DECORAH STORMWATER MANAGEMENT PLAN

The University of Iowa
IOWA INITIATIVE FOR SUSTAINABLE COMMUNITIES

The University of Iowa
School of Urban & Regional Planning

May 15, 2015

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The authors would also like to acknowledge Luther College, without whom this project would have not been possible. We would like to express our deepest gratitude to all of our project partners and individuals who assisted in the creation of this plan. We acknowledge the many hours spent coordinating fieldtrips, ground-truthing data, and educating us about the costs and benefits of implementing stormwater best management practices

Chad Bird, City of Decorah

Kevin Nelson, City of Decorah Streets Department

City of Decorah Streets Department

Don Arendt, Decorah City Council

Jon Lubke, Winneshiek County

Dean Thompson, Winneshiek County

Barb Schroeder, Winneshiek County

Todd Ihde, City of Decorah Water Treatment Plant

Mike O'Hara, City of Decorah Water Treatment Plant

Decorah Middle School

Jodi Enos-Berlage and Students, Luther College Department of Biology

Laura Peterson and Students, Luther College Department of Geology

Jane Hawley and Students, Luther College Theater/Dance Department

John Hall, Oneota Film Festival

Amy Bouska, Iowa Department of Agriculture and Land Stewardship

Wayne Petersen, Iowa Department of Agriculture and Land Stewardship

Brent Beste, Iowa Rural Water Association

Paul Scott, Decorahnews.com

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Mark Pooley, Iowa Public Policy Center

Jody Bailey, English River Watershed Management Authority

Northeast Iowa Resource Conservation and Development

James Alstad, Winneshiek County

Joe Griffin, Iowa DNR

Jon Biederman, Fehr Graham Engineering & Environmental

Richard Bernatz, Luther College Mathematics Department

Charles Connerly, University of Iowa School of Urban and Regional Planning

Lucie Laurian, University of Iowa School of Urban and Regional Planning

Phuong Nguyen, University of Iowa School of Urban and Regional Planning

Scott Spak, University of Iowa School of Urban and Regional Planning

Romeo Abraham, University of Iowa School of Urban and Regional Planning

Nick Benson, Iowa Initiative for Sustainable Communities

Sarah SanGiovanni, Iowa Initiative for Sustainable Communities

Hailey Courtney, Iowa Initiative for Sustainable Communities

AUTHORS

Vanessa Fixmer-Oraiz, M.S. University of Iowa, graduate from the School of Urban and Regional Planning with an emphasis in Land Use and Environmental Planning.

Bailee McClellan, M.S. University of Iowa, graduate from the School of Urban and Regional Planning with an emphasis in Land Use and Environmental Planning, and Community Development.

Elizabeth Minor, M.S. University of Iowa, graduate from the School of Urban and Regional Planning with an emphasis in Land Use and Environmental Planning.

ABOUT THIS DOCUMENT

The Decorah Stormwater Management Plan stems from a formal partnership between the Iowa Initiative for Sustainable Communities (IISC), the University of Iowa's School of Urban and Regional Planning and the City of Decorah. This plan is comprised of two sections, Part 1- Problem Identification and Part 2- the Management Plan. This reflects the investigative process for analyzing Decorah's current flooding areas, stormwater infrastructure, spatial characteristics such as soil, topography and water quality based on primary and secondary data as well as community and City Staff input. This research OR analysis informed our management plan by identifying locations and Best Management Practices that can improve water quality and quantity throughout Decorah. It is our hope that the Management Plan section be adopted by the City Council.

