction

Across the United States, decentralized (septic or onsite) wastewater systems provide communities and homeowners with a safe, affordable wastewater treatment option. This is particularly true in small, suburban, and rural areas where connecting to centralized treatment may be prohibitively expensive or unavailable. Decentralized wastewater treatment systems[1] are used throughout the country for both existing and new homes, as well as commercial or large residential settings. Approximately 20 percent of all U.S. households (or 1 in 5 homes) are served by individual decentralized systems.[2] Recent studies indicate that one-third of new single-family homes built between 2016- 2018 are served by individual decentralized systems.[3] Not only are decentralized systems an important component of providing clean water services to our communities, decentralized wastewater jobs provide stable employment, meaningful careers, useful technical skills, and a chance to make a real difference in communities – all while helping to protect the environment.

While it is well understood that water jobs are central to healthy communities, clean environments, and strong economies, important information gaps exist about the "decentralized workforce" for policy makers, educators, decentralized businesses, and individual workers. These gaps include a common understanding of the decentralized industry's occupations, information on the demographic characteristics of workers in these occupations, and strategies to improve linkages to education and training needed for jobs in the decentralized industry, among others.

This document is the second of two foundational reports focused on understanding the demand and supply of labor for the decentralized industry. Decentralized career pathways, occupational growth projections, and workforce challenges were discussed in the *Pipeline to a Sustainable Workforce: A Report on Decentralized/Onsite Wastewater Occupations* report. This subsequent report identifies the

What is a decentralized system?

Decentralized wastewater treatment systems are onsite or clustered systems used to collect, treat, and disperse or reclaim wastewater from a single residence, multiple residences, small community, or service area. In comparison to a centralized system, a decentralized system uses small pipes and treats small volumes of domestic wastewater.

[1] In this report, decentralized wastewater treatment systems are referred to as "decentralized wastewater systems" or "decentralized systems."
[2] 2015 U.S. Census Bureau's American Housing Survey (AHS)
[3] 2020 Onsite Wastewater Installation Assessment, National Environmental Services Center

education and training programs aligned with five key decentralized job functions necessary to be successful in decentralized career pathways and occupations.

Project Background

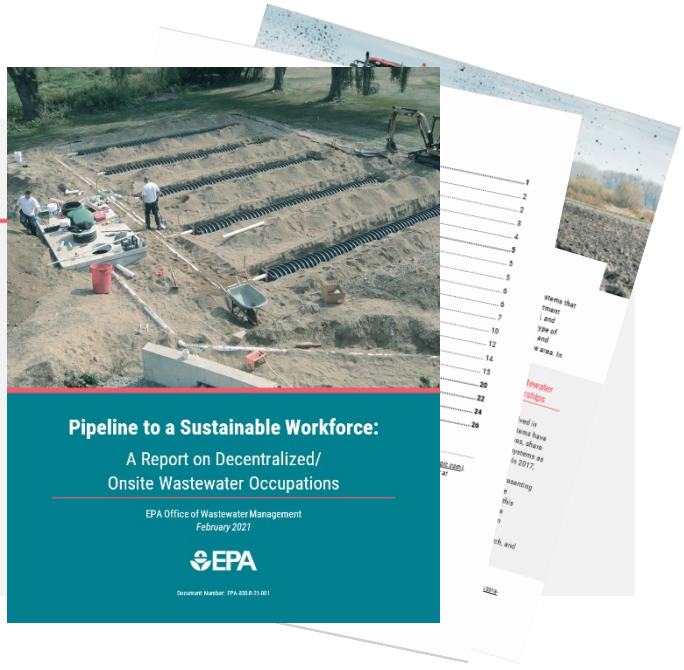
Since 2017, EPA and its Decentralized Wastewater Memorandum of Understanding (MOU) partner organizations have committed to advancing decentralized workforce growth and education. [4] The first steps in this commitment were two in-person meetings designed to identify the barriers to growing the decentralized workforce. The first meeting was held at the 2018 National Onsite Wastewater Recycling Association's (NOWRA's) Onsite Wastewater Mega-Conference in Minneapolis, Minnesota. The second meeting was part of the 2019 National Environmental Health Association's (NEHA's) Annual Educational Conference in Nashville, Tennessee.

During these meetings, participants helped develop a shared understanding of the distinct challenges and workforce opportunities in the decentralized wastewater industry. They identified a wide range of potential actions that could be undertaken to advance decentralized workforce practices while addressing workforce challenges. The overall goal was bolstering recruitment, educational programs, and market opportunities for young adults, students, and current workers. Throughout this process, a steering group of decentralized professionals provided guidance and feedback on how to best advance decentralized workforce practices.

In 2021, to better characterize the context and need for decentralized workers, EPA published the *Pipeline to a Sustainable Workforce: A Report on Decentralized/Onsite Wastewater Occupations* report to provide a foundational understanding of careers, growth projections and challenges faced by the industry. The *Pipeline* report describes four career pathways and the specific occupations under each pathway. This education and training landscape report provides a framework for understanding education and training programs aligned to five key decentralized job functions needed for decentralized occupations.

Report: Pipeline to a Sustainable Workforce

The *Pipeline to a Sustainable Workforce: A Report on Decentralized/Onsite Wastewater Occupations* report provides an overview of the types of career pathways available to decentralized workers, growth projections and the specific challenges that have led to a workforce shortage. It also provides details on high-need occupations and job characteristics for the industry. Click the link to read this report.



[4] Since 2005, EPA and organizations involved in managing decentralized wastewater systems have worked in tandem to identify key objectives, share information, and promote decentralized systems as a viable means of wastewater treatment. In 2020, EPA and 20 partners signed the latest in a series of MOUs, representing a shared and continued commitment to the decentralized wastewater industry. Learn more about EPA's Decentralized Wastewater MOU Partnership here: https://www.epa.gov/septic/decentralized-system-partners.

Purpose and Contents of the Report

This report provides a foundational understanding of the broad education and training opportunities tied to five key job functions central to decentralized career pathways and jobs in the industry. It is intended to provide the decentralized industry and educational institutions with an understanding of the skills and training aligned to these job functions and high growth decentralized occupations.

An important component of this report is defining and identifying the various decentralized credentials given to workers in the field. Credentials serve as the conduit between hiring employers and workers looking to demonstrate their skills and competencies that qualify them for those jobs.

The report is organized around the types of credentials offered and their alignment with decentralized career pathways, job clusters, and specific occupations. For each type of credential, this report includes a description, examples of how those credentials are provided, broad timeframes, and who provides the credentials. State licensing is examined in the context of five decentralized job functions: site evaluation, design, installation, inspection/monitoring, and operations/maintenance. Three examples of licensure and certifications of decentralized occupational functions from Iowa, Minnesota, and Rhode Island are highlighted in Appendices A, B, and C, respectively. Finally, the alignment between credentials and occupations is outlined in more detail in Appendix D.

Methodology

To assess the decentralized education and training landscape, a matrix was developed to organize initial data collection into a framework aligned with decentralized occupations and types of credentials offered. The matrix incorporated examples of various education and training programs being offered across the country. Data came from Decentralized MOU partners and steering group members as well as online resources and information. The purpose of the matrix was to discern the types of education and training programs offered; this project did not seek to, and does not, provide a comprehensive catalogue of education and training programs.

