TANDEM GLOBAL WHITE PAPER

SUSTAINABLE GREEN INFRASTRUCTURE

Unlocking Business Value, Biodiversity Gains, and Community Benefits

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Business and nature for good

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Message from our sponsor

DTE

As Michigan's largest energy supplier and one of the state's largest landowners, DTE Energy is proud to be a leader in conservation efforts in the communities where we live and serve. We strive to promote a positive impact on the environment through a culture that goes above and beyond regulations and reiterates responsibility.

Environmental stewardship is incorporated into our processes as we work to minimize biodiversity impacts and sustain the ecosystems necessary for healthy communities. DTE employs practical land management and conservation techniques to protect and preserve natural communities and resources at our facilities and properties.

Through strategic partnerships with organizations like Tandem Global, the Nature Conservancy and NextCycle Michigan, we seek out new and innovative ways to improve outcomes for the environment and our communities, promote a circular economy and reduce biodiversity impacts across our enterprise. DTE maintains dozens of certified wildlife habitats across our facilities and voluntarily oversees thousands of acres of land in its natural state, providing habitat for hundreds of species of birds, mammals, fish and insects. We also partner with local organizations who can reuse materials (such as poles, appliances and office equipment) and volunteer hundreds of hours each year in time and technical expertise at local non-profits to assist in projects that improve water quality, fisheries habitats and tree canopy throughout the region.

We recognize that environmental needs will vary from community to community, and we work to prioritize the people and neighborhoods who are most impacted. This led us to be founding partners in the Detroit Tree Equity Partnership, which has committed to planting 75,000 trees in targeted areas of the city to help reduce surface temperatures, improve health outcomes and restore Detroit's tree canopy where residents need it most.

Nature-based solutions are the way of the future, and DTE is committed to doing the vital work of protecting our environment and our communities, while powering a cleaner tomorrow for all.

Shawn P. Patterson
Vice President of Environmental Management and Safety
DTE Energy

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Introduction

The praxis of modern society hinges on the foundational framework of access to critical resources and utilities that consistently impact denizens, such as shelter, water, power, and transportation. Due to the necessity of these critical pieces of infrastructure in facilitating the progression of modernization, methods and techniques should be implemented to ensure their sustainability and improvement. With an ever-expanding global infrastructure gap, estimated to reach USD 15 trillion by 2040, developing nations are faced with a disproportionate number of negative effects caused by financing gaps between infrastructure needs and spending.[1] These needs stem from a plethora of project areas, ranging from new development to maintenance.

The growing infrastructure gap further separates people from leading healthy sustainable lives. Globally, 746 million people lacked access to electricity in 2023.[2] While that number has decreased by half since 2000, that still leaves a portion of the population, concentrated in sub-Saharan Africa and developing Asia in particular, without adequate access to this vital resource. Additionally, the U.N. found that water demand has increased 1% each year over the last four decades, with that trend expected to continue.[3] Depletion of groundwater is a growing concern globally, with groundwater storage being depleted at about 100 to 200 km^3/year, per the U.N.[4]

In developed nations like the U.S., moldering infrastructure persists alongside a concerning lack of greenspace access for an estimated 100 million people.[5] This modern disconnect from nature negatively impacts mental and physical health and is exacerbated in low-income, industrial and urban communities. Climate change impacts further increase disparities that are then exacerbated by infrastructure concerns. Flooding in coastal and urban settings, intense wildfires and increasing temperatures are stressing existing infrastructure. Urban and industrial communities experience higher air temperatures and an increased rate of year-round exposure to harmful emissions like PM2.5, O3, and other pollutants harmful to public health.

These challenges are prevalent in most highly urbanized, industrial societies. However, when paired with conscious practices, revitalizing existing

infrastructure by introducing green infrastructure initiatives have been shown to mitigate and reverse harmful impacts on public health and biodiversity in our urban and industrial communities.[6] Investing in sustainable infrastructure that incorporates elements of nature addresses long-term cost concerns, supports climate change resilience, public health and well-being, and biodiversity uplift.

