WIRB Final Project Report

Project Name: Dry Run Creek Watershed: Baker Hall Bioretention Cell

Project Number: 1206-004

Soil and Water Conservation District: Black Hawk

Date Report Prepared: December 15, 2013

Reporting Individual: Joshua Balk

Preparers Signature:

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(Joshua Balk) **Date**

SWCD Chairperson's Signature:

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(G.M. "Jeri" Thornsberry) **Date**

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I. PROJECT EXECUTIVE SUMMARY

The Dry Run Creek (DRC) watershed received a biological impairment in 2002 after sampling conducted by the Department of Natural Resources (DNR) revealed a lack in the diversity and the abundance of aquatic life along a 2.8 mile reach of stream along the Southwest Branch (Figure 1). Among the primary stressors identified were hydrological change, increased storm sewer inputs, lack of available habitat and sedimentation. High levels of indicator bacteria (E.coli) were observed in 2008 which resulted in a second impaired designation for Dry Run Creek on the Southwest, East, and University Branches (Figure 2). Goals put forth by the Watershed Management Plan and the preliminary Total Maximum Daily Load (TMDL) study center around the reduction in storm sewer inputs.

The WIRB awarded grant dollars in the amount of $19,853 went towards the cost of engineering, design, and installation of a bioretention cell on the campus of the University of Northern Iowa. DNR Section 319 also contributed funds for the engineering, design, and installation of the practice in the amount of $9,927.50 as well as through in-kind donation of time for Project Coordinator Salary as well as Information and Education in the amount of $6,696. This practice was included in the Baker Hall reconstruction project which included the demolition of a building and the installation of a parking lot area. The Baker Hall parking lot bioretention cell is 3,180 ft^2, drains 1.14 acres, and will treat an estimated 385,000 gallons of runoff annually.

II. BACKGROUND INFORMATION

A. Watershed Characteristics

Dry Run Creek is a 15,177 acre watershed which flows west to east from the rural and agricultural areas of Black Hawk county through residential, industrial and commercial areas of Cedar Falls before it outlets into the Cedar River. Dry Run Creek drains 45% of the City of Cedar Falls and a small amount of the City of Hudson.

According to data collected in 2002, there are 30 miles of stream channel with 12 miles of this length being contained in areas of urban development (Brandt et. al., 2005). Approximately 36% of the watershed is urban land, with an additional 1% being developed each year (Black Hawk SWCD, 2009). Areas of development shift from year to year, but the majority of development in recent years has been conducted in subwatersheds 4 and 8 (Figure 3), both of which drain into the East branch. Overall, 24% of the total watershed is covered with impervious surface. The remaining area of the watershed is designated as rural. Agricultural land uses in the area consist primarily of row cropping in a corn and soybean rotation, with limited livestock production being primarily high-density hog confinements (Figure 4).

Dry Run Creek is classified as a class B (LR) warm water stream by the Iowa Department of Natural Resources and is a Hydrologic Unit Code (HUC) 12 (070802050401 Middle Cedar River). The watershed currently has two designations on the State of Iowa's 303(d) list of impaired waters. A segment of the Southwest Branch of Dry Run Creek, within the City of Cedar Falls, is listed for a biological impairment (Figure 1) and the bacterial impairment extends on the Southwest, East, and University Branches (Figure 2).

III. ORIGINAL PROJECT PLAN

Grant funding was sought for the construction of one 3,100 ft^2 bioretention cell to treat the first flush of runoff from a parking lot totaling 1.26 acres. The practice proposed would treat 90% of annual rainfall from this area, or roughly 94,854 cubic feet of stormwater (2.17 acre feet) and reduce the annual runoff by 80, 217 cubic feet of stormwater. In addition, a monitoring program was to continue being coordinated through a partnership with the Iowa Department of Natural Resources IOWATER program and locally led volunteer efforts which allow progress to be tracked. Funding for administration, outreach, and assessment was to be provided through existing Section 319 grants. Implementation of this practice was planned to occur over a two year period.

The below table shows the practice compares the plan and the actual practice installed.

	Original Project Plan		Actual Project Plan	
WIRB Funded Items	**Units**	**Budget**	**Units**	**Budget**
Parking Lot Biocell	3,100 ft^2	$18,048.00	3,180 ft^2	$18,048.00
Engineering/Design		$1,805.00		$1,478.58
Totals	3,100 ft^2	$19,853.00	3,180 ft^2	$19,526.58

IV. PROJECT RESULTS

A. Financial Accountability

Total Project Funding by Expense Category

GRANT AGREEMENT BUDGET LINE ITME	TOTAL WIRB FUNDS APPROVED	TOTAL WIRB FUNDS EXPENDED	SECTION 319 FUNDS EXPENDED	UNI CONTRI-BUTIONS	TOTAL
Salary/Benefits*			$5,580		$5,580
Information/ Education *			$1,116		$1,116
Parking Lot Biocell	$18,048	$18,048	$9,024	$15,332.59	$42,404.59
Contractual Services	$1,805	$1,478.57	$739.29	$739.29	$2,957.15**
TOTAL	**$19,853.00**	**$19,526.57**	**$16,459.29**	**$16,071.88**	**$52,057.74**

***** Salary/Benefits and Information/Education are provided by Iowa Department of Natural Resources Section 319 Funds

**Engineering and Design of practice came in under budget. Originally $3,610 was estimated for the total; $2,957.15 was the final costs. Approved cost share rates were then applied (WIRB at 50%, 319 at 25%, and UNI at 25%).

