

IMPLEMENTING A GREEN INFRASTRUCTURE PLAN

Status Update | May 2010





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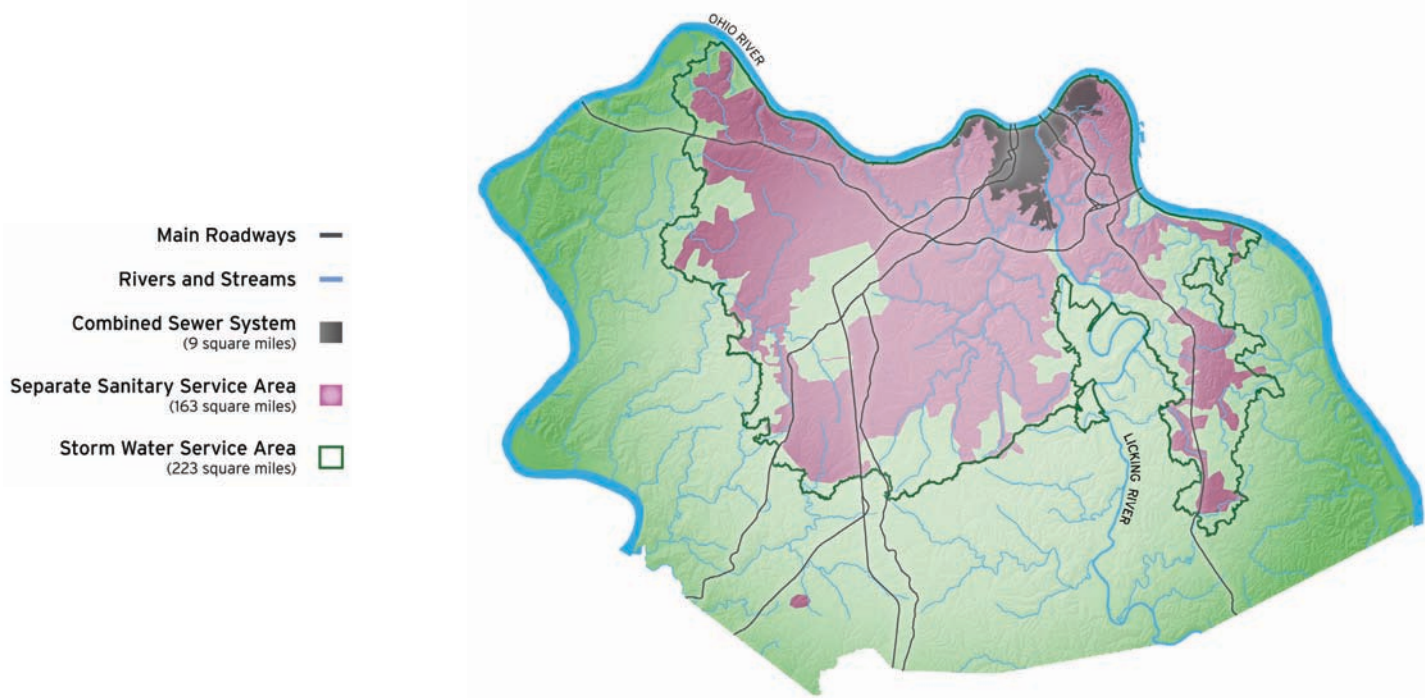


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INTRODUCTION

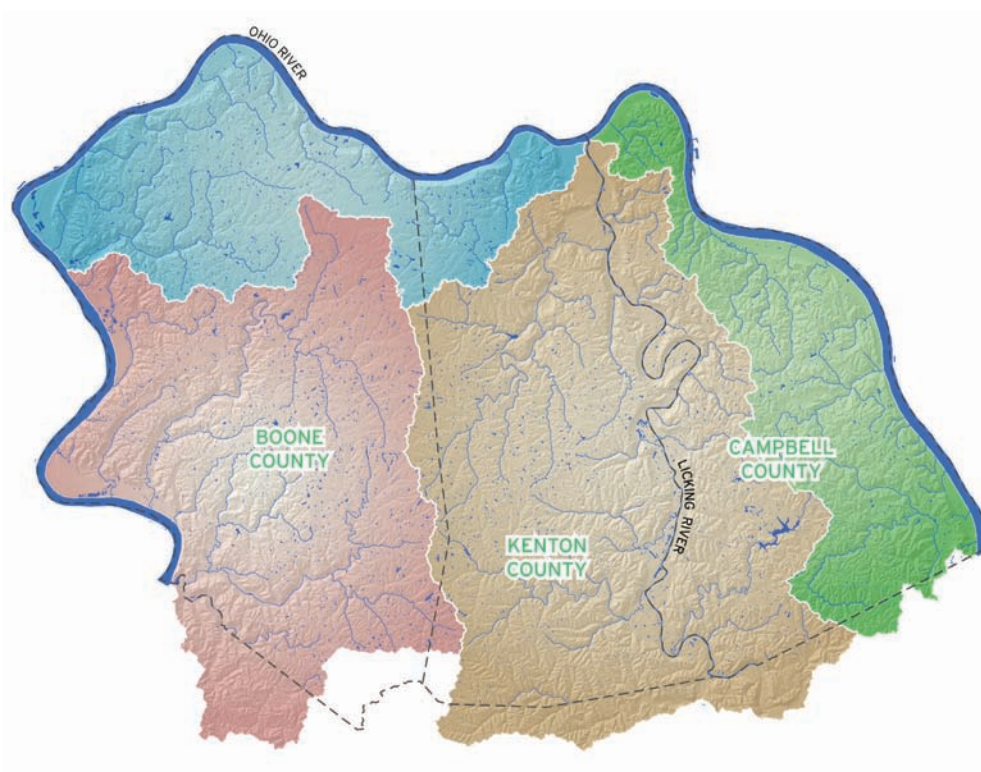
Sanitation District No. 1 (SD1) Background

A vast majority of the wastewater collection systems in Northern Kentucky were owned, operated, and maintained by the different political jurisdictions of the region until 1995, when SD1 assumed ownership of approximately 1,500 miles of sanitary and combined sewers from 28 municipalities and portions of Boone, Campbell and Kenton counties. Since that time, SD1 has continually demonstrated a willingness to be a leader in the wastewater and storm water industry. Over the past fifteen years, SD1 has placed considerable emphasis on comprehensive, holistic approaches to understanding problems, managing infrastructure, and improving local water quality in a cost-effective manner. SD1 has consistently rejected a “business as usual” approach and has attempted to develop innovative solutions, often in partnership with state and federal regulatory agencies, that are needed to meet today’s challenges of managing a regional storm water and wastewater utility.



SD1's Consent Decree Approach

SD1's management philosophy became most evident in October 2005 when faced with a Federal Consent Decree to address sewage overflows in Northern Kentucky. While traditional Consent Decrees focus solely on controlling combined sewer overflows (CSO) and sanitary sewer overflows (SSO), SD1's staff advocated a holistic watershed approach to controlling overflows and protecting the environment. This approach is based on the fact that sewer overflows are not the sole source of water quality impairment for Northern Kentucky's streams and rivers. In April 2007, SD1 entered into the country's first Consent Decree that allows a community to use the watershed management approach to more efficiently and cost-effectively meet federal Clean Water Act requirements for addressing CSOs and SSOs. The use of this watershed approach is expected to lead to more rapid improvements in water quality in critical areas with more efficient and cost-effective solutions.



The region is divided into four major basins: North, East, Central, and West. The hydrologic network contains 460 miles of major streams and rivers, and 3,410 acres of lakes.

The language of SD1's Consent Decree, while different from other Consent Decrees, more accurately reflects the watershed-based philosophy promoted by the U.S. Environmental Protection Agency (USEPA) in the "Combined Sewer Overflows - Guidance for Long-Term Control Plan" (1995).

The Guidance specifically states the following:

- Municipalities should try to evaluate all sources of pollution (e.g., point sources, CSOs, storm water) during system characterization and, wherever possible, develop control strategies on a watershed basis in coordination with the NPDES permitting authority (EPA, 1-10).

- The sources of watershed pollution and impairment in addition to CSOs are varied and include other point source discharges; discharges from storm drains; overland runoff; habitat destruction; land use activities, such as agriculture and construction; erosion; and septic systems and landfills (EPA, 1-18).

