

SEEING GREEN



**Green Infrastructure Maintenance Training and
Workforce Development Opportunities in Northeast Ohio**

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Over the coming decades, the Northeast Ohio Regional Sewer District will be making one of the largest infrastructure investments in the region's history to address combined sewer overflow (CSO) to Lake Erie and its tributary streams. In order to leverage the District's investment, a partnership has formed between The Cleveland Foundation, LAND studio and the District. The partnership marries engineering with community development in an innovative way to better serve Greater Cleveland. This report is one component of a holistic strategy to leverage the District's investment for community benefit, including job creation, vacant land strategies, and neighborhood re-investment.



Contributors



LAND studio works to identify, create and implement a public space vision for Cleveland. Its mission is to create places and connect people through public art, sustainable building and design, collaborative planning, and dynamic programming. LAND studio strives for balance in its portfolio by completing projects in the city's most visible public spaces as well as its disadvantaged communities. For more information about LAND studio, visit our website at www.land-studio.org.



Neighborhood Progress Inc. is a local community development funding intermediary with extensive experience in investing in community revitalization work in Greater Cleveland. NPI works in partnership with community development corporations, local foundations, the business community, and government to create a strong and productive system that visibly improves many neighborhoods and enables Cleveland's residents to enjoy a better quality of life. For more information about NPI, visit our website at www.npi-cle.org.



Green For All is a national organization working to build an inclusive green economy strong enough to lift people out of poverty. It works in collaboration with the business, government, labor, and grassroots communities to increase quality jobs and opportunities in the green economy – all while holding the most vulnerable people at the center of its agenda. For more information about Green for All, visit our website at www.greenforall.org.



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The Center for Economic Development is the economic development research arm of the Maxine Goodman Levin College of Urban Affairs at Cleveland State University and provides research and technical assistance to government agencies, non-profit organizations, and private industry. The Center has expertise in the research areas of ecology of innovation, entrepreneurship, performance of economic clusters, industry analysis, economic analysis of cities and regions, economic impact, economic development strategy and policy, workforce development, and evaluation of economic development initiatives. For more information about The Center for Economic Development, visit our website at <http://urban.csuohio.edu/economicdevelopment/>.

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As in most older industrial cities, Cleveland has a combined sewer system, which means that its sewers carry a combination of raw sewage, stormwater, and industrial waste in one pipe. The first sewer pipes built in the city over a century ago were designed to accommodate a much less developed urban environment than the one we live in today.¹ Thus, the capacity of the sewer system is too small to handle the quantity of stormwater runoff we receive, and even a small rain event can trigger a combined sewer overflow (CSO), releasing a combination of raw sewage and stormwater into Lake Erie and its tributaries. To address this issue, a Consent Decree was filed between the U.S. Environmental Protection Agency (US EPA), the State of Ohio, and the Northeast Ohio Regional Sewer District (NEORS) in July 2011.² Under this Consent Decree, NEORS is required to reduce the number of CSO events that occur, which will ultimately increase the water quality of Lake Erie and its tributaries. NEORS will be doing this through a comprehensive Long Term Control Plan, called Project Clean Lake, that includes both traditional gray infrastructure (pipes) and green infrastructure, or stormwater receiving landscapes.³

In addition to investing significantly in green infrastructure to meet its mandate, NEORS is implementing a stormwater fee to rate payers in 2013. The stormwater fee is based on impermeable surface area with credits available to property owners that are able to capture stormwater on site. This incentivizes the installation of green infrastructure on private property, particularly on those properties with high fees, such as universities, hospitals, and other large land holders. Parallel to the NEORS green infrastructure investment and the stormwater fee, the City of Cleveland passed a Complete and Green Streets Ordinance, requiring new projects within the public right of way to incorporate design elements for stormwater management through green infrastructure.⁴ The ordinance went into effect in January 2012 and is expected to increase the city's green infrastructure footprint over the coming decades. Like the NEORS green infrastructure practices, ongoing maintenance of the city's green infrastructure holdings is a consideration.

It is with an eye toward preparing the Greater Cleveland market for green infrastructure maintenance that this report was undertaken. LAND studio has worked in conjunction with Neighborhood Progress Inc. (NPI), Green For All, and The Center for Economic Development at Cleveland State University (The Center) to conduct the research reflected in the following report. The intention of this report is to be a conversation starter for developing both a green infrastructure maintenance training program and a workforce development program using green infrastructure as an on-ramp to an articulated career pathway for targeted populations.

Executive Summary

Green Infrastructure Potential and the National Story

The first chapter is based on Green For All's research on green infrastructure and jobs at the national level. It suggests that as the country reinvests in its water infrastructure in new ways, blending traditional gray infrastructure with green infrastructure, cities are able to reap community benefits from the investment in green infrastructure. Green infrastructure offers accessible job opportunities and triple bottom line benefits that can be realized through a number of channels, including workforce development programs. Five practices for creating a successful workforce development program are highlighted with examples of how each is implemented differently around the country.

Green Infrastructure Potential and the Local Story

The second chapter summarizes The Center's economic impact assessment of the maintenance of NEORSD's green infrastructure implemented as a part of Project Clean Lake. NEORSD will be required to maintain this green infrastructure in perpetuity, to ensure its proper functioning. With that requirement, it is possible to assess both the maintenance costs and the regional economic impact of the maintenance of NEORSD's green infrastructure.

It is expected that the maintenance cost of all NEORSD green infrastructure from 2020 to 2024 will be approximately \$11 million. That spending will create a total of 219 jobs, 146 of which will be directly related to the maintenance of green infrastructure. While only NEORSD-related green infrastructure maintenance jobs were assessed in this study, it is expected that the number of jobs created will be greater due to the installation and maintenance of green infrastructure by entities other than NEORSD, including organizations and municipalities.

Greater Cleveland and Green Infrastructure: a Need for Maintenance Training

The third chapter outlines an immediate need for developing a green infrastructure maintenance training program in the Greater Cleveland area, and foresees potential to grow a workforce development program to complement the training program. Eight local organizations are profiled for their ability to play a role in either a training or workforce development program. In addition to the eight organizations highlighted in this report, there is an ongoing conversation about the need to educate all levels of our community in Northeast Ohio on stormwater management; from school-aged children to governmental officials, grounds maintenance workers, and everyday residents.

Recommendations: Strategies for Moving Forward

As this report is an exploration of the potential that exists within the Cleveland market for the creation of a training and workforce development program, further action is required. Recommendations for moving forward could include:

1. Convening a meeting of all institutions surveyed to present the findings of the report and discuss next steps as a group.
2. Identifying a taskforce charged with overseeing the implementation of the training program.
3. Recognizing that a maintenance training program can become an integrated part of a workforce development program as the green infrastructure market develops.
4. Designing the training program to provide a credential upon completion.
5. Developing a multi-level community education program

The five best practices for creating a successful workforce development program identified in Chapter I are applied to Cleveland. The following are recommendations for how a workforce development program can be created in Greater Cleveland, using green infrastructure maintenance as an entry point to an articulated career pathway.

1. Partner with public agencies, such as NEORS and the county's Workforce Investment Board, to gain access to on the job training experience and fee for service contract work.
2. Develop training and certification programs with green infrastructure education professionals from organizations like the Cleveland Botanical Garden, Ohio State University Extension, and NEORS.
3. Establish partnerships that can help establish career development pathways with organizations like Towards Employment, Rid-All and S.A.W., Inc.
4. Support creation and development of businesses that can supply green infrastructure products and workers under the Evergreen Cooperatives model.
5. Promote and advocate with NEORS and local anchor institutions for enabling policy that guides opportunities to impacted communities.

Chapter 1: Setting the Stage

Section 1: Green Infrastructure Potential at the National Level and in Cleveland

Basic water infrastructure in the U.S. is crumbling. As a result, we see a steady stream of sewage overflows and leaks that put us all at risk of contamination from bacteria, parasites, viruses, pharmaceuticals, cleaning products, and other chemicals. According to the Environmental Protection Agency (EPA), there are now between 23,000 and 75,000 sanitary sewer overflows in this country each year, and 3.5 million Americans get sick just from swimming in polluted water. Meanwhile, 40 percent of our lakes and rivers are too polluted to support recreational activities and aquatic life.

Meeting the water challenge – building a sustainable water future – will require a national effort. The U.S. must strive to increase efficiency of water use, restore waterways and groundwater tables, repair decaying water infrastructure, decrease polluted runoff, and prevent contamination.

Cleaning up our water will also create opportunities. Investing in water infrastructure can create jobs, reduce pollution, improve public health, and promote economic growth. The EPA has estimated that the U.S. needs to invest at least \$188.4 billion over the next five years just to make water systems safe and reliable.⁵ This level of investment represents an opportunity to create roughly 2 million jobs. Investments in our water infrastructure would also generate an estimated \$265.6 billion in economic activity.⁶

By using green infrastructure – including permeable pavement, rain gardens, constructed wetlands, and green roofs – Cities can reduce stormwater runoff and pollutants, protect groundwater, and even improve air quality, at the same time that green infrastructure is improving the environment and offering accessible job opportunities and career development entry-points to communities most impacted by economic and environmental crisis.

In the coming years, thousands of new green infrastructure projects will be installed throughout the country. As a cost-effective strategy to comply with the requirements of the Clean Water Act, some cities will create enough green infrastructure work in the coming decades to support a new industry that installs, supplies, maintains, and monitors green infrastructure.⁷ For example, New York City has committed \$2.4 billion to green infrastructure projects over the next 20 years,⁸ and Philadelphia will spend approximately \$1.67 billion on green infrastructure through 2036.⁹ As an indication of the scaling up of green infrastructure investment over the next few years in cities across the country, New York City has already allocated \$192 million to green infrastructure improvements through 2015,¹⁰ and NEORS plans to spend at least \$42 million on green infrastructure through 2020 in areas around the City of Cleveland, which is the subject of this study.¹¹

Green Infrastructure Investments Represent Accessible Jobs

Not only will these major investments create construction jobs, but additional jobs will also be created, because cities will need to ensure that newly installed green infrastructure is properly maintained. Many jobs associated with green infrastructure are accessible to traditionally under-employed and disadvantaged groups, provide decent wages, and offer career advancement opportunities. A brief overview of these careers is useful because it provides an idea of what these jobs will entail, how they will benefit unemployed persons, and how they will offer starting points for better-paying jobs.

Occupations associated with the operations and maintenance (O&M) of green infrastructure are particularly accessible. These occupations range from paving to farming and landscaping, plumbing, and irrigation systems energy auditing. In addition, most green infrastructure systems require regular maintenance, caring for plantings, and ensuring proper function of green infrastructure technology. Such work can involve vacuuming pervious pavement, annual cleaning of cisterns, spot weeding, pruning, erosion repair, trash removal, and mulch raking of rain gardens, cleaning of inlets and periodic replacement of paver blocks in pervious pavement, or remulching void areas, or treating or replacing diseased trees and shrubs in vegetated swales. Occupations in this field require low to medium skills and training, and they involve a fair amount of physical labor. Table I below presents a sample of occupations in this field.

Table I: Occupations in Operations and Maintenance of Green Infrastructure

Landscaping and Groundskeeping Workers
Operating Engineers and Construction Equipment Operators
Maintenance and Repair Workers, General
Pump Operators, Except Wellhead Pumpers
Septic Tank Servicers and Sewer Pipe Cleaners
Water and Liquid Waste Treatment Plant and System Operators
General and Operating Managers
Crop, Nursery, and Greenhouse Farmworkers and Laborers
Pavement, Surfacing and Tamping Equipment Operators
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters
Energy Auditors (Irrigation Systems)

As a whole, entry-level wages in O&M may not be high enough to attract a broad spectrum of workers, but some O&M occupations represent valuable entry points. National data show that entry-level wages for many occupations associated with O&M are near minimum wage levels, with landscape workers, greenhouse workers, and pipelayer helpers all earning below \$9 per hour. This type of work is especially likely to be close to minimum wage in the private sector, where some landscaping firms are notorious for paying very low wages and providing no benefits to their workers.¹² By contrast, occupations that require higher levels of education and training command higher entry-level wages. In sum, once O&M workers gain experience and add to their skill set via training, they can receive higher wages and transition from entry-level jobs to occupations that require more training and certification.

To get an even better sense of the levels of education and training necessary to perform work responsibilities of each specific green infrastructure occupation, Green For All used Occupational Information Network (O*NET) Job Zone classifications. This additional information, in turn, makes it possible to better estimate the salaries, educational and training requirements, and nature of the work that green infrastructure investments will create in cities across the U.S. The O*NET database is sponsored by the US Department of Labor's Employment and Training Administration (USDOL/ETA), and it contains information on hundreds of standardized and occupation-specific descriptors. O*Net classifies job zone 1 as occupations that may require a high school diploma or GED certificate, job zone 2 as occupations that usually require a high school diploma, and job zone 3 as occupations that require training in vocational schools, related on-the-job experience, or an associate's degree.¹³ There are a number of occupations in the sample that can be characterized as both accessible and well compensated. These jobs require some work experience, a high school diploma, additional job-related course work, and they offer wages upward of \$20 per hour.¹⁴

The table below summarizes the types of occupations associated with O&M, along with the O*Net Job Zone classification.

