WIRB Watershed Improvement Review Board

Coral Ridge Avenue Stormwater Project

Clear Creek 1302-002

Final Project Report and Closeout

Table of Contents:

Financial Accountability

Watershed Improvement Funds

Line Item	Total Funds Approved ($)	Total Funds Approved-Amended ($)	Total Funds Expended ($)	Available Funds ($)
Contractual—Report Writing	10,000.00	10,000.00	10,000.00	
Signs	700.00	700.00	162.40	537.60
Project Tour	2,000.00	2,000.00	1,895.50	104.50
Water Quality Monitoring	2,500.00	2,500.00	2,500.00	
Bio-retention Cells	146,004.00	146,004.00	135,741.42	10,262.58
Bio-retention Swales	97,336.00	97,336.00	107,098.58	(9,762.58)
Hydromulching	5,000.00	0		0
Erosion Control Matting		5,000.00	5,500.00	(500.00)
Totals	263,540.00	263,540.00	262,897.90	642.10

Total Project Funding

	Cash		In-Kind		Total Approved Application Budget ($)	Total Actual ($)
Funding Source	Approved Application Budget($}	Actual($)	Approved Application Budget($)	Actual ($)		
Coralville	205,156.00	194,893.00	28,900.00	28,900.00	234,056.00	223,793.00
Iowa R. Friends			400.00	400.00	400.00	400.00
Johnson Roadside			9,604.00	9,604.00	9,604.00	9,604.00
Johnson SWCD			500.00	500.00	500.00	500.00
WIRB	263,540.00	262,898.00			263,540.00	262,898.00
Grand Total	468,696.00	457,791.00	39,404.00	39,404.00	508,100.00	497,195.00

Watershed Improvement Fund contribution:

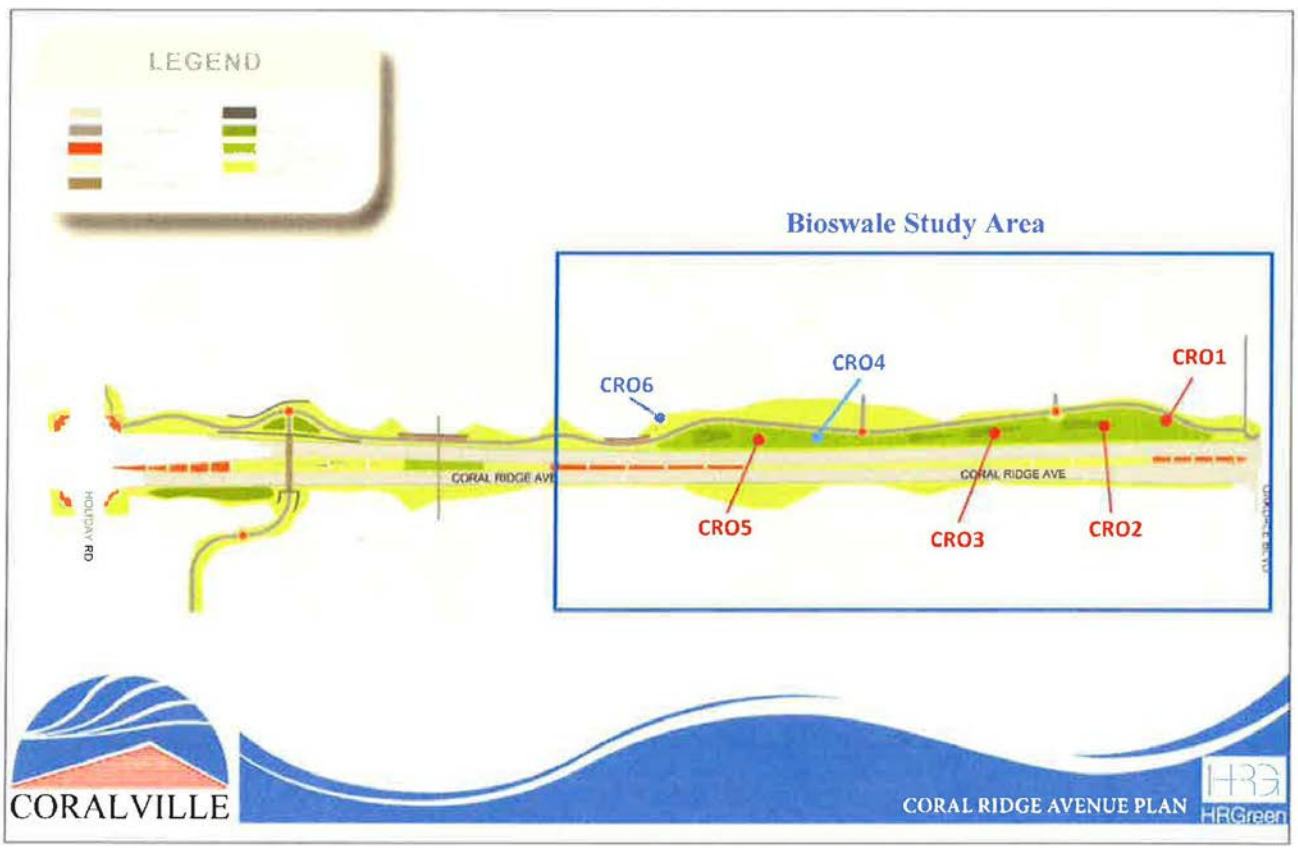
Approved application budget: 52%
Actual: 53%

Bio-Retention cell expenses came in under budget while swales were over budget due to extra stabilization that was necessary to stabilize the grade on sandy soils. The City paid for the additional cost of the bioretention swales. The WIRB request has not changed.