Total Project Funding by Funding Source

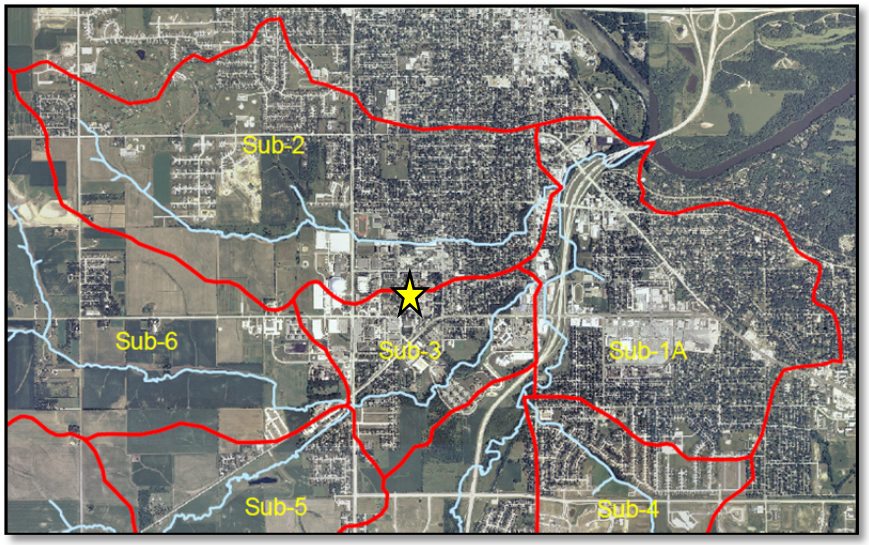
Funding Source	Cash		In-Kind Contributions		Total	
	Approved Application Budget ($)	Actual ($)	Approved Application Budget ($)	Actual ($)	Approved Application Budget ($)	Actual ($)
WIRB	19,853.00	19,526.57	0.00	0.00	19,853.00	19,526.57
IDALS	9,926.50	0.00	0.00	0.00	9,926.50	0.00
319	0.00	9,763.29	6696.00	6,696.00	0.00	16,459.29
UNI	9,926.50	16,071.88	0.00	0.00	9,926.50	16,071.88
Totals	39,706.00	45,361.74	6,696.00	6,696.00	39,706.00	52,057.74

Watershed Improvement Fund contribution: Approved application budget: 50 %
Actual: 38 %

All of the requested WIRB funds went to their intended expenses. The construction of the biocell, however, came in over budget while the engineering and design of the practice came in under the original budget. With the large scope of the project that this practice was tied to, additional costs can easily be incurred due to unforeseen changes and challenges during construction. The additional amounts were not excessive and within the range of potential error. Also, due to this practice being tied with a larger project, final costs for the engineering and design of the practice (professional services) were less slightly than expected. Given these two discrepancies, the contribution of WIRB was less than the originally intended 50%, with UNI being required to cover the additional costs. Also, with the in-kind donation from 319 for Salary as well as Information and Education, the WIRB percentage is slightly skewed down. The total unspent WIRB funds cumulated to $326.43.

B. Environmental Accountability

Location of Installed Bioretention Cell in Priority Subwatershed 3



Photographs Taken During Practice Installation

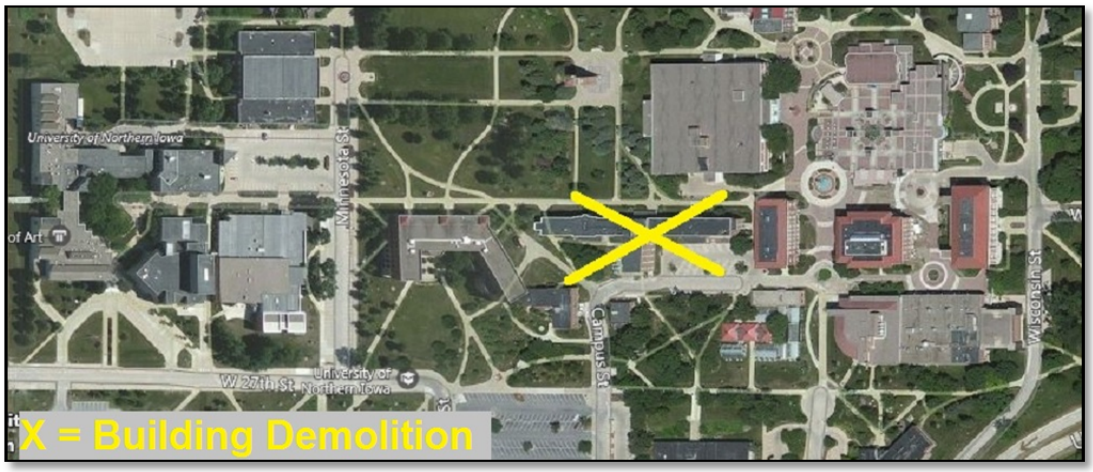
Taken June 9, 2014

Taken June 9, 2014

Taken January 29, 2015

Taken September 25, 2015

Pre-Construction Map



Post-Construction Map

The WIRB funded practice was designed following the guidelines of the Iowa Stormwater Management Manual (Section 2E-4) to provide stormwater infiltration and reduction of non-point sources pollution and sediment. The infiltration of runoff through bioretention cells not only reduces the volume of stormwater surges but also removes pollutants through percolation. According to the Iowa Stormwater Management Manual, bioretention cells can remove 80% of suspended solids, 65-85% of phosphorous, 50% of nitrogen, 70-100% of pathogens, 45%-95% of heavy metals, and 30-65% of hydrocarbons from the area draining into the practice.

The 3,180 ft^2 bioretention cell was designed to manage the 1.14 acres of adjacent impervious surface and treat 51,502 cu. ft. or 385,262 gallons of runoff annually. A reduction in annual total suspended solids, total phosphorus, and total nitrogen levels are also expected. The table below show the anticipated environmental benefits of the original planned practice and the actual environmental benefits of the installed practice.