Table 2: Wages and O*Net Job Zones for O&M Occupations

Occupation	O*NET Job Zone	National Entry Level Hourly Wage	National Median Hourly Wage
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	2	\$13.00	\$20.00
Landscaping and Groundskeeping Workers	1	\$8.23	\$11.26
Operating Engineers and Construction Equipment Operators	2	\$12.85	\$19.96
Maintenance and Repair Workers, General	3	\$10.01	\$16.84
Pump Operators, Except Wellhead Pumpers	2	\$12.41	\$21.09
Septic Tank Servicers and Sewer Pipe Cleaners	2	\$10.29	\$16.22
Water and Liquid Waste Treatment Plant and System Operators	2	\$12.21	\$20.09
General and Operating Managers	3	\$22.87	\$45.74
Crop, Nursery, and Greenhouse Farmworkers and Laborers	N/A	\$8.99	\$12.37
Pavement, Surfacing and Tamping Equipment Operators	2	\$11.40	\$16.96
Plumbers	3	\$13.61	\$22.96
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	N/A	\$8.87	\$12.99
Energy Auditors (Irrigation Systems)	3	\$16.48	\$30.78

Source: Bureau of Labor Statistics

Information in this table demonstrates that operations and maintenance jobs can open the door to other occupations in the water sustainability sector. Their accessibility and projected growth make them occupations well-suited for entry-level workers looking to explore career development options in one of the many sectors of water sustainability. Given enough training and education, those entry-level jobs can lead to higher wage green jobs.

With this background information about O&M jobs in mind, Cleveland is well positioned to leverage stormwater investments to create accessible job and career development opportunities for impacted communities. The following section describes how agencies responsible for mitigating stormwater runoff benefit from promoting green infrastructure investments using a triple bottom line framework and how these agencies can deliver inclusive opportunities to impacted communities using community benefits strategies.

Section 2: Seizing the Opportunity: Building Broad Public and Political Support for Green Infrastructure Investments by Promoting and Delivering Triple-bottom Line Benefits.

Implementing a community benefits approach as cities across the US invest millions, even billions, of dollars to upgrade their water infrastructure will result in increased support for current and future infrastructure investments. This is especially true for green infrastructure investments, because the triple bottom line outcomes possible through green infrastructure will garner support from a broad spectrum of stakeholders who have different priorities and values. Promoting green infrastructure solely through an environmental and water quality lens dramatically, and unnecessarily, limits the pool of likely green infrastructure supporters. Directing likely supporters to consider the broad range of green infrastructure's economic and social benefits and using community benefits strategies to deliver results will galvanize support for green infrastructure among stakeholders whose priorities lie outside water issues, like economic development, public health, public safety or neighborhood beautification.

Managing stormwater is a city responsibility usually allotted to stormwater utilities or water departments. As inadequacies of water systems have become clearer over time, these utilities have begun exploring and investing in solutions like green infrastructure. However, stormwater agencies have compelling reasons to pursue community benefits strategies in tandem with those green infrastructure investments.

First, public agencies have a broad duty to provide for the general welfare of their communities and their social, environmental, and economic needs. Stormwater agencies responsible for addressing problems with water infrastructure may not be specifically tasked with addressing local problems like unemployment, neighborhood blight, or challenges faced by marginalized groups. Nevertheless, these agencies do function as component parts of a government structure, and governments *do* have a duty to provide for the public good. City and county governments are charged with tasks like creating jobs, spurring economic development, addressing social ills, and protecting the environment through their agencies, which may include public utilities. By prioritizing community benefits, cities and counties will build support for their work among non-traditional partners, like economic development groups and social organizations, and they will lead communities in promising directions by acting on behalf of the public interest in the broadest sense of that term.

Additionally, city agencies strive to extract the greatest benefit possible from public funds. Cities are particularly motivated at present to squeeze maximum value out of each dollar they spend, because budgets are tight. For cities across the U.S. "recession-mindedness is still standard operating procedure," thanks to the economic crisis, and cities are forced to handle challenges using

smaller budgets than before. Cities that pursue community benefit strategies are able to extract more value out of every dollar because they advance social, economic, and environmental goals at the same time. When cities install green infrastructure, they provide environmental benefits to their communities. If these same cities also implement targeted hiring strategies during the green infrastructure installation and maintenance process, then they concurrently advance social goals because such strategies help connect residents from areas marked by high rates of unemployment and limited career pathway access to quality jobs. By hiring local, targeted workers, these same cities also boost the local economy, because those workers are more likely to spend their income locally, creating a cycle of benefits.¹⁶

Further, members of the public will closely scrutinize the green infrastructure projects that stormwater agencies install using public funds. This is particularly true given that cities throughout the U.S. will have no choice but to increase taxes and fees to install stormwater infrastructure. Stormwater agencies must convince the public that green infrastructure is a useful and valuable investment. To persuade the public of the benefits of these investments, agencies are likelier to succeed if they can point to an array of advantages resulting from green infrastructure investments. When cities can show, in measurable terms, how money spent on green infrastructure addresses several community issues at the same time – like floods, high unemployment, and local business failures – those successes will resonate with the public.

Water utilities will be able to show that community benefit strategies represent an effective use of public funds. For example, when workers are paid more under a community benefits strategy, turnover rates will decrease, levels of worker reliability will increase, and work quality will improve.¹⁷

In addition, a community benefits strategy will champion contractors who pay fair wages and benefits, and it will limit reliance on contractors who cut corners on wages and benefits to keep costs down and bids low. Using a community benefits strategy means that cities will be less likely to partner with contractors who cut corners, leaving cities to repair and replace projects after the contractors have been paid and moved on to their next opportunity. Promoting community benefits also fosters competition among reliable bidders, boosting standards for wages and working conditions. Such improvements are important because employees who receive fair wages and benefits are less likely to rely on benefits provided by cities or other levels of government for food, housing, and health care.¹⁸

By contrast, when cities award green infrastructure contracts to low road firms that pay low wages, offer no job security or benefits, provide no career pathway opportunities, leave people of color, women, and disadvantaged groups by the wayside, and fail to incorporate community benefits goals into their agenda, they limit the potential positive impact of public expenditures; and possibly also create detrimental outcomes.¹⁹

When cities select low road firms to install and maintain public works, taxpayers pay for the installation of those projects and then pay again when the workers who received poverty wages and limited or no benefits turn to public safety-net programs for basic needs.²⁰

When the sole goal of public project contractors is to keep costs low, they are not motivated to re-direct dollars back to the local economy or to transition people in underrepresented groups to career pathways. When cities rely on firms that don't pursue community benefits for green infrastructure installation and maintenance, they make shortsighted, use of limited public dollars.²¹

Finally, cities that pursue community benefits strategies will distinguish themselves by implementing innovative, comprehensive solutions to problems that face their communities. Public agencies that are already incorporating community benefits strategies into their infrastructure investments include the San Francisco Public Utilities Commission, with the adoption of an Environmental Justice Policy in 2009 and a Community Benefits Policy in 2011.²²

Similarly, the Metropolitan Sewage District of Greater Cincinnati is pursuing community benefits through Project Ground Works, a major initiative that seeks to deliver triple bottom line benefits from infrastructure investments.²³ Other agencies like the Milwaukee Metropolitan Sewerage District, Los Angeles Department of Water and Power, and the Portland Water Bureau have incorporated components of community benefits standards into their infrastructure work. Pursuing green infrastructure investments within a community benefits framework, these cities will attract recognition and have greater opportunities to get funding for their work. Cities that take the lead will also set examples for other cities facing similar challenges.

Section 3: Best Practices Using Green Infrastructure as Workforce Development Entry-points

For the last two years, Green For All has been identifying areas of opportunity in stormwater investments that can create employment and business opportunities for communities most impacted by environmental and economic crises. Green infrastructure investments will create accessible job opportunities that can serve as stepping stones on a career development pathway, particularly in the operations and maintenance field. Organizations are connecting members of local communities to green infrastructure through initiatives in workforce development, education, and economic development. These groups are diverse with respect to the populations they serve, the skills they teach, and the types of work they perform, but all of them recognize that green infrastructure has the potential to transform their communities.

Based on interviews with social enterprise and workforce development staff throughout the country, we identified five must-have elements that allow organizations to build a successful workforce development programs in green infrastructure. Organizations in our study are engaged in installation of green infrastructure, operations and management, education and outreach to community members, efficiency audits, and cultivation of food and plants.

The five elements identified in our study can help build articulated career development pathways using green infrastructure work as an entry point. Some of the case studies presented in the following pages have not been applied to green infrastructure investments yet, but the successful components of those programs may be applied to the green infrastructure realm. The five elements that organizations use to establish functional workforce development programs are:

1. Partnering with public agencies to gain access to on-the-job training experience and fee for service contract work,
2. Developing training and certification programs with green infrastructure education professionals,
3. Establishing partnerships that can help establish career development pathways,
4. Supporting creation and development of businesses that can supply green infrastructure products and workers, and
5. Promoting and advocating for enabling policy that guides opportunities to impacted communities.

I. Partnering with Public Agencies to Gain Access to On-The-Job Training Experience and Fee for Service Contract Work

One of the biggest challenges for workforce development programs in any sector is gaining access to on-the-job training experience and fee for service contract work. Public agencies can significantly address this challenge by partnering with workforce development programs that have the necessary training and skill to install and maintain green infrastructure. This allows programs to offer valuable work experience and jobs to their participants, while securing project revenue to sustain program operations that fulfill other public service goals, such as reducing high-school drop-out rates and helping individuals transition from homelessness.²⁴ For public agencies, these partnerships provide cost-effective ways to ensure work is performed by organizations that have proven track records for performing high-quality work.

Organizations around the country have established partnerships with local municipalities and utilities to perform fee for service contracts in land conservation, water conservation, and green infrastructure. Examples of such organizations include Onondaga Earth Corps, Los Angeles Conservation Corps, Mile High Youth Corps, and San Francisco Conservation Corps.

CASE STUDY:

Onondaga Earth Corps (OEC) crew members participate in urban forestry projects, stormwater management projects, private property management and community environmental education and outreach. In 2009, OEC was part of a team awarded an outreach and education grant by Save the Rain, a comprehensive stormwater management plan intended to reduce pollution in Onondaga Lake and its tributaries. Today, OEC crew members carry out educational workshops and appear in special events promoting the Save the Rain program in needy neighborhoods.

In 2010, OEC was awarded a county contract to pilot O&M on four newly built

green infrastructure parking lot projects in Syracuse. Prior to the county contract, members of OEC's operations and maintenance crews were earning \$7.25 to \$9.25 per hour. Under the county contract, members of the same crew earn between \$11.75 and \$13 per hour.

Gregory Michel, Director of OEC, believes that the organization's ability to secure contracts and funding through the Save the Rain program had a lot to do with timing and development of community relationships. OEC was a leading entity in community based urban forestry and green infrastructure prior to the current efforts by the county. When discussions began about maintenance for green

infrastructure, OEC was well positioned to access work opportunities and the political leadership was in favor of making OEC a part of their green infrastructure strategy. In the past three years, Onondaga County has installed over 100 green infrastructure projects, all of which will require some kind of ongoing, specialized maintenance. As the installation warranties for these projects expire, the county will be looking to community-based groups like OEC to implement maintenance plans. Mr. Michel sees an opportunity for OEC to take on more maintenance work and to train other neighborhood-based groups to implement green infrastructure maintenance. He expects that this will help further develop OEC and its mission.

2. Developing Training and Certification with Green Infrastructure Education Professionals

The lack of established uniform certification programs is a key obstacle for both workers seeking opportunities in green infrastructure and contractors in need of qualified workers. No universally recognized certification exists for green infrastructure installation and maintenance. Instead, efforts to develop training and certification programs remain regional, with additional differences between urban and rural areas. At the same time, a number of different entities, including city departments, workforce development programs, and educational institutions, have taken steps to address some of these gaps by developing certification programs that cover O&M as part of overall green infrastructure training.²⁵ Partnerships between local agencies, workforce development programs, education professionals, and unions that result in developing recognized training and certification programs are key to building a career development pathway using green infrastructure.

To promote green infrastructure training and certification, local governments will need to develop consistent installation and maintenance standards that are incorporated into trainings people receive, so that there is a match between the skills of the workers and the government's standards. Once a baseline is set for elective maintenance practices, local governments or outside groups would have the flexibility to design tailored programs to meet the needs of their communities. Local governments could phase in the use of certifications, beginning with informal trusted contractor programs with voluntary training opportunities. This approach is already being used in Montgomery County, Maryland, Seattle, Washington, and Arlington County, Virginia. Once a practitioner has completed stormwater training, including operations and maintenance of green infrastructure, through the local government program, that practitioner is put on a list that can be shared with homeowners. For communities that are just beginning to implement green infrastructure practices, an informal list may be most appropriate. However, the connections between government entities and certified third parties should be expanded and formalized. Formalizing the process might entail designing a certification process for landscape contractors and stormwater practitioners based on local government maintenance standards. Local governments could then steer future work opportunities toward certified contractors by maintaining a list of pre-approved certified contractors.

