Protecting our Water Resources through Low Impact Development

Building our future in the Great Miami River Watershed

MIAMI CONSERVANCY DISTRICT

PROTECTING. PRESERVING. PROMOTING.

Why Protect our Water?

Thoughtful community land use planning and development are critical to protecting our community's water resources. Our rivers, streams, wetlands, floodplains, and aquifer provide safe and plentiful drinking water and recreation opportunities; mitigate flooding and peak flows; and create habitat for wildlife.

The Miami Conservancy District is committed to preserving our region's water and can provide assistance to communities that want to integrate water resource protection into their land use plans, zoning code, and subdivision regulations. Promoting Low Impact Development is one way to accomplish water resource protection.

What is Low Impact Development?

Low Impact Development (LID) is an innovative stormwater management approach that manages rainfall where it lands. The goal is to mimic a site's pre-development landscape by using site design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

Instead of managing and treating stormwater in large, costly end-of-pipe facilities such as stormwater detention ponds, LID encourages the use of small, cost-effective management practices located on each individual lot. Almost all components of the urban environment have the potential to serve as a management practice. This includes open space, rooftops, streetscapes, parking lots, sidewalks, driveways and medians. LID is a versatile approach that can be applied equally well to new development, urban retrofits, and commercial and industrial projects.

Benefits to using LID in your community

LID has many benefits and advantages over conventional development, including:

- Enhancing the local environment and protecting public health while saving developers and local governments time and money.
- Addressing nonpoint source pollution and stormwater management regulatory challenges in a simple and economical manner.
- Protecting surface water and groundwater from the impacts of runoff and groundwater contamination that can come from urban neighborhoods.
- Helping local governments to better balance conservation, growth, and economic development objectives by having more effective and flexible technology choices.
- Reducing stormwater conveyance and stormwater management infrastructure and their associated construction, maintenance and enforcement costs.
- Reducing water pollution and improving wildlife habitat more effectively than conventional best management practices (BMPs) because LID uses multiple systems.
- Using technologies that universally apply to greenfields, brownfields, and urban redevelopment in any climatic or geological region.
- Enjoying increased quality of life, fiscal health, reduced air pollution, water conservation, better habitat protection and increased property values.

How do communities get started?

1st — Communities should take a close look at local zoning codes and ordinances and how they address water resources to identify areas that can be changed. The Miami Conservancy District (MCD) can provide tools and/or assistance to evaluate your community.

2nd — Land use plans and subdivision regulations can be altered to allow innovative Low Impact Development site design techniques. There are model development principles available to provide design guidance for economically viable, yet environmentally sensitive development.

MCD's objective is to help planners, developers, and local officials look for existing ordinances that can be modified to reduce impervious cover, conserve natural areas, and prevent stormwater pollution. These development principles are not national design standards. Instead, they identify areas where existing codes and standards can be changed to better protect streams, groundwater, and wetlands in your community. The development principles are divided into three areas:

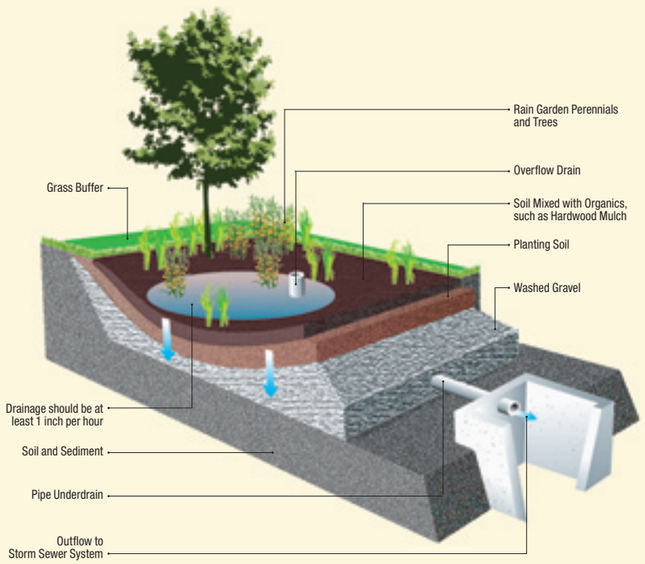
- Residential Streets and Parking Lots (Habitat for Cars)
- Lot Development (Habitat for People)
- Conservation of Natural Areas (Habitat for Nature)

3rd — MCD can help encourage developers to use these techniques in your community. The result is communities that offer greater economic benefits, more recreation opportunities, flood prevention, and a higher quality of life.

By utilizing LID practices, communities can encourage developers to maintain as much of the natural terrain as possible, clearing only the area required for the building's footprint, construction access and necessary setbacks.

By conserving existing trees and native vegetation, builders ultimately contribute to the long-term quality of life for the residents including increased property values. And in most cases, protecting trees and vegetation saves developers time and money.

Cross Section View of a Rain Garden



What is a rain garden?