	Original vs. Actual Estimated Environmental Benefits					
Baker Hall Bioretention Cell	**Units Installed**	**Acres Treated**	**Annual Runoff Treated**	**Annual Suspended Solids Reduction**	**Annual Total Nitrogen Reduction**	**Annual Phosphorus Reduction**
Planned Biocell*	3,000 ft^2	1.26	600,063 gal.	671 lb.	-	1.43 lb.
Constructed Biocell**	3,180 ft^2	1.14	385,262 gal.	1,051 lb.	4 lb.	1 lb.

*Original practice to be installed with the environmental benefits according to WinSLAMM (Source Loading and Management Model for Windows)

**Actual practices installed with the environmental benefits according to IDNR Pollutant Reduction Load Calculator

Over one hundred additional conservation practices have been installed in the Dry Run Creek Watershed since the project began in 2004. A map of all the grant funded practices installed within the watershed from FY2007 to FY2015 is included in Figure 5. These practices have been installed with multiple partners utilizing various funding sources. All practices are contributing towards addressing the goals set forth in the Dry Run Creek Watershed

Improvement Project by either infiltrating the 1.25" rainfall event in urban areas, reducing sediment delivery by 30%, or by improving streambank habitat along 25% of the stream.

Twice a year, once in the Spring and once in the Fall, Snapshot events are held in the DRC Watershed. Volunteers are trained to follow IOWATER parameters and are given locations within the watershed to collect samples and analyze for field parameters. Over thirty different sites in DRC are monitored. Information gathered from these events help provide water quality information on the overall health of the creek. Snapshot events from past years can be compared to determine if trends or improvement are occurring within the watershed. Volunteer numbers average around twenty-five per Snapshot event. The below table shows results from the most recent five Snapshot events.

Data from two Snapshot locations adjacent to Baker Biocell (Spring/Fall 2013-2015)

Site	Date	Transparency	Water Temp	pH	Nitrite-N	Nitrate-N	Dissolved Oxygen	Phosphate	Chloride
144	4/27/2013	60	50	6	0	1	8	0	48
171	4/27/2013	60	54	6	0	5	10	0	29
144	9/21/2013	60	60	8	0	1	8	0.1	41
171	9/21/2013	60	58	9	0	2	8	1	35
144	10/4/2014	60	50	8	0	1	12	0	50
171	10/4/2014	60	51	7	0	1	10	0.1	43
144	5/16/2015	60	63	7	0	5	8	0	50
171	5/16/2015	60	63	8	0	5	8	0.1	40
144	10/24/2015	60	57	8	0	5	8	0	43
171	10/24/2015	60	57	8	0	2	6	0	46

In addition to the scheduled Snapshot events, seasonal water monitoring of eleven locations throughout the Dry Run Creek watershed is conducted by the project coordinator. Results were previously analyzed by the State Hygienic Laboratory at the University of Iowa. In 2015, the funding source for this chemical analysis, as part of the IDNR's Water Monitoring Section, was not renewed. As a results, the DRCWIP partnered with the University of Northern Iowa's Hydrology Laboratory to complete the chemical analyses. UNI allowed access to their facilities by a selected, qualified intern who then conducted the analysis and the Water Monitoring Program was able to continue uninterrupted. Data from this year will be compiled with previous year's data to ensure congruency. Continued monitoring of the DRC watershed is planned to help determine if water quality improvement in the watershed is occurring.

The IDNR also conducts annual biological investigations into several sample sites of DRC within the impaired area. The biological data from Dry Run Creek suggests some improvement in the stream from 2005 through 2015. The benthic macroinvertebrate community has shown consistent improvement during the past several years and fish scores have increased as well. At the monitoring location downstream from the Baker Hall Biocell is DRC4. Past fish scores at this location have generally been in the "Fair" range. However scores at DRC4 jumped from 34 in 2014 to 55 in 2015 and resulted in the first score in the "Good" category since monitoring began in 2005. BIMI scores have slowly improved from a 39 (Fair) in 2005 to a 56-60 (Good) range for the past three years at this site. This practice being located within the drainage area of the impaired zone will have a direct impact on the continued improvement of aquatic life in the stream.

C. Program Accountability

The installed practice is a depressional basin with an engineered soil subgrade. Stormwater runoff from adjacent parking lots is directed towards this cell and is collected in the upper layer of the bioretention cell system where it filters through the surface vegetation, and pervious soil layer and is temporarily stored in a stone aggregate base layer. The Water Quality Volume (WQv) is drained from the aggregated base by infiltration into the underlying soils and/or to an outlet through a perforated pipe sub-drain.

The biocell was designed to provide storage for the Water Quality Volume of stormwater runoff with a ponding depth of 18 inches. It includes a 90% sand, 10% compost mix and installed with a soil depth of 30 inches. The biocell soil mixture was designed to connect the drainage gravel based upon relative particle size characteristics. A sub-drainage pipe is located within the drainage gravel to collect water that has been filtered by the biocell soil mix and then introduce it to the stormwater system. The biocell was planted with a mixture of native and locally adapted perennial plants with deep roots for nutrient uptake.

Research and assessment continues on the best mixture for biocells, specifically sand content. New studies suggests that lower compost content is necessary to avoid additional nutrients being delivered into the stormwater system. This practice reduced compost content to 10% and increased sand to 90%. Whether or not this is the ideal combination and how to best balance drainage and organic matter content will continue to be monitored for in future mix designs.

The Watershed Coordinator for the DRC project has been the lead in outreach and educational activities highlighting the grant funded practice. A bus tour was provided to legislators and representatives of IDNR, IDALS (Iowa Department of Agriculture and Land Stewardship), and CDI (Conservation Districts of Iowa), on June 23, 2015. This included eighty members visiting various urban practices through the watershed including this practice at UNI. An additional tour was given by the Watershed Coordinator to members of the Cedar Valley Coalition in August 14, 2015. This group comprised eight individuals touring various stormwater management practices around the UNI campus, including this biocell.