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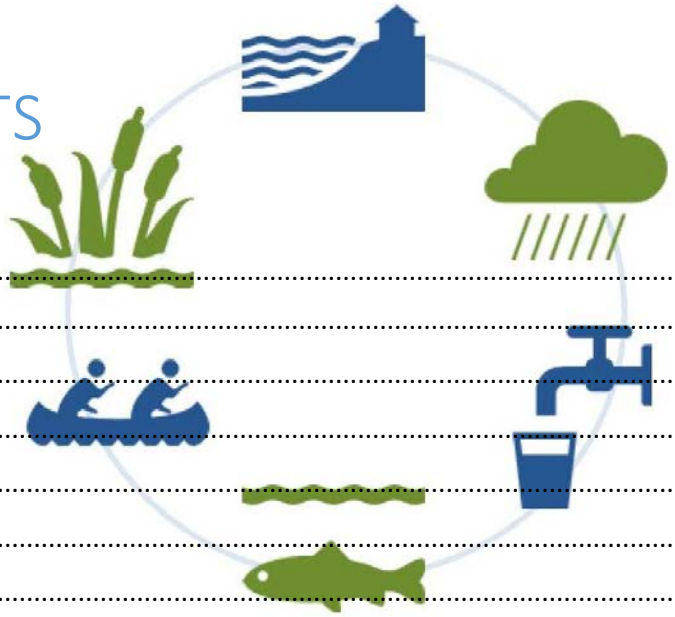


EXECUTIVE SUMMARY

Decorah is a unique community situated alongside the Upper Iowa River and traversed by Old Dry Run Creek that runs directly through the heart of the city. These natural features are what make Decorah a destination for trout fishing and other activities in nature, but they also bring their challenges. Flooding and water quality impairment have plagued the Upper Iowa River in recent years, and Old Dry Run Creek has long been covered and forgotten. Decorah essentially rests in a topographic bowl, causing major problems with stormwater ponding and runoff of contaminants into the streams and rivers. Decorah is now seeking to address these issues with sustainable solutions that will help the community to thrive.

Our team of Univeristy of Iowa School of Urban and Regional Planning students, in collaboration with the Iowa Initiative for Sustainable Communities, was tasked with helping Decorah to reach these goals. We recommend area-specific and comprehensive solutions to Decorah's stormwater management issues in this Decorah Stormwater Management Plan.

Our project involved conducting several analyses, including mapping of water flow and infrastrucutre, as well as references to several community case studies that had been addressing stormwater issues. We also participated in significant community engagement and input events that aimed to both education the public about the importance of managing stormwater and our natural water bodies, and to help us identify problems and solutions for stormwater in Decorah. City staff input and advice from stormwater and water quality experts also signficantly informed the project. Based on community- and staff-identified problems, our analyses, and consultations wit urban stormwater experts, we were able to define susceptible areas in Decorah where stormwater was of particular concern.

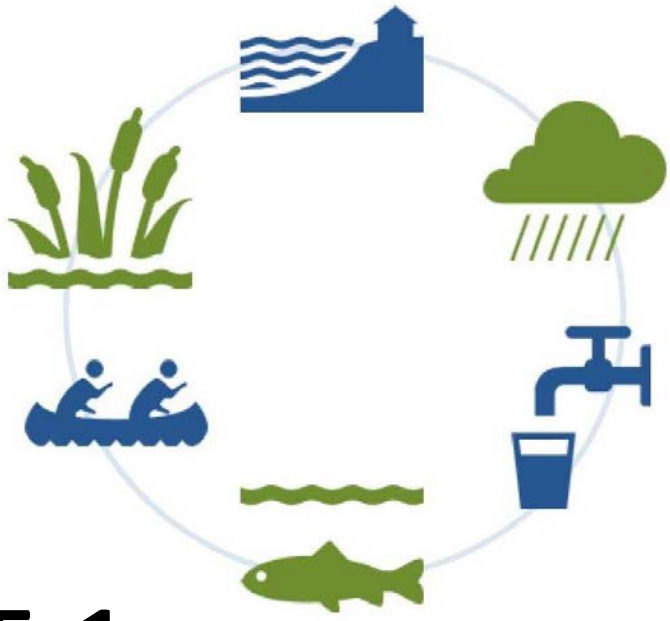
The Decorah Stormwater Management Plan provides recommendations for addressing water quality and quantity issues in Decorah, particularly in five identified mitigation areas: the Locust Road Area, Iowa Avenue Area, Heivly Street Area, Old Dry Run Creek Corridor, and Northeast Redevelopment Area. We recommend specific practices that can be used at each of these locations to mitigate identified problems, including ponding and water contamintation. The plan provides guidelines for encouraging the use of infiltration and filtration practices throughout the city to capture and filter water before it runs off into surrounding water bodies.