Green infrastructure, sometimes referred to as nature-based infrastructure (NBI), saves up to 50% the costs of traditional gray infrastructure. Additionally, experts theorize that replacing just 11% of traditional infrastructure with NBI, in meeting current global infrastructure needs, would save $248 billion every year. While infrastructure is generally considered public expenditure, there are many opportunities for public-private partnerships to invest in sustainable infrastructure.[7]

This white paper explores how companies have implemented sustainable green infrastructure solutions, encompassing biodiversity sustainability and preservation. These examples illustrate the co-benefits of green infrastructure by not only providing cost-effective access to critical infrastructure but also uplifting biodiversity and supporting community needs.

Reducing Energy Use and Temps with Green Roofs

The urban heat island effect describes a phenomenon where urban or metropolitan areas become significantly warmer than their rural surroundings, primarily due to human activities or severe alteration to natural landscapes.[8] In cities, the abundance of concrete, asphalt, and building materials that absorb and retain heat creates a microclimate that can be as much as 5°F to 10°F (-15°C to -12.5°C) warmer than areas just a few miles away.[9] In urban areas with high density, a 15°F to 20°F (-10°C to -7°C) difference.[10] This temperature difference can be attributed to various factors. As canopies are replaced with paved roads and structures, this cooling mechanism diminishes, leading to a buildup of heat. Furthermore, the addition of waste heat from vehicles, air conditioning units, and industrial processes further exacerbate the urban heat island effect.[11] This can result in increased energy consumption, higher emissions of air pollutants, and a decline in overall air quality.

Implications of the urban island heat effect are significant, particularly as climate change intensifies global temperatures. Cities facing extreme heat can suffer from heat stress, leading to health risks such as heat exhaustion or heatstroke. Public health systems may come under strain by elevated cases of dehydration, exhaustion, or heatstroke. Higher energy demands lead to higher utility costs, further stressing existing environmental circumstances. With the expansion of urban and industrial areas, understanding and combating the urban island heat effect is crucial for sustainable urban planning and maintaining the public health of urban residents.

Mitigation strategies often include urban green spaces that promote natural cooling. One of the most effective methods of combating urban island heat effect is the implementation of green roofs. Green roofs are vegetated rooftop systems that represent a sustainable model to enhance green infrastructure in urban settings. By introducing vegetation on roofs, a range of environment, economic, and social advantages may be gained. Green roofs can lower energy expenses through insulation. Naturally, vegetation goes through a daily dew

and evaporation cycle which in turns creates a cooling effect on surrounding surfaces. Furthermore, photosynthesis aids light absorption which would otherwise remain as heat energy across rooftops.[12] This ultimately shrinks energy expenses by reducing cooling loads by 70 percent, bringing internal temperatures down by 27°F, addressing the consequences of urban island heat effect.[13] Green roofs offer a holistic approach to sustainable building design that contributes to an overall healthier environment and enhances the quality of life for urban areas.

CONSERVATION IN ACTION
WETLAND STUDIES AND SOLUTION, INC. | GAINESVILLE, VA

In a strategic and innovative move towards sustainable building practices, Wetland Studies and Solutions, Inc., part of Davey Resource Group, has successfully integrated a green roof into their headquarters in Gainesville, Virginia. This addition serves not only as a practical solution for managing stormwater but also as a sanctuary for native wildlife, particularly pollinator species. Spanning a one-story extension of 3,626 square feet, the green roof has transformed into an employee amenity, complete with inviting seating areas and winding walkways. The thoughtful design incorporates paths, patios, seats, and barriers, providing both ecological benefits and aesthetic charm to the landscape. This environmentally conscious endeavor includes sustainable features such as a 75-millimeter EPDM roofing membrane alongside various layers like foam board, root barriers, landscape fabric, and a lightweight growing medium mix. The roof boasts a blend of extensive and intensive planting areas showcasing native Virginia flora, providing year-round blooms to ensure a steady stream of pollinator activity throughout the year. While extensive sedums carpet the roof, the wetland pods emerge as standout elements, sustained by pond liners for optimal plant health. To ensure efficient water use, drip irrigation systems and moisture sensors have been integrated, guiding excess water into an extensive 8,000-gallon cistern for landscaping needs. Furthermore, with its R-30 insulation and durable construction, the green roof promises a lifespan exceeding two decades, a testament to its enduring quality and commitment to sustainability.