Environmental Accountability

In December of2015, construction of the bio-retention cells and bioswales on Coral Ridge A venue were completed. The project consists of seven bioretention cells and two bioswales designed to treat stormwater runoff from Coral Ridge Avenue. These water quality practices treat 100% of the stormwater runoff from this section of roadway. Flow meters were installed as part of this project. These meters showed that up to 25% of runoff volume is recharged to groundwater. Spring of2016 was the first opportunity to monitor the practices following construction. The data included in this report represents two separate rain events. Additional monitoring will be conducted to further quantify the pollutant removal rates of the storm water practices.

Figure 1: A map of Coral Ridge Avenue and the bioswale structure surrounding the section of road



This data is currently restricted to the bioswale on the north end of the project, emphasized in Figure 1. This figure also identifies storm drain outfalls throughout the project area. CR 01, CR 02, CR 03, and CR05 are outfalls that carry untreated stormwater directly off of Coral Ridge Avenue (CRA) and into the bioswale. CR 04 carries water treated by the first three bioretention cells to the final cell in the sequence. CR 06 acts as the final outfall structure transporting the remaining water that has been fully-treated by the bioswale into the city storm sewer system.

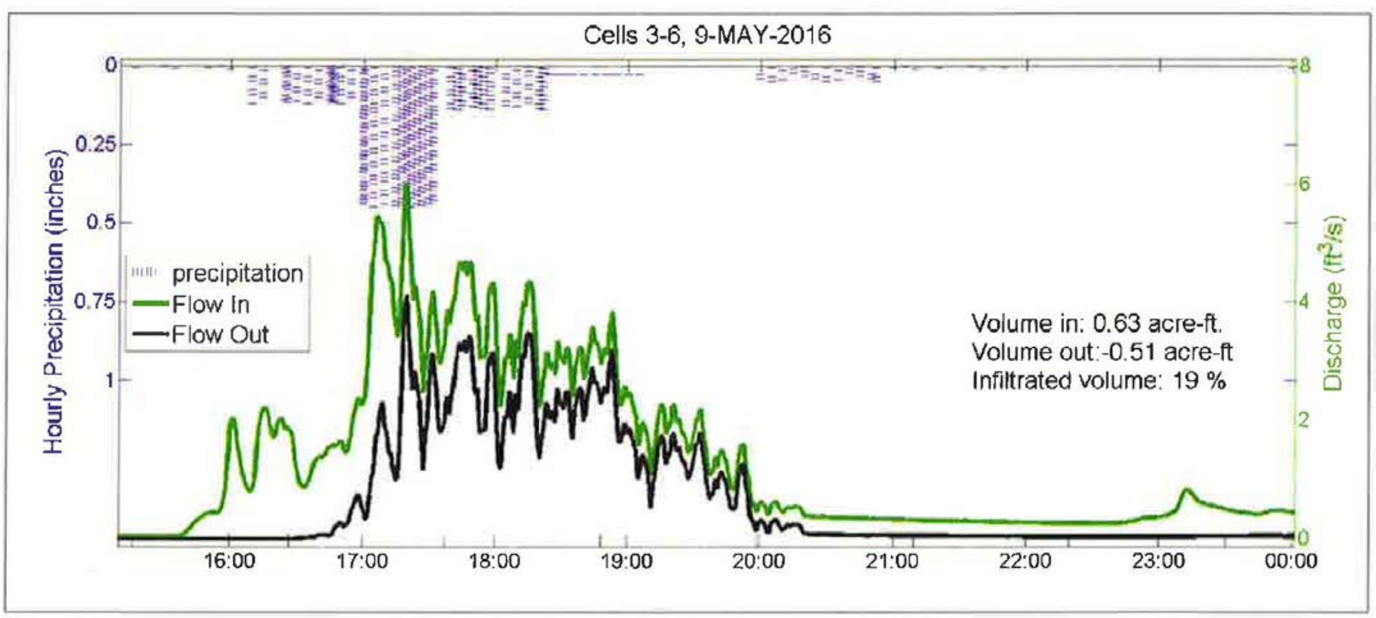
A reduction in E. coli, Chloride and Nitrate concentrations in surface runoff was observed as water was treated while moving though the bioswale. High chloride concentrations observed at the top of the bioswale were reduced by ten-fold as the water exited CR 06 into the city storm sewer. High *E. coli* levels are commonly seen in road runoff. After the biocell treated the road runoff, extremely low levels were observed, corresponding to the lowest concentration of bacteria that was observed in the data. Additionally, 20% of all storm water which enters the practice is recharged as groundwater.

This data indicates that *E. coli*, Chloride and Nitrate concentrations drop as runoff progresses through the bioswale. Additional monitoring will help to determine the quantity and quality of treatment over a longer time periods. The University of Iowa, The Iowa Institute of Hydraulic Research and The City of Coralville will continue monitoring urban pollutants to determine the effectiveness of these practices and during future rain events.