Rain gardens are attractive landscaping features planted with perennial native plants. They are bowl-shaped or saucer-shaped gardens designed to absorb stormwater runoff from impervious surfaces such as roofs and parking lots. Rain gardens can be small, formal, home owner style gardens; large, complex bioretention gardens; or anything in between.

Why do we need rain gardens?

Studies have shown that up to 70 percent of the pollution in our streams, rivers and lakes is carried there by stormwater. Rain gardens are just what they sound like—gardens that soak up stormwater, mainly from roofs, but also from driveways and lawns. The gardens fill with a few inches of water and allow the water to slowly filter into the ground rather than running off to storm drains. Compared to a patch of conventional lawn, a rain garden allows about 30 percent more water to soak into the ground.

Research shows that rain gardens, also called bioretention, are particularly effective at reducing solids and nutrients—like nitrogen and phosphorus—in stormwater runoff from residential yards and parking lots. Research done by the Center for Watershed Protection found that BioRetention Facilities installed in parking lots reduced total phosphorous by 65 percent, total nitrogen by 49 percent, and metals by 95 to 97 percent.

Examples of LID practices

Minimizing clearing and grading during construction

Instead of clearing and grading an entire development site the conventional way, developers can preserve many useful and valuable features of natural areas. By maintaining the natural hydrologic cycle and limiting the amount of disturbed soils, the developer can balance the impacts of development and save money in the process. Clearing should be limited to the minimum area required for building, construction access, and safety setbacks whenever possible.

Conserving trees and native vegetation

Instead of promoting the use of lawns, communities can conserve existing trees and native vegetation which are important contributors to the quality of the environment and help increase property values. Conserving existing vegetation also saves the developers time and money instead of landscaping the site from scratch.

Directing runoff to rain gardens

Rain gardens are strategically placed gardens that soak up rain water. Allowing runoff to flow over a pervious surface, such as a rain garden, before it reaches a sidewalk or street can decrease the annual runoff volume from residential development sites.

Installing stormwater treatment on driveways and parking lots

Parking lots and driveways can be a significant source of stormwater pollution. These areas can be made more attractive and provide stormwater management by utilizing pervious pavers or pervious concrete and/or by using rain gardens to treat stormwater before it enters our streams.

Below: A green roof, or "vegetated roof," is a plant-filled rooftop garden that offers an attractive and energy-saving alternative to a conventional rooftop. A green roof can keep buildings cooler, save energy, and extend the useful life of the roof.

Above: Close-up of the gravel drainage layer and the native plants used on the rooftops of the Downtown Dayton Litehouse Demonstration Project.

Local LID demonstration projects

The Miami Conservancy District was awarded a U.S. Environmental Protection Agency's Targeted Watershed Grant in 2003 to implement projects that protect water resources. These projects are guided by three principles: broad stakeholder involvement, environmental results, and market incentives.

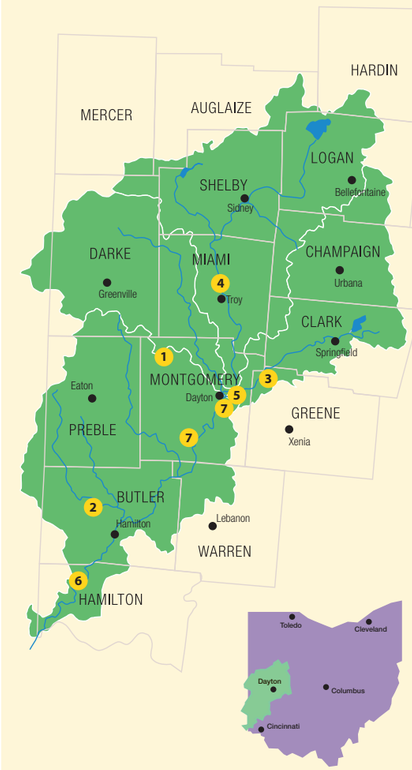
MCD partnered with local communities, universities, and nonprofit organizations to implement projects in the Great Miami River Watershed. These projects demonstrate that LID practices are effective in the Miami Valley.

Local LID projects include the following practices:

- Installing pervious pavers.
- Revising zoning standards to allow open space design.
- Minimizing clearing and grading at construction sites.
- Conserving trees and native vegetation on new housing developments.
- Preserving open space in subdivision design.
- Conserving and restoring streamside buffer areas.
- Constructing rain gardens to treat parking lot and rooftop runoff.
- Enhancing wetlands to treat stormwater runoff.
- Installing stormwater treatment systems to treat oil, grease and debris from parking lot runoff.
- Installing green roofs and rain barrels to capture rain water from rooftops and downspouts.
- Utilizing grassy drainage swales to collect stormwater from streets and driveways.