CASE STUDY:

Certification programs should be modeled after existing trainings organized by local governments like Montgomery County and through universities and community colleges, all of which offer the infrastructure to conduct certifications. For instance, North Carolina State University (NCSU) Cooperative Extension offers a Best Management Practice (BMP) Inspection and Maintenance Certification for commercial landscapers, property owners, municipal staff, homeowners associations, and other professionals. This program offers sessions on stormwater BMP functions, stormwater regulations, elements of maintenance, maintenance for green BMPs including bioretention and permeable pavements, and licensing and certification. As of 2010, there were approximately 10 cities and counties across North Carolina that require NCSU's certification for anyone maintaining or inspecting stormwater BMPs. The University of Minnesota Extension's Stormwater Education Program, known as Stormwater U, also offers workshops for practitioners, engineers, developers, and field staff about stormwater issues for MS4 operators. Part of Stormwater U is an Advanced Stormwater BMP Maintenance workshop for stormwater BMPs that includes sessions on properly scheduling maintenance, designing BMPs for maintenance, stormwater plants and maintenance, essential elements of maintenance, and field assessments. Pratt Institute in New York City offers a Green Infrastructure Certificate through its Center for Continuing and Professional Studies in partnership with Pratt's Urban Environmental Systems Management Program and the New York City Soil and Water Conservation District. The program requires 21 hours of coursework focusing on green roofs, public rights-of-way, or innovative green infrastructure study with core courses in design, construction, maintenance, and monitoring.

For more information on this topic see [Staying Green: Strategies to Improve Operations and Maintenance of Green Infrastructure in the Chesapeake Bay Watershed by American Rivers and Green For All.](#)

3. Establishing Partnerships that Can Help Establish a Career Development Pathway

Effective workforce development pathways often grow out of strong partnerships. Incorporating diverse stakeholders into the design and implementation of workforce development programs broadens support for initiatives, ensures that training is aligned with employers' needs, and increases the likelihood of achieving successful outcomes, which include job placement, a well trained workforce providing high quality work, and the provisions to disadvantaged residents of access to career pathways.

It is instructive to identify the shared elements that make models successful. They all take steps to create accessible on-ramps for trainees, by engaging employers in the design and delivery of skills training. Through this process employers can provide paid work-based learning opportunities. Where there are barriers to access, such as civil service requirements or union apprenticeship exams, programs provide targeted educational and vocational training and mentorship. Most also include intermediary job classifications leading to full-time paid employment with public agencies and membership in partner craft unions assuring increased access to quality career pathways. Most importantly, successful programs demonstrate the power of diverse stakeholder partnerships to meet public agencies' need for skilled workers and disadvantaged communities' need for access to entry-level jobs and quality career pathways. Below are snapshots of three model workforce development partnerships creating access to entry-level jobs with municipal utilities, and a more in-depth case study.

Philadelphia Water Department: Water Instrumental Apprenticeship Pipeline

Philadelphia Water Department's (PWD) Apprenticeship Pipeline program is a successful workforce development partnership model building pathways into quality careers with a municipal utility. The program grew out of a recognized need to recruit and train local workers to fill existing and projected vacancies caused by a shortage of eligible workers and expected retirements. Leveraging existing capacity, PWD partnered with Philadelphia Academies Incorporated, an intermediary that connects area high schools with the business community through the academy model, and the Utilities' union to provide mentors.

The program advances pipeline model with an industry-informed, high school-based pre-apprenticeship component linked to a post-high school apprenticeship program offering full-time civil service employment with the utility. While in high school, students participate in structured career planning and industry supported work readiness and technical skills training. In their senior year, qualified participants become pre-apprentices. Immediately after graduation, they enter into paid internships with the utility and mentorship with trained utility employees. During their internship, participants earn industry-recognized certificates and become eligible for employment with the utility. Upon completing their internship, pre-apprentices transition into full-time entry-level Water Instrument Apprentices with the utility.

Philadelphia Water Department's (PWD) Apprenticeship Pipeline program provides an effective model of how to leverage existing resources and stakeholders to create high quality, employer-aligned workforce training embedded in an articulated pipeline into quality union careers with the utility.

The San Francisco Public Utilities Commission: 9910 Pre-Apprenticeship Training Program

The San Francisco Public Utilities Commission (SFPUC) operates another successful workforce development partnership program. The *9910 Pre-Apprenticeship Training Program* is a pipeline model creating opportunities for disadvantaged residents to receive the requisite training and support to become Stationary Engineer Apprentices and full-time civil service employees at the Utility's Waste Water Enterprise.

Participants for the program are recruited from disadvantaged communities adjacent to the city's Southeast sector wastewater treatment. Following rigorous admissions screening participants become employees of the utility under a special classification. They receive paid on-the-job training and mentorship along with job readiness, academic, and apprenticeship exam preparation services. The goal of the training, designed in partnership with the local Stationary Engineer union and delivered by California Maritime Academy faculty, is to help participants pass the Stationary Engineers Apprenticeship exam. Candidates who pass the exam enter the Stationary Engineer's Apprenticeship program become full-time employees of the utility and continue to receive on-the-job training until they become eligible to become journey-level Stationary Engineers.

SFPUC's *9910 Pre-Apprenticeship Training Program* is notable for providing a fully articulated pathway linking residents of the city's disadvantaged Southeast communities to and preparing them for entry-level union jobs performing mission critical duties for the utility.

San Francisco Department of Public Works: Gardener Apprenticeship Program

The *San Francisco Department of Public Works' (SFPW) Gardener Apprenticeship Program* is another successful workforce training partnership model. The program, also known as the Horticulture Training Program, provides structured training for entry-level gardening positions with the agency. Like SFPUC's *9910 Pre-Apprenticeship Training Program*, the agency created a special trainee classification for participants who receive paid on-the-job training designed to develop the competencies needed to meet the minimum qualifications for journey level Gardener positions with the agency.

Developed in partnership with the Laborers International Union of North America (LiUNA 261), participants become agency employees for two to three years, where, under the supervision of journey-level DWP Gardeners, they develop the skills and work habits necessary for agency employment. While employment is not guaranteed upon completing the program, participants

gain valuable paid work experience, technical skills, and job readiness training and are assured of having the minimum qualifications to apply for full-time permanent gardener positions with the city.

Complementing the Apprenticeship program, the Agency operates the *SFDWP Pre-Apprenticeship Program* designed to bridge disadvantaged residents involved in city programs to the *Gardener Apprenticeship Program*, ensuring accessible on-ramps to the training pathway. *SFDWP's Gardener Apprenticeship Program* is another strong model of a municipal utility partnering with a craft union to provide paid on-the-job training preparing local workers to become eligible for

CASE STUDY:

The Los Angeles Department of Water and Power's Utility Pre-Craft Trainee Program

The Los Angeles Department of Water and Power's (DWP) *Utility Pre-Craft Trainee (UPCT)* program is an 18-month pre-apprenticeship training program designed to connect disadvantaged residents to entry-level jobs and careers with the Los Angeles Department of Water and Power (LADWP). The program is administered by LADWP and the utility's electrical union, IBEW Local 18, in partnership with Los Angeles Trade Technical College (LATTC), public workforce agencies and RePower LA, a coalition of community, environmental, business and labor organizations.

In 2010, LADWP was failing to achieve its energy savings goals and the UPCT program a concept. Key program drivers were the city asking LADWP to administer its ARRA-funded, Federal Weatherization Assistance grant, compounded by RePower LA's advocacy for increased energy-efficiency investments with strong workforce provisions to sustain the program. By 2012, RePower LA's advocacy secured a doubling of LADWP's energy efficiency investments

and a commitment from the utility to view energy-efficiency investment as a procurement strategy linking increased energy-efficiency investments to quality job creation for local workers.

The UPCT program grew out of a partnership among diverse stakeholders, largely driven and coordinated by RePower LA. LADWP sought a trained workforce to implement energy efficiency programs. Disadvantaged communities sought access to quality career path jobs and residential energy efficiency services. IBEW Local 18 sought to fill projected utility workforce vacancies and environmentalists sought reduced fossil fuel dependence.

How does it work?

RePower LA partners Los Angeles Alliance for a New Economy (LAANE) and Strategic Concepts in Organizing and Policy education (SCOPE) recruit potential trainees from low-income and minority communities in Los Angeles and refer them to IBEW Local 18. The union refers candidates to the Southeast Los Angeles County WorkSource Center for a one-day orientation and pre-screening

followed by a three-day job-readiness training tailored to the newly created UPCT position and a full day of interviews and assessments. The WorkSource Center also provides continuous, as-needed support services for trainees, including case management, transportation assistance, and retention services.

Following intake, assessments, and orientation, candidates enter a 4-week, 40-hour basic skills and weatherization training program designed by LADWP and Local 18 and delivered by LATTC. Upon completion, trainees work full-time for LADWP in a special pre-civil service classification, earning reduced, trainee wages, weatherizing the homes of low-income residents recruited through RePower LA's community outreach, for 18 months. Every other week, trainees attend civil service exam preparation classes and learn about career pathways within the utility. The goal is to qualify trainees for as many civil service exams as possible, increasing their chances for permanent jobs with the utility after their participation in the UPCT program.

employment with the agency. This program is distinct from the other programs highlighted in this section in that it doesn't guarantee employment with the agency, but participants are assured admission into LiUNA 261, which affords opportunities for on-going training and employment.

4. Supporting the Creation and Development of Green Infrastructure Businesses

Training and preparing individuals for work in green infrastructure is key to developing a career pathway for people with limited access. Equally important is developing the capacity of businesses to access opportunities in green infrastructure and hire trained workers to perform green infrastructure work. Currently, most green infrastructure business opportunities are being offered through the public sector, but practitioners anticipate that the private sector will also begin to adopt green infrastructure as the practice becomes more common place and as property owners try to find ways to reduce stormwater fees calculated in relation to the amount of runoff generated by their properties.

Helping social enterprises that focus on green infrastructure work become competitive in the private market is related to career development. Social enterprises like Verde in Portland and Generation Water in Los Angeles offer individuals from impacted communities the chance to receive green infrastructure training and work experience through traditional workforce development programs. Similarly, DC Greenworks in Washington, D.C., is training and hiring green infrastructure workers. It has secured multiple contracts to perform green infrastructure work on private and public property because it is one of a few businesses with the expertise necessary to install and maintain green infrastructure in the D.C. area.

A business model that is poised to take advantage of the increased use of green infrastructure is urban agriculture. Urban farming operations have developed in many cities' urban cores. Operations like Brooklyn Grange in Brooklyn, N.Y. and Evergreen Cooperatives in Cleveland, Ohio have the expertise to shift their farming operations to grow greenery that can be applied to green infrastructure projects. Furthermore, these businesses can add installation and maintenance as part of their overall business model to serve as one-stop shops for public and private sector patrons interested in installing green infrastructure projects.

Green infrastructure businesses can also incorporate education and outreach as a component of their business model, and this provides yet another job that individuals with limited access can perform. Surveying the urban landscape for areas that are appropriate for green infrastructure projects is a job better performed by trained local residents who are knowledgeable of the neighborhood and who have the local sensibility to better communicate to their neighbors about the benefits of green infrastructure. Performing this type of asset mapping can be packaged in the overall services performed by a green

CASE STUDY:

Since 2005, Verde, a community wealth building Social Enterprise, has brought new environmental investments to Portland's neighborhoods, involved community members in the planning and building of these investments, and ensured that low-income communities and people of color directly benefit from the investments.

Verde trains and employs a workforce capable of installing and maintaining systems to manage stormwater. The company's crews are trained in performing construction, restoration, and cultivation services. Verde also offers landscape labor to general contractors and landscape subcontractors, with a focus on contractors subject to the City of Portland's Workforce Training & Hiring Program. Verde is certified as a Section 3 business, a designation that supports job training, employment, and contracting opportunities for low-income people on local projects.

Verde has secured several contracts to perform green infrastructure work in Portland and employs six full-time and six part-time landscapers. However, Verde's staff have expressed concern that the company cannot compete with the low prices their competitors offer. Verde was recently outbid to perform services they had been contracted to perform for the past five years, because a competitor was able to offer a very low rate for the same services. "Low-road" contractors who don't focus on hiring local and disadvantaged workers can have a pricing advantage on non-prevailing wage projects. This sometimes challenges Verde's ability to compete for projects. When a project requires prevailing wages, or includes social goals such as workforce diversity or training, Verde Landscape has had success competing against low-road contractors.

In 2012, Verde established a Training Liaison position to support crew member training and transitions to post-Verde opportunities. Crew members work with the Training Liaison to develop and implement an Individual Learning Plan that sets their training goals and participation in

up to 80 hours of paid training per year. Verde's long-term goal is that each landscape crew member receives resources and support for success as a small business owner, as an employee at a for-profit business with opportunities for wage and career growth, or as the experienced crew leader who supervises and trains future landscape crew members.

infrastructure business and can lead to more effective green infrastructure planning.

5. Enabling Policies and Community Benefit Standards

Cities across the U.S. enact policies designed to maximize the public benefits generated by public investments. Often falling under the umbrella term, "community benefits," these enabling policies establish guidelines for the workforce, job quality and contracting standards, and procurement related to publicly funded projects. Recently, some cities have passed citywide community benefit policies, which address, these issues for all qualifying public works projects. More common, however, are agency-wide or project-specific policies. In general, community benefits strategies include provisions guiding opportunities to impacted communities, communities burdened by high unemployment, high poverty, and barriers to opportunity. Enabling policies which are associated with public investments in green infrastructure present strong opportunities to achieve clear, measureable triple-bottom line outcomes- improved environmental quality, economic development, and opportunities for disadvantaged communities and businesses. The following discussion provides a high level overview of common elements found in community benefits enabling policies.