Numerous presentations to various groups and organizations have been given highlighting the practices installed in the watershed, including the WIRB funded practices. Among the organizations and groups that received presentations about the DRC project and infiltration based practices and conservation practices installed in the watershed were: the Cedar Falls City Council, members of a local church congregation, a local homeowner's organization, and local contractors and engineers. An estimated fifty-five people were in attendance at these various events.

An additional form of outreach utilized as part of this program included two news articles being published in the local newspaper. One article was submitted during construction of the practice to raise awareness, in December of 2014. The second article was submitted after the completion of the practice to document its impact, in November of 2015. The Waterloo/Cedar Falls Courier has a subscription base of around 24,500 members. In addition to this, articles are also uploaded to the Courier's website to reach additional individuals. These articles also can have increased outreach through the utilization of the District's website and the Dry Run Creek Facebook page.

Educational brochures of the Dry Run Creek Watershed Improvement Project (Figure 6) are updated annually and distributed at outreach events. An informational sign was installed indicating how the bioretention cells function and acknowledging WIRB as the funding source for the practices (Figure 7).

Over the past year, the outreach efforts have been considered a success. In many cases, residents, officials, and organizations were not necessarily aware of the Dry Run Creek Watershed Improvement Project or the efforts to install best management practices in the area. Given the numbers achieved through the outreach events, it would have included the first time some individual had been introduced to a stormwater management practice. These individuals therefore, could be strongly impacted and afterwards have a greater understanding of the importance of stormwater management and the continued efforts to improve the Dry Run Creek Watershed. These same individuals also might begin to think how they can responsibly manage their own runoff and be sources for future success within the watershed.