After categorizing the education and training programs based upon the type of credential offered, an assessment of the linkages between credential types and the occupation(s) identified in the *Pipeline* report provided information on the following:

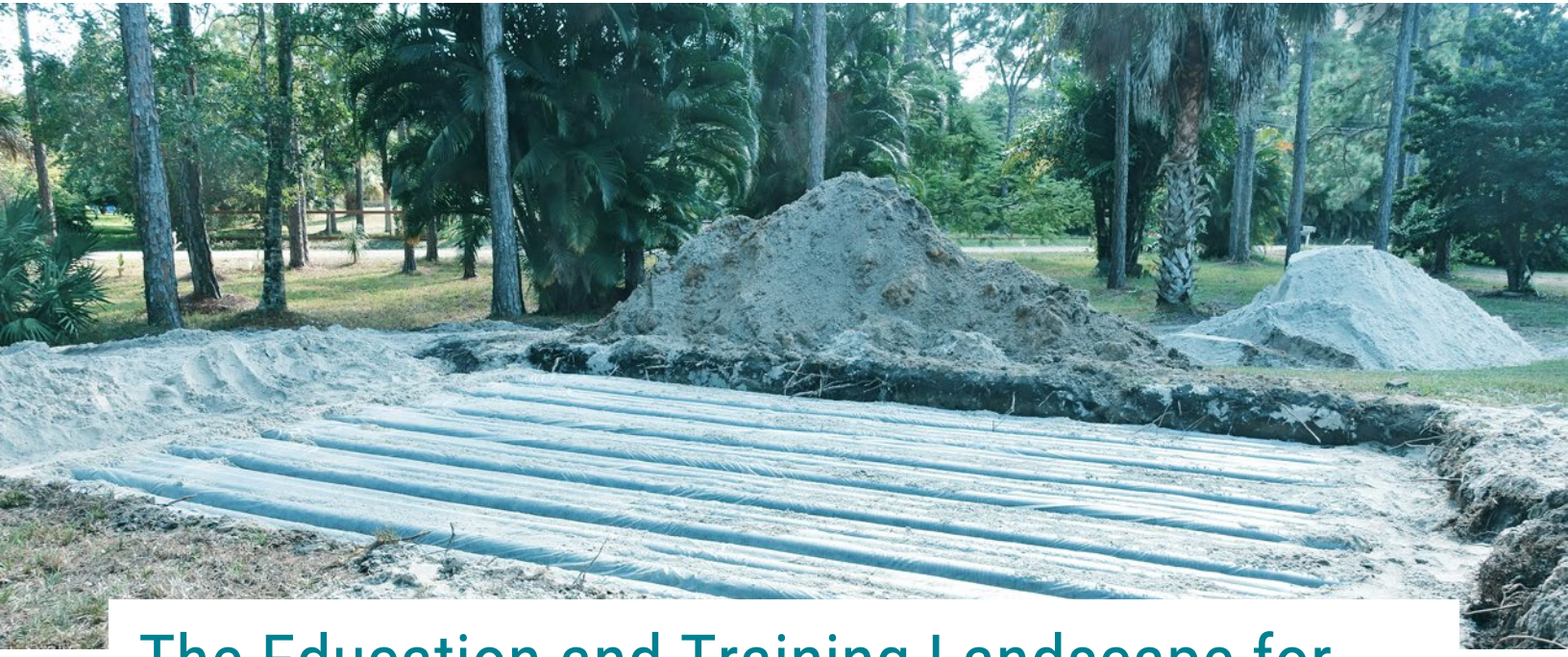
1. Opportunities for curriculum and program development to promote a recognized demonstration of skills gain for key decentralized job functions lacking an aligned credential(s).
2. Landscape of education and training trends or programs for key job functions with aligned credentials, such as what types of credentials are offered, how comprehensive a training program is, and what gaps may be evident.

Because state licensing requirements vary among the 50 states, tribal lands, and U.S. territories, this report looks generally at state requirements around the decentralized job functions of site evaluation, design, installation, inspection/monitoring, and operations/maintenance and uses three state examples of how licensing frameworks influence approaches to credentialing.

Limitations

In compiling this report, the following limitations were identified:

- **Capturing All Decentralized Related Education and Training Programs:** While a wide net was cast to understand the array of the types of decentralized education and training programs across educational institutions, the project did not develop a full database of all programs across the country. Therefore, the education and training matrix shown in Appendix D provides a representative list of credentials, as well as examples of the institutions providing the education, training, and credentials aligned to jobs.
- **Documenting All State Licensing Requirements and Implications:** Due to the number and variety of occupations and affiliated licensing requirements in the decentralized industry, state licensing requirements that impact the education and training for key job functions needed by decentralized workers in a variety of occupations are difficult to capture comprehensively. This report uses examples from states to highlight this variation. A list of state agencies and contacts associated with the decentralized industry can be found on EPA's website at: https://www.epa.gov/septic/state-septic-system-program-contacts.



The Education and Training Landscape for the Decentralized Wastewater Workforce

The workforce that provides decentralized wastewater services represents a wide range of occupations in skilled trades and professional positions across both private and public sectors, as illustrated in the *Pipeline* report. This report builds on those findings by providing a landscape analysis of the types of credentials available and their alignment to the key job functions in decentralized wastewater careers. It is designed to support the decentralized industry, educational organizations, and current and future workers. The report concludes with a summary of ideas to address opportunities for students, workers, and adults to gain credentials as well as new or enhanced skills to perform in decentralized occupations.

Overview of Key Decentralized Job Functions

This report focuses on five key job functions specific to occupations and careers in the decentralized wastewater industry. These job functions were categorized for this report, based on a phase in the life cycle of a decentralized system, from initial site evaluation to routine upkeep and maintenance. The key job functions for decentralized workers include the following: site evaluation, design, installation, inspection/monitoring, and operations/maintenance.[5] The job functions are associated with specific types of credentials that seek to elevate competency in the decentralized wastewater industry.

Site Evaluation

A site evaluation is conducted to assess the system site and relationship to other features, such as groundwater and surface water. Basic activities include a characterization of the landscape, soils, ground and surface water location, lot size, and other conditions. Advanced activities may include an assessment of the site and cumulative watershed impacts, groundwater mounding potential, long-term specific pollutant trends, and cluster system needs.

[5] Definitions were developed using EPA, "Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems," EPA No. 832-B-05-001, December 2005 accessed August 21, 2020: https://pdhonline.com/courses/c241/onsite_handbook.pdf

Design	The design of a decentralized wastewater system ensures that the system is appropriate for the site, watershed, and wastewater characteristics. A basic design may prescribe a limited number of acceptable options for site-specific conditions. While most designs present one option based on prescriptive standards, some may evaluate a wider range of options due to varying regulation or challenging site conditions.
Installation	Installation at a site involves the activities needed to construct an operational system, including repairs, for a home or business.
Inspection & Monitoring	Inspections are conducted to minimize health or environmental risks from handling, use and dispersal of septage and wastewater. Inspections often include a full in-person review of the entire system to ensure compliance with approved local/state plans and permit requirements for new construction, replacement, or major repair. They also ensure the system is working properly. Some states and localities require inspections when properties change ownership, while others may require inspections at different intervals, such as in the event of a loan application or permit.
Operations & Maintenance	Proper operations and maintenance (O&M) ensure a system performs as designed. Basic operations often include tank cleaning and service work and may also provide homeowner education and reminder programs that promote adequate O&M. Advanced systems may require service contracts or renewable, revocable operating permits with periodic reporting to ensure responsibility for O&M activities.