Targeted Hire

Targeted hire provisions can be city or agency-wide or project-specific. Local-hire and first-source hiring are common targeted-hiring strategies. Local hire policies establish requirements for a certain percentage of work to be performed by residents of targeted communities — generally areas with disproportionately high poverty and unemployment. They may also require the use of apprentices at established levels, a strategy designed to support entry of disadvantaged workers into union career pathways.

First source policies are another type of targeted-hire strategy. They require public works contractors to hire new employees from designated workforce training providers delivering skills training to community members with barriers to employment. These may be pre-apprenticeship programs, conservation corps, or types workforce developers. Both local-hire and first-source hiring policies assure that impacted communities and disadvantaged workers have access to employment opportunities generated by investments in public works projects.

Job Quality Standards

Job-quality standards may be imbedded in request for proposals, contracts, project- labor agreements, and policies at the city, agency and/or project level. Job quality generally refers to wage levels and the provision of health benefits. Commonly, living-wage ordinances and prevailing wage rules address wage issues. By enacting policies establishing job-quality standards, cities and public agencies can be assured that jobs created through their public investments are good, high road, family-supporting jobs.

Contracting Standards

Like targeted-hire provisions, contracting standards may be found in policies at the city, agency, or project-level. Typically, contracting standards ensure that disadvantaged or minority, woman or veteran owned business benefit from the opportunities generated by public investments. The standards may include provisions that support targeted firms' capacity to bid on future public works project, exemptions for targeted firms around specified performance targets where they lack capacity or until they achieve greater capacity. They may require prime contractors to mentor their targeted sub-contractors. The goal of implementing contracting standards is to guarantee access to business opportunities for these businesses and to help them build their capacity to competitively bid on future projects.

Community Benefit Agreements

Community benefit agreements (CBAs) are, as previously mentioned, citywide, or more commonly, project-specific agreements negotiated between community groups and a project developer. The recent citywide CBAs that have emerged were negotiated between labor unions, community groups, cities, pre-apprenticeship programs and contractors in lieu of more traditional project labor agreements (PLAs). PLAs are collective bargaining agreements negotiated between labor unions and developers covering specific projects. Negotiating a CBA tends to be resource intensive, but the process creates a venue for multiple stakeholders to build partnerships toward achieving shared objectives.

Procurement Policies

Procurement policies govern how public agencies purchase goods and services. They typically include targets for disadvantaged and minority, women; and veteran-owned businesses. Like contracting standards, the goal of procurement policies is to maximize business opportunities for businesses with barriers to access. As public agencies increasingly adopt community benefit strategies, some cities have broadened their definitions of procurement to include investments in energy efficiency and green storm water infrastructure. The rationale is that these investments effectively substitute for the need to purchase energy. In classifying these investments as procurement, cities and agencies are expanding opportunities to maximize the economic impacts and community benefits generated by their investments.

For all of the strategies above, data collection, monitoring, and enforcement are fundamental components. Effective enabling policies include clear targets, reporting requirements, accountability mechanisms, and consequences for non-compliance. In their absence, well-intentioned policies often fail to achieve their objectives. Cities and public agencies that pursue community benefit strategies should pay particular attention to these programmatic elements and ensure that they have appropriately staffing and funding.

Chapter 2: Cleveland's Impact

To better understand the potential of green infrastructure job creation and workforce development in Greater Cleveland, LAND studio engaged Cleveland State University's Center for Economic Development (the Center) to conduct an economic impact assessment. While it is expected that additional green infrastructure will be installed in the region beyond NEORS's projects, the focus of the Center's study is on NEORS's green infrastructure to be installed as a component of its strategy to meet the requirements of the Consent Decree. The focus is on NEORS's green infrastructure, because NEORS must ensure proper maintenance, in perpetuity, of all green infrastructure installed to meet Consent Decree requirements, thus ensuring a certain amount of expenditure in the local economy on maintenance activities. It is this guaranteed expenditure that can be assessed and measured to provide a sense of what the impact of green infrastructure maintenance will be.

Based on where it was in the site selection and design of the green infrastructure projects in the first quarter of 2013, NEORS provided estimates of the quantity of green infrastructure it will be implementing. These estimates were used by the Center to derive an overall cost for maintaining the green infrastructure over the course of the five year period from 2020 to 2024. It is expected that these years will be the first five fully operational years of NEORS's green infrastructure. Additionally, the Center used the estimated cost maintaining the green infrastructure to derive the economic impact of its maintenance for the Cleveland-Elyria-Mentor Metropolitan Statistical Area (MSA)²⁶. The following section will provide a summary of CSU's report. The report can be found in full in Appendix A.

Assumptions

Based on information provided by NEORS, it was assumed that all green infrastructure practices to be installed will be retention ponds with stormwater pipe conveying stormwater runoff to the cells. The maintenance of the retention ponds and the stormwater pipes were considered separately in the analysis of maintenance costs and economic impact.

To meet its requirements, NEORS will install 14 green infrastructure projects at approximately one acre each. The estimated total water quality volume captured by each practice will be 132,000 cubic feet. Each practice will require 8,500 linear feet of new stormwater pipe. The Center used these assumptions and the Water Environment Research Foundation (WERF) User's Guide to the Best Management Practices (BMP) and Low Impact Design (LID) Whole Life Cost Model 2.0²⁷ as a framework to calculate the green infrastructure maintenance costs for NEORS projects.²⁸

Maintenance Costs

Using the WERF Whole Life Cost Model 2.0, the Center estimated the combined maintenance cost over the five-year study period for green infrastructure and stormwater pipe will be approximately \$11.3 million, or \$2.26 million per year. A breakdown of yearly maintenance costs for all NEORS D green infrastructure can be found in Table I.

Table I

Total Maintenance Cost Estimates for all Green Infrastructure Projects, 2020-2024

	2020	2021	2022	2023	2024	Total
Green Infrastructure Maintenance	45,558	48,608	49,644	5,011,706*	51,814	5,207,330
Pipe Maintenance	1,166,404	1,191,591	1,217,322	1,243,613	1,270,467	6,089,397

Note: Dollars displayed in future dollars (2020 to 2024)

*Note: sediment removal occurs only in the year 2023 and accounts for a dramatic increase in maintenance costs for that year. For detailed assumptions about maintenance activities and schedule, refer to the full report in Appendix A.

Economic Impact

Using the maintenance costs derived using the method mentioned above, the Center determined the economic impact that maintenance spending will have on the economy using the IMPLAN model, an input-output model that captures the buy-sell relationships among all industries, government, and the household sector. The IMPLAN model anticipates that the economic impact on the MSA of the maintenance of NEORS D's green infrastructure will be as follows:

Total Employment Impact:	219 jobs
Total Labor Income Impact:	\$11.0 million
Total Value Added Impact:	\$13.8 million
Total Output Impact:	\$23.9 million
Tax Impact:	\$2.8 million

Three categories of jobs make up the 219 jobs created by green infrastructure maintenance spending: direct, indirect, and induced. Direct jobs are those in which employees are directly involved in the maintenance of green infrastructure. The indirect impact represents employment in industries from which NEORS D purchases goods and services and that sell inputs for the goods and services. The induced impact represents employment created as a result of the economic influence of the employees of NEORS D and its suppliers.

Of the 219 jobs that will be created through the spending on green infrastructure maintenance, 146 (66%) will be jobs directly related to the maintenance of green infrastructure. Forty-five jobs will be dedicated to the direct maintenance of the green infrastructure, and 101 jobs will be dedicated to the maintenance of the stormwater pipe. The remaining 73 jobs created represent both indirect and induced jobs.

Chapter 3: Local Implications

Greater Cleveland and Green Infrastructure: A Need for Maintenance Training

While NEORS D will be installing green infrastructure at a large scale in the coming years, a number of institutions and municipalities have already implemented varying types of green infrastructure throughout the region. Bioswales, permeable pavement, green roofs, and rain gardens are popping up in response to a growing regional concern for stormwater. These are the region's early adopters and, as with early adopters in any new sector, some are experiencing growing pains. Several stories of early successes and challenges are highlighted below.



Zone Recreation Center

Opened in 2012, the site features a mixture of green infrastructure practices, including meadows, bioretention swales, rain gardens, and permeable pavement. Upon handing off the site to the City of Cleveland, the landscape architect, McKnight Associates, provided training and a one-page informational sheet on maintenance of the various green infrastructure practices. Information included things like where and where not to mow, and the timing of mowing for the meadow, which can be particularly difficult to establish. In spite of best efforts, the meadow was mown prematurely. Using lessons learned from previous projects, the landscape architects, intentionally reduced the variety of plants in bioswales and rain gardens located close to the highly trafficked areas of the park. This strategy not only eases maintenance and also provides a more manicured appearance, with which people are more comfortable.



Collinwood Recreation Center

Opened in 2011, the Collinwood Rec Center is Cleveland's first new recreation center in over a decade. The building achieved LEED Gold certification in part due to its on-site stormwater management. The site features cisterns, which are used for irrigation, tree trenches, and a bioswale. The site is still under a 2-year landscape maintenance contract, a helpful strategy that can be employed to help guarantee plant establishment. Upon expiration of the contract, Northeast Shores Development Corporation will employ landscapers to assume maintenance responsibilities.

Rain Gardens at Various Recreation Centers and Parks

Rain gardens, installed by the Cleveland Division of Water, can be found sprinkled throughout the City's parks and recreation centers. These well-intentioned rain gardens, maintained by City staff, frequently fall into disrepair due to budget constraints, limited staff ability to maintain them, and improper installation of plant material. Plants that are planted too small or too far apart can take too long to become established and thus allow more time for invasive species to take over. With the City's tight budget, limited staff is dedicated to the maintenance of the rain gardens and, if plants die, no replacement budget exists. Rain gardens can end up as mulch pits.

With multiple organizations and municipalities in Northeast Ohio taking on green infrastructure, the need for a competent workforce capable of maintaining the region's new stormwater management assets will be necessary. Several training programs exist on the topic of green infrastructure maintenance across



the country, but no consistent training program exists in Northeast Ohio. A regularly occurring training would help educate contractors and municipal and institutional grounds maintenance staff. The training of maintenance workers could ensure that our region's green infrastructure will continue to function properly well into the future.

Current efforts of organizations like the Northeast Ohio Stormwater Training Council (NEOSWTC) are helping to fill the knowledge gap. NEOSWTC is a consortium of organizations and agencies that seek to educate, train, or build curricula on stormwater issues. This year, NEOSWTC will offer two trainings for green infrastructure maintenance, one focused on residential-scale green infrastructure and one focused on commercial-scale green infrastructure.

In addition to the work of NEOSWTC, the Cleveland Metroparks recently opened the West Creek Watershed Stewardship Center. The newly constructed center is designed to educate the public and specific groups on watershed issues, including stormwater management. The landscape around the Watershed Stewardship Center showcases a wide array of green infrastructure practices, including bioswales, permeable pavement, constructed wetlands, and a green roof. The center, developed in partnership with NEORS, is designed for hosting educational events and would be an ideal site for a regularly-offered training program.

As a component of our research, LAND studio and NPI interviewed institutions, municipalities, and design professionals to gain a better understanding of the green infrastructure landscape as it stands in Greater Cleveland. Overwhelmingly, the message was clear: Organizations are interested in implementing green infrastructure but are leery of budget constraints and have maintenance or installation concerns. When asked about whether a green infrastructure maintenance training program would be helpful, the majority of interviewees responded that it would be. NEORS has echoed similar sentiments and believes that a regularly offered green infrastructure maintenance training program in the region could help to address a knowledge gap that exists for those who are already in the landscape maintenance industry.

The green infrastructure already in the ground and NEORS's pending investments have the potential to be just the beginning of a Northeast Ohio with much more green infrastructure. Coupling this investment with the stormwater credits that both commercial and residential property owners can qualify for, the incentive and use of green infrastructure practices is just beginning. With additional regional green infrastructure investment over time, there will be a need to grow a workforce capable of maintaining this new type of landscape.

With a growing portfolio of green infrastructure practices, including those at Zone Recreation Center, Collinwood Recreation Center and rain gardens dotted around town, the City of Cleveland has indicated that it would welcome a training program on green infrastructure maintenance. City budgets remain tight, with no money allocated to training. The City would be an eager participant if the program were made available at no cost to City employees. The city's current green infrastructure capacity is relatively low, with one full-time and four seasonal qualified staff able to maintain current practices.

Several anchor institutions, including Case Western Reserve University, University Hospitals, the Cuyahoga Metropolitan Housing Authority, and MetroHealth, have indicated an interest in green infrastructure and concern for its proper maintenance. Several institutions already have green infrastructure installations, which are maintained through a variety of methods. Case Western Reserve University maintains its infrastructure with in-house grounds maintenance crews, University Hospitals contracts its work to a landscape contractor, while MetroHealth is in the exploratory stages of determining how it will maintain recent green infrastructure investments. Some institutions have already implemented green infrastructure practices and are working to develop systems for their maintenance. Other institutions considering upcoming capital investments are open to incorporating green infrastructure practices and recognize that maintenance will be a future concern.