For more information on LID, stormwater management, or protecting water resources, please visit: **www.miamiconservancy.org.**

Great Miami River Watershed and Location of Featured LID Projects



Project Listing Table of Contents:

Denotes location of LID project

New Housing Development Uses Conservation Design

Project Description

The Wenger Woods housing development uses rain gardens and paver driveways to reduce stormwater runoff while improving water quality in the 10-home development adjacent to Brookville High School. Runoff from these homes in western Montgomery County flows into a shared, constructed wetland and the city's storm sewer system, eventually draining to the Great Miami River.

Project Details

McCoy Homes, Inc. is installing two types of Low Impact Development (LID) practices—rain gardens and pavers. These practices will allow rainwater to soak into the ground, slowing stormwater flows and filtering potential pollutants.

A rain garden, an attractive landscaping feature planted with flowering native shrubs and perennial native plants, is constructed at each new home site. The rain gardens are designed to maximize the characteristics of slopes and conditions of each individual lot so they can best absorb stormwater runoff.

The rain gardens consist of several layers, beginning with a 12- to 24-inch deep planting layer made up of organic topsoil and course sand. This layer is under laid with an open, graded gravel layer with a perforated pipe to handle larger volumes of water from bigger storm events.

These layers allow for small rainfalls up to one-half inch to be fully absorbed into the system. The water is cleaned of contaminants and then either infiltrated into the surrounding soil or put back into the air through evapotranspiration processes.

Instead of traditional driveways, made of impervious materials such as concrete, McCoy Homes installed attractive pavers at each home. Rainwater flowing over concrete driveways and lawns brings with it pollutants, chemicals, fertilizers, sediment and oils, degrading the quality of water flowing into storm sewers.

Pavers permit rain water to be cleaned and absorbed by the ground underneath. Pavers also provide a very stable and long-lasting surface for vehicles. Paver driveways allow water to flow through the cracks between each paver very quickly so that no water ponds during a rainstorm, and ice doesn't form in the winter. The pavers are set with a space in between that is filled with an open graded fine gravel.

The pavers are laid on a structural gravel layer of clean #57s or one-half to three-quarter inch gravel that locks together to assist in supporting the pavers. This layer never becomes saturated with water.

The development is adjacent to Brookville High School's stormwater wetland.

Under this layer is a varying depth of #2 clean gravel. This gravel accepts the surface water, slows it, allows infiltration into the underlying soil, and channels the rest of the water into the neighboring rain garden.

Benefits

Rain gardens and pavers reduce the amount of potential pollutants and impervious surface. They also reduce the volume of water from rooftops, lawns, driveways, and sidewalks that eventually flow into the Great Miami River. In addition, property values are potentially increased by using the attractive paver surfaces and the colorful and seasonally interesting planting beds that make up the rain gardens.

Water Quality Results

As of the completion of this brochure, actual water quality monitoring at the site had not been completed. Early results, however, show reductions in runoff quantity and improvements in water quality. The monitoring is designed to collect nutrient and flow data as it drains from the stormwater into the wetland. Contact The Miami Conservancy District for final results for this project.

Lessons Learned

The design and installation of this project went smoothly. By working with an experienced landscape architect, many problems with design and construction were avoided. However, a very dry year prevented the housing developer from planting the rain gardens the same season that the base was constructed.

Costs

Traditional driveways at each home were estimated to cost $5/square foot. The paver driveway system cost an additional $3.50/square foot more than the traditional design. The homebuilder had originally planned to provide each new home with a $5,000/per home landscaping allowance. The rain garden design and construction cost an additional $4,000.00/per home more than the original allowance.

Installing these practices as a part of the original development, however, could have saved time and money. The developer wouldn't have had to install the traditional pipe and catch basin system and the size of the neighboring constructed wetland could have been reduced. To be fully cost-effective, these practices should be incorporated early into the development design. If they are added to traditional stormwater controls, there is less cost savings, but they still offer a high environmental benefit.

Above: In addition to sidewalks near the street, the development includes a paver walkway to allow residents easy access to the nearby middle/high school complex. Installing a paver brick pathway instead of a standard cement sidewalk allows rain water to seep into the soil.

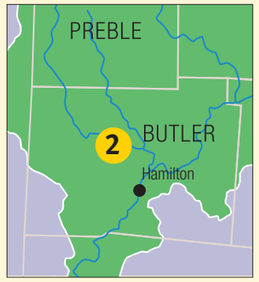
Left: All sidewalk, driveway and apron surfaces are constructed of paver bricks which allow runoff water to be absorbed into the soil. As a result, there is less burden to the city's storm sewer system.

Below: All downspouts are routed underground to a rock-filled swale that leads to the rain garden located on each homeowner's property.

Above: Pervious paver bricks are used for the driveway as well as the driveway apron and pedestrian sidewalks.

Right: Each home has its own rain garden, like the one shown here. It is planted with native perennials, grasses and shrubs.