To achieve the objectives of this plan, Decorah must have a sustainable resource to implement stormwater management in the future. Funding for stormwater management, especially in small communities like Decorah, can be a challenge. We recommend that the City of Decorah adopt a stormwater utility fee based on the EPA's Equivalent Residential Unit model and a $5 monthly base fee. This will provide an equitable and reliable funding source for stormwater improvements and maintenance, e.g., to construct bioswales and provide cost-share to residents interested in improving stormwater practices on their property. Over 50 Iowa communities currently have similar stormwater fees.

In addition to the practices and the fee, we recommend that the city adopt three ordinances to control stormwater in the community – the first is a post-construction ordinance requiring onsite stormwater detention for new developments, the second is a stream buffer easement ordinance granting the city an easement for new development around Old Dry Run Creek, and the third is a

stormwater utility ordinance iniating the recommended fee. These ordinances will ensure that stormwater management is engrained in future decisionmaking.

Decorah is now taking a proactive and comprehensive approach to managing stormwater runoff, and simultaneously beautifying and enhancing its unique community. With continued investment and dedication, Decorah can greatly mitigate the effects of stormwater, helping the city to become a proactive model for holistic and sustainable stormwater management to communities across Iowa.



PART 1

INTRODUCTION

CHAPTER 1

BACKGROUND

DECORAH'S WATER BODIES

Decorah, Iowa is a town of approximately 8,200 residents located in the Upper Iowa River watershed, the drainage basin for the Upper Iowa River and its tributaries. Due to its unique location in the valley of steep bluffs alongside the river, Decorah is highly susceptible to impacts from water inundation, particularly flooding and stormwater runoff. To protect its urban areas, Decorah has used many techniques to manage water throughout history.

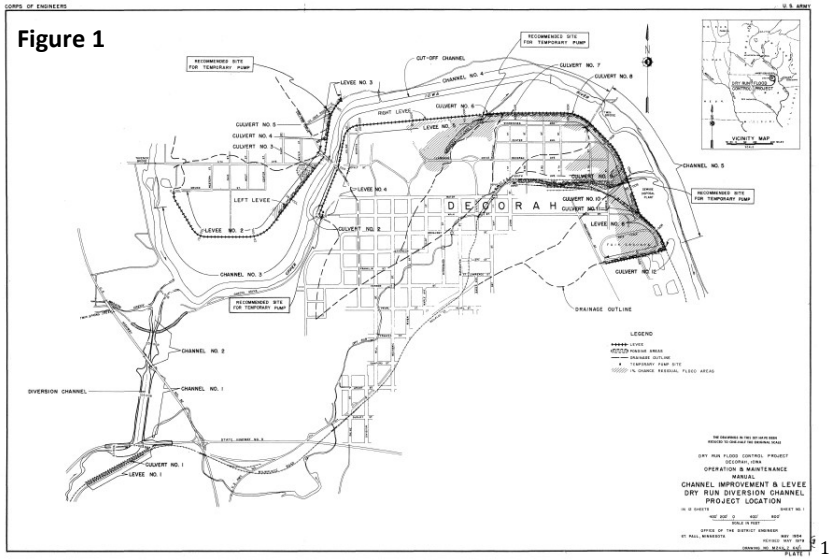
Decorah was originally built closely around Old Dry Run Creek (ODRC) and the Upper Iowa River, and the city's stormwater runs directly into both of these water bodies. Old Dry Run Creek is an urban stream that flows through the center of town along a northeastern diagonal. The urban creek begins at the base of a large bluff near Decorah Implement Co., a farm machinery company, and continues through the city, eventually connecting with the Upper Iowa River in the town's northeast corner.

The ODRC is mostly fed by rainwater and urban stormwater, and can therefore serve as a true indicator of urban water quality. The Upper Iowa River flows through rural and agricultural areas upstream before it cuts through the City of Decorah. As a result, pollution of the Upper Iowa River upstream of the city is largely from agricultural uses, while Upper Iowa River contamination downstream of Decorah comes from agriculture in the watershed plus the urban contribution.