Survey of existing institutions capable of providing maintenance or maintenance training

LAND Studio and NPI conducted interviews with several local organizations that may be able to play a role in the development of a green infrastructure maintenance training or workforce development program. These organizations include those with specialties in horticulture, employment services, education, and advocacy.

Based on interviews with each organization, we identified eight areas in which an organization could play a role in the development of a training or workforce development program. These eight areas fall into two categories: training programs and workforce development programs. Each area is represented by an icon and is described below. In the next section, a synopsis of each organization is given, and the icons are used to identify how each organization could play a role in the development of one or both programs.

Training includes a specific area of specialization and the ability to develop project-specific curriculum, host provide training facilities and develop community education around green infrastructure.



Curriculum Development – organizations that have experience with education and can guide or assist in the process of developing an appropriate curriculum tailored to educate existing or prospective workers on the subject of green infrastructure maintenance.



Training Facilities – organizations that have a building and/or green infrastructure practices that could be used as a part of a training program.



Technical Expertise – organizations that can lend either horticultural or engineering expertise to be a trainer for a training program.



Community Education – organizations that are rooted in the community and can educate and provide outreach on the neighborhood level. Through this research, it became clear that several levels of education are necessary. Many residents do not know about stormwater or green infrastructure, so providing community outreach and education on this topic will help to broaden community understanding and gain community acceptance of this new type of landscape.

Workforce Development includes wrap-around services, recruitment, and job placement capabilities.



Wrap-Around Services – organizations capable of providing support to those that may have barriers to employment and need assistance in the form of resume building, job interviewing skills, GED preparation, and other related job-readiness skills.



Recruitment – organizations with a stream of individuals or community connections that can be used to place individuals in a workforce development program or an employment position.



Job Placement – organizations which have specialized in the development of job-placement strategies, particularly for individuals with barriers to employment, limited education, and marginal employment opportunities.

Cuyahoga Community College

Cuyahoga Community College (Tri-C) was founded in 1963 and serves over 30,000 students annually throughout Cuyahoga County. With four main campuses around the county, Tri-C offers over 1,000 associate degree courses. In addition to its course offerings, Tri-C also provides a number of work force training, professional development, and lifelong learning programs.

The workforce training programs offered by Tri-C apply to multiple employment sectors. From Advanced Manufacturing to Alternative Energy and Information Technology; the breadth of options uniquely positions Tri-C to provide adaptive and forward reaching curriculum for 21st century jobs.

Tri-C has made forays into the green economy before with an initiative known as the Green Academy and Center for Sustainability (Green Academy) and learned many important lessons about workforce development and training in the green economy from the initiative. This program linked local economic sectors such as construction, interior design, and alternative energy, to provide a green job lattice in Northeast Ohio. Tri-C's Workforce & Economic Development Division (WEDD), under which the Green Academy was housed, has the capability of responding quickly to market demands and is able to develop and provide courses ranging in intensity from a workshop to certificate program to a full academic degree.

Potential Role



Tri-C could develop a program similar to those delivered at the Green Academy offering either an accredited program or a certification training program for the installation and maintenance of green infrastructure projects. Due to their multiple campuses, wide range of expertise and previous experience with 'green job' workforce development, Tri-C is a logical partner to advance the widespread use of such a training program.

OSU Extension

The Ohio State University (OSU) is Ohio's land-grant university. As a land-grant university, the school has a particular mission to promote agricultural and land-use practices in every county throughout Ohio. In Cuyahoga County, OSU Extension has developed a number of unique programs that advance its mission. Programs range from food-related policy to community gardening assistance, nutritional education, and master gardener training programs. These programs make OSU Extension one of the premier public resources for horticultural knowledge in the region.

Through the various programs and efforts that OSU Extension has undertaken, it has proven a capable leader in regional collaboration. The Cleveland Crops program run by OSU Extension is a partnership with the Cuyahoga County Board of Developmental Disabilities employment arm, Solutions At Work (S.A.W.). In this program, master gardeners provide agricultural training, and graduates of the program are placed in jobs on one of several urban farms. OSU Extension has also partnered with the City of Cleveland Planning Commission, the Cuyahoga County Land Bank, the Department of Housing and Urban Development (HUD), the USDA Natural Resources and Conservation Services (NRCS) and others.²⁹

One of the main concerns surrounding green infrastructure is maintenance, particularly the ability to correctly identify various plant species. Given the horticultural expertise of OSU Extension, its robust network throughout Cuyahoga County, and its proven track record of effective collaboration, it is well positioned to facilitate the training of those who will be practitioners of green infrastructure projects throughout Cuyahoga County.

Potential Role



One needed skill in green infrastructure maintenance is the ability to identify invasive species that were not intended to be in its landscape. Thus, plant identification is an important skill, and OSU Extension has the ability to lend their horticultural expertise towards the advancement of hands-on training and capacity building in the field of green infrastructure by supplying training

to the program. Their extensive network throughout the county could also be leveraged to assist with community education efforts. OSU Extension can use this opportunity to expand its educational mission to include sustainable landscaping.

Cleveland Botanical Garden

The Cleveland Botanical Garden (CBG) has been a bastion of horticultural knowledge and resources for the Greater Cleveland since 1930 when it was established as the Garden Center of Greater Cleveland. CBG offers a variety of educational opportunities, from children and family programming to adult programs and field research. Their scope is far reaching and serves a large portion of the Greater Cleveland population.

One program in particular works to reach high-school-aged youth through a program known as the Green Corps. The mission of this organization is Growing Youth, Growing Food, and Growing Cleveland and it achieves this through leadership development, place-based learning, and education in sustainable agricultural practices while employing, on average, 70 to 75 teenagers every summer. Through working with a network of six urban farms, Green Corps student employees work 20 hours a week while cultivating environmental and community-based stewardship. Through an innovative partnership with Tri-C, Green Corps allows participants to earn college credit while enrolled in the program.

Additionally, the CBG has recently developed a program called Vacant to Vibrant: Redeveloping Vacant Land as Green Infrastructure (V2V) in Great Lakes Cities. V2V uses the triple bottom line to gather data, provide ecological surveys and explore potential social and economic benefits green infrastructure might have on particular communities. V2V will build on the success of the Green Corps and train individuals on assessment, installation, operation and maintenance of green infrastructure. These two unique programs aim for two distinctly different outcomes. The former, Green Corps, seeks to build community-wide capacity within various fields of sustainability from gardening techniques to stormwater management. The latter, V2V, is a workforce development project that seeks to build on the developed capacity of the Green Corps to implement and sustain the various community benefits of green infrastructure, while creating meaningful 21st-century jobs.

Potential Role



CBG could assist in the development of a training program in several ways. Using their Green Corps experience, CBG could help with the development of learning goals and objectives for the training program. It could also lend its

agricultural and horticultural expertise to training endeavors. Additionally, they could provide training on how to use urban agriculture as green infrastructure, or use the Green Corps program as a way to provide youth training around urban agriculture and farming. They could also serve as a source of recruitment of former Green Corps youth who may be interested in additional training or workforce development.

Beyond their horticultural expertise, CBG conducts field research on stormwater infiltration, soil remediation, and green infrastructure appropriate plant selections for urban vacant lots. Based on the findings of the field research, CBG could be a source of information for the region on these topics.³⁰

Towards Employment

Towards Employment (TE) works to empower individuals through employment opportunities which can help individuals achieve self-sufficiency. TE achieves this by working with individuals with barriers to employment, such as those who are coming off public assistance, formerly incarcerated, or facing other systemic barriers to access. TE provides job pathways through a suite of services that include job-readiness training, research skills, legal services, and vocational training.

TE is able to achieve its mission by developing robust partnerships with employers throughout the Cleveland area. The programming that TE helps to facilitate is sector-specific and requires collaborating with key employers in the region. TE has a proven track record of success, high hire rates, and reductions in turnover. Its training and job readiness programs have changed the lives of more than 120,000 individuals throughout Greater Cleveland since 1976.³¹ As recently as 2009, TE developed a program known as Green Jobs & Fresh Opportunities that works to advance job-placement with companies who embrace environmentally sound practices, such as Evergreen Cooperative Laundry and Ohio Cooperative Solar.³²

TE is continually looking for new ways to collaborate and enter new and emerging sectors that provide meaningful employment opportunities. Their structure and support system ensures that, even after job placement, its clients will continue to receive ongoing support and career services. To ensure the highest quality of service, in both for the partnering organization as well as the client, TE's interest is not in temporary fixes but creating opportunities for lifelong careers.

Potential Role



TE has the ability to assist in green infrastructure workforce development in a way that would most directly benefit segments of the population that face significant barriers to employment. By working with existing institutions, TE has the ability to train and place individuals into green job pathways. TE could also serve as the job-readiness training and wrap around service provider for a workforce development program that could involve recruitment and screening as well as training and wrap-around supports, in addition to ongoing job-coaching support for the first six months to a year of employment.

Further, the aforementioned services could be coupled with a technical trainer contractor with the expectation that participants spend between 1-6 months working in the field with strong coaching support, gaining experience in both the technical aspects of the job as well as in meeting general employment expectations. This experience is then leveraged to find full-time employment outside the program, freeing up a spot in the crew for a new trainee. This model would maximize the value of jobs created by opening the experience up to more people and using it as a training and resume-building opportunity.

Additionally, TE's sector-specific training can help develop green infrastructure as an entry point for individuals. It was suggested that green infrastructure maintenance work could potentially be an ideal re-entry program, providing a low-barrier employment opportunity for those just coming out of prison. This could help provide structure for individuals, while building their resumes and skills that can be transferred to other sectors.

Cuyahoga County Board of Developmental Disabilities and S.A.W., Inc.

Solutions at Work, Inc. (S.A.W.) is the employment arm of the Cuyahoga County Board of Developmental Disabilities (CCBDD). CCBDD works with its clients on a cradle-to-grave basis, providing life-long services from the point of diagnosis to end-of-life care. When the time comes for clients to enter the workforce, CCBDD works with clients through S.A.W. to ensure safe work environments, adequate wages, and on-site assistance when needed. S.A.W. owns and operates several internal businesses that range from high-volume shrink-wrapping to a network of urban farms throughout Cuyahoga County, as part of its Cleveland Crops program. S.A.W. also works with a wide variety of employers around Cuyahoga County, through its community employment program, where individuals are placed to work in business, manufacturing or other facilities, depending on the employer's need.³³

S.A.W. embraced an entrepreneurial spirit during the recession and became determined to foster and expand its companies when the job market slowed. In addition to running at least 10 farms, S.A.W. owns and operates its own retail stores, grounds-maintenance services, and businesses in the food industry, to ensure the financial success the organization and its clients.

Potential Role



S.A.W. has the ability to re-tool some of its existing entrepreneurial endeavors, particularly its grounds maintenance program and its Cleveland Crops program, to provide green infrastructure maintenance training and services. While still under the S.A.W. umbrella, clients would have access to wrap-around services. With their pipeline of individuals, S.A.W. has the capacity to expand and develop a specialized track for its clients to engage with new projects, including green infrastructure maintenance. By working with a green infrastructure professional, S.A.W. team members could work in crews to maintain a wide range of green infrastructure as it is implemented by NEORSD and others.

Evergreen Cooperatives

The Evergreen Cooperatives are a portfolio of companies founded in 2008 as part of a joint collaboration between the United States Department of Housing and Urban Development (HUD), the City of Cleveland, and The Cleveland Foundation.³⁴ The mission of the Evergreen Cooperatives is to bring about community-wealth-building businesses in economically depressed segments of Greater Cleveland. Using the Mandragon Cooperative Corporation in the Basque region of Spain as its inspiration, the Evergreen Cooperatives were developed to mitigate poverty and produce social enterprises through the development of employee-owned businesses that leverage anchor institutions as sources of revenue.

Since the inception of the Evergreen Cooperatives, Evergreen Cooperative Laundry, Evergreen Energy Solutions, and, most recently, Green City Growers Cooperative have joined the umbrella organization. The creation of a new Evergreen business is founded on three major principles. First, it must be in response to market demand and be supported by an anchor institution, which could be a hospital, university, or municipality. Second, it must be a local business with shared ownership. All employees at Evergreen Cooperatives businesses are employee-owners, which helps to build wealth in communities by returning profits to the employees and keeping money in the local economy. Finally, each Evergreen business must have a green component. Each existing portfolio company specializes in delivering a green service and product. The Evergreen Cooperative Laundry uses less water and electricity to clean linens. Evergreen Energy Solutions focuses on renewable energy but also does construction work, including demolition, home rehabilitation, and solar-panel installation. Green City Growers Cooperative is a large-scale hydroponic lettuce and fresh herb-growing operation that reduces the carbon footprint of food for consumers and businesses, while keeping money circulating within a more localized economy.

The Evergreen Cooperatives are able to provide meaningful employment to a population that frequently has substantial barriers to employment. The jobs provide its employees with a living wage and ownership in a company. Evergreen is explicitly committed to building jobs and companies that hire local Cleveland residents, providing a unique relationship between work and community. This brings with it a sense of stewardship and a recirculation of resources within the communities where the Evergreen companies exist.

Potential Role



The Evergreen Cooperatives Initiative could potentially create one or more businesses using its model that focuses on the green infrastructure industry.³⁵ One potential business would be one that provides green infrastructure maintenance services that could contract with either NEORS or other anchor institutions for green infrastructure maintenance work.