Overview and Definitions of Credentials

"Credential" is an overarching term that describes what a student or training participant receives upon successful completion of an education or training program. The Workforce Innovation and Opportunity Act (WIOA) defines a "recognized postsecondary credential" as a credential consisting of an industry-recognized certificate or certification, a certificate of completion of an apprenticeship, a license recognized by the state involved or federal government, or an associate or baccalaureate degree.[6] Guidance issued by the U.S. Department of Labor, Employment and Training Administration states, "Recognized postsecondary credentials are an attestation of qualification or competence issued to an individual by a third party (such as an educational institution or an industry or occupational certifying organization) with the relevant authority or expertise to issue such a credential."[7] The terms most commonly used for educational credentials are: diploma, certificate, and degree."[8]

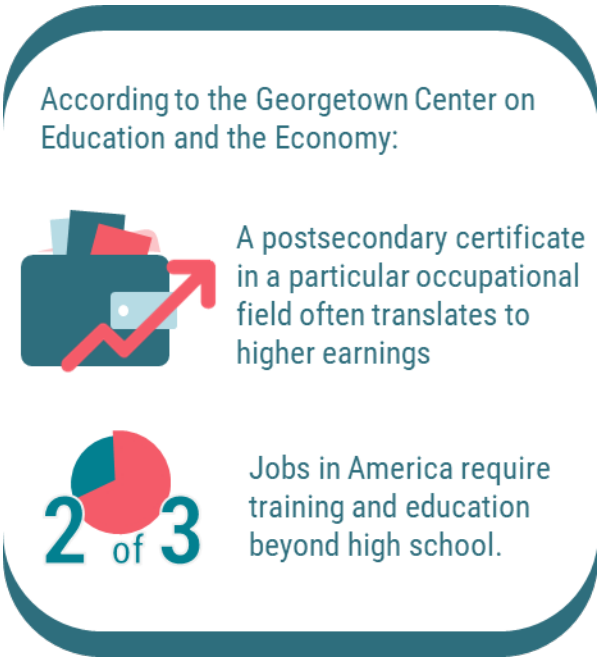
Credentials are the outcome of an education or training program and demonstrate knowledge, skill, and competency attainment for the subject matter taught. Credential attainment is an important barometer of upward mobility and gainful employment. An examination of credentials aligned to decentralized occupations is a useful organizing principle to assess the ability to supply a pipeline of workers that meet decentralized workforce needs. The

[6] Workforce Innovation and Opportunity Act (WIOA), Section 3(52)
[7] Carnevale, Anthony P. et al. 2012. Certificates: Gateway to Gainful Employment and College Degrees. Georgetown University, Center on Education and the Workforce. Washington, DC and Carnevale, Anthony, Nicole Smith, and Jeff Strohl. (2014) "Recovery: Job Growth and Education Requirements Through 2020 | Executive Summary." Georgetown Center on Education and the Economy. Washington, DC
[8] Employment and Training Administration, Training and Employment Notice (TEN) 25-19, June 8, 2020

characterization of this relationship helps to determine if there are gaps in education and training as compared to the needed supply of workers.

In this report, credentials are organized into four categories: degree, certification, certificate, and occupational license.[9] Licensing is a broad category that may include a combination of the other credentials. The categories are defined as follows[10]:

- **Degree**: Educational degrees are issued by accredited institutions and include, but are not limited to, associate, bachelor's, and master's degrees.
- **Certification**: Certifications attest to attainment of competence through a rigorous examination or demonstration and may also have a work experience requirement. Certifications are usually considered to be more rigorous and indicate a higher level of competence or proficiency than a certificate.
- **Certificate**: Certificates are completion based and denote participation in a defined course of study. Certificates are often related to discrete skills within one or more industries or occupations.
- **Occupational License**: Occupational licenses are credentials awarded by government agencies that constitute legal authority to do a specific job. Licenses are based on some combination of degree or certificate attainment, certifications, assessments, or work experience. They are also time limited and must be renewed periodically.



The following sections provide a more detailed review of each credential type and an exploration of the credential in the context of decentralized education and training. Each section highlights one example of a program offering that type of credential, the relationship of the credential to the key decentralized job functions and examples of decentralized occupations connected to the credential.

Degree Programs and Occupational Alignment

Degree programs include associate, bachelor's, and master's degrees and are obtainable typically in two, four, and six years of study, respectively. Degrees are obtained in the U.S. by attending an accredited college or university and taking courses that earn enough credits toward obtaining the degree. Decentralized occupations most aligned to degrees fall in the regulatory and professional career pathways, as described in the *Pipeline* report. Environmental health specialists and technicians, engineers, and soil scientists are all occupations that play core roles in the decentralized industry and positions where workers typically need degrees to qualify for positions.

[9] It should be noted that postsecondary courses on decentralized topics are available for enrollment, but they are not part of a complete educational pathway and no credential is offered upon completion of the course(s). Examples of these classes are included in the matrix.
[10] These definitions were created based on descriptions included in the Employment and Training Administration, Training and Employment Notice (TEN) 25-19, June 8, 2020

However, research and feedback received from steering group members and interviewees indicate that very few bachelor's degree programs in relevant fields incorporate concepts and principles specific to decentralized wastewater.

In 2014, Dr. Bob Siegrist, a researcher and professor at the Colorado School of Mines, conducted a survey of existing decentralized industry wastewater education programs. His research concluded that few U.S. universities have integrated a full decentralized/onsite course into their programs.[11] Dr. Siegrist's work also found that while some universities do provide mentoring to students doing decentralized/online research or provide decentralized lectures a part of other courses, only five universities offer a full, semester-long course on decentralized/onsite systems. In these five cases, the courses are offered as part of Agricultural and Biosystems Engineering or Civil and Environmental Engineering degree programs.

Many degreed professionals have to learn on the job and/or participate in additional training programs due to the lack of decentralized/onsite courses and degree pathway programs. While this is the case in most professions, the lack of formal courses in degree programs makes it more of an issue in the industry, for both the private and public sectors.

Examples of Decentralized Occupations Relevant to Highlighted Degree Programs

- Environmental Engineer
- Civil Engineer
- Hydraulic Engineer
- Wastewater Engineer

Certification Programs and Occupational Alignment

Certifications attest to attainment of competence through a rigorous examination or demonstration of skills. Certifications may also have a work experience requirement. Because certification programs typically require a test or a demonstration of competency of the subject matter, the course time is typically longer and more rigorous in nature than the certificate programs discussed below.[12] Certifications are named an "industry-recognized credential" when the standards and certification are developed and provided by an industry association. According to the Employment and Training Administration, being "industry-recognized" is a characteristic of the credential that consists of the following features[13]:

[11] Siegrist RL. 2014. Onsite and decentralized systems water and wastewater engineering: course development and delivery experiences in higher education. In: Innovations in Soil-based Onsite Wastewater Treatment, Proc. Soil Society of America Conference, Albuquerque, NM, April 6-7, 2014. 13 pp. (29Apr14)
[12] Employment and Training Administration, Training and Employment Notice 25-19
[13] Ibid

- The credential may be developed and offered by, or endorsed by, a nationally or regionally recognized industry association or organization representing a sizeable portion of the industry sector, or
- The credential is sought or accepted by companies within the industry sector for purposes of hiring or recruitment, which may include credentials from vendors of certain products.

Another important feature of credentials, which aligns with certifications that are industry-recognized, is "portability." A credential is considered portable when "it is recognized and accepted as verifying the qualifications of an individual in other settings— such as other geographic areas across the country, other educational institutions, or other industries or businesses."[14]

A widely recognized certification connected to the decentralized industry is the National Environmental Health Association's (NEHA) Registered Environmental Health System/Registered Sanitarian (REHS/RS) certification. According to NEHA, the REHS/RS certification "is the most prevalent NEHA credential and professionals demonstrate competency in an impressive range of environmental health issues, directing and training personnel to respond to routine or emergency environmental situations, and providing education to their communities on environmental health concerns. In addition, REHS/RS credential holders are key members in ensuring communities follow local, state and federal environmental health regulations."[15]

The REHS/RS certification has six content areas where a recipient has demonstrated competency and skill: 1) Conducting Facility Inspections: food manufacturing, restaurants, hotels, recreational waters, homes, waste, bio-medical; 2) Conducting System Inspections: workplace/occupational safety and health, wastewater, drinking water; 3) Conducting Investigations: epidemiology, air quality, complaints; 4) Ensuring Compliance: local, state, federal regulations; 5) Promoting Environmental Public Health Awareness: public health assessment, education, partnerships, outreach; and, 6) Responding to Emergencies: risk assessment, emergency preparedness.