WATER INFRASTRUCTURE

Decorah's storm sewers were installed in the early 1900s to carry water away from the city and into the river. In the 1950s, the US Army Corps of Engineers constructed a levee system that stretched for over three miles around Decorah to prevent flooding from the Upper Iowa River. Decorah also rechanneled Dry Run Creek in the 1950s, a small stream that ran northeast through Decorah, diverting most of its water to the Upper Iowa River before it reached Decorah's urban areas. The U.S. Army Corps of Engineers map (figure 1) details these infrastructure changes.

Figure 1



[1]

[1] US Army Corps of Engineers Operation and Maintenance Manual- Flood Control Project, Dry Run, Decorah, Iowa. October 1983.

Though the original Dry Run Creek, now called Old Dry Run Creek, still runs through the city, it has been covered in many areas by large, tunneled culverts to allow for land development to occur over the creek. The Army Corps of Engineers also planned intentional ponding areas that were developed to retain excess water. [2] Subsequently, additional levees were constructed in western Decorah and at Luther College.[3]

FLOODING

Despite these interventions, Decorah today is still vulnerable to the quantity and quality effects of stormwater runoff. Decorah's levee infrastructure has been successful in preventing flooding from the Upper Iowa River, but the levee also contributes to ponding within the City of Decorah due to stormwater backup during heavy rain events.

In 2008, for example, the levee successfully prevented the Upper Iowa River from flooding the urban areas of Decorah, but it also contributed to abundant ponding inside the levee that forced the City of Decorah to ask local farmers to use their manure pumps to send water back over the levee and into the river for three consecutive days. The image below shows internal flooding from stormwater after the levee flood gates were closed.[4]

The internal stormwater flooding made the western side of Decorah completely inaccessible, thus the City was unable to pump ponded water out of those areas of the city, requiring evacuation of those residents. The costs of the flood damages totaled over $890,000, of which the City of Decorah paid approximately $50,000 after receiving funds from FEMA and Iowa Homeland Security.[5]

While flooding threats may be minimized for now, water inundation, or ponding, resulting from heavy precipitation is still a substantial problem for the city. These issues will likely become worse in the future as climate change is predicted to increase the severity of weather events; therefore, pumping and other reactive strategies are not sustainable, or no longer effective, options for the future.

Community members and Decorah City staff have indicated areas within the city that regularly experience water inundation; these areas are widespread and are likely to become more susceptible in the future if no action is taken. Stormwater management, therefore, is a high priority for Decorah and strategies must be developed to capture, store, and infiltrate stormwater runoff so it does not adversely affect people, property, or stress existing infrastructure.

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2 Ibid.

3 In-person meetings. Chad Bird, Decorah City Manager. August 28 and October 3, 2014.

4 "Sandbagged levee holds in Iowa, protects city." MPR News. Cedar Falls, Iowa. 11 June 2008. http://www.mprnews.org/story/2008/06/11/iowa_flood

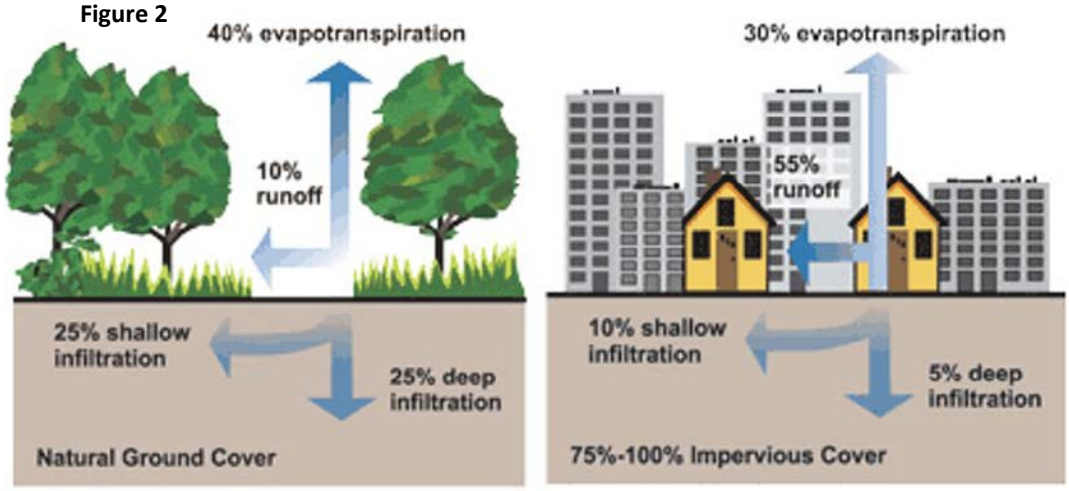
5 Email correspondence. Chad Bird, Decorah City Manager. September 11, 2014.