By using the sediment delivery calculator, it was determined that the receiving stream is contributing 108 tons of sediment to the receiving regional detention basin per year. By reducing the amount of flow going through this area we are reducing the total sediment of this drainage area by 75%. The total reduction of sediment is 81 tons per year. By reducing this sediment load to the regional flood control basin, it will reduce sedimentation, extending the lifespan of the basin. Additionally, by infiltrating the first flush of pollutants off the roadway we are drastically reducing the amount of urban pollutants which would historically be carried into the receiving regional detention basin and Clear Creek. All of the stormwater practices have been installed and are reducing flow, thus reducing sediment from this drainage area by 75% giving us an 81 Ton reduction in sediment load yearly.

Figure 2: A cross section of bio cells surrounding Coral Ridge Avenue

Figure 3: A graph displaying the inflow and outflow of the bioswales, yielding a difference of 19% groundwater recharge volume



Practices and Activities

Practice or Activity	Unit	Approved Application Goal	Accomplishments	Percent Completion
Rio-retention cells	Cells	7	7	100%
Rio-retention swales	Swales	2	2	100%
Traditional Design vs. Green Design Analysis and Report	Reports	1	1	100%
Educational Tour	Tours	1	1	100%
Film Highlighting Project	Films	1	1	100%
Creation, Printing and Distribution of the "Coralville Connection"	Editions	1	1	100%

Practices and Activities -Method of Achievement

OBJECTIVE 1: Administer the Coral Ridge Avenue Stormwater Project to ensure all objectives and activities planned are implemented.

<u>Goals:</u>

A. Submit progress reports, annual project reports and final report.
B. Obtain needed training for project manager and committee members.
C. Manage the project to maintain quality control and to maximize communication with, and involvement of, local advisors and state and local staff of participating agencies.

Actions:

A. Ensured all objectives and activities planned were implemented. Prepared and submitted progress reports by the 15th of the month following the end of the reporting period. In addition, annual reports detailing project progress were submitted in 2015 and 2016. This final comprehensive report will wrap everything up by documenting the result of the project.
B. To obtain the necessary training for this project, Amy Foster attended the WIRE-sponsored new project manager training. Amy also received training from Wayne Petersen on measuring reductions regarding urban conservation practices.
C. In an effort to maximize communication and involvement, a pre-construction meeting was held amongst local advisors and participating agencies. From there, construction meetings with contactors, researchers and partners were conducted weekly. The Plan of Work was reviewed monthly and remarks were added as needed.

OBJECTIVE 2: Construct seven biocells and twobio swales to manage water quality and quantity volumes generated from a four lane high way.

Goals:

A. Ensure that practices are installed according to the Iowa Stormwater Management Manuals.
B. Provide quality control to ensure long term function of the stormwater practices.

Actions:

A. Amy Foster provided daily construction oversight to ensure that the bio cells and bio swales were installed according to the Iowa Stormwater Management Manuals.
B. Amy Foster enforced erosion and sediment control as well as good housekeeping requirements to provide quality control and ensure proper functionality of these practices in the long term.

OBJECTIVE 3: Determine cost difference between traditional and green infrastructure.

Goals:

A. Complete a cost feasibility study that determines the cost differences between traditional infrastructure and green infrastructure.

Actions:

A. Howard R. Green was hired as an outside consultant to detail the cost feasibility study. This study has been included with this report, see Appendix A.

OBJECTIVE 4. Conduct watershed tour to highlight Coral Ridge Avenue Stormwater Project and agricultural projects within the Clear Creek Watershed

Goals:

A. Have 50 people attend the watershed tour

Actions:

A. Amy Foster in conjunction with the Johnson County Soil and Water Conservation District and Iowa River Friends planned and conducted a successful tour of the Clear Creek Watershed and Coral Ridge Avenue Project. Ninety-nine participants attended. The Coral Ridge Avenue bus tour was featured on the City of Coralville's Facebook "Water Quality Wednesday" post in addition to the project being highlighted in the Coralville Connection quarterly magazine.

Figure 4: The City of Coralville featured the Clear Creek Watershed Bus Tour that included Coral Ridge Avenue on its Facebook "Water Quality Wednesday" post

City of Coralville, Iowa Government shared Johnson County Soil & Water Conservation District's album

It's #WaterQualityWednesday! A group stopped by the bioretention cells and bioswales along Coral Ridge Avenue during a recent tour of the Clear Creek Watershed.

The group, which included educators and government officials, learned about urban and agricultural conservation practices that enhance water quality and reduce flooding in our local waterway.

Johnson County Soil & Water Conservation District added 35 new photos to the album Clear Creek Watershed Bus Tour

Like Page

Featuring Agriculture and Urban Conservation Practices Maas Farm, Kent Park, Coral Ridge Avenue