The REHS/RS certification is a core credential for many people in the decentralized industry, particularly those occupations in the regulatory and professional positions career pathways. For example, local regulatory staff generally provide site inspections prior to, during and/or after a decentralized system is installed based on local/ state regulations. These workers also respond to and investigate complaints about failing decentralized systems. For those in regulatory jobs, the REHS/RS certification also may be a required step as part of career advancement.[16]

The REHS/RS certification has provided some uniformity in credentialing expectations across states. In other words, instead of separate state requirements for credentials for sanitation related work functions, some states allow or require the REHS/RS certification as the qualifying factor.[17]

[14] Ibid
[15] https://www.neha.org/professional-development/credentials/rehsrs-credential
[16] Ibid
[17] https://www.neha.org/professional-development/credentials/Reciprocity

Examples of Decentralized Occupations Relevant to Highlighted Certification Programs

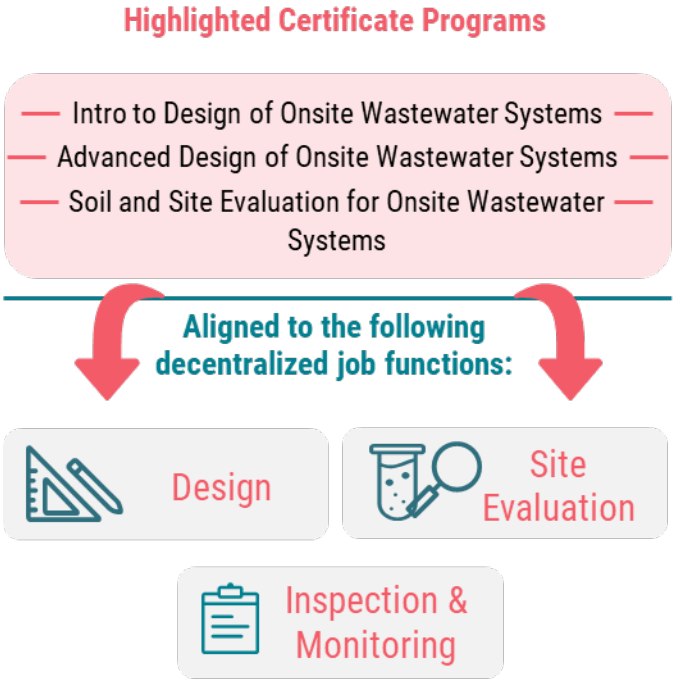
- Environmental Engineer
- Wastewater Engineer
- Soil Scientist
- Environmental Health Specialist
- Installation, Maintenance, and Repair Worker

Certificate Programs and Occupational Alignment

Certificate programs are typically topic intensive and usually do not require a final test or demonstration of competency. Certificate programs provide exposure to a topic and teach concepts needed to perform in jobs. The decentralized industry has multiple examples of certificates provided through an array of providers, including colleges and universities. Many university cooperative extensions or continuing education departments provide training and certificates. People who obtain certificates do not receive college credit after completion of the instruction.

The University of Arizona provides certificates in decentralized wastewater concepts. The University of Arizona's Cooperative Extension website states, "The overall objective of the Onsite Wastewater Education program is to empower the users, installers, maintainers, and regulators of onsite wastewater treatment and dispersal systems to make informed and effective choices to protect human health and the environment."[18]

The University of Arizona describes decentralized/onsite wastewater-specific training as a critical component of protecting public health and the environment in its state. It cites findings that failing onsite/septic systems contribute significantly to water quality impairments in Arizona.[19] To address this issue, the University's Cooperative Extension offers courses in the following areas: Inspection Training; Basic and Advanced Onsite Wastewater Design; Soil and Site Evaluation for Onsite Systems. Courses range from 1 - 3 days and are done in conjunction with the Arizona Department of Environmental Quality. The trainings support three decentralized career pathways: regulators, skilled trades workers, and professional positions, such as engineers (designers) and soil scientists.



Many other examples exist of these types of training and certificate programs across the U.S. to support the existing decentralized workforce and to address competency gaps that may be tied to the lack of decentralized coursework in degree programs.

[18] https://extension.arizona.edu/water
[19] https://extension.arizona.edu/onsite-wastewater

Example Decentralized Occupations Relevant to Highlighted Certificate Programs

- Civil Engineers
- Environmental/Hydraulic Engineers
- Wastewater Engineer
- Wastewater Operator
- Environmental Health Specialist
- Environmental Health Technician
- Installation, Maintenance, and Repair Worker

State Licensing and Occupational Alignment

Licenses allow for an individual to participate in decentralized wastewater work after the successful completion of required state testing/exams. Requirements for licensure in the decentralized industry are highly variable across states. Licensing requirements focus on job functions within the decentralized industry, particularly for design, installation, and operations/maintenance. For example, in Delaware, licenses are issued in eight different classes focused on different aspects of system design, installation, and maintenance.[20] Delaware has an organized system of licensure for every major job function of working with decentralized systems.

The Delaware Technical Community College (DTCC) program focuses on providing training and skills necessary to meet state licensing requirements. DTCC's continuing education department offers courses to prepare decentralized workers for the various classes of licensure (mentioned above) required to work in the industry, in Delaware. However, taking courses to quickly prepare workers for licensing has challenges in building a strong, long-lasting workforce, which can be better achieved through well-developed certification programs. This is highlighted in DTCC's development of certification programs for operators of wastewater treatment systems. The primary goal for DTCC's Wastewater Operations Certification courses is to train skilled operators and prepare them to take the Delaware state licensing examination.[21] DTCC offers both a baseline "Wastewater Operator Certification Level I" course where students sit for the Delaware Level I licensing exam, and a "Level II/III" course where students prepare for the state exam for either a level II or III classification.[22]

In general, most states have their own credentialing and licensing processes. There are some discussions in the decentralized industry on how to improve portability of credentials and state licensing requirements.

A solution to the lack of decentralized wastewater degree programs in some areas has been the use of

[20] Each of these classes are as follows: Class A – Percolation Tester, Class B/C – Designer, Class D – Site Evaluator, Class E – Installer, Class F – Liquid Waste Hauler, Class H – System Inspector, Class I – Construction Inspector. More information available at https://dnrec.alpha.delaware.gov/water/groundwater/licenses/

[21] Interview with Department Chair of Technical Training, DTCC, 2020.

[22] https://www.dtcc.edu/continuing-education/workforce-training/stanton/certificate-programs/wastewater-operator

individually tailored certificate programs to address labor demand. The aforementioned DTCC programs are examples of more intensive certification programs incorporated into community college or even bachelor's programs.

Example Decentralized Occupations Relevant to Highlighted Licensing Programs

- Installation, Maintenance, and Repair Workers
- Wastewater Treatment Operator
- Plumbing Technician

The following state examples of education and training approaches aligned to state licensing are included in these appendices:

- Appendix A: Iowa Onsite Waste Water Association Certified Installer of Onsite Wastewater Treatment System. Provides an example of decentralized certification targeted to state licensing requirements.
- Appendix B: Minnesota's decentralized training and certifications. Education requirements are coordinated with the state regulatory agency's recognition of these programs.
- Appendix C: Rhode Island Department of Environmental Regulation, Office of Water Resources. State licensing regulations are specified for certain decentralized job functions.