STORMWATER AND IMPERVIOUS SURFACES

In addition to quantity issues, Decorah must also consider water quality problems. As stormwater moves across impervious surfaces like lawns and roads, it carries with it chemicals and pollutants that eventually are deposited into larger water bodies. In Decorah, approximately 50 percent of the city's land area is impervious surfaces, impeding the ability of water to absorb into the ground and filter out pollutants. [6]

Compared to natural vegetated areas in Iowa, impervious surfaces in urban areas infiltrate significantly less water from rain events (figure 2). This stormwater instead runs off the impervious surfaces, collecting pollutants and sediment directly into streams and rivers. Without infiltration, urban areas are also more susceptible to flash flooding or extreme flooding from stormwater runoff stuck on impervious surfaces. About 55% of rain is unable to infiltrate and becomes runoff in urban areas, compared to only 10% in natural landscapes. Natural areas are also able to retain 50% of water from rain events in the ground, compared to only 15% in urban areas.

Figure 2



U.S. Environmental Protection Agency

Much of the stormwater runoff in Decorah's urban areas drains into Old Dry Run Creek, which is then carried into the Upper Iowa River, an impaired water body according to the EPA.[7] Decorah's drinking water has been impacted in recent years by chemicals in the Upper Iowa River, and, even though the urban contribution of pollutants to the source water supply is likely minimal compared to the contribution of the rural parts of the watershed, it is important that the City understands and minimizes its contribution of pollutants to the river.

Water quality testing up- and downstream of the Upper Iowa River and within Old Dry Run Creek provides a baseline from which Decorah can measure its urban contribution of pollutants to the river, and can serve as a measure for the effectiveness of stormwater management practices implemented in the future.

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[6] US Environmental Protection Agency.

[7] The Upper Iowa River is impaired for bacteria and other microbes, degraded aquatic life, and mercury. There is no Total Maximum Daily Load (TMDL) Cleanup Plan in place. See Chapter *- Water Quality Assessment.

SURFACE WATER QUALITY

Water quality is important for drinking water, aquatic habitat and recreational users such as anglers and fishermen. Degraded water quality threatens drinking water supplies and deteriorates habitats in local water bodies.[8] Each U.S. state must identify and list all of these impaired waters within the state as required by the Clean Water Act. Impaired waters are those that do not meet state water quality standards because of pollution or degradation. States must rank their impaired waters by priority and create a TMDL for all such waters. The Upper Iowa River is an impaired water body according to the Iowa Department of Natural Resources (figure 3). Table 1 below details impairment reports from the past decade for the Upper Iowa River.