Communities Update Zoning Codes to Enhance Stream Protection



Project Description

This project, in Butler County, was divided into two parts. The first part focused on providing local officials a set of recommendations for improving open space conservation and enhancing stream protection through innovative zoning tools. The project's second part focused on planning and building a conservation housing development that would enhance water quality protection using innovative Low Impact Development (LID) practices.

Project Details

Part One—Zoning Education

Located in Southwest Ohio, The Three Valley Conservation Trust (TVCT) works to conserve the natural environment and cultural heritage in the Four Mile/Seven Mile, Indian Creek and Twin Creek watersheds which are major tributaries to the Great Miami River.

TVCT worked with key zoning officials to develop zoning code standards that encourage open space conservation during development. Forty-five area public officials and citizens examined and learned about conservation development concepts in workshops designed to encourage adoption of open space policies in local zoning codes.

The TVCT also helped form a Project Advisory Board to examine innovative zoning tools. This group had diverse representation and key players in the development process: a county commissioner, the county director of development, the county engineer, a soil and water conservation district office administrator, two township trustees, a zoning administrator, two city council members, a planning commission member, a developer, an extension agent, private citizens, and the Butler County environmental services manager.

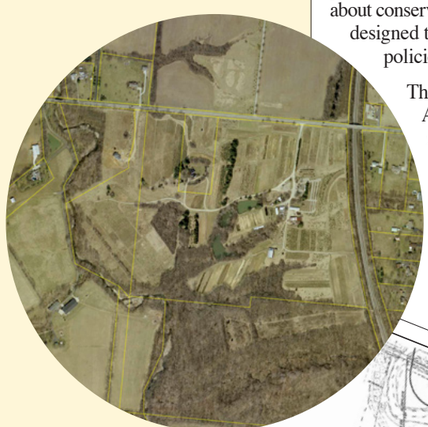
The advisory board developed a set of recommendations to enhance conservation of natural resources within Butler County. Conservation development and open space standards were included in the County's rewrite of its Zoning Code, adopted in March of 2006, and published in June of 2006. These standards included 35 percent open space for major subdivisions (five or more houses) and 50 percent for Conservation Subdivisions (CPUD). Liberty Township adopted a CPUD standard of 40 percent open space.

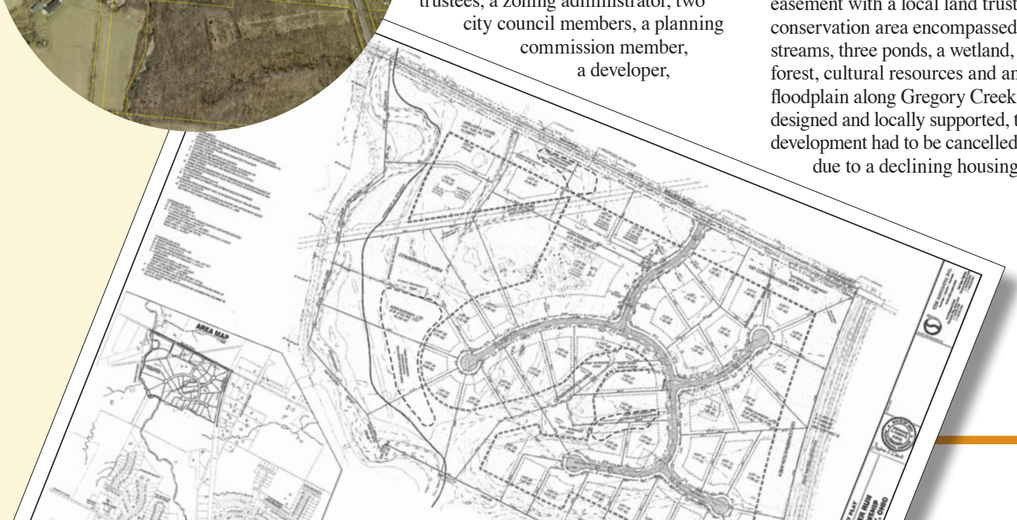
The TVCT also acquired and used—with several communities—a software tool known as Community Viz. The software is a 3D, 360-degree visualization tool that permits onsite alteration of zoning models in graphic, powerful images based on complex GIS modeling.

Part Two—Conservation Development

Originally, a 95-acre conservation housing development was planned along the Gregory Creek in Butler County. Forty-four acres of land (more than 45 percent of the site) as well as portions of most individual lots would be placed into a permanent conservation easement with a local land trust (TVCT). The conservation area encompassed four high quality streams, three ponds, a wetland, 20 acres of streamside forest, cultural resources and an expansive riparian floodplain along Gregory Creek. Although uniquely designed and locally supported, the conservation development had to be cancelled by the developer due to a declining housing market.

Below: An aerial view of the housing development shows the location of streams and creeks in the area. The Conservation Trust Project guidelines required that the developer keep such natural features intact.





Left: Adopting open space standards preserves streams and wetlands, and benefits the entire watershed that is under pressure from development.