Lessons Learned

This education and training landscape analysis provides a framework for understanding the types of education and training methods and credentials available to address key decentralized job functions and the workforce and employment needs in the decentralized wastewater industry. Through this initial research, opportunities arise for further work and action, which can be pursued to provide opportunities to develop a skilled and qualified decentralized workforce.

Formal Education and Degree Program

Supplying more courses integrated into college engineering and public health programs would provide engineering and public health graduates with a basic foundation in decentralized design and operations.

Degree-seeking students often do not have access to full, semester-long courses or programs related to decentralized wastewater treatment. A renewed effort to support and develop college curriculum and courses in decentralized/onsite design and operations for engineering and public health degree programs would create more industry exposure and background for graduates of degree programs.

Cataloguing Certification Programs

Developing a catalog of standards and certifications for the key decentralized job functions would improve understanding of common training needs and support improvements in certification programs.

Industry-recognized certification programs provide an avenue for developing rigorous and portable credentials used by workers in all states. A catalogue of certification programs for the key decentralized job functions would enable educational organizations to provide training required for their state and for common elements in other states. Some in the industry are seeking to better understand approaches that allow portability of credentials across state lines and explore the potential for common credential systems.

Certificate Programs

Certificate programs provide an opportunity to quickly expose workers to decentralized industry concepts and regulatory requirements and serves as a foundation for more extensive decentralized curriculum development.

Certificate programs in decentralized site evaluation, design, installation, inspection, and operations are important because they are the primary means to rapidly train workers in the decentralized industry. Certificate programs are widely available and provided by university and college departments. They can serve as the basis for developing courses, modules, and programs that can be part of long-term, sustainable degree or certification tracks.

State Licensing and Certifications

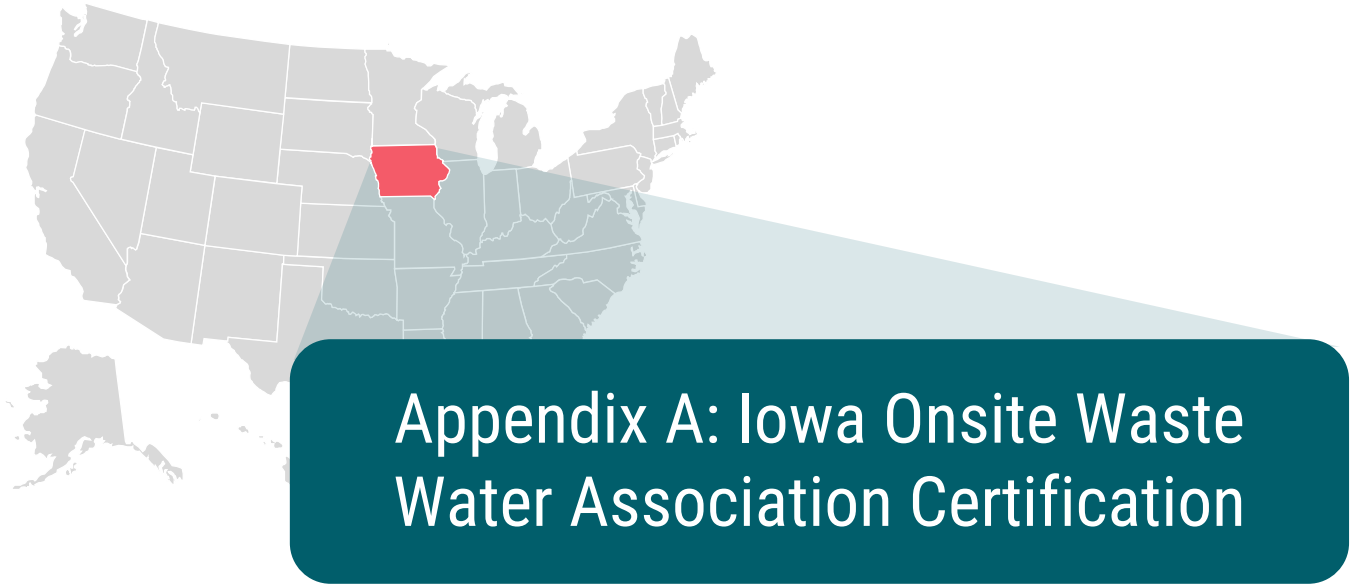
Engaging community colleges and other training institutions in developing certification programs tied to passing state licensing exams can help address state variations in licensing requirements.

Using courses and certifications that tie learning outcomes directly to meeting state licensing requirements (such as the DTCC, Minnesota, and Iowa models) is a sound approach to develop decentralized curricula that bolster worker knowledge and skills. Actively engaging other educational institutions in multiple states could help expand decentralized curriculum growth across the country. This approach may help minimize state licensing impacts on barriers to entry for new and seasoned decentralized industry workers.

Conclusion

The decentralized wastewater industry provides stable employment, meaningful careers, technical skills, pathways to innovation, and a chance to make a real difference in communities. This education and training landscape analysis provides a foundational understanding of the broad education and training opportunities tied to five key job functions central to career pathways and jobs in the decentralized industry. The key decentralized job functions identified for purposes of this document include site evaluation, design, installation, inspection/monitoring, and operations/maintenance. Information is also included on the skills and training aligned to these job functions and high-growth decentralized occupations.

The analysis also identified gaps in the training and education offered for decentralized workers, as well as some steps that could be pursued to address these gaps. For example, there are viable opportunities to grow decentralized wastewater education and training programs by further networking of university and community college providers. The gaps identified in this report demonstrate that the path to a tenable decentralized workforce calls for improvement, especially surrounding the education and training needs of those five key job functions. Continued focus on this workforce and its training needs will help develop and then connect skilled water workers that are central to the public health and environmental protection in our communities.



Appendix A: Iowa Onsite Waste Water Association Certification

Overview

The Iowa Onsite Waste Water Association (IOWWA) provides a credential titled Certified Installer of Onsite Wastewater Treatment System (CIOWTS). According to IOWWA's website[23]: "The primary purpose of the credential is to set a standard of practice and create a baseline of knowledge for onsite wastewater system installations. Iowa counties are encouraged to adopt regulations providing for the certifying of installers and to require the CIOWTS credential."

The information included in this appendix is from the IOWWA webpage and more detailed information on the program and certification can be found at: https://www.iowwa.com/

The CIOWTS was originally developed by the National Environmental Health Association (NEHA) as a national certification. After NEHA discontinued managing the credential as a national credential, IOWWA took the certification and now uses it as the basis of a state certification in Iowa. Currently, 23 counties require their onsite installers to hold the CIOWTS, with another county planning to add the requirement in 2021.

IOWWA provides a course that aligns with the credential test. This course, the Installation Overview Course, is a two-day seminar and counts toward 12 continuing education hours in Iowa. While the course is designed to prepare students for the test, the course is not required in order to sit for the CIOWTS exam.

The CIOWTS exam consists of two parts:

1. A Basic Level Exam that consists of 75 questions and takes 2 hours to complete; and
2. An Advanced Level Exam that consists of 125 questions and takes 3 hours to complete.