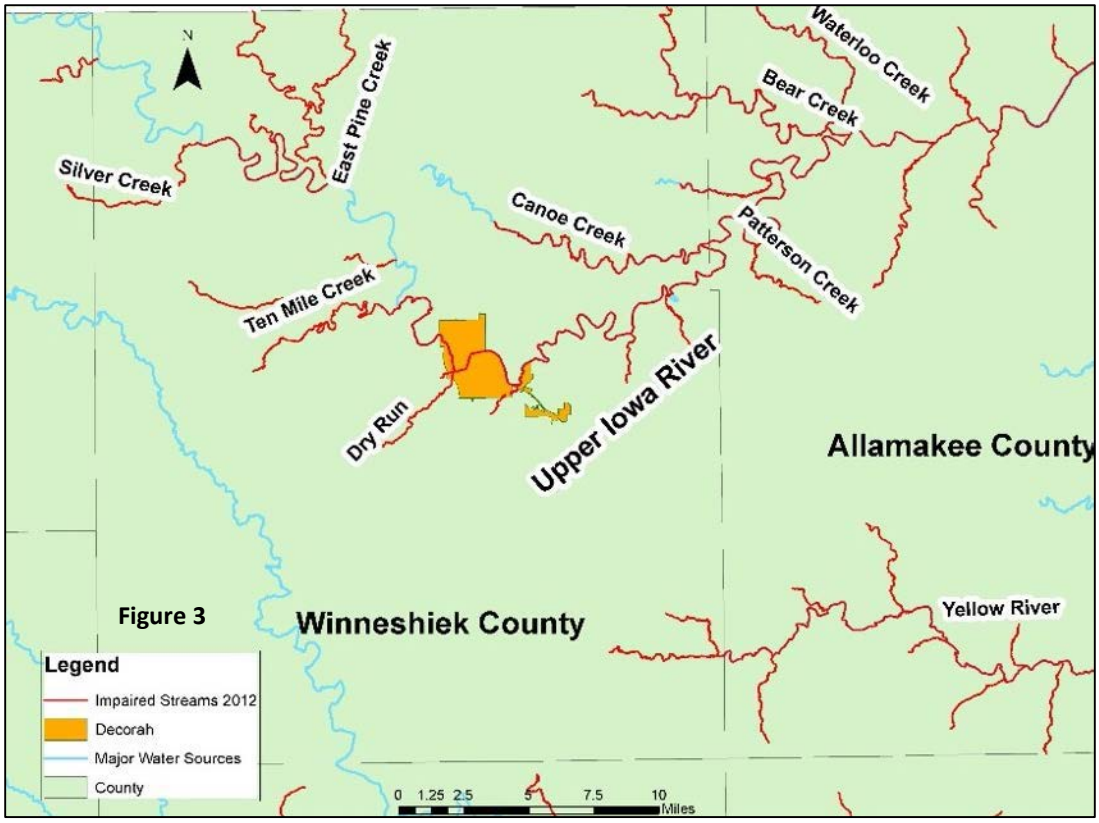

Figure 3

[8] "National Water-Quality Assessment Program: Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial Aquifer System, Northern United States." *U.S. Geological Survey*. Scientific Investigations Report 2009-5086. 2009: U.S. Geological Survey, Reston, Virginia.

Table 1

Iowa's 2012 Integrated Report:
Category 5: EPA-approved Section 303(d) impaired waters