Like Comment Share

Program Accountability

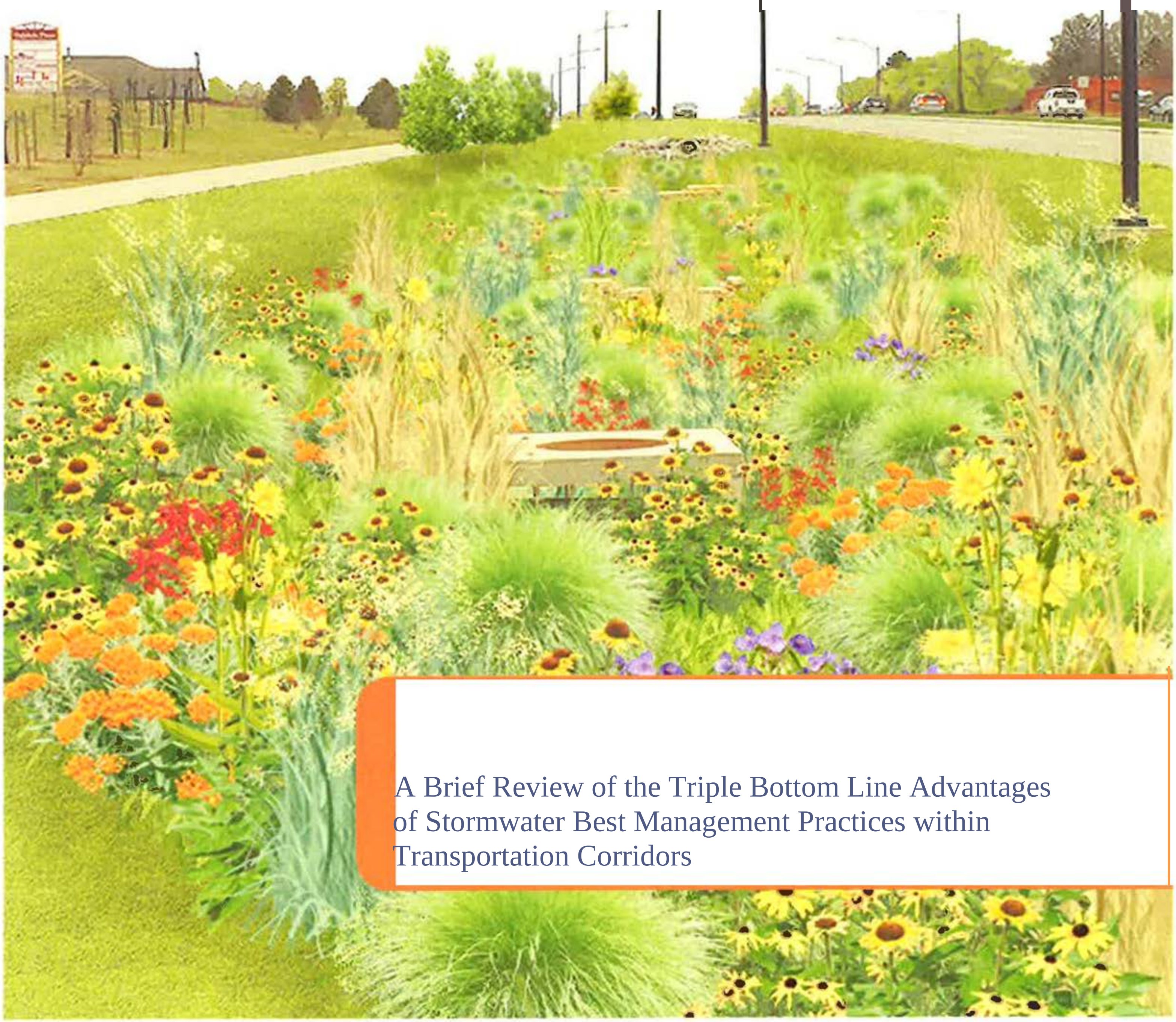
Education was a big element of this program. Many contractors, engineers, City staff members, students and water quality professionals were on-site during construction. These people were included in the construction process. They were able to see firsthand the coordination and flurry of erosion control installations that happen before a rain event. Many of these professionals helped grab samples from the outflow pipes during rain events and were able to see how these practices function.

Anyone who has worked on a green infrastructure project knows that there are many challenges to overcome. The first challenge is communication. Ensuring that the contractor, sub- contractors, engineers, inspectors and City personnel are on the same page and working towards the same goals. Weekly meetings to ensure that water quality practices are being installed per the Iowa Stormwater Management Manual (ISWMM) are essential. Continued project oversight of the installation to ensure the quality control is the other side of the coin. It's important to look at every load of rock that is used to ensure that it is indeed "clean rock". Watching the sub- contractors place the amending soil mix to ensure that the cell is not compacted is another example of ensuring quality control on the site.

Soil types include their own set of challenges. On this project we were working in very sandy soils. This made the basins highly erodible. Looking back, I would not have used these basins as sediment control practices prior to installation of the post construction stormwater practices. Because they were installed as swales, we were constantly fighting erosion on the sides and bottom. Next time would wait to excavating the swales until I was ready to install rock, soil amendments, plants, etc.

Attachment A

NEW PATH FOR STORMWATER



A Brief Review of the Triple Bottom Line Advantages of Stormwater Best Management Practices within Transportation Corridors

Attachment A

Table of Contents

Executive Summary

When it comes to options in stormwater management, many people understand that green infrastructure practices provide multiple ecological benefits compared to traditional gray infrastructure; however, they incorrectly assume that those benefits come at a premium cost. Data generated from the expanded implementation of green stormwater practices in recent years indicates just the opposite. The City of Coralville, Iowa, for example, saved over $45.000 (I 0%) in construction costs on one roadway project alone by replacing large longitudinal storm pipes with bioswales and bio-retention cells.

Detailed case studies and academic research on installed practices indicate that green infrastructure can provide reliable, long-term performance, and in many cases cost significantly less than traditional concrete pipes which provide no runoff quality or flood control benefits.