Another business possibility is a nursery that could specialize in plants used in green infrastructure practices like bioretention swales and rain gardens. Frequently plants required for these applications are native and more difficult to find in cultivation from major wholesale nurseries.

Rid-All Green Partnership

The Rid-All Green Partnership (Rid-All) is an urban farming and educational center located within the Forgotten Triangle in Cleveland's Kinsman neighborhood. This 20+ acre sector of the neighborhood is now known as the Urban Agricultural Innovation Zone and is reclaiming a former illegal dumping ground for the production of healthy, organic food. Rid-All is one of two organizations actively farming the land and, in 2012, harvested 14,000 pounds of produce from its 1.5 acre site.³⁶ It also serves as a training center for urban agriculture and is affiliated with the nationally renowned urban agricultural non-profit Growing Power, based in Milwaukee and founded by Will Allen. Rid-All also happens to be located adjacent to a planned NEORS green infrastructure site. The organization already manages some of its stormwater on site, using a rain catchment pond and several rain barrels, and it has plans to implement a small bioswale. The addition of a large-scale green infrastructure practice could increase the ability of Rid-All to offer environmental education around the topic of stormwater and green infrastructure.

The property Rid-All grows on has been remediated to grow healthy produce for area institutions, restaurants, and residents in its two greenhouses and four hoop houses. Using aquaponics, Rid-All produces black tilapia and vegetables in one continuous system. This system, based on the nitrogen cycle, is a highly efficient means to produce large quantities of protein and vegetables while

occupying a relatively small footprint. Additionally, Rid-All uses food waste from the Cleveland Food Bank and a local brewery to produce compost, which it uses in its food production and sells to consumers. In tandem with its food and compost production, Rid-All has a strong educational mission and offers classes and workshops to those interested in learning about how to start a farm.

While Rid-All is efficiently using the space it already has, the demand for food and educational programming is quickly outpacing their current capacity. Rid-All is currently planning to expand its facilities to a site across the street. The new greenhouse it plans to build will be a 21st-century greenhouse, complete with classroom facilities, a kitchen for a green catering business, market stand, and additional space for growing produce. Rid-All has indicated an interest in adding stormwater and green infrastructure to its educational topics and desires to build the greenhouse in an environmentally sensitive way, paying particular attention to stormwater. It is currently in discussion with NEORSD to include a stormwater-focused amphitheater as a part of the campus that Rid-All hopes to be able to use in its training curriculum. The additional space will allow Rid-All to accommodate field trips from local schools. Already, the Cleveland Metropolitan School District sees the value of using Rid-All as a field trip site to teach children about agriculture and food production and is in negotiations with Rid-All to send all fourth graders to the site during the school year.

Potential Role



Rid-All is located in the heart of the Kinsman neighborhood and is well-positioned to be a community educator. It could potentially provide community education on stormwater to better help residents understand the urban water cycle. Additionally, with the new addition, Rid-All will have a dedicated classroom for education. While some education will be agriculture-oriented, Rid-All has indicated a willingness to partner with other organizations to deliver green infrastructure maintenance training at its facility.

As Rid-All provides outreach into the community, it could potentially also serve as a recruitment vehicle for a workforce development program centered on green infrastructure maintenance. Being a part of the community positions Rid-All well to be able to make local community connections and reach target populations.

Environmental Health Watch

Environmental Health Watch (EHW) was founded in 1980 to create and promote programs that reduce exposure of residents of Northeast Ohio to

environmental health hazards.³⁷ EHW specializes with on-the-ground grass-roots organizing around community issues that range from home radon detection to the promotion of community agricultural initiatives such as the Rid-All Green Partnership.

EHW brings attention to the connections between environmental conditions and health outcomes within communities throughout Northeast Ohio. From air quality to heat waves, extreme rainfall and flooding to drought, EHW works with communities most vulnerable to understand the implications of these weather events. EHW works with communities to promote wellness, knowledge of sustainability initiatives and to direct residents to resources advance sustainability while improving personal or community health.

EHW staff have knowledge of stormwater management and land-use planning and have done a number of grant related activities and trainings for neighborhood residents, national projects, and local universities on various components of green building, healthy homes, and related activities. EHW has worked to install rain barrels, start community gardens, provide weatherization services and installed energy-efficient appliances and lighting, to ensure that those most affected by a changing climate have the ability to save on their food expenses and utilities; these prices are forecasted to rise if climate change is not addressed on larger levels.

Potential Role



EHW has the potential to incorporate green infrastructure into its wide range of programming that is already ongoing throughout Greater Cleveland. Doing this creates a conversation around stormwater on a community-wide level. As much of the construction is taking place in neighborhoods that EHW is already working in, it has the ability to communicate how the new stormwater fees will impact residents, and where the potential for savings and residential credits exist.

Furthermore, EHW could work with convening employment services to ensure that local hiring is taking place in areas where construction is most present, thereby insuring that the investments being made in their communities provide meaningful job opportunities for its residents while furthering the conversation and connection between residents, anchor institutions, and our region's water quality.

While Greater Cleveland has a wealth of organizations capable of playing a role in the creation of a green infrastructure maintenance training or workforce development program, significant barriers still exist to creating such a program.

Funding, contracting practices, and institutional policies are all hurdles that must be overcome. A carefully crafted partnership could help overcome some of the hurdles to deliver a program to meet Cleveland's green infrastructure maintenance needs.

Chapter 4: Recommendations and Next Steps

Strategies for Developing a Green Infrastructure Maintenance Training Program

We have found that a number of organizations currently exist in the Greater Cleveland area that could partner to deliver a green infrastructure maintenance training program that could be offered regularly. Such a program would help to build a knowledge base in the region that would enable green infrastructure practices installed by both NEORSD and other organizations to be maintained properly and continue functioning as designed. The following recommendations outline the next steps for developing a training program.

1. Convene a meeting of all institutions surveyed to present the findings of the report and discuss next steps as a group.

In conducting interviews for this report, many organizations voiced an interest in the findings and in continuing the conversation. Disseminating the information found in this report is the first step in developing a training program. Once all the information is presented, an informed conversation can be conducted to determine which organizations have the interest in continuing with the work of implementation.

2. Identify a taskforce charged with overseeing the implementation of the training program.

This taskforce will oversee the implementation of a training program. The taskforce will be charged with setting goals, developing metrics to measure success, and committing to reconvene to evaluate and track the program through implementation. Duties of the taskforce will be to ensure that a curriculum is developed, trainers with horticultural and engineering expertise are identified, a training facility or facilities are arranged for, schedule of training offerings is set, and a marketing strategy is developed. The taskforce can use example curricula from other similar training programs, such as North Carolina State University's BMP Maintenance and Inspection Certificate program, as a basis for designing a curriculum to suit the needs of Greater Cleveland. It was found that several institutions with green infrastructure practices already in place voiced an interest in not only operations and maintenance training, but also installation training.

3. Recognize that a maintenance training program can become an integrated part of a workforce development program as the green infrastructure market develops.

While the immediate need in the region is to retrain individuals already in the landscape maintenance industry to provide them with the necessary skills to maintain green infrastructure, the potential for using green infrastructure as an entry point into a career pathway is great. As indicated in earlier sections, green infrastructure presents an opportunity to engage target populations that may be difficult to employ and can provide an on-ramp to sustainable careers.

4. Design the training program to provide a credential upon completion.

Making the training program into a certificate program will enable institutions and government agencies to require certification in green infrastructure maintenance. This will help to ensure the quality of work being performed on green infrastructure, and also has the potential to increase the value of the job opportunities presented by green infrastructure maintenance.

5. Develop a multi-level community education program.

Developing a training program for individuals already in the landscape maintenance industry is an immediate need. Also needed is community-wide education effort on green infrastructure and stormwater management. Residents, elected officials, institutional and municipal leaders should all be included in this education effort.

Opportunity to Create a Workforce Development Program

The economic impact assessment (Appendix A) indicates that jobs will be created as a result of the requisite maintenance of green infrastructure. While the assessment focused on the maintenance needs of NEORSR-specific green infrastructure, we believe that this is just the beginning of the impact of green infrastructure on the economy at a regional scale. Nationally, it has been shown that green infrastructure maintenance can be an ideal on-ramp for a career in the green economy or related field. We have an opportunity in Greater Cleveland to capitalize on this opportunity by creating a successful workforce development program that incorporates the best qualities of successful workforce development programs around the country. We can take lessons learned from Green For All's extensive research and apply those lessons to Cleveland using the following recommendations:

1. Partner with public agencies to access work and training opportunities.

Use the NEORSR investment as an anchor for green infrastructure maintenance jobs in the region. As green infrastructure is implemented by NEORSR, the maintenance of each of the practices must be considered and planned for. Several ways of providing for the maintenance of the green infrastructure are outlined in recommendation 5, but one way NEORSR can positively effect change in the communities it touches with green infrastructure is to partner with a workforce development program that specializes in training future workers to maintain green infrastructure. The workforce development program could target specific neighborhoods affected by NEORSR green infrastructure. If NEORSR uses graduates of a targeted workforce training program, jobs will be provided to those most impacted by the construction of the green infrastructure practices.

Instead of relying on the market to deliver a workforce development program for green infrastructure maintenance workers, NEORSR could spearhead the creation of a workforce program around the topic of green infrastructure. The City of Columbus recently released a Request for Proposals soliciting consultants to design a workforce development program to leverage the City's

potential future investment in green infrastructure.³⁸ A similar approach could be taken in Cleveland, with NEORS as the driving force.

Whether the market or NEORS drives a workforce development program, the county Workforce Investment Board should be engaged at the next level of planning process. Its resources could be leveraged to fund a training or workforce development program.

2. Develop training and certification programs with green infrastructure education professionals.

A training and certification program should be created that will educate current workers in the landscape maintenance field, and serve as a critical component of the workforce development program. Experts in green infrastructure, both with engineering and horticultural backgrounds, will serve as instructors. Expertise in green infrastructure engineering already exists within NEORS, and they could partner with experts in horticulture from either the Cleveland Botanical Garden or OSU Extension to deliver a comprehensive training program.

3. Establish partnerships that can help establish career development pathways.

The training and certificate program is only one component of a complete workforce development program. Creating the training opportunity and the entry-level job and career pathway are both critical to providing a comprehensive and successful program. Several organizations exist locally that could help develop a career pathway for individuals entering the workforce through a green infrastructure maintenance job. Towards Employment, a regional leader in job placement and career development for individuals with barriers to employment, could help build career-development pathways for individuals entering the workforce development program. The Cuyahoga County Board of Developmental Disabilities and its workforce arm, S.A.W. Inc., already provides career-development services for individuals with developmental disabilities. Should S.A.W., Inc. incorporate green infrastructure maintenance into its portfolio of services that, it would be able to continue to provide career development services for its employees.

4. Support creation and development of businesses that can supply green infrastructure products and workers.

Evergreen Cooperatives is a Cleveland-based group of social enterprises with a focus on community wealth building through creating local businesses that hire locally. With sustainability at the core of its mission, the Evergreen Cooperatives is an ideal candidate for developing businesses related to green infrastructure that can supply both green infrastructure workers and products. One business that could be built around green infrastructure is one that provides maintenance services for green infrastructure. Another business could be a supplier of green

infrastructure specific products, such as plants suitable for vegetative green infrastructure and engineered soils for bioretention.

5. Promote and advocate for enabling policy that guides opportunities to impacted communities.

NEORSD has a unique opportunity to impact the community in a positive manner through the way in which it chooses to maintain its green infrastructure practices. To maximize the direct benefit to communities impacted by green infrastructure, three possible options exist and are outlined below:

Use a social enterprise.

An early commitment to contract maintenance work to a social enterprise, potentially a new Evergreen Cooperatives, would guarantee the jobs created by the maintenance of NEORSD green infrastructure will be locally sourced. NEORSD would act as the anchor institution to guarantee a certain amount of work for the new business, and with enough lead time, Evergreen Cooperatives could begin the process of developing a business model suited to NEORSD's needs. As green infrastructure maintenance work may not provide a business with full year-round employment, other complimentary types of work could be incorporated into a business plan.

Use multiple hyper-local contracts.

Identify organizations local to each green infrastructure practice or cluster of practices capable of maintaining each practice. In this scenario, NEORSD would potentially hold contracts with as many organizations as there are green infrastructure practices. This strategy would guarantee that the jobs created by the maintenance of green infrastructure would go to those living and working closest to it. One example identified in the course of this research is Rid-All and the Urban Agriculture Innovation Zone green infrastructure site. Based on Rid-All's current programming and experience in on-site stormwater management, they could potentially hold a contract for the maintenance of NEORSD's green infrastructure. The green infrastructure site will be located in proximity to Rid-All's property. With Rid-All's presence on site at all times of the year, they would be able to monitor and maintain the practice with a level of care that might not be possible for another organization.

The downside to this organizational structure is that contract management and oversight could be difficult. NEORSD procurement practices might make it difficult to award smaller contracts to smaller agencies. However, with enough lead-time, these policy issues have time to be worked out if this is an appealing approach.

Use one umbrella contract for hyper-local benefit.

Another way to achieve hyper-local benefit is for NEORS to engage a green infrastructure maintenance management firm. This firm would then be responsible for subcontracting with hyper-local businesses to maintain each green infrastructure practice. Requirements of the hyper-local contract could be developed to include parameters that would encourage minority and women owned businesses to benefit from some of the work. Additionally, distance requirements could be developed to guarantee that businesses in the area directly impacted by green infrastructure would benefit. For example, it could be required that for each green infrastructure maintenance contract, the winning firm must be located within the same neighborhood as the practice.