Below: Requiring developers to preserve natural areas within commercial, industrial and residential developments can be cost-effective and more attractive to prospective tenants.

Benefits

Butler County successfully adopted new conservation development and open-space standards in its zoning code, and Liberty Township adopted a new open space standard for planned developments. These changes will benefit the watershed by encouraging conservation development during new construction.

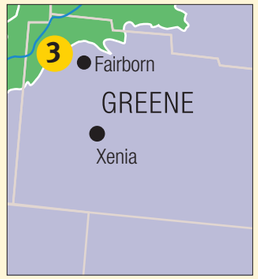
Lessons Learned

The computer model bogged down the project and required far more staff investment than anticipated. The zoning tools notebook and the dissemination of the Conservation Design workbook were more valuable as outreach tools.

Costs

Since the Conservation Development was cancelled, the costs were low for this project—funding only the staff time for the TVCT.

Enhanced Wetland Slows Stormwater and Filters Pollutants



Project Description

The Hidden Hills Detention Basin is designed to enhance a wetland along the Hebble Creek just upstream of Fairborn, Ohio. The wetland slows stormwater that could flood downstream properties and reduces polluted runoff that would otherwise drain to the Hebble Creek which flows to the Mad River.

Project Details

A 450-foot channel was created to move stormwater overflows from the Hebble Creek into a 28-acre wetland and prairie. Ground was excavated to create two pools connected together at various elevations to control the flow from the channel into the pools. A channel was constructed to flow toward the wetland when the water in Hebble Creek reaches a certain height. Therefore, the pools fill with water during high water or prolonged rain events. The site is planted in native wetland and prairie grasses that help slow the water. They also allow the plants to absorb excess nutrients in the water that can be used for plant growth but could be detrimental to aquatic life.

Invasive plant species were removed and replaced with native wetland and prairie species that provide superior erosion control and wildlife habitat. Finally, the Hebble Creek streambank was planted with native hardwood tree species to stabilize possible erosion. The creek, wetland, and surrounding prairie are now a wildlife-rich passive recreation area and outdoor classroom managed by the City of Fairborn.

Partners

The City of Fairborn led this project in partnership with the Greene Soil and Water Conservation District (SWCD) office. The city's Park and Recreation Department provided project management, and the SWCD provided scientific and engineering expertise to help design the wetland and prairie.

Benefits

Before the project, the Hidden Hills Detention Basin could only hold 4 acre-feet of water, and could barely handle a "one-year" flood. The wetland is now designed to adequately handle floodwaters, allow sediments and nutrients to settle out, and provide an opportunity for water to seep back into the ground, recharging the aquifer.

Planting trees along the banks of the Hebble Creek helps to stabilize areas that were eroding and decreases the amount of soil that can flow into the stream. The site also has trails, educational signage, and naturalist-led programs that increase the community's awareness of water quantity and quality issues.

Water Quality Results

As of the printing of this brochure, water quality monitoring is ongoing. Preliminary results show a decrease in sediment and nutrients since the wetland was completed. Contact The Miami Conservancy District for final results for this project.

Lessons Learned

Originally, the project was designed to measure pollutants that might be washed off of the adjacent highway (Interstate 675), such as oil and gas from cars and trucks. Because of the difficult and expensive nature of quantifying those compounds, water quality data is only being collected on sediment and nutrients that flow through the Hebble Creek. Also, due to an unusually rainy season, construction was delayed several times.

Costs

The total cost of the project was $55,700, including:

- Hiring a contractor to remove extensive invasive species (primarily honeysuckle).
- Enhancing the wetland through soil movement.
- Planting native prairie grasses and hardwood tree species.

While the Hebble Creek wetland area is a joint venture between the City of Fairborn and the Miami Conservancy District, the benefits to the local ecosystem will be enjoyed by the entire region.

Left: Land in the Hebble Creek wetland and prairie had to be moved to achieve the water flow conditions needed to maintain the desired pool height during prolonged rain events. Still, the wetlands quickly recovered and now serve as a sanctuary to animals and native grasses.

Below center: Construction of I-675 (shown in the background) no doubt obstructed the natural flow and drainage of rainwater from the area, making even "one-year floods" a common occurrence.

Below: Native wetland and prairie grasses allow the Hebble Creek wetland to mimic the habitat common in Southwest Ohio in the early and mid 1800s.

Filtering Stormwater from Municipal Facilities and Construction Sites

Project Description

A swirl separator system at the Miami County Engineer's facility is filtering out pollutants in stormwater runoff that drains into an adjacent drainage ditch and then flows into the nearby Great Miami River. The facility includes several large garages, storage buildings, and an office complex arranged on a 30-acre parcel. Soil, rock, and salt stockpiles are maintained on the property to support road and bridge maintenance functions for the entire county. Potential stormwater pollutants include:

- Sediment from soil stockpiles.
- Oil and other vehicle-generated wastes that accumulate on the asphalt driveway and parking lots.
- Gasoline or diesel fuel generated in the event of a catastrophic spill.
- Miscellaneous debris from rooftops and other impervious surfaces.