Traditional stormwater infrastructure utilizes concrete catch basins and piping to quickly and effectively transport storm water runoff downstream to the nearest waterbody. Green infrastructure aims to minimize gray infrastructure needs by maximizing on-site retention and infiltration of small to moderate rainfall events. This paradigm shift leads to stormwater management designs where the additional cost of green stormwater improvements are offset by the reductions in pipe length and diameter, and number of catch basins and manholes needed. Green infrastructure also reduces the size of flood control structures such as detention basins, which saves on construction cost and maximizes developable area. While green stormwater practices do require seasonal maintenance (removing debris and sediment, plant management, etc.), the comprehensive long-term operations, maintenance and repair costs are similar to or less than gray infrastructure practices.

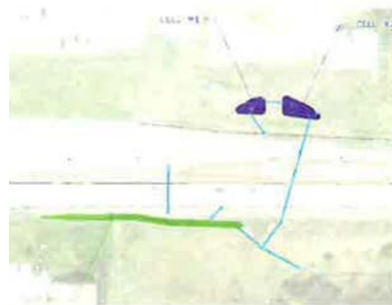
Additionally, the costly downstream consequences associated with traditional gray stormwater infrastructure, such as stream bank and channel erosion, localized flooding, transport of roadway pollutants and overall ecosystem degradation, are avoided. Instead, a myriad of monetary and non-monetary benefits are realized: reduction of runoff volume, improvement of runoff stormwater quality, reduction in long-term receiving-stream maintenance, enhanced aesthetics, increased property value, and improved overall public perception of stormwater and how it's managed within one's community. Overall, the net effect of using green stormwater infrastructure instead of gray piping is a reduction in total cost, and an improvement in the water quality in local lakes and rivers, which leads to improved quality of life of local citizens.

Academic research and engineering case studies have quantified the cost-savings, environmental and social benefits of green infrastructure. These findings have empowered community leaders to revise their comprehensive stormwater management plans to consider the total life cycle cost or the stormwater management system from raindrop to riverbed. A few examples of case studies and research results are included here.

CASE STUDY

Coral Ridge Avenue, Municipal Gateway Corridor

Coral Ridge Avenue is a heavily used primary gateway into the City of Coralville, Iowa. When the roadway was reconstructed, it presented a unique opportunity for sustainable stormwater management and roadway improvements to intersect. This project increased traffic and pedestrian capacity by adding two lanes and a 10 foot-wide multi-use trail. Aesthetic streetscaping elements, including six bioswales and six bio-retention cells were added within the right-of-way to improve the quality and reduce the quantity of storm water runoff from the roadway.



The City of Coralville chose to manage stormwater with a hybrid system including both green and gray infrastructure elements. Pavement runoff is captured with traditional curb inlets and piping, then routed to the right-of-way and medians with minimal longitudinal piping. In place of longitude piping, infiltration and conveyance of stormwater is provided through bioswales with flagstone drop structures. The bio-retention cells collect runoff from the bios wales and process roadway contaminants and pollutants.

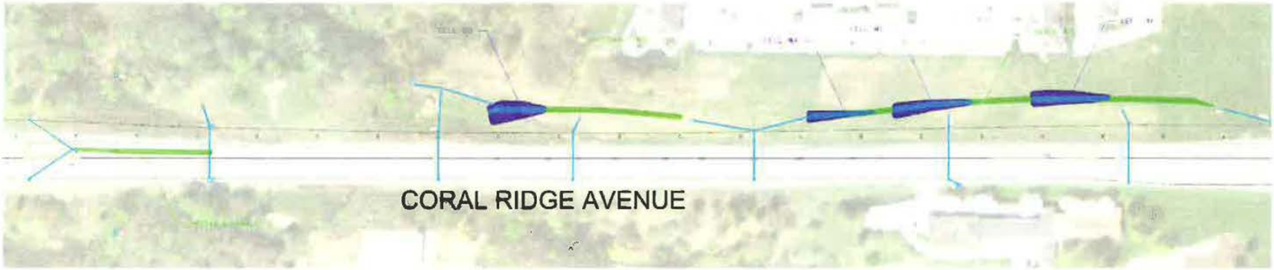
Funding for this project was provided by the City of coralvile, Iowa DOT, Watershed Improvement Review Board, and Rockwell Collins.

The overall system was sized with the goal of treating the “Channel Protection Volume” (CPv), which includes the minimum required “Water Quality Volume” (WQv). The WQv / CPv is the runoff generated from a 1.25 / 2 4-inch rainfall, respectively. The average retention volume achieved by the system is 160% of the WQv, and 123% of the CPv.

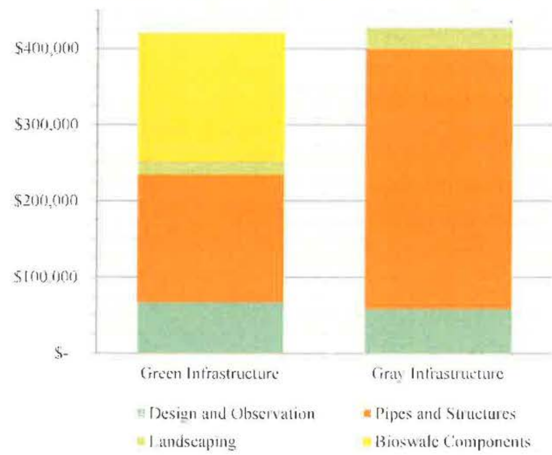
Overall, stormwater infrastructure capital costs were reduced approximately 10%, primarily by replacing large longitudinal pipes and storm structures with bioswales and bioretention cells.

In addition to initial construction cost savings, long-term benefits include: enhanced aesthetics, reduced runoff volume, improved runoff water quality, reduced stream degradation, increased pollinator habitat, and increased community awareness.