The CIOWTS exam includes the content areas listed below[24]:

[23] https://www.iowwa.com/pages/certification

[24] The following text is an excerpt from, "Certified Installer of Onsite Wastewater Treatment Systems (CIOWTS) Test Components," https://www.iowwa.com/pages/certification

10% Plan Assessment

1. Knowledge of site plans, basic surveying, topography, site features
2. Knowledge of materials requirements, standards and specifications, soil profile descriptions, pump performance, treatment and dispersal technologies
3. Ability to conceptualize an installation activity
4. Ability to make mathematical calculations of area, volume, elevation, rates, measures, and weights

20% Job Staging

1. Knowledge of installation plans, elevations, topography
2. Ability to transfer designer's plan to site, reconcile variations, identify conflict
3. Knowledge of equipment needs and limitations, materials and supplies, soil characteristics
4. Ability to make mathematical calculations
5. Ability to identify subcontractor and homeowner needs and potential conflicts

70% Site Development/Installation

1. Knowledge of soil characteristics; ability to recognize soil characteristics in the field
2. Knowledge of specifications and installation techniques for tanks, baffles, filters and screens, piping and fittings, aggregate and fill material, proprietary treatment components, pumps and siphons, liner materials, valves, switches, tubing
3. Knowledge of electrical requirements
4. Knowledge of gravity and pump/siphon dosed system requirements
5. Knowledge of timers and remote monitoring
6. Knowledge of bedding, testing, pipe connection methodologies
7. Knowledge of pump performance specifications, total dynamic head in pressurized systems
8. Ability to make mathematical calculations, conversions

Appendix B: Minnesota Decentralized Certification and Training

Overview

Minnesota provides an example of a state certification framework aligned to state licensing requirements, decentralized/onsite job roles, and specific training opportunities for workers provided by the University of Minnesota Water Resources Center. The information included in this section is obtained from the Minnesota Decentralized Certification and Training website and more detail on the program can be found in its webpage: https://www.pca.state.mn.us/water/subsurface-sewage-treatment-systems.

State Certification Framework

The Minnesota Pollution Control Agency regulates decentralized/onsite wastewater systems in its state. Many decentralized job roles such as design, installation, repair, maintenance, operation, and inspection can only be done by certified individuals.

All Minnesota licensed Subsurface Sewage Treatment Systems (SSTS) businesses must employ at least one designated certified individual for each specialty area offered by the business. Local and state government employees must obtain individual certification in the specialty area(s) applicable to their work, and local governments must have at least one staff member who has taken the online SSTS administrator training. In Minnesota, local units of government cannot require additional local licenses for septic system professionals beyond the state requirements.

Becoming and remaining certified requires:

- Training and examination
- Experience with SSTS work
- An application, including verification of experience
- Continuing education
- Certification renewal every three years

The following table includes the training and certification requirements as laid out in the Minnesota Pollution Control Agency (MPCA)'s SSTS individual certification and training program[25].

Type of Work	Training and Exams Needed	Required Certification	Required Experience
Install SSTS	Introduction, installing	Installer	• 15 SSTS installations, at least 1 each above- and below-ground • Observe five pump-outs and disposal with a Maintainer
Sewage tank evaluation, cleaning, and repairs; portable toilets and septage management	Introduction, maintaining	Maintainer	• 15 pump-outs and disposal with a Maintainer
SSTS operational assessment, adjustment, sampling, and interpretation of operational performance, repair, groundwater monitoring, and collection system maintenance	Introduction, service provider	Service Provider	• None
Design of Type I – Type III systems ≤ 2,500 gpd for residential strength waste	Introduction, installing, basic design, soils	Basic Designer	• 15 Individual Sewage Treatment System (ISTS) site and soil evaluations, designs, and management plans, at least one each above- and below-ground • Observe 4 installations and 5 pump-outs and disposal with a Maintainer
Design of Type I – Type V* systems ≤ 2,500 gpd for residential strength waste	Introduction, installing, basic design, soils, intermediate design and inspection	Intermediate Designer	• None

[25] https://www.pca.state.mn.us/water/ssts-individual-certification

Type of Work	Training and Exams Needed	Required Certification	Required Experience
Design of Type I – Type V* systems ≤ 10,000 gpd	Introduction, installing, basic design, soils, intermediate design and inspection, advanced design and inspection	Advanced Designer	• None
Inspection of Type I – Type III systems ≤ 2,500 gpd for residential strength waste	Introduction, installing, basic design, inspecting, soils	Basic Inspector	• 15 ISTS inspections, at least 1 each above- and below-ground • Observe 5 site and soil evaluations, designs, and management plans • 5 installations and 5 pump-outs and disposal with a Maintainer
Inspection of Type I – Type V* systems ≤ 2,500 gpd for residential strength waste	Introduction, installing, basic design, inspecting, soils, service provider, intermediate design and inspection	Intermediate Inspector	• None
Inspection of Type I – Type V* systems ≤ 10,000 gpd	Introduction, installing, basic design, inspecting, soils, service provider, intermediate design and inspection, and advanced design and inspection	Advanced Inspector	• None
Operation of systems > 10,000 gpd (Large SSTS)	Introduction, service provider	Service Provider	• Must also earn wastewater operator certification

* Type V SSTS require the expertise of an appropriately licensed Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience, and Interior Design (AELSLAGID) professional

University of Minnesota Training Aligned to Certifications

The University of Minnesota's Onsite Sewage Treatment training program offers training for all the certification specialties. The information from this section is from the Minnesota Decentralized Certification and Training website and can be found at: https://www.pca.state.mn.us/water/business-licensing-and-individual-certification.

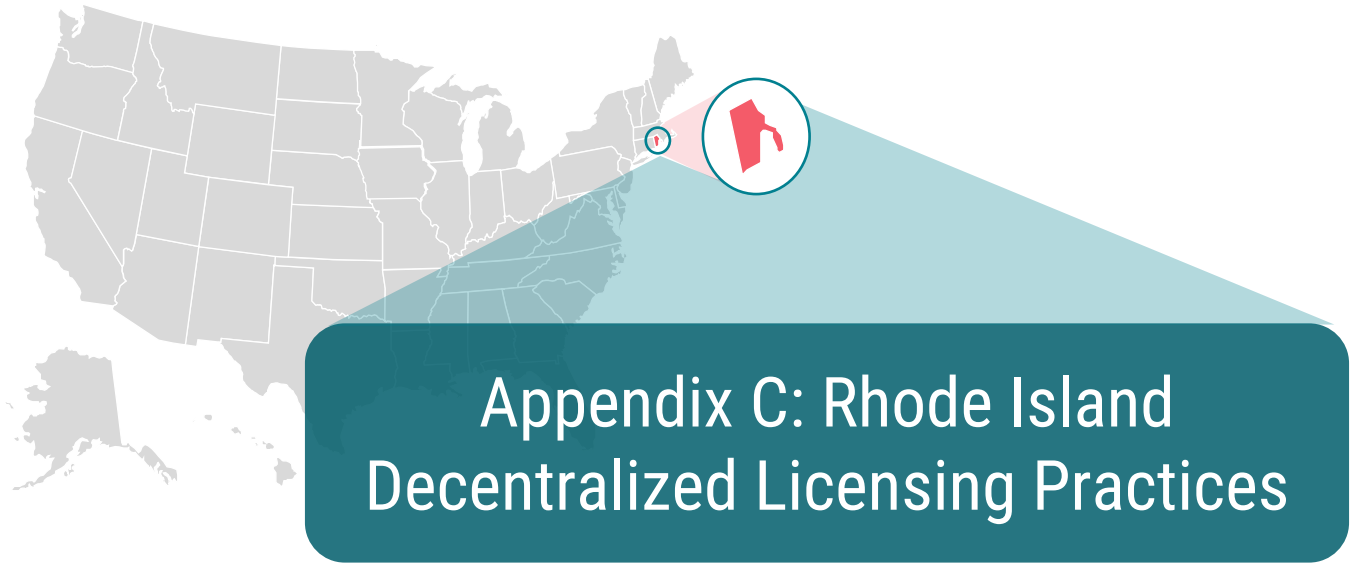
To enroll in the Intermediate and Advanced Design/Inspection workshops, a worker must first be an unrestricted certified designer or inspector. No other course has a prerequisite and can be taken in any order.