April 25, 2013

IR Cycle Added	2012 IR Cat.	ADB Code	Waterbody Name	Location Description	WB Type	Impaired Use	Use Support	Cause/ Stressor	Listing Rationale	Data Source	TMDL Priority
2004	5a	IA 01-UIA-0090_0	Upper Iowa River	mouth (Allamakee Co.) to Lane's Bridge at river mile 6 (NW 1/4 S31 T100N R4W Allamakee Co.).	River	Primary Contact	Partial	Indicator Bacteria	Geometric mean of E. coli greater than Class A1 criterion.	IDNR/UHL ambient WQ monitoring	Medium
2006	5a	IA 01-UIA-0090_0	Upper Iowa River	mouth (Allamakee Co.) to Lane's Bridge at river mile 6 (NW 1/4 S31 T100N R4W Allamakee Co.).	River	Fish Consump-tion	Partial	Mercury	> IDNR/IDPH trigger level for 1 meal/week advisory; consumption advisory issued in 2006	fish contaminant (RAFT) monitoring	Low
2004	5a	IA 01-UIA-0100_0	Upper Iowa River	from Lane's Bridge (NW 1/4 S31 T100N R4W Allamakee Co.) to confluence with Canoe Cr. in S25 T99N R7W Winneshiek Co.	River	Primary Contact	Partial	Indicator Bacteria	>10% of samples exceed Class A1 single-sample maximum criterion	IDNR/UHL ambient WQ monitoring	Medium
2006	5a	IA 01-UIA-0100_0	Upper Iowa River	from Lane's Bridge (NW 1/4 S31 T100N R4W Allamakee Co.) to confluence with Canoe Cr. in S25 T99N R7W Winneshiek Co.	River	Fish Consump-tion	Partial	Mercury	> IDNR/IDPH trigger level for 1 meal/week advisory; consumption advisory issued in 2006	fish contaminant (RAFT) monitoring	Low
2008	5a	IA 01-UIA-0110_1	Upper Iowa River	confluence with Canoe Cr. (S25 T99N R7W Winneshiek Co.) to confluence with Trout Cr. in S9 T98N R7W Winneshiek Co.	River	Fish Consump-tion	Partial	Mercury	Fish consumption advisory (1 meal/week) issued in 2006.	IDNR/U.S. EPA fish contaminant (RAFT) monitoring.	Low
2004	5b	IA 01-UIA-0110_2	Upper Iowa River	from confluence with Trout Cr. (S9 T98N R7W Winneshiek Co.) to confluence with Tenmile Cr. in S1 T98N R9W Winneshiek Co.	River	Aquatic Life	Not supporting	Biological	> 50% decline in mussel species richness	ISU freshwater mussel study	Low
2006	5b	IA 01-UIA-0110_2	Upper Iowa River	from confluence with Trout Cr. (S9 T98N R7W Winneshiek Co.) to confluence with Tenmile Cr. in S1 T98N R9W Winneshiek Co.	River	Primary Contact	Not supporting	Indicator Bacteria	geometric mean > WQS	IDNR/UHL ambient WQ monitoring 2002-04	Medium
2006	5b	IA 01-UIA-0110_2	Upper Iowa River	from confluence with Trout Cr. (S9 T98N R7W Winneshiek Co.) to confluence with Tenmile Cr. in S1 T98N R9W Winneshiek Co.	River	Fish Consump-tion	Partial	Mercury	> IDNR/IDPH trigger level for 1 meal/week advisory; consumption advisory issued in 2006	fish contaminant (RAFT) monitoring	Low
2004	5b	IA 01-UIA-0120_1	Upper Iowa River	confluence with Silver Cr. (S10 T99N R9W Winneshiek Co.) to confluence with Silver Cr. in S2 T99N R10W Winneshiek Co.)	River	Aquatic Life	Not supporting	Biological	> 50% decline in mussel species richness	ISU freshwater mussel study	Low
2012	5b	IA 01-UIA-0120_1	Upper Iowa River	confluence with Silver Cr. (S10 T99N R9W Winneshiek Co.) to confluence with Silver Cr. in S2 T99N R10W Winneshiek Co.)	River	Primary Contact	Not supporting	Indicator Bacteria	Geometric mean of indicator bacteria slightly exceeds Class A1 criterion.	Upper Iowa River Watershed Project 2008-10.	Low

[9]

[9] "Iowa's 2012 Integrated Report: Category 5: EPA-approved Section 303(d) impaired waters. 25 April, 2013.

In the past decade the Upper Iowa has been impaired with mercury, E. coli, and biological deficiencies. The most recent report in 2012 lists the Upper Iowa as impaired for E. coli indicator bacteria again. The Upper Iowa is also one of the many water bodies in need of a Total Maximum Daily Load (TMDL) in Iowa. The TMDL refers to the "maximum amount of a pollutant that a water body can receive and still safely meet water quality standards."[10]

Although the Upper Iowa River is one of the state's top recreational rivers, recent water quality testing has indicated high levels of bacteria that could threaten the health of those recreating in the river.[11] Rural and urban areas both contribute to water quality problems through rural runoff and urban stormwater runoff, respectively. In Decorah, the ODRC is an entirely urban stream fed by stormwater runoff and other urban water outlets, collecting runoff through the downtown area before flowing directly into the Upper Iowa River. Decorah is made up of numerous sub-watersheds which carry runoff either directly into the Upper Iowa River or into the ODRC before traveling to the Upper Iowa. Impairment of the Upper Iowa River is therefore a combination of rural and urban runoff contaminants.