WHC-CERTIFIED SINCE 2022 **CERTIFIED SILVER**

Managing and Filtering Stormwater Runoff

Stormwater runoff, water that flows over land and impervious surfaces during rainstorms or snowmelts, plays a significant role in impacting water quality.[14] As stormwater travels over surfaces, it picks up various pollutants such as trash, sediment, chemicals, and nutrients before entering water bodies like rivers, lakes, and oceans. These pollutants can have detrimental effects on aquatic ecosystems and human health. Sediment may cloud water, blocking sunlight from reaching aquatic vegetation and reducing oxygen levels for aquatic animals.[15] Chemical pollutants such as fertilizers and pesticides can create toxic conditions for fish and other marine organisms. Annually, an estimated 100,000 marine mammals die each year due to stormwater runoff pollution.[16]

To mitigate the impacts of stormwater runoff on water quality, various management practices can be implemented. These include green infrastructure solutions like rain gardens, bioswales, and retention ponds to redirect, capture, and filter stormwater before it reaches water bodies. Proper maintenance of stormwater management systems, public education on reducing pollution sources, and the implementation of green infrastructure can help protect water quality and preserve the health of aquatic environments.

CONSERVATION IN ACTION
BLUETRITON BRANDS | EVART, MICHIGAN

Located in Evart, Michigan, the Twin Creek Nature Area is a thriving hub of environmental benefits and community engagement in Northern Michigan. The road enhancement initiative at Twin Creek included the installation of a stormwater storage system designed to manage water runoff effectively. Drainage basins were strategically placed on the road surface to collect runoff and direct it into the bioswale, which featured rain gardens acting as natural filters for stormwater. These measures protected the neighboring cold-water stream, provided a wetland ecosystem for wildlife, and boosted plant diversity using native Michigan flora. Different plant species were strategically selected and introduced to the bioswale and rain garden to support pollinators year-round and contribute to habitat stabilization. Monitoring efforts

post-construction have shown positive developments in flora, with ongoing management activities focusing on controlling invasive species while promoting native plant populations. Community outreach programs aim to educate students of all ages on environmental issues, green infrastructure, and water conservation. Rain gardens and bioswales play crucial roles in managing stormwater runoff, filtering out pollutants, reducing erosion, and providing habitat for wildlife. By utilizing native plants and soil, these green infrastructures help improve water quality, recharge groundwater supplies, and enhance urban landscapes.

WHC-CERTIFIED SINCE 2023 **CERTIFIED GOLD**

Bioswale Benefits

Bioswales are vegetated channels designed to manage stormwater and reduce runoff pollution. These landscape features are engineered to slow down, collect, and filter stormwater runoff before it reaches larger bodies of water.[17] One bioswale can filter more than 75,000 gallons of water each year.[18] By utilizing native plants and soil to absorb and treat the water, bioswales help improve water quality, reduce erosion, and recharge groundwater supplies. Vegetation found in bioswales plays a key role in absorbing pollutants, such as heavy metals and sediment, while the soil acts as a natural filter.[19]

CONSERVATION IN ACTION

TOYOTA | ANN ARBOR, MICHIGAN

Retention ponds are artificial water bodies designed to manage stormwater runoff by providing storage space for excess water during heavy rain events. By allowing sediments to settle at the bottom of pond, retention ponds also help to improve water quality by filtering out pollutants before the water is discharged.[20] Additionally, retention ponds create habitats for wildlife and improve the aesthetic value of an area. These features make retention ponds an effective piece of green infrastructure to mitigate the impacts of urban development on the environment.