Each bioswales bio-retention cell is outfitted with monitoring devices to assess system performance for multiple parameters including flow reduction, chloride concentration, nutrients, bacteria, and other urban contaminants.



COMPARISON OF COST ELEMENTS



SUMMARY STATISTICS

Total Project Area	**10 acres**
Area Draining to BMPs	**8.4 acres**
BMP Footprint Compared to Impervious Area	
This Project	**8.8%**
Typical Green Infrastructure Footprint	**10%**
Total Retention Volume	**34,000 cu ft.**
Native Plant Plugs	**8,609 plugs**
Native Plant Seed	**4 acres**
Reduction in 5-yr Storm Runoff Volume	**47%**
Reduction in 10-yr Storm Runoff Volume	**38%**
Reduction in 100-yr Storm Runoff Volume	**19%**
Reduction in Overall Cost Compared to Traditional Infrastructure	**10%**

CASE STUDY

Hinsdale – The Woodland, Residential Stormwater Retrofits

Thinking Outside the Pipe

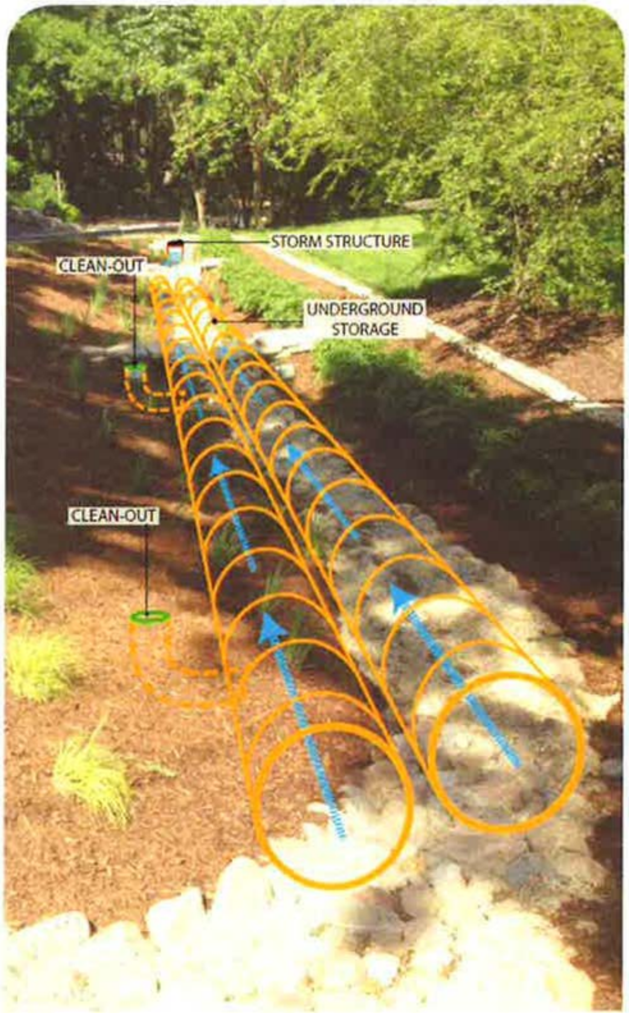
The Woodlands is a fully developed residential area that suffered chronic drainage problems within the right-of-way. When roadway and drainage improvements were first studied in 2008, traditional gray infrastructure was planned to collect and convey up to the 100-yr· storm. The estimate for these improvements was $24.4 million in 2009, a feasibility study was conducted to determine if green stormwater initiatives could reduce grey infrastructure needs and save money. The green infrastructure option was estimated at $15 million, a 39% savings in capital cost alone.

An aggressive hybrid approach was ultimately implemented that combined traditional curb and gutters for the City roadways, but avoided costly large pipes, catch basins and manholes as much as possible, replacing them with curb cut flumes. bioretention cells, bioswales, rain gardens, permeable pavers, and porous underground detention chambers. This combination simple surface conveyance, infiltration and treatment practices, and underground detention chambers reduced overall stormwater management to a clean form that blended well with the existing neighborhood aesthetics. In addition, the peak runoff leaving the storm sewer system during the 10-yr event is expected to be reduced by approximately 60%.

This melding of green infrastructure design strategies not only addresses the ecological and aesthetic values, but meets the cost-savings goal of the City. The case study of the project in its final stages was presented at conferences across the Midwest where it received awards from the American Public Works Association (APWA) and the American Council of Engineering Companies (ACEC).

Before

After



SUMMARY STATISTICS - PHASE 1

Decrease in Peak Outflow from Storm Sewer with BMPs compared to existing conditions

50-year 2-hour event	66% flowrate reduction
10-year 1-hour event	58% flowrate reduction

Green Infrastructure Footprint

Rain Gardens	35,020 square feet
Bioswales	8,41 0 square feet
Underground Storage Volume	27,827 cubic feet

Reduction in Overall Cost Compared to Traditional Infrastructure 39%

CASE STUDY

Comparison between Traditional Pavement and Permeable Pavement

Permeable Pavement can be Cost-effective

Traditional pavement surfaces (concrete or asphalt) are designed to quickly move water away from the travel surface, into the gutter and then to traditional catch basins and piping. Alternatively, permeable pavements are designed to allow stormwater runoff to move down through the pavement, almost eliminating the need for catch basins and piping. Permeable pavements have been thoroughly vetted and proven successful across many different temperature and rainfall climates, and can be implemented in parking lots and low-speed roadway applications.