NEORS can extend a positive influence in the community not only by how it maintains its green infrastructure, but also through its stormwater fee credit program. To maximize community benefit and ensure that green infrastructure continues to function, NEORS could require that a certified maintenance technician maintain the green infrastructure practice in order to receive the stormwater fee credit. This policy could increase the success rate of green infrastructure and create demand for workers trained in green infrastructure maintenance.

Conclusion

Our goal of this research was to understand the state of existing green infrastructure maintenance in Cleveland and project future needs based on anticipated green infrastructure investments by NEORS, the City of Cleveland, and private institutions. We found that the maintenance of current green infrastructure installations is varied in quality and an immediate need for a training program exists to re-train the existing workforce, primarily landscapers, to properly maintain existing green infrastructure.

It was also revealed that additional jobs will be created by NEORS's green infrastructure investment. The jobs created to maintain the green infrastructure will be sustainable jobs with dedicated funding through NEORS. It has been shown on a national-level that green infrastructure jobs present an entry point into the workforce that has a relatively low barrier. Given this, there is future potential to create a workforce development program that can target specific populations with historic barriers to employment. If NEORS, the City and private institutions utilize graduates of a workforce program for green infrastructure maintenance needs, true community benefit from public and private investments can be realized.

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**ECONOMIC
IMPACT OF
GREEN
INFRASTRUCTURE
MAINTENANCE**

**Center for
Economic Development**

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EXECUTIVE SUMMARY

The Center for Economic Development (the Center) at the Levin College of Urban Affairs at Cleveland State University prepared this report for LAND studio. The objective of this report is to present an economic impact of the green infrastructure maintenance of the green infrastructure projects that the Northeast Ohio Regional Sewer District (NEORS) will undertake as a part of the Consent Decree NEORS has entered into with the U.S. Environmental Protection Agency (US EPA) and the State of Ohio. This report will guide LAND studio as it engages in a broader study of best practices of green infrastructure maintenance, the needs of the sector, and to develop a foundation for the creation of a green infrastructure maintenance education and training program.

Since the exact expenditures of green infrastructure maintenance could not be provided, the Center used the Water Environment Research Foundation (WERF) User's Guide to the Best Management Practices (BMP) and Low Impact Development (LID) Whole Life Cost Models 2.0¹ as a framework to calculate the green infrastructure maintenance for the NEORS projects. These calculations were based upon water quality volume and drainage area of the future NEORS green infrastructure projects. The Center made modifications to the model in order to derive a more accurate economic impact model. To do this, the research team separated labor expenditures from machinery and equipment expenditures. Moreover, since the model was calculated using a national survey, other adjustments were made to the model to better fit the Cleveland-Elyria-Mentor Metropolitan Statistical Area (MSA).²

Using the data derived from the adjusted WERF model, the economic impact conducted by the Center was done in two phases. First the economic impact of the green infrastructure maintenance, and then the economic impact of green infrastructure storm water pipe maintenance. The total impact represents the summation of these two impacts.

The economic impact of green infrastructure maintenance in the Cleveland-Elyria-Mentor MSA (including Cuyahoga County) for the combined years 2020 to 2024 is as follows:

- Total Employment Impact: 69 jobs
- Total Labor Income Impact: \$3.1 million
- Total Value Added Impact: \$4.1 million
- Total Output Impact: \$7.5 million
- Tax Impact: \$849,000

The economic impact of green infrastructure storm water pipe maintenance in the Cleveland-Elyria-Mentor MSA (including Cuyahoga County) for the combined years 2020 to 2024 is as follows:

- Total Employment Impact: 150 jobs
- Total Labor Income Impact: \$7.9 million
- Total Value Added Impact: \$9.8 million
- Total Output Impact: \$16.4 million
- Tax Impact: \$2.0 million

¹ Water Environment Research Foundation. (2009) *User's Guide to the BMP and LID Whole Life Cost Models 2.0* Alexandria, VA: Water Environment Research Foundation.

² The Cleveland-Elyria-Mentor MSA consists of Cuyahoga, Geauga, Lake, Lorain, and Medina counties

The total economic impact of green infrastructure projects in the Cleveland-Elyria-Mentor MSA (including Cuyahoga County) for the combined years 2020 to 2024 is as follows:

- Total Employment Impact: 219 jobs
- Total Labor Income Impact: \$11.0 million
- Total Value Added Impact: \$13.8 million
- Total Output Impact: \$23.9 million
- Tax Impact: \$2.8 million

INTRODUCTION

The Center for Economic Development (the Center) at the Levin College of Urban Affairs at Cleveland State University prepared this report for LAND studio. The objective of this report is to present an economic impact of the green infrastructure maintenance of the future green infrastructure investments that the Northeast Ohio Regional Sewer District (NEORS) will undertake. LAND studio will use this study as a component to a broader study of best practices in green infrastructure maintenance, the needs of the sector, and to develop a foundation for the creation of a green infrastructure maintenance education and workforce training program.

The report contains two sections: the first section includes the creation of the green infrastructure maintenance estimates, and the second details the economic impact of the green infrastructure maintenance estimates. The Center's estimates of the green infrastructure maintenance are of a five year period (2020-2024) for the Cleveland-Elyria-Mentor Metropolitan Statistical Area (MSA).³ In the next section, the Center estimates the economic impact of this industry using the IMPLAN software.

Traditional storm water management, also known as grey infrastructure, uses a network of sewers and pipes to collect and treat sewage and storm water so that it may be returned as clean water. Green infrastructure, on the other hand, is an environmentally friendly waste water cleaning technique that uses vegetation and soil to manage rainwater.⁴ Green infrastructure, also known as Best Management Practices (BMP) and Low Impact Development (LID), can take many forms. The green infrastructure that this report examines is that of bioretention ponds, defined as vegetated areas that are planted with native plants to collect and treat water runoff.⁵

It is not only the implementation and construction of green infrastructure that is important to consider, but it is also key to examine the maintenance and upkeep of these areas. It has been suggested that green infrastructure maintenance can create jobs in many cities since the maintenance of green infrastructure requires more manual labor and less heavy equipment than traditional storm water facilities.⁶

³ The Cleveland-Elyria-Mentor MSA consists of Cuyahoga, Geauga, Lake, Lorain, and Medina counties

⁴ Environmental Protection Agency. (2013, April 23). *Water: Green Infrastructure*. Retrieved May 2, 2013, from Green Infrastructure: <http://water.epa.gov/infrastructure/greeninfrastructure/>

⁵ The City of Lancaster. (April 2011). *Green Infrastructure Plan*. Lancaster, PA: The City of Lancaster.

⁶ Environmental Protection Agency. (14 December 2012) *How Can I Overcome the Barriers to Green Infrastructure?*, from Water: Green Infrastructure: http://water.epa.gov/infrastructure/greeninfrastructure/gi_barrier.cfm

GREEN INFRASTRUCTURE MAINTENANCE

OVERALL METHODOLOGY

Since the exact expenditures on the amount of green infrastructure maintenance could not be provided, the Center used the Water Environment Research Foundation (WERF) User's Guide to the BMP and LID Whole Life Cost Models 2.0⁷ to calculate the green infrastructure maintenance for the NEORSD projects. The WERF User's Guide to the BMP and LID Whole Life Cost Models 2.0 is an Excel based cost estimator that facilitates the estimation of the costs of implementing and maintaining green infrastructure projects. The retention pond model was used in calculating green infrastructure maintenance for this economic impact, which was derived from the first edition of the whole life cost model in 2005.

Information obtained from LAND studio on the size and quantity of the NEORSD green infrastructure projects indicated that NEORSD would implement 14 bioretention ponds, with a total water quality volume of 132,000 cubic feet per pond. These estimates were provided by NEORSD based on where they were in the design of the green infrastructure practices in the first quarter of 2013. Water quality volume is an important factor because according to the Ohio Environmental Protection Agency (EPA), "Water quality volume is generally used to define the amount of storm water runoff from any given storm that should be captured and treated in order to remove a majority of storm water pollutants on an average annual basis."⁸ Using this information the Center was able to use the WERF model to calculate the total drainage area for each project (72.73 acres).

Using the above information, the green infrastructure maintenance calculations were run using the traditional WERF model, but the research team made a few adjustments for several reasons:

- 1) In order to run a more detailed economic impact, labor and machinery/materials estimates needed to be broken out into two separate line items. The unadjusted WERF model created one dollar amount for maintenance schedules.
- 2) The maintenance schedule created by the WERF model seemed limited based upon other documentation on bioretention ponds. The WERF model provided a high, medium, and low maintenance schedule to calculate maintenance costs; the medium maintenance schedule was selected, but this was deemed too simplistic. The Center modified the medium maintenance schedule based upon current literature of bioretention maintenance. The research team adjusted the maintenance to occur twice a year (up from once a year), and inspections and vector control would stay at one site visit per year. The WERF base model for medium maintenance was 2 individuals for 4 hours per visit. However, based upon the literature,⁹ this

⁷ Water Environment Research Foundation. (2009) *User's Guide to the BMP and LID Whole Life Cost Models 2.0* Alexandria, VA: Water Environment Research Foundation.

⁸ Ohio EPA (20 March 2007) *RE: Guidance Regarding Post-Construction Storm Water Management Requirements of Ohio EPA's Storm Water Construction General Permit #OHC000002* from: Storm Water Post-Construction Questions & Answers <http://www.epa.ohio.gov/dsw/storm/CGPPCQA.aspx>

⁹ Russell, Doug (2012) "Willows Special Improvement District" *City of Kalispell, Office of the City Manager*. Memo to Mayor Fisher and Kalispell City Council, September 19, 2012 http://kalispell.com/mayor_and_city_council/documents/SID345.pdf

was adjusted up to 6 hours per visit. All other maintenance schedules were maintained from the WERF model.

3) Since the WERF model used a national survey to gather its data, the Center used the WERF model as a framework and made workforce adjustments based upon the Cleveland MSA. Each maintenance duty was matched to an occupational category based upon the Standard Occupational Classification (SOC) code. Based upon the matches by SOC code, hourly median wage rates were used for the Cleveland MSA from the Bureau of Labor Statistics Occupational Employment Statistics data.

LABOR MAINTENANCE ESTIMATES

Table 1 and 2 describe the labor estimates for the green infrastructure maintenance for one NEORSD project (there are 14 in total). Table 1 multiplies the hourly wage by the hours per visit, crew size per visit, number of visits per year to establish the total cost of labor maintenance estimates for each occupation. This information was derived from the WERF model. Moreover, the WERF model accounts for the sediment dewatering and removal maintenance that will occur within the bioretention basins. The WERF model estimates that this will occur every 20 years. Based upon other literature the research team reviewed, we thought this was too infrequent and adjusted the sediment removal to every 5 years.¹⁰ Total costs for all visits in Table 1 are inflated to 2020 and 2024 dollars in Table 2 using a projected Cleveland MSA consumer price index (CPI) for 2020 to 2024.

Table 1. Labor Maintenance Costs for One Green Infrastructure Project, 2005

SOC Code	SOC Name	WERF Model Name	Hourly Wage (\$2005)	Hours Per Visit	Crew Size, per visit	Number of Visits, per year	Total Cost, all visits, per year (\$2005)
17-2051	Civil engineers	Inspection, reporting & information mgmt	\$31	2	1	1	\$62
37-3011	Landscaping and groundskeeping	Vegetation mgmt with trash & minor debris removal	\$10	6	2	2	\$251
37-2021	Pest control	Vector control	\$15	1	1	1	\$15
47-2073	Operating engineers and other construction equipment operators	Sediment Dewatering & Removal: Main Pool	\$21	16	2.5	Only in 2023	\$858

Source: Bureau of Labor Statistics; Water Environment Research Foundation

Table 2. Total Labor Maintenance Costs, All Visits Per Year for One Green Infrastructure Project, 2020-2024

SOC Code	SOC Name	WERF Model Name	2020	2021	2022	2023	2024
17-2051	Civil engineers	Inspection, reporting & information mgmt	\$84	\$86	\$88	\$90	\$92
37-3011	Landscaping and groundskeeping	Vegetation mgmt with trash & minor debris removal	\$339	\$347	\$354	\$362	\$370

¹⁰ The City of Lancaster. (April 2011). *Green Infrastructure Plan*. Lancaster, PA: The City of Lancaster.

Economic Impact of Green Infrastructure Maintenance

37-2021	Pest control	Vector control	\$21	\$21	\$21	\$22	\$22
47-2073	Operating engineers and other construction equipment operators	Sediment Dewatering & Removal: Main Pool				\$1,240	

Source: Table 1

MACHINERY AND EQUIPMENT ESTIMATES

Table 3 and 4 display the calculations for machinery and equipment estimates for one green infrastructure project; these formulations were derived from the WERF model. Table 3 calculates machinery costs for each occupation based upon machinery and equipment costs, hours per visit, number of visits per year, and any incidental costs. As noted earlier, the model accounts for the sediment removal based upon a given quantity from the total drainage area of the project (each NEORS bioretention pond has a sediment quantity of 1,222 yd³). The materials and machinery costs were derived from the WERF model and were calculated by the cubic yard. Table 4 estimates the total costs for all visits for each green infrastructure project (there are 14) shown in Table 3, and inflates it to 2020 and 2024 dollars using a projected Cleveland MSA CPI.