The major advantage in using a watershed-based approach to develop a long-term control plan is that it allows the site-specific determination of the relative water quality impacts of CSOs and non-CSO sources of pollution on water quality. For some receiving water reaches within a watershed, CSOs are less significant contributors to nonattainment than storm water or upstream sources. In such cases, a large expenditure on CSO control could result in negligible improvements in water quality (EPA, 1-18).

The benefits to implementing a watershed approach are significant and include (EPA, 1-18):

- *Consideration of all important sources of pollution or impairment*
- *Closer ties to receiving water benefits*
- *Greater flexibility*
- *Greater cost effectiveness (through coordination of monitoring programs, for example)*
- *Fostering of prevention as well as control*
- *Fairer allocation of resources and responsibilities*

The Consent Decree required, among other things, the development of Watershed Plans for each of the four watershed basins in Northern Kentucky to address SSOs and a long-term plan for bringing permitted CSOs into compliance. These plans had to also establish priorities and remedial measures to improve water quality based on major pollution factors unique to each area.

With the development of the Watershed Plans, SD1 recognized that it was embarking on one of the most significant capital investment programs in the history of Northern Kentucky, and was required to do so with little or no Federal or State funding. Therefore, maximizing the community benefits associated with the expenditures of the Watershed Plans is a key tenet to SD1 leadership. The watershed approach allows SD1 to consider and assess other control methods beyond the traditional gray engineering solutions to determine a combination of affordable controls to improve water quality, eliminate SSOs and comply with the CSO policy.

Green Infrastructure's Role in the Consent Decree

SD1 is one of the first utilities to conduct a comprehensive, regional green infrastructure and large-scale watershed opportunities analysis to help elevate the role of green solutions in mitigating the impacts of sewer overflows. USEPA encourages the use of green infrastructure as an "effective and environmentally preferable approach to reduce storm water and other excess flows entering combined or separate sewer systems in combination with, or in lieu of, centralized hard infrastructure solutions" (EPA, 2007a, 1). In addition, Linda Boornazian (Director of USEPA Water Permits Division) and Mark Pollins (Director of USEPA Water Enforcement Division) co-authored a memorandum to state and regional staff stating:

In developing permit requirements, permitting authorities may structure their permits, as well as guidance or criteria for storm water plans and CSO long-term control plans, to encourage permittees to utilize green infrastructure approaches, where appropriate, in lieu of or in addition to more traditional approaches (EPA, 2007b, 2).

The purpose of this effort was to identify a comprehensive list of regional, watershed and site specific green infrastructure opportunities and strategies to reduce the frequency and volume of CSOs while also enhancing, restoring and connecting natural systems throughout Northern Kentucky. A detailed summary of this effort is presented in the 2009 report titled "The Anatomy of a Regional Green Infrastructure Plan," prepared by Human Nature, Inc. and Strand Associates, Inc.

This comprehensive planning effort, which encompassed the entire Boone, Campbell and Kenton County area (581 square miles), evaluated such factors as soils, geology, hydrology, topography, impervious area, land cover (existing and future), and both built and natural systems; established a vision for a green urban core; and identified a number of high profile and high impact green projects that should be considered for implementation.

While green infrastructure is likely not the sole solution to the various water quality challenges that Northern Kentucky faces, it does represent a valuable tool that, in conjunction with more traditional engineering solutions, can provide the community with a cost-effective means to achieve compliance with the Clean Water Act.

Implementing a Green Infrastructure Plan

SD1 is committed to the evaluation and implementation of green infrastructure projects throughout Northern Kentucky as a means to reduce the overall cost of CSO control and to maximize the environmental benefits to the community. Beginning with the development of the regional plan and now moving forward with the implementation of green projects including the generation of local performance data for various green components, SD1 continues to embrace its role as an industry leader in identifying and evaluating innovative solutions to long-standing problems.

The map included in this update presents an overview of the green projects SD1 has pursued from the regional green infrastructure plan. Many of these projects were included in the proposed Watershed Plans submitted June 30, 2009. Following the map are more detailed Project Profiles that offer additional information on SD1's current green projects. The Project Profiles summarize project benefits in terms of their respective ability to provide environmental, economic and social benefits, which is commonly referred to as the Triple Bottom Line. Also included are highlights of SD1's various community outreach efforts.

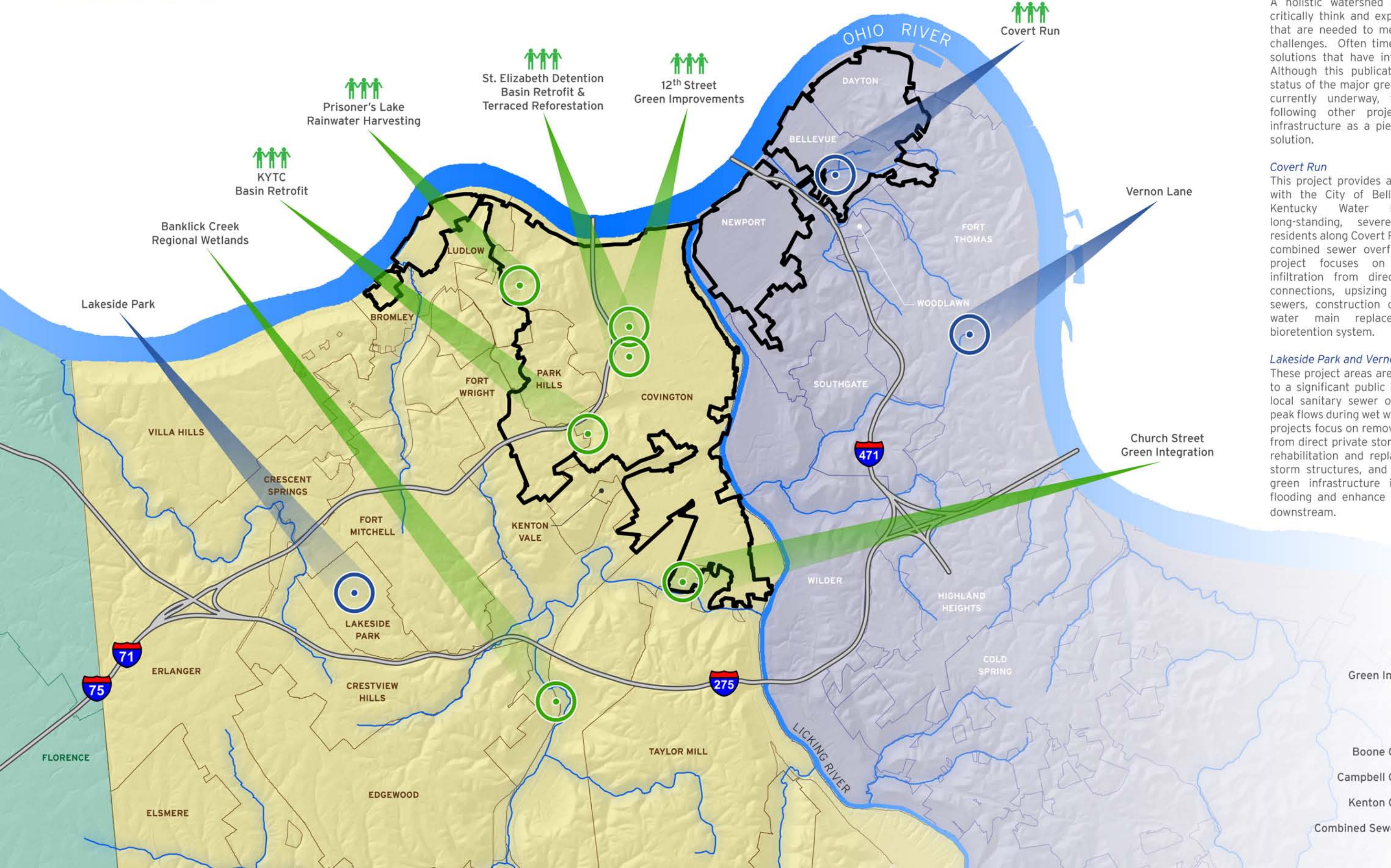
References

- EPA, 1995. *Combined Sewer Overflows - Guidance for Long-Term Control Plan*. EPA 832-B-95-002, September 1995.
- EPA, 2007a. *Memorandum from B.H. Grumbles to EPA Regional Administrators*. "Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs." March 5, 2007.
- EPA, 2007b. *Memorandum from Linda Boornazian and Mark Pollins to Water Division Directors, Regions 1-10; Regional Counsel/Enforcement Coordinators, Regions 1-20; State NPDES Directors*. "Use of Green Infrastructure in NPDES Permits and Enforcement." August 16, 2007.