V. APPENDIX A: MAPS OF THE WATERSHED

Figure 1 – Dry Run Creek Watershed Map Biological Impairment

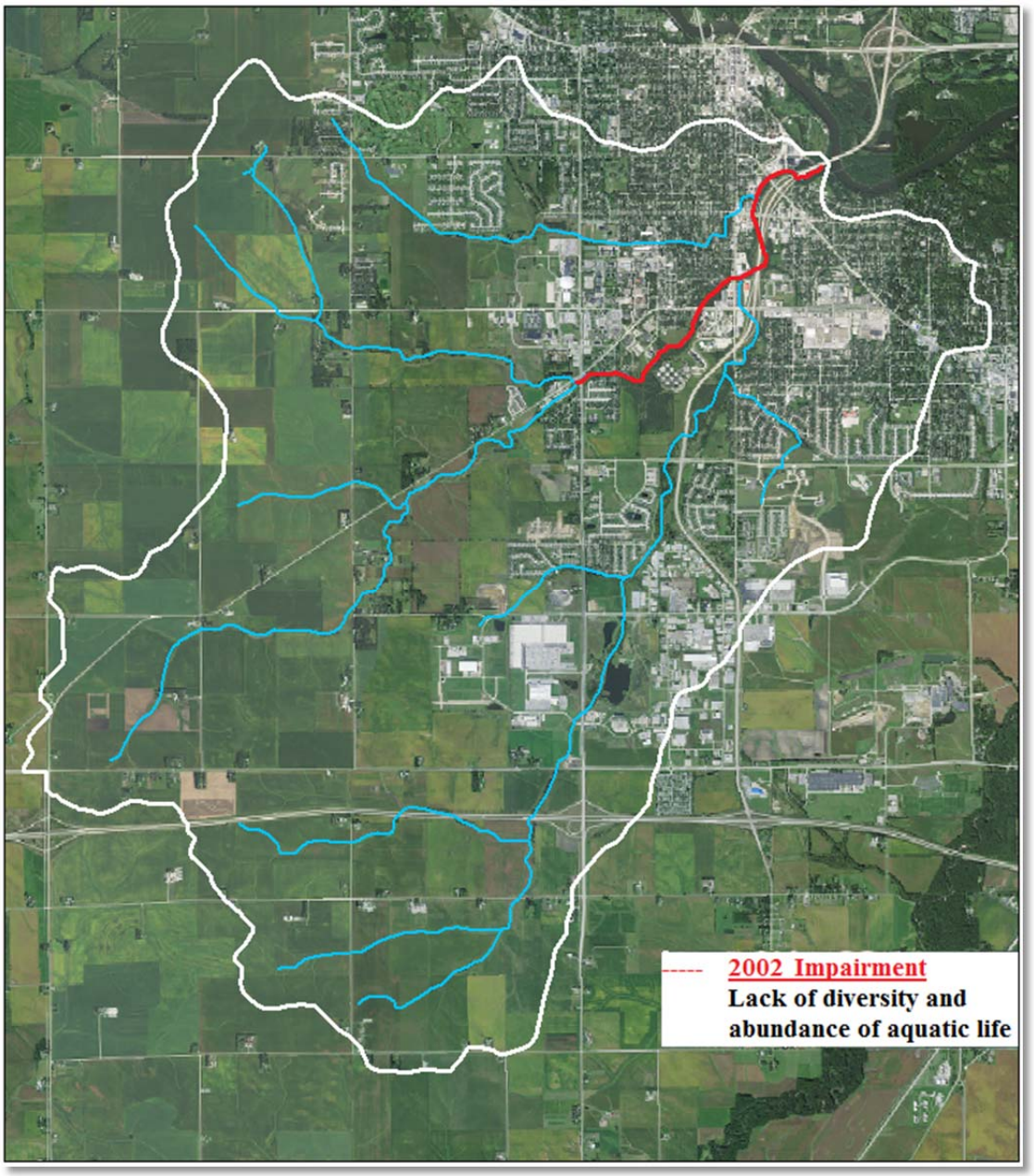