For certified individuals taking continuing education training, the courses provided by the University of Minnesota's Onsite Sewage Treatment Program are MPCA-accredited as direct credits, except the pipe layer certification, which earns attendees two direct credits and one related credit.

Courses are offered at varying intervals. Example of courses include[26]:

2019 OSTP X020 - Basic Design of Onsite Systems	**Description:** This 24-hour workshop teaches attendees to properly design various septic systems in preparation for the Basic Designer exam. Enrollees must have the current manual to use during the workshop.
2019 OSTP X515 - Soils	**Description:** This workshop prepares attendees for the Soils exam and provides participants with a detailed understanding of how particular soils affect the treatment of sewage. Participants will also receive instruction at a field location. Munsell Color Guides and other soil related materials are available for an additional fee.
2019 OSTP X030 - Inspecting Onsite Systems	**Description:** This 12-hour workshop identifies Minnesota requirements for existing and new system inspections and prepares participants for the Inspector exam.

[26] Information pulled from: https://septic.umn.edu/workshop-enrollment/precertfall and https://www.pca.state.mn.us/water/ssts-individual-certification



Appendix C: Rhode Island Decentralized Licensing Practices

Overview

The Rhode Island Department of Environmental Management (RIDEM), Office of Water Resources administers the regulations and programs related to decentralized/onsite wastewater systems for the state. The information from this appendix is from RIDEM's Onsite Wastewater Treatment System Program website and can be accessed at: http://www.dem.ri.gov/programs/water/owts/.

Rhode Island's decentralized regulations and requirements are premised on a set of administrative findings that impact the state's approach to standards around the decentralized/onsite wastewater industry. Among these findings are:

- Decentralized/onsite systems are an integral part of total wastewater infrastructure.
- Systems are not merely disposal systems. They are wastewater treatment and dispersal systems.
- Improper location, design, construction, and operations/maintenance may have a number of harmful effects, including contamination of drinking water and environmental impacts of bacteria and nutrient contamination.
- The science and technology for onsite wastewater treatment is advancing and regulators need to grow professionally in knowledge and information sharing to protect public health and the environment.
- Excess nitrogen and phosphorus in the water are contaminants.
- Cesspools are not an approved method of wastewater disposal and are considered substandard.

Decentralized/Onsite Job Functions

Below are highlights of basic standards required to participate in Rhode Island decentralized/onsite job roles. [27]

Site Evaluation and Design

Rhode Island established a four-level licensing framework for evaluation and design of onsite wastewater systems:

Class I Designer's License

Authorizes a person to design a repair to an onsite system if the system is not an alternative or experimental system with a design flow of less than or equal to 900 gallons per day or if the system is an alternative or experimental system with a design flow under 900 gallons per day and is designated by the state director as suitable for a Class I License designer.

Class II Designer's License

Authorizes a person to design a repair or an alteration to a structure of an onsite system under the following criteria:

- An onsite system, other than alternative or experimental systems, for residential use with a design flow of less than or equal to 2,000 gallons per day
- An alternative or experimental onsite system for residential use designated by the state director as suitable for a Class II Licensed Designer with a design flow of less than or equal to 2,000 gallons per day
- A commercial onsite system that is not an alternative or experimental system with a design flow of less than or equal to 900 gallons per day
- An alternative or experimental commercial onsite system designated by the state director as suitable for a Class II Licensed Designer with a design flow of less than or equal to 900 gallons per day.

A Class II License authorizes the design of an onsite system for new building construction that meets certain criteria, and the onsite system is on a lot that does not require a variance from any of the following provisions of the rules:

- The regulation related to onsite system installation in areas where there is a shallow depth to the seasonal high groundwater table or to a restrictive layer or bedrock from the original ground surface;
- Setbacks in the regulations for drinking water supplies; or
- Setbacks in the regulations for the Salt Pond and Narrow River Critical Resource Areas.

[27] https://rules.sos.ri.gov/regulations/part/250-150-10-6 accessed Sept 9, 2020

Other Design and Evaluation Licenses

- **Class III Designer's License:** A Class III license authorizes the design of any onsite system.
- **Class IV Soil Evaluator's License:** A Class IV license authorizes the performance of soil evaluations described in the regulations.

Class I, II, III, and IV licenses are in effect up to three years following the date of issuance.

Installation and Maintenance

The requirements to obtain a license for installation and maintenance of onsite wastewater systems in Rhode Island include the following:

Installer's License

Authorizes an individual to install, construct, alter, or repair an onsite system. A Licensed Installer shall install an onsite system in accordance with the regulations.

An Installer **obtains** a license by submitting a completed application along with a non-refundable application fee.

- Applicants for an Installer's License will be required to demonstrate possession of and ability to properly use a level or transit and to obtain a passing grade on a written examination. The examination is intended to demonstrate an applicant's understanding of the rules and the ability to read and interpret approved plans and specifications for onsite systems.
- Installer's Licenses are not transferable or assignable and shall automatically become invalid upon suspension or revocation.
- Installer's Licenses shall be in effect for a period not to exceed three years following the date of issuance.

Once an Installer's License has **expired**, the individual that held such license is prohibited from practicing as a Licensed Installer.

An Installer's License shall be **renewed** upon payment of a renewal fee and the submittal of proof of completion of any professional development continuing education required by the state director. There are different requirements for renewal based upon length of expiration.

An Installers License may be denied or revoked in an individual has provided incorrect, incomplete, or misleading information in obtaining the license or demonstrated gross or repeated negligence, incompetence, or misconduct in installing onsite systems.

Requirements to Obtain a License

An individual seeking a license must pass the appropriate examination administered or sanctioned by the Department. To qualify for an examination, the applicant must meet the minimum qualifications described below.

Class I: A valid Installer's License authorizing the installation of onsite systems or registration as a Professional Land Surveyor with the Rhode Island State Board of Registration for Professional Land Surveyors, or Registration as a Professional Engineer with the Rhode Island State Board of Registration for Professional Engineers. Professional Engineers registered in Rhode Island after December 31, 1994 must be registered as a Civil Engineer or Environmental Engineer.

Class II: Registration as a Professional Land Surveyor with the Rhode Island State Board of Registration for Professional Land Surveyors or Registration as a Professional Engineer with the Rhode Island State Board of Registration for Professional Engineers. Professional Engineers registered in Rhode Island after December 31, 1994 must be registered as a Civil Engineer or Environmental Engineer.

Class III: Registration as a Professional Engineer with the Rhode Island State Board of Registration for Professional Engineers. Professional Engineers registered in Rhode Island after December 31, 1994 must be registered as a Civil Engineer or Environmental Engineer.

Class IV: The minimum qualifications for the Class IV exam shall be satisfied by meeting any one of the following:

- Registration as a professional soil scientist by the Society of Soil Scientists of Southern New England or the American Registry of Certified Professionals in Agronomy, Crops and Soils;
- Four years professional experience in soil studies for onsite systems design in Rhode Island or in soil classification, mapping, interpretation, or a combination thereof and successful completion of nine semester hours in soil science from an accredited college or university; or
- Two years professional experience in soil studies for onsite systems design in Rhode Island or in soil classification, mapping, interpretation, or a combination thereof; and a bachelor's degree or graduate degree from an accredited college or university in soil science, geology, engineering, or similar discipline with successful completion of nine semester hours in soil science.

Examination Descriptions

The examination for a **Class I Designer's License** shall be a written examination that, at minimum, addresses the following:

- Principles of onsite wastewater treatment and dispersal;
- Understanding of the applicable state rules;
- Analysis of onsite systems failures; and
- Design and construction of onsite systems repairs, with consideration given to soil types and related constraints.