OVERVIEW MAP

OVERVIEW OF GREEN INFRASTRUCTURE PROJECTS



Integrated Projects

A holistic watershed approach allows SD1 to critically think and explore innovative solutions that are needed to meet today's water quality challenges. Often times, this results in project solutions that have integrated control options. Although this publication is dedicated to the status of the major green infrastructure projects currently underway, the map indicates the following other projects that utilize green infrastructure as a piece of the overall project solution.

Covert Run

This project provides an opportunity to partner with the City of Bellevue and the Northern Kentucky Water District to alleviate long-standing, severe flooding issues for residents along Covert Run Pike, as well as reduce combined sewer overflows. The improvement project focuses on removing inflow and infiltration from direct private storm water connections, upsizing the existing combined sewers, construction of new storm sewers, a water main replacement, and a green bioretention system.

Lakeside Park and Vernon Lane

These project areas are considered to contribute to a significant public health risk as a result of local sanitary sewer overflows caused by high peak flows during wet weather. Both improvement projects focus on removing inflow and infiltration from direct private storm water connections, the rehabilitation and replacement of sanitary and storm structures, and up to five regional-type green infrastructure installations to mitigate flooding and enhance water quality locally and downstream.



Rivers and Streams

Green Infrastructure Project

Integrated Project

Partnership Project

Boone County Jurisdictions

Campbell County Jurisdictions

Kenton County Jurisdictions

Combined Sewer System Boundary



PROJECT PROFILES

Banklick Creek Regional Wetlands.....	10
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BANKLICK CREEK REGIONAL WETLANDS

Water quality monitoring data from Banklick Creek show that elevated bacteria densities in the creek occur during both base flow and wet weather related conditions, and that water quality standards are exceeded in both situations. Therefore, primary water quality concerns in Banklick Creek are not simply wet weather related problems; thus, solutions that address only wet weather controls will not be fully protective of human health. For this reason, SD1 has examined the idea of watershed controls that offer both wet weather and base flow water quality benefits.



PROJECT OVERVIEW



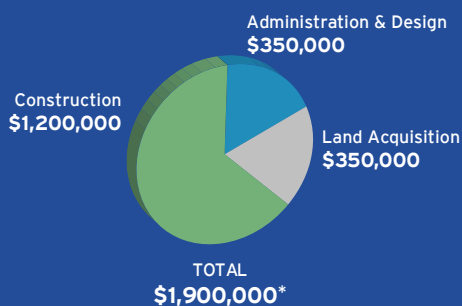
This project involves construction of six acres of wetland to improve water quality within Banklick Creek. The primary objective is to reduce bacteria densities during the recreation season (i.e., May through October); however, a year-round operation of the system will also provide other water quality benefits such as nutrient and sediment removal.

start date **March 2010**

estimated completion **November 2010**

status **Under Construction**

monitoring **Water Quality
(pre & post-construction)**



*Approximately \$1,500,000 is being funded through the ARRA.

TRIPLE BOTTOM LINE Project Benefits



Based on assumptions with respect to wetland operation and treatment effectiveness, modeling results indicate a 54% reduction in average bacteria densities in Banklick Creek (immediately downstream of the wetland) during the recreation season. This reduction is estimated to achieve approximately 31 more days of compliance with the state's bacteria standard. The potential water quality benefits for other pollutants have not yet been quantified.



This project provides greater water quality, public health and community benefits than a more costly alternative to contain or treat sanitary sewer overflows in the area. The alternative control is estimated to cost approximately \$20 million, and will not provide additional days of compliance with regard to water quality standards in Banklick Creek.



The primary purpose of the project is to reduce in-stream bacteria densities; however, the use of the regional wetland also allows for other ancillary benefits not provided by traditional gray infrastructure controls. These benefits include reduction of other pollutants (e.g., total suspended solids, phosphorus and nitrogen), improved wetland habitat, and educational opportunities.

CHURCH STREET GREEN INTEGRATION

The Church Street CSO, which has an average annual overflow volume of approximately 56 million gallons, is the largest on Banklick Creek. The 152-acre drainage area spans two cities, Taylor Mill and Covington, and consists of primarily residential land use. Through a combination of gray and green infrastructure, the goal of this project is to improve and restore natural habitats, reduce the combined sewage entering the Banklick Creek, improve the quality of storm water flowing to the stream, and provide recreational improvements to an under-utilized open space area.



SD1 currently anticipates the construction of a storm water wetland. This area will be surrounded by a 0.8 mile pedestrian trail loop through restored habitat. Native wetland plants and amended soils will provide a valuable, natural filter for storm water before it flows directly into Banklick Creek.

PROJECT OVERVIEW



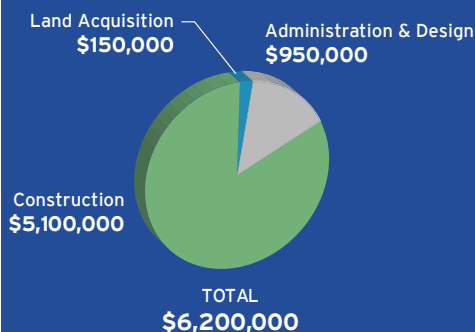
This project involves the rehabilitation and replacement of existing combined sewers, construction of approximately 2,000 linear feet of separate storm sewer system, and removal of 200 private-source wet weather flow connections to the combined sewer system. A storm water management feature will be constructed to receive the separated storm water runoff and private source wet-weather flow removal.

start date **May 2011**

estimated completion **May 2013**

status **RFP in Progress**

monitoring **Water Quantity
(pre & post-construction)**



TRIPLE BOTTOM LINE Project Benefits



This project will provide an improvement in both water quantity and quality. Based on typical year rainfall, the model shows a reduction in the annual volume of the Church Street CSO by 37 million gallons. By separating and treating the storm water runoff, the water quality of Banklick Creek will also be improved.



This project provides greater water quality, public health and community benefits than a more costly gray alternative could offer. The unit cost of the predicted annual CSO volume reduction from this project is approximately \$0.20 per gallon, which compares favorably with traditional gray infrastructure costs of \$0.50 per gallon.