The engineer's office is also utilizing storm sewer inlet protection devices throughout the county on construction projects where sediment control is necessary to protect the Great Miami River and its tributaries.

Project Details

The Miami County Engineer's Office is adjacent to a drainage ditch that flows directly to the Great Miami River, 500 yards east of the facility. A series of catch basins and storm sewer pipes collect surface stormwater on the property and channel it to one primary discharge pipe. This pipe empties directly into the drainage ditch. A Vortechnic swirl separator unit was installed at the outlet of the primary discharge pipe that drains the facility to filter out pollutants.

The system incorporates a hydrodynamic separator that uses gravity to separate floating and settling materials from stormwater flows. Stormwater enters the unit and gently swirls within a grit chamber, causing pollutants to move toward the center of the unit where velocities are the lowest. Most of the solids are left behind as stormwater exits the grit chamber through openings on the chamber perimeter. Next, floating debris, oil, and grease are separated from water flowing under the baffle wall due to their low specific gravity. Stormwater then exits the system relatively free of floating and settling pollutants. The solids are regularly removed from the system and disposed of properly.

The sediment control devices are placed on existing catch basin grates and curb inlets to stop silt, sediment, construction debris and other contaminants that might run off of a construction site, while allowing filtered stormwater to flow into the storm sewers. This method stops contaminants at the stormwater collection inlet, rather than allowing contaminants to enter the system and be treated downstream, or not at all.

Partners

The County Engineer partnered with the Miami County Commission, which own the property.

Benefits

Stormwater pollutants are now captured within the swirl separator unit rather than being discharged into the Great Miami River.

Water Quality Results

The swirl separator is pumped out to remove the pollutant material that it collects. Approximately 322 lbs. of material were removed from the unit the first time it was cleaned after it was functioning for 3 months, which would have otherwise been discharged into the drainage ditch.

Lessons Learned

Installation went smoothly. The unit is operating as expected.

Costs

Approximately $31,500 was spent to acquire and install the swirl separator unit and inlet protection devices.

Miami County Engineer's facility LID Project:

The Miami County Engineer's Facility parking lot drains into a ditch that flows into the nearby Great Miami River.

Above: Parking lot runoff drains into a Vortechnic swirl separator unit that gently forces pollutants such as floating debris, oil and grease to separate from the expelled water. The solids are regularly removed from the unit and disposed of properly.

Below: Interior view of the Vortechnic separator.

Examples of other sediment control practices used throughout Miami County:

Storm sewer protection devices, such as the one shown above, are placed over existing catch basins to reduce silt, sediment and debris from entering the storm drain.

Drains built into curbs can benefit from the storm sewer protection device pictured above.

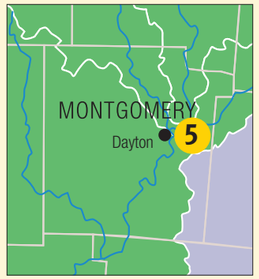
Grate protection devices can be installed at existing drains and are especially helpful at new construction sites. Once construction is complete and landscaping and plantings are installed, the covers can be easily removed, and in many cases, reused.

Grate covers for cement precast drainage systems are easy to install.

Close-up view of the interior of a drain protection device showing how the metal grate openings are shielded from debris and other contaminants.

Grate covers can provide protection from runoff for residential and commercial construction sites that may take years to fully develop.

Reducing Pollutant Runoff from a Municipal Parking Lot



Project Description

The City of Dayton project captures runoff that drains from a municipal parking lot—storing the City of Dayton's garbage trucks—and reduce pollutants that could drain to the Mad River. The trucks have hydraulic operated systems that use hoses and fittings. Despite regular maintenance, leaks from these trucks are probable. The city, through a competitive bid process, chose to install a BaySaver Separator System that filters out pollutants before they reach the river. The parking facility drains an area of approximately 3.5 acres.

Project Details

The BaySaver is made up of two standard pre-cast manholes and the BaySaver separator unit. The two manholes allow pollutants to be removed and stored. The separator unit directs the flow of water to provide the most efficient treatment possible. The BaySaver "3K" system was selected because it can treat 7.8 cubic feet per second of stormwater or a 2-inch-per-hour storm event over the 3.5-acre area.

The primary manhole is generally installed in-line with the storm drain and can be used as a multiple inlet structure. The storage manhole acts as a secondary treatment device to collect oils, fine sediments, and floatables. It is a key component of the system and stores pollutants to prevent their re-suspension. The main part of the system is the separator unit and trapezoidal weir. The separator unit is the device that controls the influent flow through the two manholes.