Toyota North America's Ann Arbor Woodridge campus features two retention ponds, the North Pond and the South Pond, designed to hold stormwater discharge from building roofs, roads, and parking lots. The ponds help reduce the risk of flooding by temporarily holding back stormwater and slowly releasing it into nearby water sources or the ground. The pollution runoff from parking lots is contained within oil booms at the discharge point into the North Pond. Sediment discharge into the South Pond is prevented by the "Stormceptor" system near the large employee parking lot along with thick vegetation surrounding the South Pond which aids in preventing sediment discharge.

Both the North and South Ponds serve as habitats for a variety of wildlife species, maintained with minimal interference to preserve natural ecosystems. The North Pond is surrounded by minimal mowing, except for a narrow access lane mowed monthly in the summer for inspection of sedimentation and rainfall impact. The addition of pervious pavement on parking lots allows rainfall to filter through underground stormwater systems before reaching the ponds, thereby improving water quality. Wildlife, such as birds and amphibians, benefits greatly from these efforts as it utilizes the water for hydration and breeding.

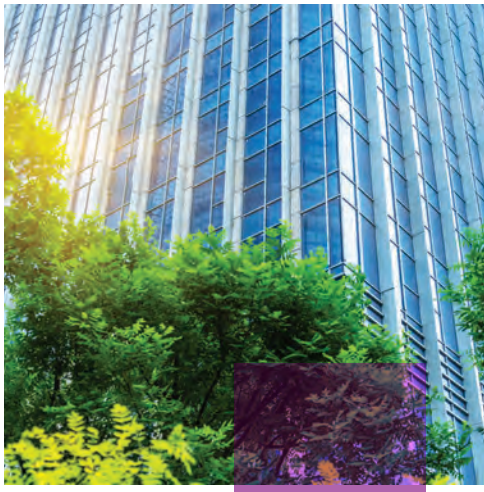
Regular inspections and management strategies ensure the wetland areas stay healthy and sustainable, while ongoing plans include improving invasive species management, vegetation control, and monitoring protocols to ensure the long-term preservation of these crucial habitats.

WHC-CERTIFIED SINCE 2019 **CERTIFIED SILVER**

Rain Gardens 101

Rain gardens are shallow depressions designed to capture and absorb stormwater runoff and prevent the entrance of pollutants into waterways. These green infrastructures use native plants and soils to filter out pollutants, allowing the water to slowly percolate into the ground and recharge the groundwater.[21]

Green Aesthetics and Industry Innovations



Just as traditional infrastructure remains innovative through materials research and building strategies, so does green infrastructure. By widening the scope of green infrastructure, further applications may be implemented across urban and industrial areas. Not only does green infrastructure mitigate the effects of urban and industrial development on biodiversity and environmental sustainability, but it also enhances the aesthetic appeal and overall quality of life. Green infrastructure may create opportunities for outdoor recreational activities, fostering a sense of community, and allows for a symbiotic balance between urban living and environmental sustainability.

As with all forms of infrastructure, green infrastructure may have certain limitations in its application. However, research and development efforts can provide us with new methods and strategies to increase effectiveness. By increasing soil health and biodiversity, green infrastructure can support project goals such as bioswales to maximize filtration and water retention, vegetation during harsh weather conditions, and the structural integrity of retention ponds during stormwater collection.

Most green infrastructure projects rely on soil health, which is a foundational piece of the overall health of local ecosystems. Biochar, a type of charcoal produced through the process of heating biomass in the absence of oxygen, can help improve soil health by enhancing its water retention capacity, reducing nutrient leaching, and promoting beneficial microbial activity.[22] This, in turn, can lead to increased vegetative success and overall plant growth. Biochar also has the potential to sequester carbon dioxide from the atmosphere, making it a promising tool for climate change mitigation. Recent studies have shown the effectiveness of biochar on environmental sustainability and health.[23]

GENERAL MOTORS | SÃO JOSE, BRAZIL

Located in São Jose, Brazil, General Motor's Chevrolet Boulevard is a model example of utilizing green infrastructure to simultaneously enhance site aesthetics and benefit local biodiversity. The project at Chevrolet Boulevard aimed to address the poor lighting and discomfort reported by employees when passing through the area at night. Initiated in 2019, the ongoing project focuses on revitalizing the space by incorporating green infrastructure elements to benefit biodiversity. Key components include an orchid house, native tree planting (Quaresmeiras - Tibouchina granulosa), rain gardens, and a mini solar photovoltaic power plant. The installation of rest benches provides a tranquil space for employees to connect with nature, while actions like maintaining native seedlings and rain gardens contribute to biodiversity conservation.