Table 3. Machinery and Equipment Costs for One Green Infrastructure Project, 2005

SOC Code	SOC Name	WERF Model Name	Machinery & Equipment Cost (\$2005)	Hours Per Visit	Number of Visits, Per Year	Incidentals(\$2005)	Total Machinery & Equipment Cost (\$2005)
17-2051	Civil engineers	Inspection, reporting & information mgmt	\$30/hour	2	1	\$0	\$60
37-3011	Landscaping and groundskeeping	Vegetation mgmt with trash & minor debris removal	\$60 /hour	6	2	\$1,000	\$1,720
37-2021	Pest control	Vector control	\$400 /hour	1	1	\$0	\$400
47-2073	Operating engineers and other construction equipment operators	Sediment Dewatering & Removal: Main Pool	\$50 materials / (yd ³) \$150 machinery / (yd ³)	-	Only in 2023	\$0	\$244,400

Note: Machinery costs for sediment removal the product of the sediment quantity (1,222 yd³) * material cost per yd³ plus the product of the sediment quantity (1,222 yd³) * machinery cost yd³.

Source: Bureau of Labor Statistics; Water Environment Research Foundation

Table 4. Total Machinery and Equipment Costs, All Visits Per Year for One Green Infrastructure Project, 2020-2024

SOC Code	SOC Name	WERF Model Name	2020	2021	2022	2023	2024
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17-2051	Civil engineers	Inspection, reporting & information mgmt	\$81	\$83	\$85	\$87	\$89
37-3011	Landscaping and groundskeeping	Vegetation mgmt with trash & minor debris removal	\$2,330	\$2,381	\$2,432	\$2,485	\$2,538
37-2021	Pest control	Vector control	\$542	\$554	\$566	\$578	\$590
47-2073	Operating engineers and other construction equipment operators	Sediment Dewatering & Removal: Main Pool				\$353,115	

Source: Table 3

STORM WATER PIPE MAINTENANCE

In addition to the green infrastructure maintenance calculated in Tables 1 to 4, storm water pipes that will deliver storm water runoff to the bioretention ponds should be included in the calculations. Based upon the assumption that 50% of storm water pipes will be replaced over 20 years,¹¹ we amortized the pipe replacement and maintenance from the beginning of the project to year 20. According to the Southeast Storm Water Association it costs \$325 per linear foot to replace a pipe in 2011.¹² According to NEORS, each bioretention pond will require 8,500 linear feet of storm water pipe. Using the above information, approximately 213 linear feet of pipe will be replaced each year. Moreover, according to the EPA, labor accounts for 85 to 95 percent of the maintenance costs of storm water pipes.¹³ It is from this information that we can determine the amount of storm water pipe maintenance costs and inflate it to 2020 and 2024 dollars using a projected Cleveland MSA CPI. Then using the EPA guidance estimate that 90% of this amount will be used toward labor costs and 10% to materials (Table 5).

Table 5. Storm Water Pipe Maintenance Cost Estimations, 2020-2024

Year	Total Costs in future dollars	Labor (90% of total)	Materials (10% of total)
2020	\$1,166,404	\$1,049,764	\$116,640
2021	\$1,191,591	\$1,072,432	\$119,159
2022	\$1,217,322	\$1,095,590	\$121,732
2023	\$1,243,613	\$1,119,251	\$124,361
2024	\$1,270,467	\$1,143,420	\$127,047

Source: Southeast Storm water Association Conference; Environmental Protection Agency

¹¹ Central Oregon Intergovernmental Council. (August 2010) *Central Oregon Storm Water Manual* http://www.lcog.org/documents/sub_action/CentralOR_StormwaterManual_201008.pdf

¹² Southeast Storm Water Association (11 October 2011) *Estimating Storm Water System Annual Maintenance and Repair Costs - A GIS Approach*. 2011 SESWA Annual Conference

¹³ Environmental Protection Agency. (2000) *Wastewater Technology Fact Sheet: Sewers, Force Main*. EPA 832-F-00-071

http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_force_main_sewers.pdf

ECONOMIC IMPACT METHODOLOGY

Economic impact modeling assumes that the green infrastructure projects whose impact is estimated in this report came into existence one day and the appearance of these projects stimulates the local economy through increased demand for goods and services. The value of this stimulus is defined as the purchase of labor and goods and services by NEORSD for final consumption. The effect of this change is then traced through the Northeast Ohio economy using the IMPLAN model.

IMPLAN is an input-output (I/O) model that captures the buy-sell relationships among all industries, government, and the household sector. These relationships largely determine how an economy responds to changes in economic activity. I/O models estimate inter-industry relationships in a county, region, state, or country by measuring the industrial distribution of inputs purchased and outputs sold by each industry and the household sector. Thus, by using I-O models, it is possible to estimate how the impact of one dollar or one job ripples through the local economy, creating additional expenditures and jobs. The economic multiplier measures the ripple effect that an initial expenditure has on the local economy.¹⁴

NEORSD buys goods and services in order to have the green infrastructure projects, which, in turn, leads into the three components of economic impact: direct, indirect, and induced effects. *Direct impact* is the initial value of goods and services that NEORSD purchases in the region. *Indirect impact* measures the jobs and production needed to manufacture goods and services required by NEORSD through the local supply chain. *Induced impact* is the increase in spending of local households because of income received through their work at NEORSD and with its suppliers. Since the analysis only looks at the impact on the five county region of the Cleveland MSA, any purchases made outside each region were excluded from that respective model.

This report measures five impacts for the region: employment, labor income, output, value added, and taxes. *Employment* measures the number of jobs that exist due to NEORSD spending. *Labor income* is payroll paid to employees, plus proprietors' income. *Output* measures the total value of goods and services produced in the region as a result of the spending. *Value added* measures the value of goods and services less the intermediary goods and represents a portion of output. *Taxes* include federal as well as state and local tax revenues.

EMPLOYMENT IMPACT

The activities of NEORSD affect job creation in Northeast Ohio through the goods and services that it purchases, beyond the hiring of its own employees. The total employment impact equals the sum of NEORSD employment involved in green infrastructure (the direct impact), the indirect impact (employment in industries from which NEORSD purchases goods and services

¹⁴ For example, suppose that Company A reports sales of \$10 million to NEORSD. From the revenues of the company, they pay suppliers and workers, cover production costs, and take a profit. Once the suppliers and employees receive their payments, they will spend a portion of their money in the local economy purchasing goods and services, while another portion of the money will be spent outside the local economy (known as leakage). By evaluating the chain of local purchases that result from the initial infusion of \$10 million, it is possible to estimate a regional economic multiplier.

and that sell inputs for the goods and services), and the induced impact (jobs created through the purchases of the employees of NEORSD and its suppliers).

LABOR INCOME IMPACT

Labor income impact, or earnings impact, is the estimated total change in money paid to local households due to NEORSD spending on goods and services from businesses and other entities in the region for the purpose of green infrastructure projects. In the economic impact, the direct impact represents the total amount of NEORSD spending on the maintenance of green infrastructure in either payroll and benefits or contract labor spending. The indirect impact is estimated by summing the money paid to persons who work for companies from which NEORSD makes purchases and those that provide inputs to the producers of the goods and services ultimately consumed by NEORSD. The induced impact represents money paid to workers in all industries who are employed as a result of purchases by households whose income is affected by NEORSD's demand for products and services.

OUTPUT IMPACT

In order to calculate the output impact, the spending of NEORSD on the green infrastructure maintenance projects in the region were categorized into industry classifications based on the IMPLAN 3.0 model. The direct impact here represents the total spending of NEORSD (excluding payroll and benefits). The indirect effect is the summation of local purchases by individual industries from which NEORSD makes purchases and that provide inputs to the producers of the goods and services ultimately consumed by NEORSD. The induced effect is estimated by measuring the spending of workers who are employed as a result of NEORSD's demand for products and services.

VALUE ADDED IMPACT

Value added measures the value of goods and services less the intermediary goods, such as utilities, and represents a portion of output. NEORSD may directly hire workers for green infrastructure maintenance or outsource the duties through contracts. The direct effect here (equal to that of labor income) represents NEORSD's total payroll and benefits or contract labor spending.

TAX IMPACT

The tax impact is a sum of the state and local taxes and the federal taxes paid from the green infrastructure projects.

ECONOMIC IMPACT OF GREEN INFRASTRUCTURE MAINTENANCE

ECONOMIC IMPACT OF GREEN INFRASTRUCTURE MAINTENANCE, 2020-2024

Using the expenditures outlined in the previous section of this report, this section outlines the economic impact of the maintenance of the green infrastructure projects of NEORS on the Cleveland MSA between 2020 and 2024. The maintenance will create an estimated 69 jobs, \$3.1 million in labor income, \$4.1 million in value added impact, \$7.5 million in output, and generate \$849,000 in taxes (Table 6).

The majority of the jobs created are in *Maintenance and repair construction of nonresidential structures*, (42), while the remaining jobs are in various industries that support the industry and the individuals that work on the projects. Other top industries affected included *Services to buildings and dwellings*, *Food services and drinking places*, *Architectural, engineering, and related services*, and *Real estate establishments*.

Table 6. Economic Impact of Green Infrastructure Maintenance Impact, 2020-2024

Impact Type	Employment	Labor Income	Value Added	Output	Tax
Direct Effect	45	\$1,984,013	\$2,159,604	\$4,422,456	\$437,665
Indirect Effect	9	\$480,826	\$711,150	\$1,191,007	\$149,220
Induced Effect	15	\$670,153	\$1,181,665	\$1,902,024	\$262,207
Total Effect	69	\$3,134,992	\$4,052,419	\$7,515,487	\$849,092

Note: Data displayed in 2013 dollars

ECONOMIC IMPACT OF GREEN INFRASTRUCTURE STORM WATER PIPE MAINTENANCE, 2020-2024

This section outlines the economic impact of the maintenance of the storm water pipes associated with green infrastructure projects of the NEORS on the Cleveland MSA between 2020 and 2024. The maintenance of the storm water pipers will create an estimated 150 jobs, \$7.9 million in labor income, \$9.8 million in value added impact, \$16.4 million in output, and generate \$2.0 million in taxes over the five years (Table 7).

As with the green infrastructure maintenance, the largest number of jobs created are in *Maintenance and repair construction of nonresidential structures*, (107). The other jobs are again spread across various industries that support the projects and the individuals that they employ. Other top industries affected included *Food services and drinking places*, *Private hospitals*, *Real estate establishments*, and *Offices of physicians, dentists, and other health practitioners*; mostly through the induced effect.

Table 7. Green Infrastructure Storm water Pipe Maintenance Impact, 2020-2024

Impact Type	Employment	Labor Income	Value Added	Output	Tax
Direct Effect	101	\$5,648,845	\$6,036,354	\$10,306,495	\$1,150,229
Indirect Effect	6	\$299,407	\$347,299	\$678,497	\$71,021
Induced Effect	43	\$1,911,195	\$3,369,338	\$5,423,947	\$745,640
Total Effect	150	\$7,859,447	\$9,752,991	\$16,408,939	\$1,966,890

Note: Data displayed in 2013 dollars

TOTAL ECONOMIC IMPACT, 2020-2024

Overall, the maintenance projects will create an estimated 219 jobs, \$11.0 million in labor income, \$13.8 million in value added impact, \$23.9 million in output, and generate \$2.8 million in taxes over the five years (Table 8).

Table 8. Total Green Infrastructure Maintenance Impact, 2020-2024

Impact Type	Employment	Labor Income	Value Added	Output	Tax
Direct Effect	146	\$7,632,858	\$8,195,958	\$14,728,951	\$1,587,894
Indirect Effect	15	\$780,233	\$1,058,449	\$1,869,504	\$220,241
Induced Effect	58	\$2,581,348	\$4,551,003	\$7,325,971	\$1,007,847
Total Effect	219	\$10,994,439	\$13,805,410	\$23,924,426	\$2,815,982

Note: Data displayed in 2013 dollars

In the employment impact, 66% of the impact is in the direct effect (146 jobs). Seven percent is in the indirect effect (15 jobs) and 27% is in the induced effect due to household spending (58 jobs). In the labor income impact, 69% of the total effect comes from the direct impact (\$7.6 million). The indirect effect accounts for 7% (\$780,233) and the induced effect accounts for 24% of the total (\$2.6 million).

The value added impact comes from \$8.2 million in the direct effect (59%), \$1.1 million in the indirect effect (8%), and \$4.6 million in the induced effect (33%). The output impact comes from \$14.7 million in the direct effect (62%), \$1.9 million in the indirect effect (8%), and \$7.3 million in the induced effect (30%).

Fifty six percent (56%) of the tax impact is in the direct effect (\$1.6 million). Eight percent (8%) is in the indirect effect (\$220,241) and 36% is in the induced effect (\$1.0 million). Figure 1 shows the percentage of each project that represents the total impact in each type of impact. The maintenance of the pipes represents the clear majority of each type of impact, between 69% and 71% of the total impact.

Figure 1. Total Economic Impact by Green Infrastructure Maintenance and Green Infrastructure Pipe Maintenance, 2020-2024