An often cited fact about permeable surfaces is that they cost more than traditional pavement, which is accurate when pavement costs alone are compared. However, when the total stormwater management costs for a development, parking lot or street are included, permeable pavement can be competitive, or cost less than traditional pavement with gray stormwater infrastructure. This is especially true when detention requirements are included, because the rock chamber below the permeable pavement can discount online detention requirements.

A hypothetical development was designed to directly compare the costs of standard pavement and a combination of standard and permeable pavement. Two different options were included: one option assumed that each residential property retained the Water Quality Volume onsite (WQv, 1.25" precipitation), which is the standard NPDES Post-Construction Stormwater Management requirement. The second option assumed that the Channel Protection Volume (CPv, 2.4" precipitation) was retained on-site, a more aggressive goal required by some communities. The receiving stormwater infrastructure was designed to receive runoff from the 5-year precipitation event (minimum SUDAS design).

All options assume an online detention basin is required for the development

5 Major Components

Rock Storage Chamber – The rock area underneath the permeable pavement that temporarily retains and stores runoff.

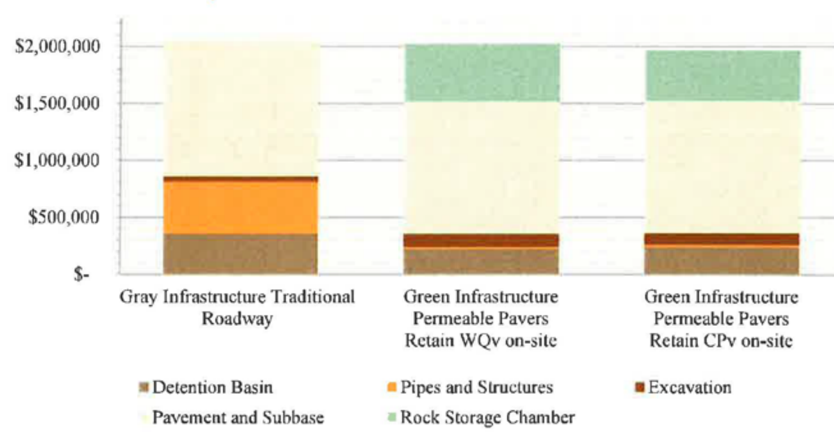
Pavement and Subbase – Includes both permeable and traditional pavement and road foundation.

Excavation – The excavation volume was assumed to equal the volume of pavement, subbase and rock storage chamber.

Pipes and Structures – Traditional gray stormwater management components.

Detention Basin – Required size of basin is reduced significantly by the rock storage chamber volume (more developable area).

CONSTRUCTION COST COMPARISON: Traditional Roadway, Retain WQv on-site and Retain CPv on-site



to reduce peak flowrates for events larger than the 5-year precipitation event. The detention basin for each scenario was sized to meet typical detention ordinance requirements (detain the 100-year runoff and release at less than the 5-year pre-development runoff rate). A storage volume to cost relationship developed by the EPA was applied to estimate the detention basin costs for each scenario. The volume required tor the basin was over 50% less thanks to the permeable pavement and rock chamber volumes, which would result in more developable area, and lead to even greater net cost benefits.

SUMMARY STATISTICS - GI OPTIONS

Decrease in required detention basin volume	53% to 58%
Decrease in pipe and structure cost	4% to 5%

Total pavement costs were functionally identical

Precipitation totals for Coralville, IA

- WQv – 1.25”
- CPv – 2.4”
- 5-year – 3.78”

STANDARD CROSS SECTION

PERMEABLE PAVER PARKING CROSS SECTION

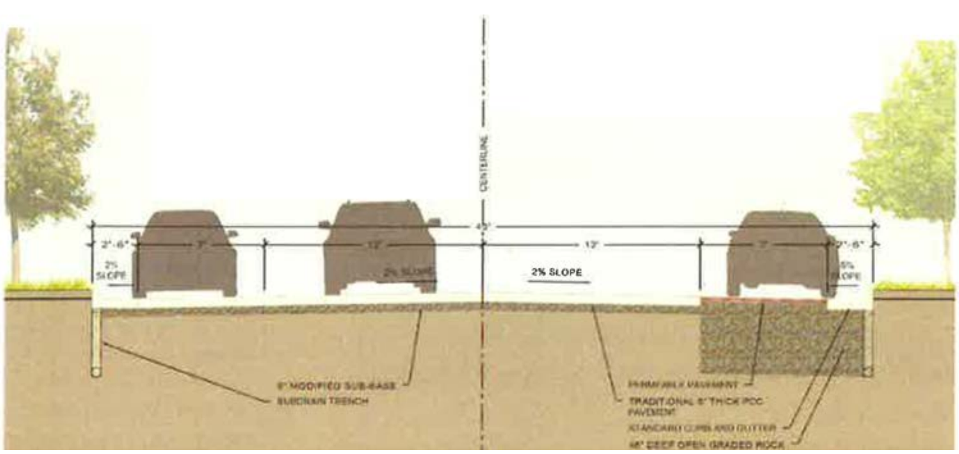


Figure: The typical sections included in the hypothetical residential development are shown above. The residential street would include space for two-way traffic and one lane width of parking on each side. Note that the rendering above illustrates only half of the typical section for each separate design.