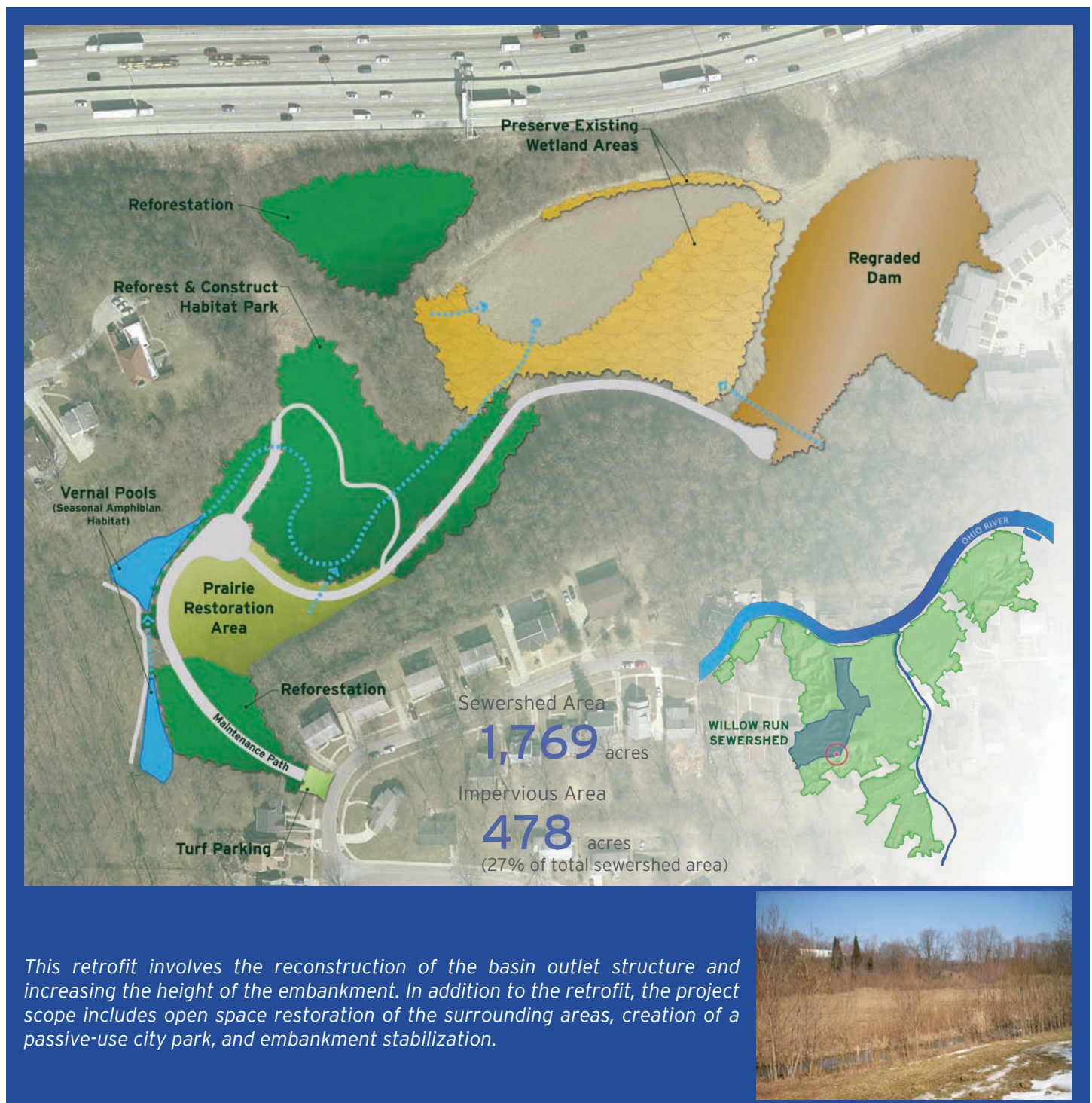


The concept plan for the storm water management feature currently includes amenities such as a walking path and benches. These amenities would improve the public recreation value of the open space area and could potentially allow for its designation as a city park with connectivity to other, nearby public park areas.



KYTC BASIN RETROFIT

Storm water runoff from a drainage area of approximately 110 acres drains to an existing detention basin located along Interstate 71/75 in the City of Covington, which ultimately discharges storm water into SD1's combined sewer system located in the Willow Run CSO basin. It is estimated that 25 million gallons of runoff enter the combined sewer system from the existing basin on an annual basis. By retrofitting the existing basin, SD1 can improve water quality and reduce the volume of storm water runoff entering the combined sewer system.



PROJECT OVERVIEW



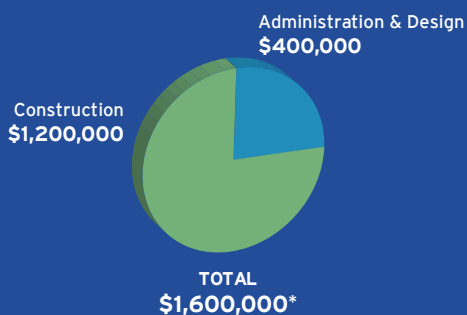
This project involves the modification of an existing dry detention basin located on Kentucky Transportation Cabinet (KYTC) right-of-way and the City of Ft. Wright's property, which will allow for it to function as an extended detention basin and significantly reduce storm water discharge flow rates. The project has been designed to reduce peak flow rates entering the downstream combined sewer system by 85%.

start date April 2010

estimated completion October 2010

status Under Construction

monitoring Water Quantity
(pre & post-construction)



*Project is fully funded by ARRA stimulus funds.

TRIPLE BOTTOM LINE Project Benefits



Based on a typical year model, the project will provide approximately 7.8 million gallons of annual volume reduction at the Willow Run CSO. Additionally, the project will offer wildlife habitat improvement through open space restoration.



The unit cost of the predicted annual CSO volume reduction from this project, approximately \$0.14 per gallon, compares favorably with typical gray infrastructure costs of \$0.50 per gallon. The project cost excludes the cost of basin embankment stabilization which represents approximately 30% of the total project cost.

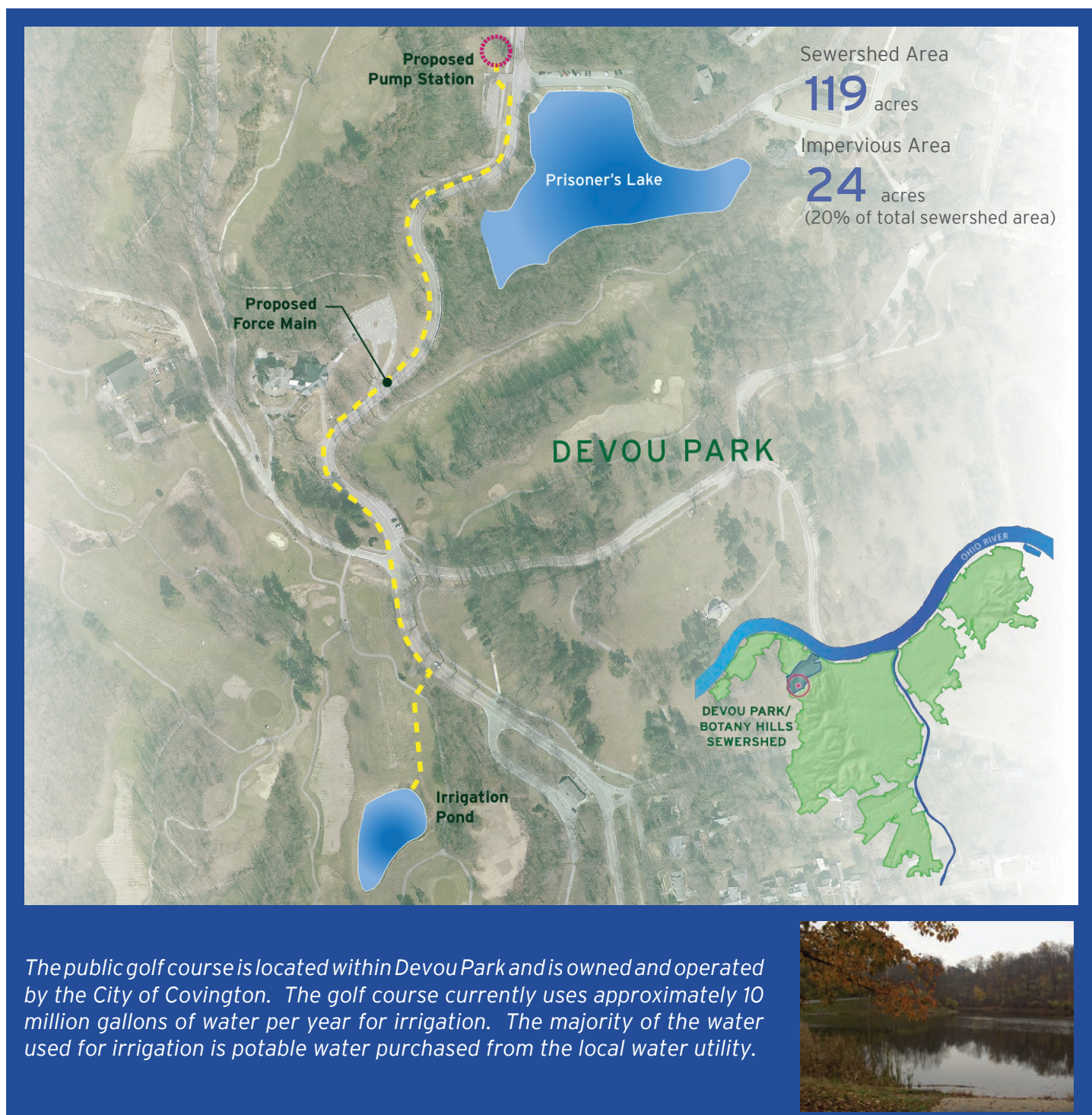


One of the key elements of the KYTC Basin project is the creation of a passive use recreational area for the City of Ft. Wright. This area will feature a walking trail, vernal pools, and restored meadows with prairie grasses and wildflowers. Another important benefit is the stabilization of the existing basin embankment; this will reduce damage risk for residential properties located immediately downstream of the project site.



PRISONER'S LAKE RAINWATER HARVESTING

Prisoner's Lake is a 4-acre lake located in Devou Park in the City of Covington, and is situated adjacent to a public golf course. Currently, the outlet structure for the lake discharges to the combined sewer system upstream of a combined sewer overflow. This improvement project will allow for the capture of storm water runoff that currently flows into the lake and ultimately to the combined sewer system and the re-use of that storm water for irrigation of the golf course.