Figure 2 – Dry Run Creek Watershed Map Bacterial Impairment

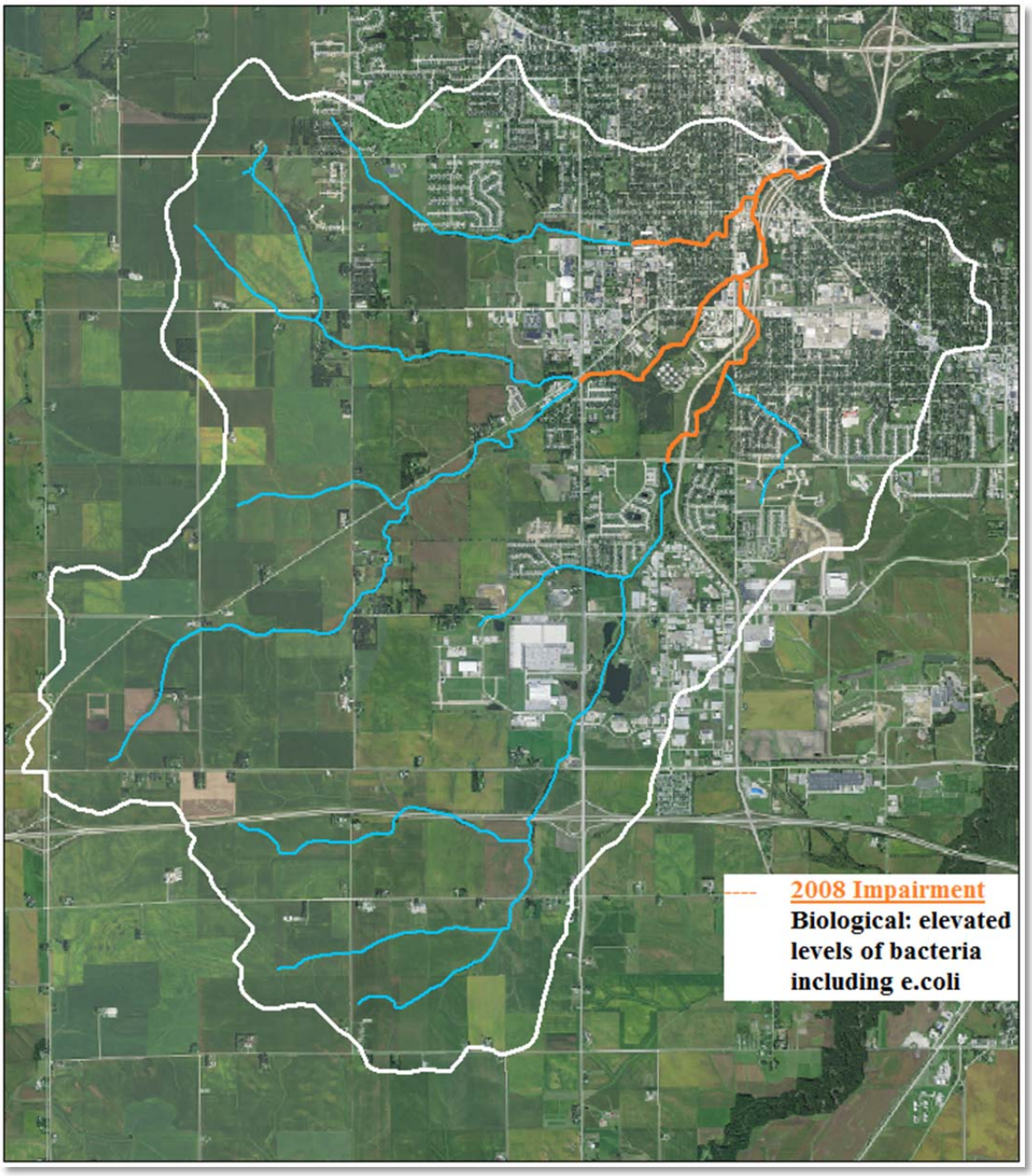


Figure 3 – Dry Run Creek Subwatersheds

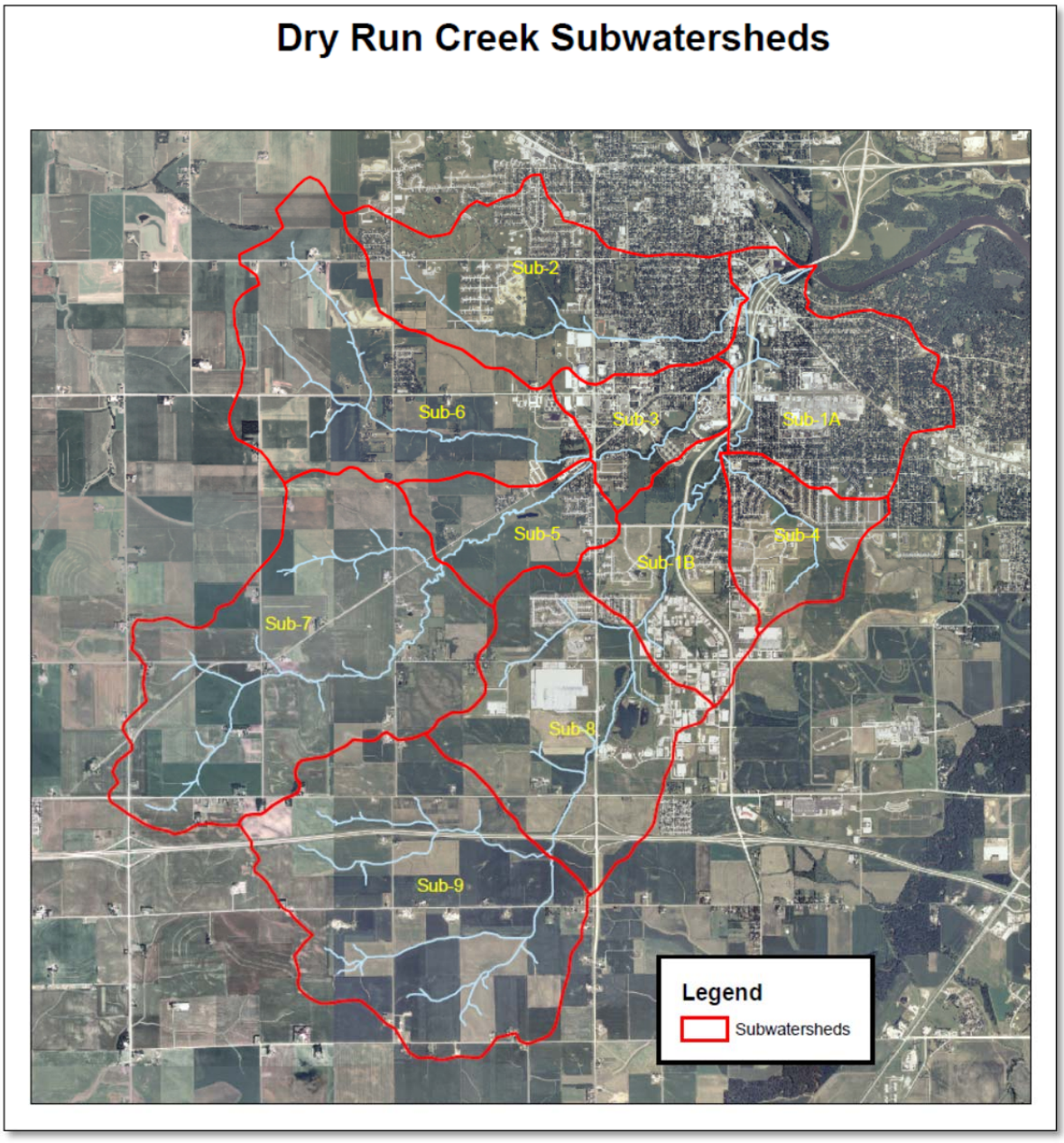