Water enters the system's primary manhole through the inlet pipe. Gravel and sand immediately fall to the floor of the primary manhole. Water, flowing into the manhole, carries floatables and fine sand. It is skimmed off the surface and sent into the storage manhole. When water enters the storage manhole from the submerged inlet pipe, oils and other floatables rise to the surface, while sediments settle to the floor. These contaminants remain trapped off line and are not re-suspended during larger flows. The water flowing into the manhole displaces clean water from the center of the column, which is forced back up the return pipe to the storage manhole for secondary treatment. During extreme flows, the water is directed through the system to avoid re-suspension of materials that have already been collected and to prevent flooding upstream in the system.

Right: Runoff from the City of Dayton's parking facility for garbage trucks drained into the adjacent Mad River, home to abundant aquatic life and recreational opportunities. A new separator system has reduced the amount of solid and liquid contaminants entering the river.

Benefits

The BaySaver unit not only reduces potential pollutants from running off the parking area and flowing into the Mad River, it is cost-effective. Maintenance is less frequent and labor intensive than previously employed methods.

Water Quality Results

The separator system was cleaned and serviced after functioning for four months. A Vactor vacuum truck removed the stormwater, sludge, and oil from both manholes. The truck was then taken to the City's wastewater treatment plant. Approximately 6.6 gallons of oil were collected in the storage manhole and nearly a cubic yard of sediment was removed from both manholes, which implies that the BaySaver Unit is working effectively.

Lessons Learned

Some minor issues were encountered during installation. The parking lot's drainage system is intertwined with several other utilities. The initial installation site was moved downstream about 50 feet when an unmarked electrical line was discovered. Other concerns included a high-pressure water line that ran near the excavation and a sanitary sewer line that ran under the storm sewer. After accounting for these concerns, the separator system was installed downstream of the parking lot. The installation itself went smoothly.

Costs

The BaySaver Unit, including installation, totaled $47,212.

Construction of the Separator System shows the excavation site at the parking facility.

The primary manhole is installed in-line with the storm drain (left unit) alongside the storage manhole (right unit).

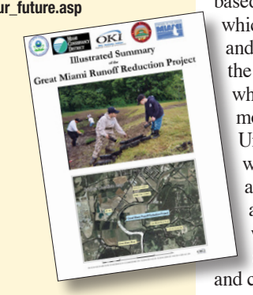
Both manholes are capped, and backfill aggregate is installed around each unit.

The BaySaver Separator System shows final backfill, with grading and surfacing to be completed.

Pervious Pavers and Rain Gardens Filter Pollutants

Far right: Water quality samples are collected from the Heritage Park pervious parking area.

Below: A fully illustrated report of the Heritage Park Rain Garden Project is available from: www.miamiconservancy.org/water/building_our_future.asp



The Heritage Park Rain Garden Project in Hamilton County is a good example of multi-government and community-based organizations working together to implement water runoff solutions.

Project Description

Located along the Great Miami River in Hamilton County, pervious parking spaces and a rain garden were installed to filter the stormwater runoff from a large parking lot at Heritage Park. The park is a 125-acre recreational facility owned and operated by Colerain Township along the Big Bend of the Great Miami River, near Dunlap Run.

Partners

The Ohio-Kentucky-Indiana Regional Council of Governments (OKI) is a regional planning agency which designed and managed the project and recruited the project partners. The agency collaborated with the Friends of the Great Miami, a community-based watershed organization which managed the promotion and marketing of the project; the Greenacres Foundation, which managed the water monitoring program; the University of Cincinnati, which provided technical and scientific knowledge; and Colerain Township which donated the project site, landscape architect, and construction contractors.

Benefits

The pervious pavers and rain garden are designed to slow stormwater runoff, increase groundwater recharge, and reduce water pollution. The parking spaces are used for a roadside, pull-off area for school buses and vans and total approximately 1,300 square feet. The rain garden is approximately 11,000 square feet or about a quarter-acre and can handle up to a 10-year storm event (which is the typical runoff in about 90 percent of the storm events from this site). In addition, the pervious pavers eliminate standing water or ice on pavement and are easy to maintain and repair. The project's outreach and education activities show how these practices can be installed, maintained, and easily duplicated in other settings and communities.

Water Quality Results

The project was monitored monthly before, during, and after construction. Both the pervious and impervious parking areas were monitored to determine a difference in the quality and quantity of runoff that flowed from the different parking surfaces. Research showed that both the rain garden and pervious pavers allowed stormwater to infiltrate the ground, reducing and delaying the amount of pollution that runs to nearby streams and rivers.

Lessons Learned

The project succeeded, but there were challenges along the way. The challenges outlined below impeded project progress at times, and generated a learning experience in adaptive management for the project partners.

Be ready to redesign your project monitoring systems

Originally, the practices were monitored with lysimeters, which measure the amount of actual evapotranspiration released from an area of vegetated land. By recording the amount of precipitation that an area receives and the amount lost through the soil, the amount of water lost to evapotranspiration can be calculated.