By integrating green infrastructure solutions, the beautification project at Chevrolet Boulevard shows a sustainable approach to improving the environment while meeting the needs of employees through effective project management and biodiversity consideration planning.

WHC-CERTIFIED SINCE 2024 **CERTIFIED GOLD**

CONSERVATION IN ACTION

MEG ENERGY | ALBERTA, CANADA

At the Christina Lake Regional Project in Alberta, Canada, MEG Energy has shown its ability to not only meet industry standards, but to surpass them through innovative practices. When a loss of topsoil at a reclamation site threatened the project's success, MEG partnered with Saskatchewan Polytechnic to find a solution. The answer? Biochar. This carbon-rich material not only enhances soil health but also helps sequester carbon, making it a potentially game-changing addition to green infrastructure projects.

The research collaboration between MEG and Saskatchewan Polytechnic aims to assess biochar's impact on soil quality, plant growth, and biodiversity over a three-year study period. The goal is not just to benefit MEG's reclamation efforts but to also provide valuable insights for the broader industry, fostering environmental sustainability and biodiversity conservation in Alberta's ecosystem.

Despite delays caused by the pandemic, the biochar trial was successfully implemented in 2022 at a selected MEG reclamation site. Student researchers funded by Mitacs (a Canadian nonprofit that operates research and training programs related to technological innovations) are conducting field studies and producing valuable insights that will help shape future reclamation practices in Alberta. Through sharing the results of this study, MEG aims to contribute to the enhancement of biodiversity and ecosystem restoration in the region.

WHC-CERTIFIED SINCE 2019 **CERTIFIED GOLD**

A Call to Action for Corporate Landowners

It is pertinent that corporate landowners recognize the significant impact of green infrastructures on our environment and communities. By implementing ecofriendly solutions such as green roofs, bioswales, rain gardens, and retention ponds, corporate landowners can reduce their overall carbon footprint, mitigate urban heat island effect, improve air and water quality, and boost biodiversity around your local sites. Embracing sustainable practices not only benefits the environment but also enhances the overall well-being of your employees and local communities, which in turn may correlate to a more positive public opinion. Corporate landowners are presented with a unique opportunity to take the lead and create a healthier and more sustainable future by integrating green infrastructures into corporate properties.

Corporate landowners can engage in the following actions when exploring the use of green infrastructure solutions for their lands:

- Assess the environmental challenges on the property that may be addressed with green infrastructure. Are there any areas that experience heavy stormwater runoff or flooding issues? Are there roads with frequent wildlife vehicle collisions? Are heating or cooling costs high, or are there any parts of the building that seem to heat up quickly in the summer or always seem cold in the winter?
- Evaluate whether your facility can install wildlife-friendly green infrastructure to lower or even eliminate the burden of municipal stormwater fees or rain taxes, exceed regulatory requirements for stormwater management, or boost property values.
- Download our free Green Infrastructure Project Guidance to assist you in designing a green infrastructure project that will both address your environmental challenges and provide meaningful benefits to biodiversity.
- Implement green infrastructure activities that aid in, or contribute to, an environmental goal.
- Demonstrate the success of your facility's green infrastructure projects by seeking WHC Certification, powered by Tandem Global, a rigorous, third-party standard. Through the Green Infrastructure project theme, WHC Certification recognizes and incentivizes a variety of green infrastructure projects, including those discussed in this white paper.

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Tandem Global connects leading thinking with practical solutions that positively impact climate, nature, and water. From field operations to boardrooms and beyond, corporate leaders turn to Tandem Global for impact strategies and resilient solutions that can support a better future.

consulting@tandemglobal.org | www.tandemglobal.org