Green Infrastructure with permeable pavers on the parking strip was estimated to cost less than the traditional roadway and storm infrastructure by:

1.4% (retain WQv on-site)

4.1% (retain CPv on-site)

SUMMARY OF RESEARCH

The Economic Bottom Line

Green Infrastructure: Proven Technology – Multifaceted Benefits

The photo was taken a few years after the City of Seattle completed construction of 2nd Avenue through their Street Edge Alternatives (SEA) program. The street provided a proof-of-concept for improving the streetscape with native perennial plantings, and managing stormwater within the right-of-way effectively – even on an existing, narrow right-of-way.[4]

Over the past 30 years, numerous research publications and case studies have shown that green infrastructure can substantially reduce both upfront capital and long-term operations and maintenance costs over traditional gray infrastructure. The breadth of research knowledge and project experiences mirror the climatic and seasonality differences across the United States, from the Pacific Northwest to the Midwest to the East Coast, proving that municipalities across all climatic regions in the United States can achieve cost savings by incorporating green stormwater management. In addition, green stormwater infrastructure has been implemented successfully into a wide variety of municipal, commercial and residential construction projects.

A recent survey of 300+ registered Landscape Architects found that 75% of green infrastructure projects reduced or did not influence costs, and over half of these projects 59% cost less than a comparable grey infrastructure design.

The Environmental Protection Agency conducted the survey and all survey participants were verified members of the American Society of Landscape Architects and were registered Landscape Architects. Survey participants provided data from nearly 479 projects that incorporated green infrastructure into a wide range of projects including schools, universities, parks, streetscapes, commercial and residential construction. The projects were completed in a variety of climatic conditions, across 43 states.[1]

SUMMARY OF RESEARCH

The Ecological and Social Bottom Lines

Benefits beyond the Right-of-Way

In addition to potential cost savings to municipalities and taxpayers, green infrastructure can provide a wide array of ecological and social benefits that are external to the project costs. **The benefits and advantages of green infrastructure have the potential to impact each of the following:**

- ecosystem and habitat (trees, plants and animals)
- neighborhood (aesthetic, livability and property values)
- local watershed (water quality, stream stability, hydrologic cycle restoration and flood hazard mitigation)
- improved quality of life
    - people (air quality, safety, recreation, increased environmental awareness)
    - society (public health, environmental education)

Improved Air Quality/Climate Change

Urban Heat Island
Green infrastructure practices that include trees and other vegetation can reduce the urban heat island effect, which reduces energy use and the incidence and severity of heat-related illnesses.

Air Quality
Green infrastructure improves air quality by increasing vegetation, specifically trees, that absorb air pollutants, including CO_2, NO_x, O_3, SO_2, and PM_{10}.

Greenhouse Gases
Green infrastructure's ability to sequester carbon in vegetation can help to meet greenhouse gas emission goals by contributing to a carbon sink.

Water Quality and Quantity

Water Conservation
Green infrastructure that incorporates locally adapted or native plants reduce the need for irrigation, which reduces demand for potable and recycled water. Rain barrels and cisterns that capture rainwater also reduce water use.

Water Quality and Flood Mitigation
Green Infrastructure can decrease the frequency and severity of local flooding by reducing stormwater discharge volumes and rates.

Habitat
Vegetated green infrastructure can provide habitat for wildlife, particularly birds and insects, even at small scales of implementation.

Quality of Life

Public Health
Residents have more recreational opportunities in the presence of large-scale green space in their community, which can improve public health and well-being.

Public Safety
Green streets that include curb bump-outs at pedestrian crossings improve pedestrian safety by slowing traffic and decreasing the distance that pedestrians must travel in the roadway.

Recreational Opportunities
Larger-scale green infrastructure facilities that include public access, such as constructed wetlands, offer recreational opportunities.

Property Aesthetics
Green infrastructure that includes attractive vegetation can improve property aesthetics, which can translate into increased property values.

Educational Opportunities

Public Education
The visible nature of green infrastructure offers enhanced public education opportunities to teach the community about mitigating the adverse environmental impacts of our built environment. Signage is used to inform viewers of the features and functions of the various types of facilities.

Appendix A

Credits

Funding for this document was provided by the **Watershed Improvement Review Board ("WIRB")**

This document was produced for the City of Coralville by **HR Green, Inc.**

Additional support and assistance was provided by:

Wayne Petersen, Iowa Department of Agriculture and Land Stewardship
Pat Sauer, Iowa Stormwater Education Partnership
Jenn Coleman, City of Coralville

CORALVILLE

WIRB Watershed Improvement Review Board

HRGreen

Prior to the Coral Ridge Avenue construction, the road was a two lane highway between Oakdale Rd. and Holiday Rd.

Initial grading and infrastructure installation where the bike tunnel is now in place.

Excavation of one of the two southern biocells after proper stabilization of the surrounding area.

Looking South down Coral Ridge Avenue, new prairie growth is observed and final stabilization is completed.

Aaron Gwinnup, an engineer from HR Green, and the construction site supervisor walk the nearly completed biocell located in the median of Coral Ridge Avenue.

Amy Foster and Art Bettis walk along Coral Ridge Avenue after construction is completed.

The bus tour group walking up Coral Ridge Avenue to view the bio swale.

The bus tour group gathers around the large biocell on the Southwest side of Coral Ridge Avenue.

Pre-construction - 2005

Post-construction - 2016

Aerial images illustrate the roadway, stormwater, and recreational improvements made to Coral Ridge Avenue through this project.