Because the lysimeters were located within 650 feet of the Great Miami River over a high-yield portion of the Great Miami Buried Valley Aquifer, it was assumed that they would collect enough sample water for laboratory analysis, but this didn't happen. In response, the monitoring managers devised sub-surface water collection troughs with pipes, buckets and sampling ports. The monitoring managers also placed more emphasis on data collected from the project's two monitoring wells.

Accept no substitutes for rain garden materials

The contractor excavated deeper than necessary to create the depression for the rain garden. The extra material needed to re-fill the hole would have caused a budget overrun. Project partners agreed to control costs by using soil from other parts of Heritage Park for the rain garden's topsoil layer. The use of this material, however, is believed to be the cause of a drainage problem—the rain garden began to retain surface water for more than 48 hours. The substitute topsoil probably included silty clay particles that created an impervious layer. Other possible causes are that soil erosion runoff—from the nearby park construction—helped to create the sealing layer, or soil compaction from the heavy equipment working in the rain garden area.

Whatever its cause, the problem was solved by excavating holes through the rain garden's topsoil layer and filling them with gravel, allowing them to drain. Each hole was fitted with an intake pipe to ensure that stormwater would flow directly into the gravel pads whenever water levels exceeded 3 to 4 inches.

Outreach and education helps promote the project

Originally, OKI planned to promote the project solely through presentations to elected officials, but the plan was expanded to include local festivals, entertainment events, gardening programs, hunting and fishing shows, and site tours.

Costs

The pervious parking area cost $16,500 for labor and materials, excluding curbs and excavation—$12.70 per square foot (approximately). The rain garden cost approximately $15,000 excluding donated labor and materials.

Twenty-seven species of native grasses and spring-flowering perennials were planted around the pervious parking lot and in the rain garden, providing an important habitat for animals, and a burst of spring color for park visitors.

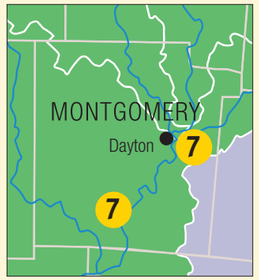
Heritage Park's parking area being prepared for pervious pavers.

Geotextile is installed in parking area.

Pervious brick pavers are installed to allow runoff to seep into the ground.

Completed parking area.

Building Green Homes in Urban Communities



Above: Modular components of the downtown Dayton Litehouse project are pre-built then assembled onsite, helping to reduce wasted construction materials sent to the landfill.

Project Description

The Litehouse Demonstration Homes project is building homes on reclaimed vacant lots in low- to moderate-income neighborhoods throughout Montgomery County, Ohio. The homes feature state-of-the-art, energy-efficient technology and Low Impact Design (LID) practices. Stormwater best management practices, such as rain gardens, pervious parking areas, rooftop collection systems, and green roofs are included at the homesites.

Partners

The Miami Conservancy District partnered with the Litehouse Development Group whose mission is to create a responsible approach to home building, delivering an affordable, energy-efficient, sustainable home concept to the market. The group is working with the City of Dayton, City of Kettering, and City of West Carrollton—which are donating the lots—and CountyCorp.

Benefits

Energy efficiency and sustainability make the Litehouse a green, eco-friendly home. The use of zero-VOC paint, natural flooring and a whole-house ventilation system improve indoor air quality. Additionally, care has been taken during the construction process to ensure less waste material is sent to the landfill.

Building on in-fill sites and previously developed property uses the existing infrastructure (i.e., sewers and water supply), avoiding sprawl and development on environmentally sensitive sites (i.e., farmland and wooded areas). Native species have been selected for the landscaping minimizing the demand for irrigation and the need for harmful pesticides.

Water conservation strategies are employed in the interior and exterior of the Litehouse houses. Water-efficient faucets, low-flow showerheads and dual-flush toilets all contribute to decreased consumption. Outside, a rain harvesting system captures rainwater that can be used to water the lawn or garden. Also, permeable pavement and drought resistant native plants are used to control soil erosion and runoff that would otherwise end up in the municipal storm sewers.

Nearly complete, state-of-the-art, energy efficient Litehouse Demonstration Home in West Carrollton.

Water Quality Results

Pre- and post-water quality conditions are monitored to determine impacts to local rivers and streams. As of the completion of this brochure, post-construction water-quality monitoring had not begun.Contact The Miami Conservancy District for final results for this project.

Concept drawing of the Litehouse Demonstration project in downtown Dayton near Fifth Third Field.

MIAMI CONSERVANCY DISTRICT

38 E. Monument Avenue
Dayton OH 45402-1265
Phone: (937) 223-1271
Fax: (937) 223-4730
www.miamiconservancy.org

Information used in this brochure from resources by Larry Coffman and the LNSB, LLLP Stormwater Services Group, and the Center for Watershed Protection.

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