PROJECT OVERVIEW



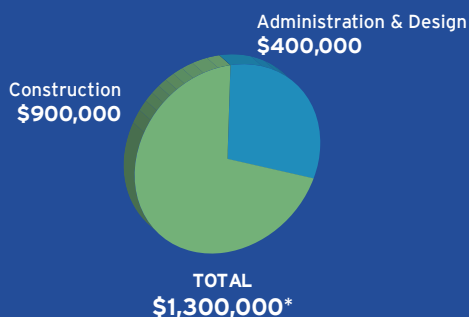
This project involves the construction of a small storm water pumping station and force main next to Prisoner's Lake. This will allow for the transfer of water from the lake to a small irrigation pond located in the adjacent watershed, which does not drain to combined sewers. The pumped storm water runoff will be used for irrigation during the dry months and will discharge to the Pleasant Run Creek during overflow periods and during the winter.

start date November 2009

estimated completion October 2010

status Under Construction

monitoring Water Quantity (post-construction)



*Project is fully funded by ARRA stimulus funds. The city of Covington is sharing the local match portion with SD1.

TRIPLE BOTTOM LINE Project Benefits



Based on a 3-month, 6-hour design storm event, approximately 425,000 gallons of storm water runoff will be captured and made available for reuse. The reuse of captured storm water is supportive of water conservation efforts, as it decreases the demand and use of local potable water supplies.



The unit storage cost of the project is approximately \$2.30 per gallon (based on SD1's 75% cost share), which compares favorably with typical gray infrastructure storage costs of \$5 - \$10 per gallon. In addition, preliminary estimates indicate that the City of Covington will save approximately \$20,000 in annual irrigation costs.



The reduced irrigation costs provides a direct benefit to the City of Covington by lowering its operating costs. The reduction of operating costs helps to ensure that recreational options like the golf course are available and can continue to operate.



ST. ELIZABETH DETENTION BASIN RETROFIT

In 2008 St. Elizabeth Medical Center and SD1 began working together to incorporate a number of green infrastructure techniques into their new 8-acre hospital facility site design. The construction of the medical center was of particular interest because the storm water runoff from this site enters an antiquated combined sewer system. The additional volume of storm water that would be generated from this development had the potential to negatively impact the frequency, volume and duration of combined sewer overflows from the sewer system.



The green infrastructure elements of the project include bioretention and landscaping improvements that have been designed to capture, infiltrate, and reduce peak flow rates of storm water runoff. The 17,900 square foot rain garden design features 36 inches of engineered soil above 24-inches of a sand storage layer as well as plant species that are native to the Greater Cincinnati/Northern Kentucky region.

PROJECT OVERVIEW



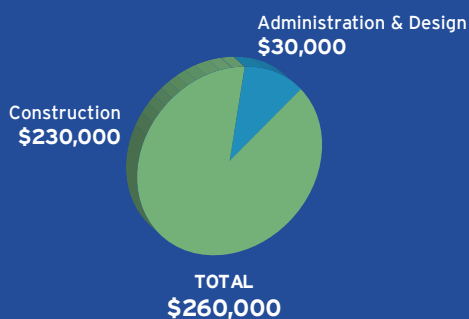
The St. Elizabeth project involved the modification of an existing dry detention basin located on property owned by St. Elizabeth Medical Center. The project has been designed to control storm water entering SD1's combined sewer system by reducing peak flow rates by 71% and volume by 24%. In addition, St. Elizabeth installed a 20,000 square foot green roof and additional 7,800 square feet of individual rain gardens.

start date February 2009

estimated completion May 2009

status Complete

monitoring Water Quantity (post-construction)



TRIPLE BOTTOM LINE Project Benefits



Based on a typical year model, approximately 3.1 million gallons of annual CSO volume reduction will be achieved. Additionally, wildlife habitat improvement will be provided through open space improvements. The CSO volume reduction benefit is based on a combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects.



The unit cost of this project is approximately \$0.37 per gallon, which compares favorably with typical gray infrastructure costs of \$0.50 per gallon. The proposed unit costs are based on the combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects. If SD1 had to construct storage facilities to keep this storm water from entering the combined sewer system, it is anticipated to cost approximately \$575,000.



The retrofit site is located in a highly visible portion of the newly constructed St. Elizabeth Medical Center, and is featured as an aesthetic amenity in some of the patient care areas that have window views of the basin.

TERRACED REFORESTATION

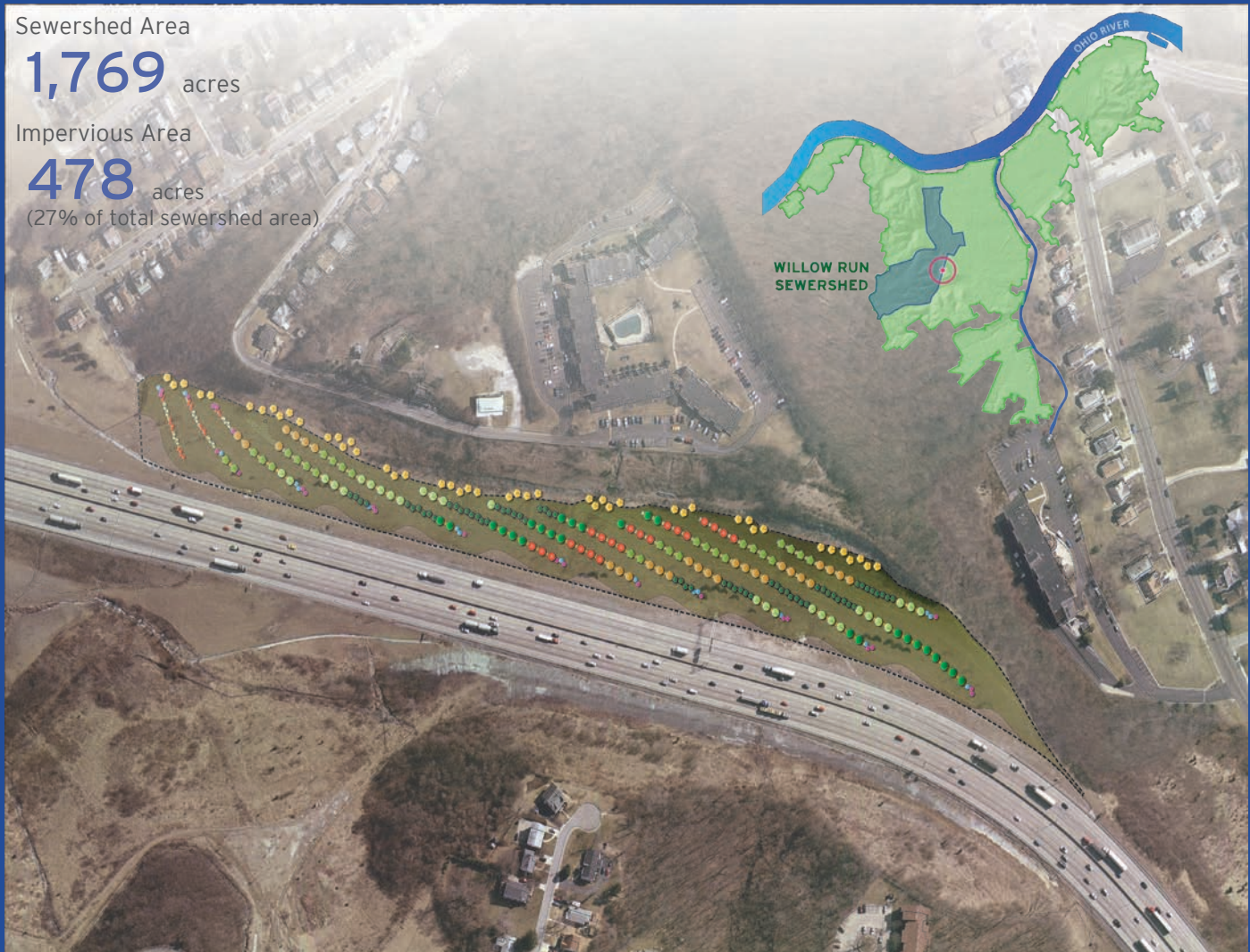
Storm water runoff from a drainage area of approximately 17 acres flows down an open space area along the east side of Interstate 71/75 in the City of Covington, where it ultimately enters the combined sewer system and discharges through the Willow Run CSO. By using adaptive reforestation techniques along the interstate right-of-way, this project will reduce the amount of storm water runoff that enters the combined sewer system while providing an aesthetic amenity to the community.