The examination for a **Class II Designer's License** shall, at minimum, address the following:

- Principles of onsite wastewater treatment and dispersal;
- Analysis of onsite system failures;
- Design and construction of onsite systems repairs, with consideration given to soil types and related constraints;
- Advanced principles of onsite wastewater treatment and dispersal;
- Understanding of the applicable state rules; and

- Design and construction of new onsite systems, including constraints to design imposed by soils.

The examination for a **Class III Designer's License** shall be a two-part written examination, each of which will be graded separately. The first part shall consist of the test given for the Class II License. Passage of the first part makes the applicant eligible for the Class II Designer's License. Active Class II Licensed Designers in good standing need only take the Class III portion of the exam. The two parts of the Class III examination do not have to be passed concurrently. However, if more than three years elapse after the applicant passes one of the components of the examination, the applicant must retake that portion of the examination originally passed more than three years earlier, unless a Class II License has been issued and is in good standing. In addition to including the Class II examination, the Class III examination shall address the following:

- Understanding of additional applicable state rules;
- Groundwater hydrology;
- Commercial wastewater treatment;
- Advanced wastewater treatment technologies; and
- Operation of electrical and mechanical components of onsite systems.

The examination for a **Class IV License** shall have a written and field component, each of which shall be graded separately. The written and field examinations for Class IV do not have to be passed concurrently. However, if more than three years elapse after the applicant passes one of the components of the examination, the applicant must retake that portion of the examination originally passed more than three years earlier. The Class IV License examination shall at minimum address the following:

- Principles of onsite wastewater treatment and dispersal;
- Understanding of the applicable state rules;
- Geology and soils of Rhode Island;
- Soil textural analysis and profile descriptions;
- Estimating mean seasonal high groundwater elevations using soil morphology; and
- Soil moisture and drainage characteristics of soils.

University of Rhode Island Training Opportunities

The University of Rhode Island houses the New England Onsite Wastewater Training Program, which provides both classroom and field training. Its mission is "to educate the public and wastewater practitioners on onsite wastewater systems, advance the use of conventional and innovative and alternative technologies to improve and protect public health and water quality, and to encourage sustainable development in the New England region." [28] The program's courses are approved for continuing education credits by regulatory agencies in Rhode Island, Massachusetts, and New Hampshire and allow individuals to prepare for their state's licensing exams.

[28] https://web.uri.edu/owt/

Appendix D: Matrix of Credential Programs and Alignment to Decentralized Career Pathways, Job Clusters, and Occupations

DECENTRALIZED CAREER PATHWAYS*, JOB CLUSTERS, AND OCCUPATIONS

			REGULATORY (PUBLIC SECTOR)						SKILLED TRADES (PRIVATE SECTOR)													PRIVATE SECTOR/PROFESSIONAL POSITIONS									
			Environmental Health		Environmental Compliance		Occupational Health/Safety		Manufacturing		Installation and Maintenance						Plumbing		Electrical		Servicer	Engineering				Sales		Science			
CREDENTIAL TYPE	CREDENTIAL	INSTITUTIONAL EXAMPLE	Specialist	Technician	Managers	Inspectors	Specialists	Technicians	Engineering Technologist	Technician	Installation and Maintenance, and Repair Workers	Wastewater Treatment Operator	Pipelayer	Excavating Operator	Earth Drillers	Equipment Operator	Plumber	Plumbing Technician	Electrician	Electrician Apprentice	Tank Servicer/ Sewer Pipe Cleaner	Civil Engineer	Environmental Engineer	Hydrologist	Wastewater Engineer	Manager	Representative	Geological Sample Test	Geologist	Water Resource Specialist	Soil Scientist
Degree Programs	Bachelor's Degree in Engineering: Civil, Biosystems, Wastewater, Hydraulic	Colorado School of Mines, University of Arizona, University of Tennessee-Knoxville, University of Washington, University of Wisconsin, University of South Florida																				X	X	X	X					X	X
Degree Programs	BS in Public or Environmental Health	Arizona State University, Ohio State University, University of Minnesota, University of Pittsburgh, University of Washington	X	X																										X	
Degree Programs	BS in Occupational Health and Safety	Columbia Southern University, Grand Valley State University, Southeaster Oklahoma State University					X	X																							
Degree Programs	AAS, Water Quality Management (WQM)	Red Rocks Community College																												X	
Degree Programs	AAS, Water and Environmental Technology	Clackamas Community College			X	X						X											X							X	
Degree Programs	AS, Manufacturing Engineering	North Central Technical College, Chippewa Valley Technical College							X	X												X									
Certification	Certified Safety Professional (CSP) and Associate Safety Professional (ASP)	Board of Certified Safety Professionals					X	X		X				X	X	X	X	X	X	X											
Certification	Certified Safety Auditor (CSA)	The Institute of Internal Auditors			X		X																								
Certification	Construction Health and Safety Technician (CHST)	Board of Certified Safety Professionals						X			X			X		X															
Certification	Earth Driller Certification	The National Groundwater Association													X																
Certification	Registered Environmental Health Specialist/Registered Sanitarian	National Environmental Health Association (NEHA)	X	X																		X	X	X	X			X	X	X	X
Certification	Industrial Technology Maintenance (ITM) Certifications	National Incident Management System (NIMS)																													
Certification	Occupational Health and Safety Technologist (OHST)	Board of Certified Safety Professionals						X	X	X	X									X											
Certification	Manufacturing Technologist (CMfgT) Certification	Standards for Manufacturing							X																						
Certification	Wastewater Operator Certification Review (aligned to state licensing)	Delaware Technical Community College									X	X		X							X										
Certificate**	Onsite Wastewater Design Certificate	University of Arizona, Michigan State University, University of West Alabama, Colorado School of Mines, Florida Onsite Wastewater Association									X																				
Certificate**	Onsite Wastewater Installation Certificate	University of Arizona, Michigan State University, University of West Alabama, Texas A&M University's OSSF									X																				
Certificate**	Onsite Wastewater Soil Certificate	University of Arizona, North Carolina State University (Crops and Social Sciences Department), Ohio State University, Soil Environment Technology Learning Lab, Virginia Tech																													X
Certificate**	Environmental Health Certificate Program	Rochester Institute of Technology OSHA Education Center, Pacific Northwest OSHA Education Center University of Washington	X	X																											
Certificate**	Water and Wastewater Environmental Engineering Certificate	Kansas State University, Wilkes University, University of Washington, University of Wisconsin (Agriculture and Biosystems Department)																					X		X						
Certificate**	Water Technology Certificate of Completion	New Mexico State University										X																			
Post-Secondary Courses - No Credential**	Decentralized/Onsite Wastewater Environmental Training	Delaware Technical Community College, University of Minnesota, University of Rhode Island, University of Tennessee, Utah State University									X	X			X																
Post-Secondary Courses - No Credential**	Wastewater Treatment, Onsite Water Reclamation, and Reuse (Class Credit)	California State University - Sacramento, Colorado School of Mines										X																		X	
Post-Secondary Courses - No Credential**	Environmental Compliance Program	USC Environmental Health and Safety Department			X	X																									
Post-Secondary Courses - No Credential**	Sewer and Pipe Cleaning Courses	International Institute of Sewer and Pipe Cleaning Courses																			X										

* The academic/educational pathway is not included in this matrix because 1) there are no training programs to train people in the job clusters of "research" or "teaching" and, 2) those jobs are likely only accomplished with advanced degrees, not bachelor's or associates and none of the other categories (e.g., certification, certificate, or post-secondary) would suffice for training in that area.
** (Includes Continuing Education)