Figure 4 – Dry Run Creek Land Use Map

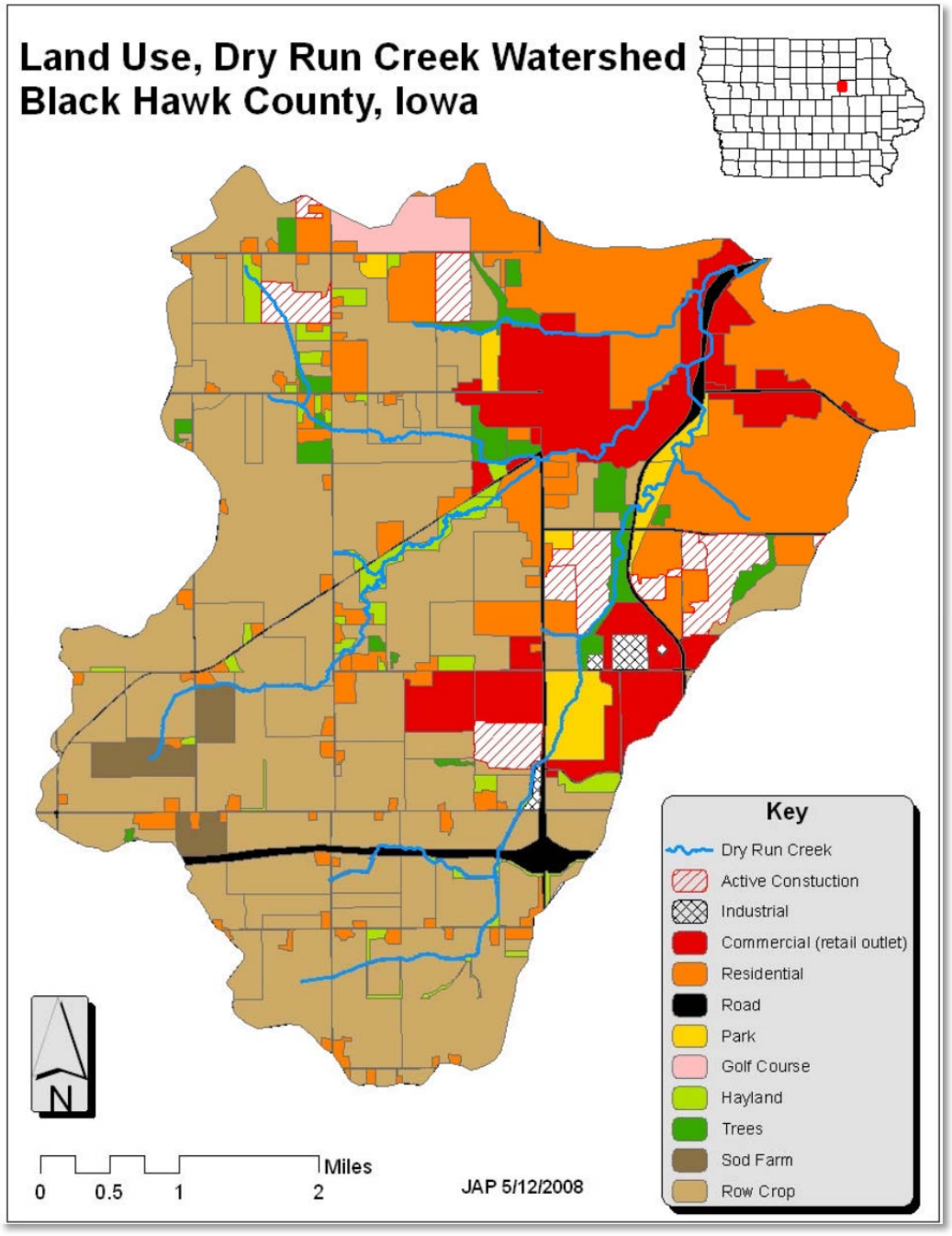
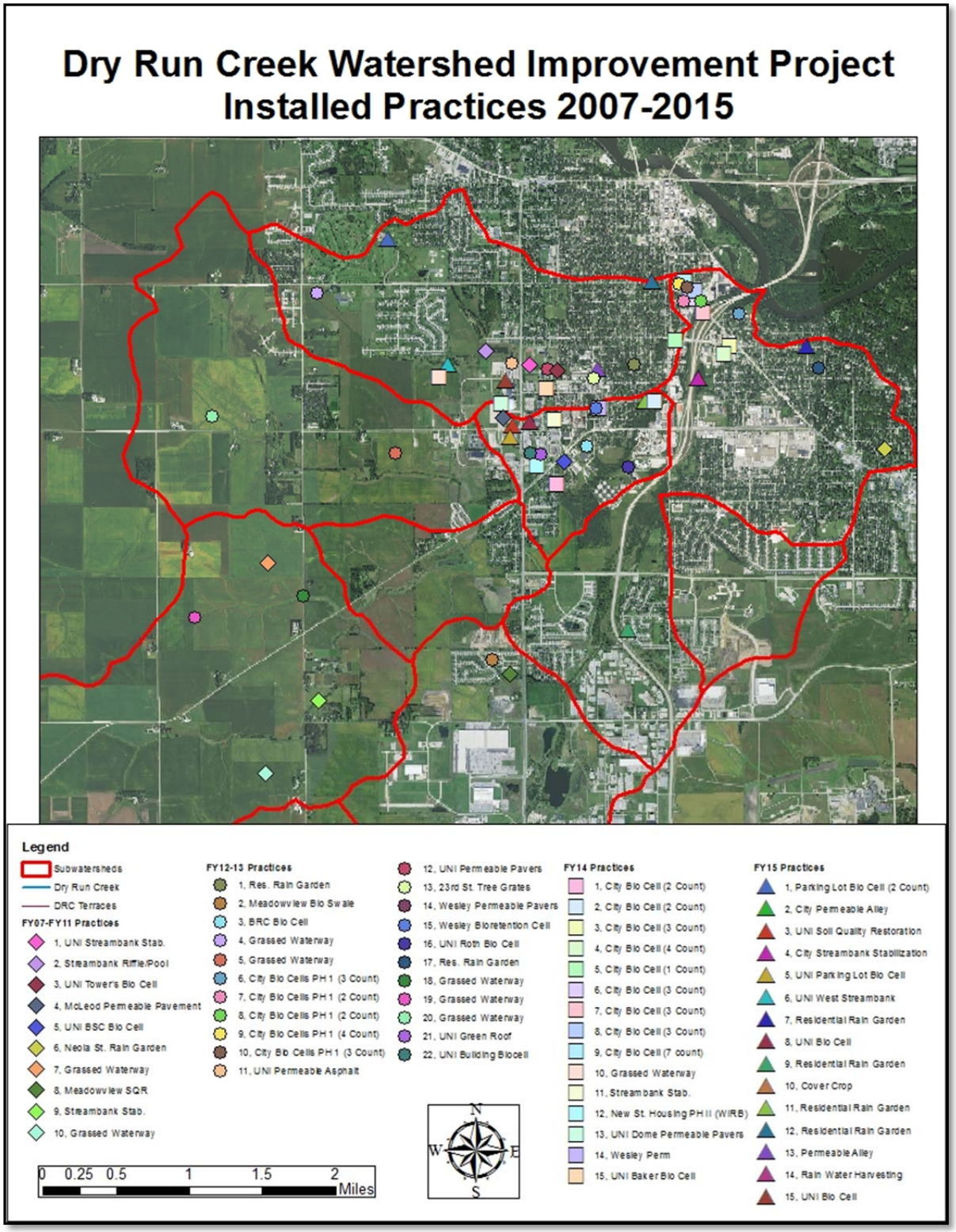
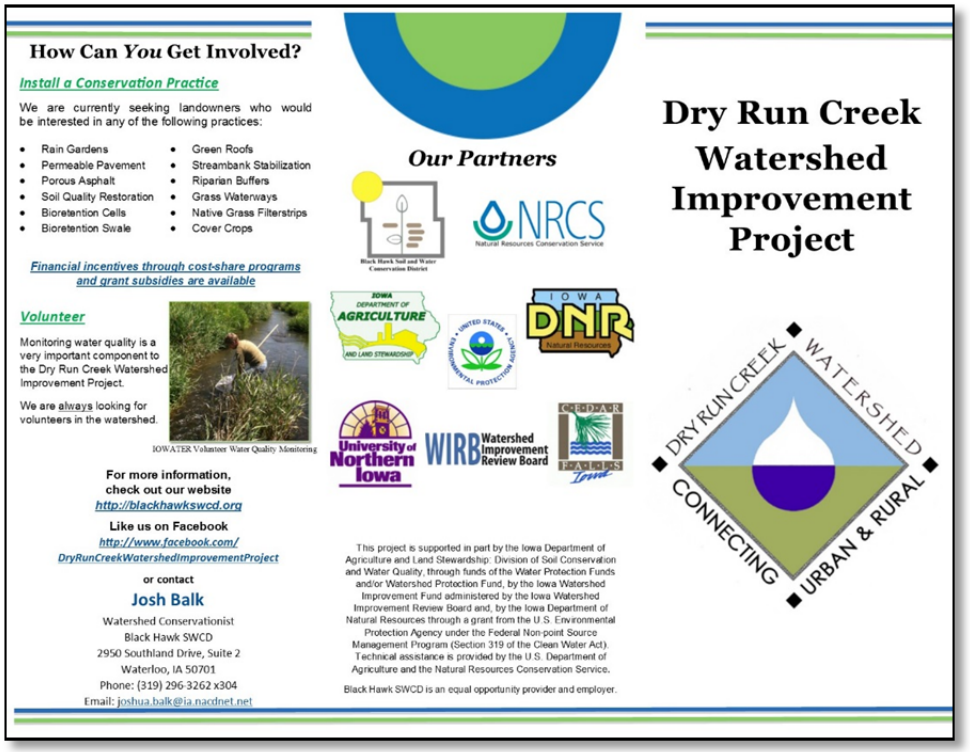