Sewershed Area

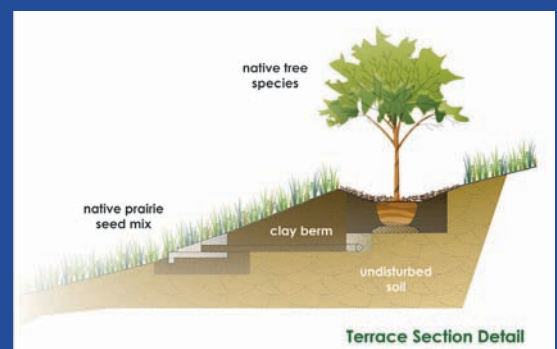
1,769 acres

Impervious Area

478 acres
(27% of total sewershed area)



The green infrastructure practices of the project include bioretention and reforestation improvements that have been designed to capture, infiltrate, and reduce peak flow rates of storm water runoff. Berms will be strategically constructed along specific contours to intercept runoff from the upstream drainage area. The existing soil will be augmented with more permeable soil to promote better infiltration. Trees will be incorporated into the berm system to promote interception, evapotranspiration, and infiltration.



PROJECT OVERVIEW



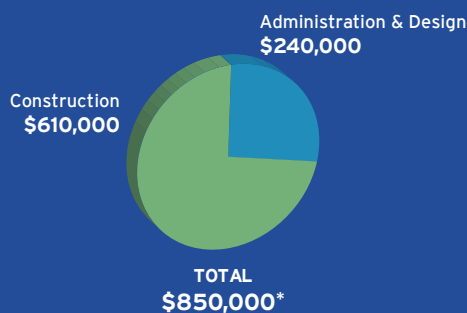
The Terraced Reforestation project involves the construction of a series of vegetated, terraced berms within the I-71/75 right-of-way in the City of Covington. The project has been designed to manage storm water entering SD1's combined sewer system by reducing peak flow rates by 71% and volume by 24%.

start date May 2010

estimated completion November 2010

status Construction Contract Awarded

monitoring Water Quantity (pre & post-construction)



*Project is fully funded by ARRA stimulus funds.

TRIPLE BOTTOM LINE Project Benefits



Based on a typical year model, approximately 3.1 million gallons of annual CSO volume reduction will be achieved. Additionally, wildlife habitat improvement will be provided through open space improvements. The CSO volume reduction benefit is based on a combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects.



The unit cost of this project is approximately \$0.37 per gallon, which compares favorably with typical gray infrastructure costs of \$0.50 per gallon. The estimated unit costs are based on the combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects.

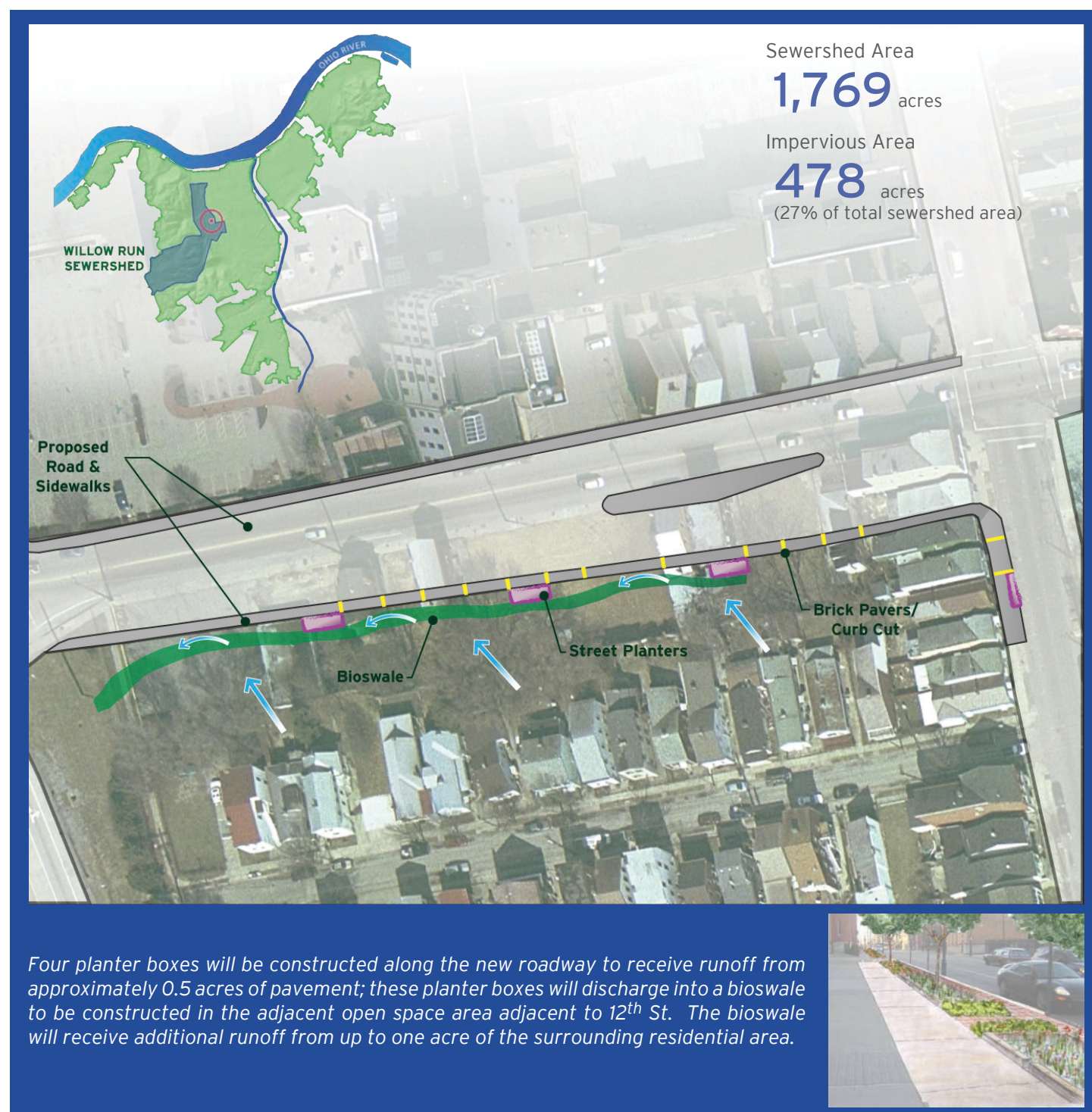


The project site is located in a highly visible area of the I-71/75 right-of-way, which has a current traffic volume of approximately 150,000 vehicles daily. This project will significantly improve the aesthetic value of this open space area through the planting of trees, shrubs, and native prairie grasses.



12TH STREET GREEN IMPROVEMENTS

The City of Covington and Kentucky Transportation Cabinet (KYTC) have been developing plans for a major road expansion of the 12th Street corridor for several years. SD1 has worked closely with them to incorporate green infrastructure elements into this road widening plan. The result is an innovative design that reduces the volume of storm water runoff entering the combined sewer system from this new roadway.



PROJECT OVERVIEW



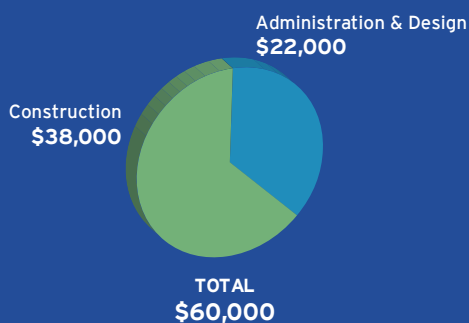
The Green Street Improvement project involves the incorporation of bioretention planter boxes and bioswale improvements into the design and construction of KYTC's 12th Street project in the City of Covington. The bioretention boxes were designed to capture over 30% of annual storm water runoff from their respective drainage areas and the bioswale will be designed to provide additional volume / peak flow reduction benefits.

start date September 2009

estimated completion May 2011

status Under Construction

monitoring Water Quantity (post-construction)



TRIPLE BOTTOM LINE Project Benefits



Based on the typical year model, the planter boxes and bioswale together are predicted to provide approximately 300,000 gallons of annual CSO volume reduction.



The unit cost for the planter boxes is approximately \$0.15 per gallon of annual CSO volume reduction, which compares favorably with typical gray infrastructure costs of \$0.50 per gallon. The unit cost goal for the bioswale improvement component is \$0.30 per gallon.



In addition to storm water runoff and CSO reduction benefits, the planter boxes and bioswale areas will provide an opportunity for landscape plantings and will serve as examples of a green infrastructure along a highly-visible urban street.



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INNOVATION & STEWARDSHIP

Public Service Park

When SD1 began planning for the expansion of its main office in early 2000, an idea emerged to utilize the available green space to create a Public Service Park that was dedicated to those who enhance Northern Kentucky's quality of life through public service. This park would also serve as a place that could empower and educate the public and development community on the vital importance of protecting our waterways for future generations to come. Rather than designing a standard building on a conventional site (with a large retention basin and acres of impervious surfaces), SD1 decided to create a multifaceted and multipurpose site design to demonstrate on-site examples of storm water best management practices.

Numerous sampling locations and monitoring wells have been installed to generate performance data on the various pollution prevention practices. SD1 has initially focused performance monitoring on its biofiltration swale and vegetated roof.





Biofiltration Swale

SD1's biofiltration swale is approximately 125 feet long and 11 feet wide. The vegetation includes Service-berry, Red Twig Dogwood, Palm Sedge Grass, and Pink Summer Sweet. The underground drainage and detention system collects and conveys filtered storm water to Banklick Creek. The system consists of a 72-inch pipe that provides 2,900 cubic feet of storage. The drainage system also helps to minimize flooding during heavy rain events.

SD1 began monitoring the storm water peak flow and volumes in 2008. Figure 1 provides a summary of the monitoring data collected since that time. Percent volume reduction values are indicated in green.

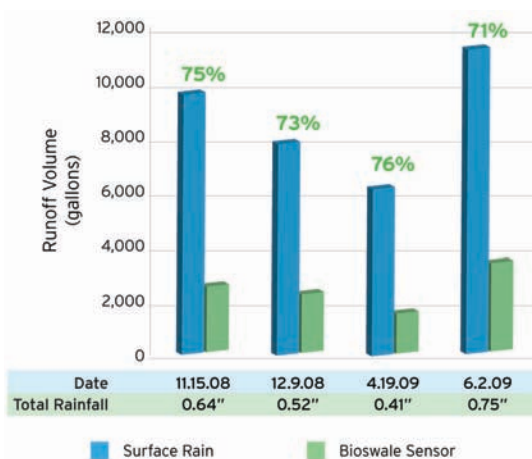


Vegetated Roof

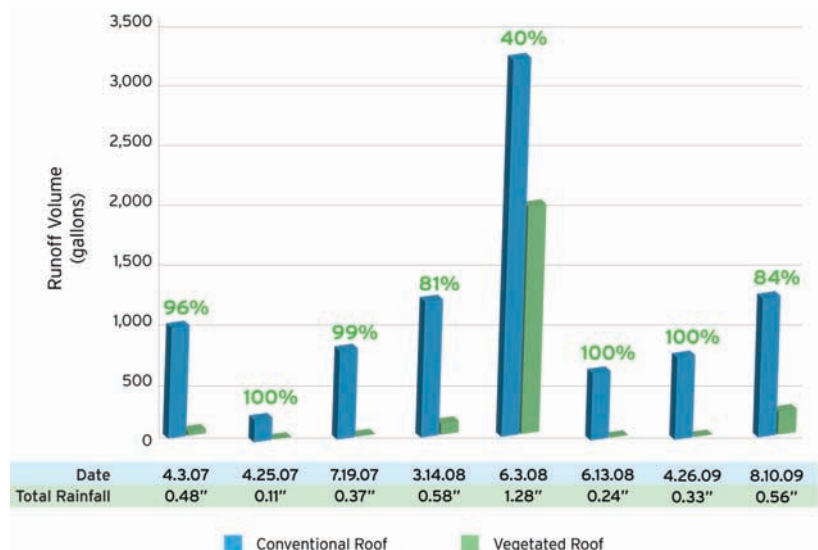
SD1's vegetated roof is 3,600 square feet. It is a Savannah Type III design, which is comprised of 2 inches of growth media, a root permeable fabric, 2 inches of drainage gravel, a waterproof membrane, insulation, and the roof decking. The vegetation consists of a variety of sedums, ornamental grasses, and chives. Separate piping systems were installed on the vegetated roof as well as an adjacent conventional roof to monitor the storm water runoff, this data will be used in comparison with each other.

SD1 began monitoring the storm water peak flow and volumes in 2007. Figure 2 provides a summary of the monitoring data collected since that time. Percent volume reduction values are indicated in green.

**Figure 1: Biofiltration Swale
Percent Volume Reduction**



**Figure 2: Vegetated Roof
Percent Volume Reduction**



PUBLIC EDUCATION

Elementary Curriculum

SD1 has partnered with the local school systems to develop an environmental curriculum for fourth and fifth graders, which has been embraced by many private and public schools in Northern Kentucky. The curriculum is targeted to this age group because this is the time when students typically develop the ability to learn behaviors. More than 55 participating schools receive a credit toward their storm water surcharge for implementing the curriculum.

The students participate in five one-hour lessons focused on water quality and storm water runoff. Concepts covered in the lessons include point and non-point source pollution, watershed management, erosion, wetlands and best management practices. The curriculum continues to reach hundreds of teachers and over 3,900 students annually. The students are also sharing the information with members of their families and community.



From 2003 to 2009 over 26,000 students have been taught the five-lesson environmental unit. In 2009, SD1 saw a 25% increase in the elementary environmental unit pre/post test scores.

Classroom Presentations

SD1 is committed to empowering students to protect the environment and has reached thousands of students through interactive school presentations. These presentations introduce students and scouts to concepts such as point source and non-point source pollution. SD1 uses an interactive model called the Enviroscape to teach the negative impact of polluted storm water runoff on local waterways.

College Curriculum

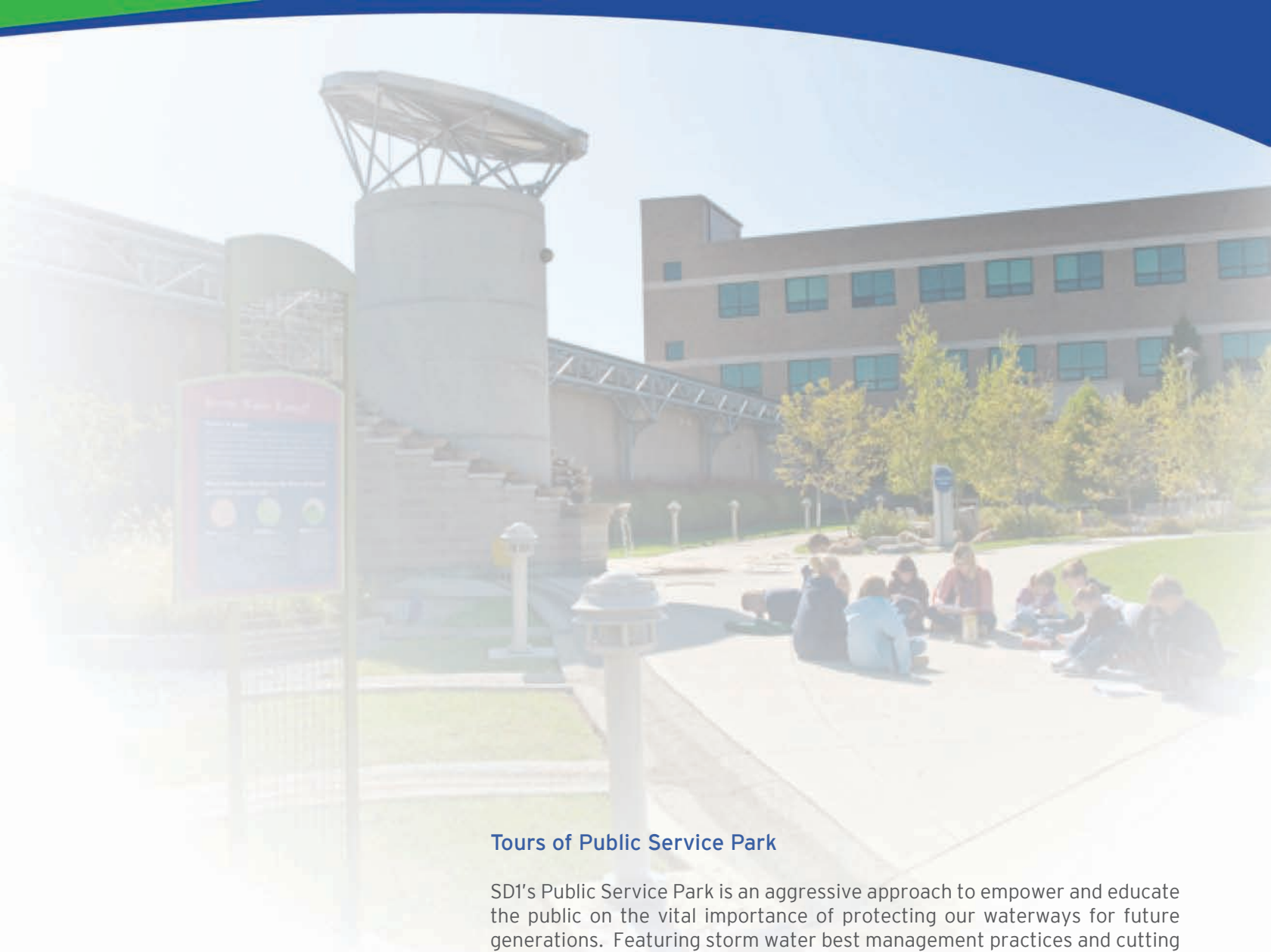
In an effort to expand storm water education to students in different grade levels, SD1 coordinated with Northern Kentucky University (NKU) during 2009 to offer college students a course about storm water titled "Protecting Water Resources". The 200-level lecture and lab examine water quality issues from a global perspective down to a local view.