Figure 5 – Dry Run Creek Grant Funded Installed Best Management Practices



VI. APPENDIX B: DRY RUN CREEK OUTREACH MATERIAL

Figure 6 – Dry Run Creek Brochure 2015



How Can *You* Get Involved?

Install a Conservation Practice

We are currently seeking landowners who would be interested in any of the following practices:

- Rain Gardens
- Permeable Pavement
- Porous Asphalt
- Soil Quality Restoration
- Bioretention Cells
- Bioretention Swale
- Green Roofs
- Streambank Stabilization
- Riparian Buffers
- Grass Waterways
- Native Grass Filterstrips
- Cover Crops

Financial incentives through cost-share programs and grant subsidies are available

Volunteer

Monitoring water quality is a very important component to the Dry Run Creek Watershed Improvement Project.

We are always looking for volunteers in the watershed.

IOWATER Volunteer Water Quality Monitoring

For more information, check out our website
http://blackhawkswcd.org

Like us on Facebook
http://www.facebook.com/DryRunCreekWatershedImprovementProject

or contact

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Our Partners

This project is supported in part by the Iowa Department of Agriculture and Land Stewardship: Division of Soil Conservation and Water Quality, through funds of the Water Protection Funds and/or Watershed Protection Fund, by the Iowa Watershed Improvement Fund administered by the Iowa Watershed Improvement Review Board and, by the Iowa Department of Natural Resources through a grant from the U.S. Environmental Protection Agency under the Federal Non-point Source Management Program (Section 319 of the Clean Water Act). Technical assistance is provided by the U.S. Department of Agriculture and the Natural Resources Conservation Service.

Dry Run Creek Watershed Improvement Project

DRY RUN CREEK WATERSHED CONNECTING URBAN & RURAL

Background About Dry Run Creek

- 15,177 acre watershed, consisting of 30 miles of stream, and 4 main branches.
- Flows from rural areas of Black Hawk county through residential, industrial and commercial areas including the city of Cedar Falls and the University of Northern Iowa before it outlets into the Cedar River.
- 35% Urban, 65% rural and agricultural
- In 2002 a segment of the southwest branch was listed on the State's 303(d) list of impaired waters due to a lack in the diversity and abundance of aquatic life.
- In 2008 the creek received a second impairment designation when it was placed on the 303(d) list for bacterial impairment.
- Due to impairment, the Dry Run Creek Watershed Improvement Project began in 2004 and is eligible for state and federal funding to improve it.

Watershed Stressors

The causes of impairments are many. Excessive amounts of sediment from construction sites, bank erosion, and agricultural runoff can silt over existing habitat and make it difficult for aquatic life to find food or shelter. Changes in the way the watershed drains caused by stream channelization, tiling and an increase in the amount of impervious surface and storm sewers have resulted in a drastic increase in the volume of storm water surges which move through the creek during rainfall. This washes away habitat, erodes banks and channels and contributes to flash flooding.

Permeable Pavement

Permeable Asphalt

Bioretention Cells

Rain Garden

Green Roof

Project Goals

- Treat runoff from the initial 1.25" of rainfall events in urban areas
- Reduce sediment by 30 percent delivered to the stream
- Improve/protect in-stream habitat along 25 percent of the stream corridor
- Increase the awareness of Dry Run Creek and understanding of water quality issues among the watershed stakeholders
- Increase community support

Project Accomplishments

The Black Hawk Soil and Water Conservation District, through the Dry Run Creek Project, works to provide technical and financial assistance to watershed stakeholders interested in implementing conservation practices.

To date, over $1.5 million has been used on implementation for over 100 conservation practices. Much of this effort has focused on infiltration based practices, which serve to remove water from the storm sewer system and infiltrate it into the ground in a manner which mimics the native prairie hydrology.

Working with partners such as the City of Cedar Falls, the University of Northern Iowa, and private businesses and landowners, the Dry Run Creek project has developed the capacity to infiltrate over 170,000 gallons of storm water per day through practices such as rain gardens, bioretention cells, permeable pavement, and bioswales. We've also worked to repair damage that has been done to the stream and reduce sedimentation through a number of stream bank stabilization and habitat enhancement projects, as well as traditional rural sediment runoff practices such as filter strips, grassed waterways, and conservation tillage. Over 200 annual tons of sediment runoff has been removed from the stream due to the Dry Run Creek Project.

Soil Quality Restoration
Top left — Application of compost
Bottom left — Deep tine aeration
Top right — Picture taken in early spring. Yard on left had fall application of soil quality restoration. Yard on right did not.

Cover Crops

Riparian Buffer

Figure 7 – Informational Sign installed at Baker Hall Biocell

VII. APPENDIX C: SUPPORTING INFORMATION - BIBLIOGRAPHY

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