TMC students have assisted with teaching in the classroom, lesson development, fish shocking and water quality monitoring.

Environmental Academy

The Biology Department at Thomas More College (TMC) offers an innovative major in environmental science. Students participating in this major are required to complete a research project or an internship at an outside agency, with a focus on either ecology or education. SD1 has partnered with TMC to develop the Environmental Academy. Through the Environmental Academy, TMC provides student help for SD1's peak sampling and field trip seasons and in exchange students receive hands-on experience in the field.



Tours of Public Service Park

SD1's Public Service Park is an aggressive approach to empower and educate the public on the vital importance of protecting our waterways for future generations. Featuring storm water best management practices and cutting edge public educational programming, Public Service Park is targeted at all audiences ranging from the development community, to students, to the general public who can follow a self-guided tour. Visitors to Public Service Park include Kentucky Governor Steven Beshear, business professionals from the Ukraine and Republic of Georgia, and a research group from China studying water treatment processes.



Over 14,700 adults and students have visited Public Service Park from 2004 to 2009.

Student Field Trips

Upon completing SD1's Environmental Curriculum, students can visit Public Service Park and play the role of a scientist following the journey of a drop of water. This journey leads them through a wetland, a Native American Creek Trail, across porous pavement and eventually to the top of a vegetated roof. These young adventurers learn how to prevent storm water pollution by not dumping wastes into storm drains, disposing of trash properly and reducing non-point source pollution. Teacher and parent chaperones are trained prior to field trips so that they can effectively lead the students through the journey of a drop of water. The students and chaperones use a Public Service Park Field Notebook as a guide during their visit to the park.

PROMOTION & SUPPORT OF GREEN SOLUTIONS

Rain Barrel Campaign

In 2009, SD1 launched a rain barrel sales campaign in an effort to educate and engage the public about protecting the local waterways and the benefits of green infrastructure. In addition, SD1 was able to gauge public interest and gather additional information for evaluating the use of such a program as a control measure for reducing combined sewer overflows.

SD1 chose to promote the sale of a rain barrel based on surveys conducted prior to the campaign, which indicated that people wanted a container that was easy to clean and blended in with the landscaping. A 55-gallon rain barrel, with multiple pre-drilled openings that make it possible to easily draw water from the barrel, was selected as the style to be promoted. Also, the lid of the selected style can be used as a self-watering planter and can be easily removed to clean the inside of the barrel.

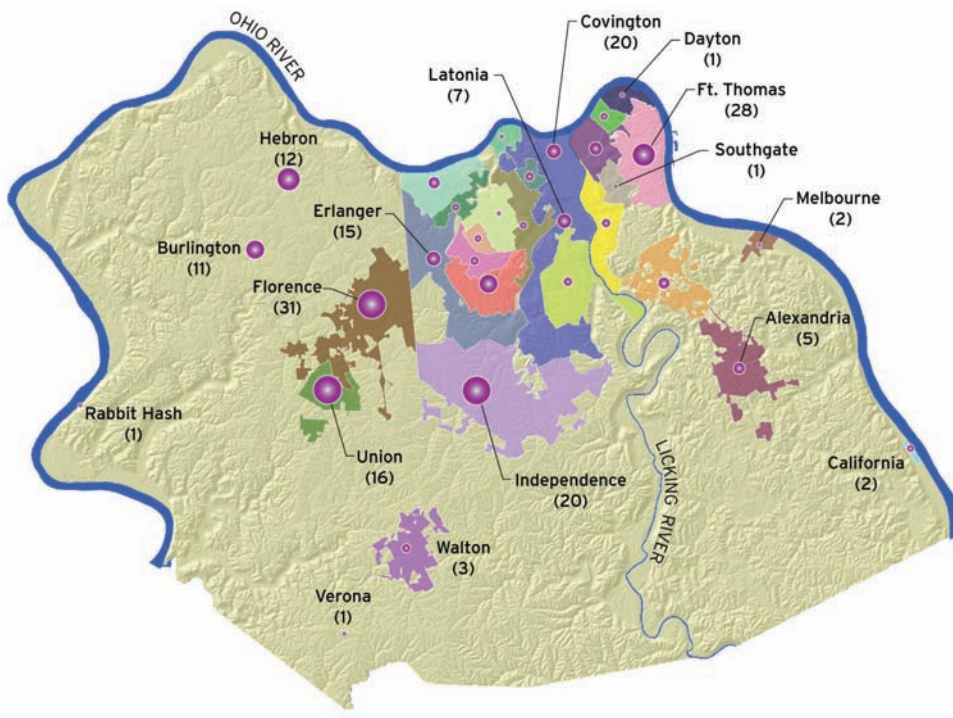
SD1 began promoting the sale of rain barrels in early 2009 through newspaper articles and ads, flyers, a lobby display, information on SD1's web site, and highlights on the evening news. As an additional promotional effort, local cities compete against each other to purchase the most rain barrels per citizen (based on each individual city's population). SD1 awards an annual "Green City" plaque to the winning city.



Photo courtesy of Four Water

With proper use and maintenance, one rain barrel has the potential of reducing combined sewer overflows by 1,000 to 2,000 gallons per year at a cost of between \$0.05 to \$0.10 per gallon removed.

Rain barrels provide an on-site storm water system that collects and stores water runoff from your roof, aiding in the reduction of water pollution and flooding downstream. They require little maintenance and can reduce water bill costs.



SD1 has sold a total of 258 rain barrels through the 2009 and 2010 sales campaigns.



The 2.5-acre TANK site contains 1.36 acres of porous asphalt.

TANK Performance Monitoring

The Transit Authority of Northern Kentucky (TANK) has provided transit services to Boone, Campbell and Kenton counties as well as downtown Cincinnati since 1973. TANK has utilized porous asphalt at several of the Park & Ride locations located in Northern Kentucky, and SD1 has partnered with them to collect performance monitoring data at the Ft. Wright location.

At this specific site, a drainage system under the porous asphalt collects and conveys the storm water runoff from the site into a single outlet structure. This structure serves as the location for a series of monitoring activities intended to measure the effectiveness of porous asphalt as a means of storm water control. The collection and analysis of water quality and quantity at this site will help SD1 in producing local data on the efficiency and effectiveness of this pollution prevention practice.

Green Workshops

SD1 hosts workshops to provide developers, engineers and contractors an opportunity to learn more about green infrastructure. In 2009, SD1 hosted a "Designing Green" workshop that took forty-eight attendees on a green bus tour to three key green infrastructure sites in Northern Kentucky. At each site, attendees heard about the successes and failures that went into each plan from the actual designer. The attendees were able to see the green technologies first-hand, hear about the real-life application of those technologies, and speak directly with experts about their questions. The workshop ended at SD1's main office where attendees were presented information about the up and coming green infrastructure projects in the community.



Storm Water Credit Policy

SD1's Board of Directors approved a credit policy for eligible non-residential property owners to receive credits on their storm water surcharge bill for water quantity or water quality measures. This policy is intended to promote and encourage the design and installation of post-construction water pollution prevention practices. Several developers have designed and installed water pollution controls, such as:

- An enhanced detention basin at IDI's Park West Industrial site in Hebron
- A bioinfiltration swale at Crestview Hills Mall's site in Crestview Hills
- Site grading improvements to redirect storm water flow through landscaping features at McDonald's site in Crescent Springs