The State of Iowa began using E. coli as its water quality indicator bacteria as part of revisions to state water quality standards in 2003. According to the U.S. Environmental Protection Agency, the presence of E. coli bacteria in streams and rivers, like the Upper Iowa River, is correlated with increased swimming-related illnesses.[12] E. coli bacteria standards are based on the probability of human illness as a result of the bacteria's presence in a water body. For example, the Class A1 recreational use standard for E. coli is 235 counts per 100 mL in a single sample. If bacteria counts exceed this standard, the probability for more than 8 out of 1,000 people in the river to have a stomach illness increases. The Upper Iowa is a Class A1 recreational water body.

The Northeast Iowa Research Conservation and Development (RCD) group is engaged in protecting and enhancing area natural resources through watershed and water monitoring research. The group recognizes that the Upper Iowa River is popular for its fishing and canoeing, and that there is significant public interest in reducing levels of E. coli bacteria in the watershed.[13] Old Dry Run Creek is a cold-water stream that runs through the City of Decorah into the Upper Iowa River, directly contributing to the river's water quality. The ODRC also has the potential for multiple recreational uses, and understanding its water quality is important to protecting those uses.

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[10] "Impaired Waters and Total Maximum Daily Loads." U.S. Environmental Protection Agency. 9 April 2014. <http://epa.gov>.

[11] "Geologic Mapping of Impaired Watersheds in Northeast Iowa: Upper Iowa and Yellow River Watersheds." Northeast Iowa Resource Conservation and Development. 2005. <http://rcd.resourcefulthinking.com>.

[12] "Geologic Mapping of Impaired Watersheds in Northeast Iowa: Upper Iowa and Yellow River Watersheds."

[13] "U.S. EPA criteria for E. coli bacteria." Chattahoochee River BacteriAlert.

NPDES PERMITTING IN DECORAH

To control water pollution in the U.S., the Clean Water Act authorizes the National Pollutant Discharge (NPDES) permit program. The NPDES program regulates pollutant discharges from point sources into U.S. waters. There are three types of private NPDES Storm Water General Permits in Iowa: Industrial Activities (No. 1), Construction Activities (No. 2), and Asphalt Plants, Concrete, Rock Crushing Plants and Sand and Gravel Facilities (No. 3).

Table 2 details current NPDES permits and the Stormwater General No. 1 and No. 2 NPDES permits in Decorah. Individual permit holders include two schools, the State Hatchery, the City's wastewater treatment plant, and Deco Products Co. There are 11 general stormwater permits in Decorah, including industrial activities, the county landfill, and the Decorah wastewater treatment plant. Construction permits regulate the impact of temporary construction projects on water quality. Current permits include private building construction, improvements to public buildings, stream bank stabilization projects, and wetland construction.

Table 2

INDIVIDUAL NPDES PERMITS LOCATED IN DECORAH

Permit #	EPA ID	Expire Date	Facility Name	Facility Address	Facility City	Facility State	Facility Zip	Permit Type	Class	Owner Name	Owner Address1	Owner City	Owner State	County	RIVER BASIN	Treatment Type
9630101	0003794	5/31/2012	DECO PRODUCTS CO.	506 SANFORD STREET	DECORAH	IA	52101	INDUSTRIAL	MINOR	DECO PRODUCTS CO.	506 SANFORD STREET	DECORAH	IA	Winneshiek	UPPER IOWA RIVER	NO TREATMENT
9630001	0035220	7/31/2015	DECORAH CITY OF STP	1766 OLD STAGE ROAD	DECORAH	IA	52101	*MUNICIPAL*	MAJOR	CITY OF DECORAH	CITY HALL, P.O. BOX 138	DECORAH	IA	Winneshiek	UPPER IOWA RIVER	ACTIVATED SLUDGE
9630502	0084000	6/30/2017	DECORAH COMM SCH DIST - THOMAS R. ROBERTS HIGH SCHOOL	100 CLAIBORNE DRIVE	DECORAH	IA	52101	INDUSTRIAL	MINOR	DECORAH COMMUNITY SCHOOL DISTRICT	510 WINNEBAGO STREET	DECORAH	IA	Winneshiek	UPPER IOWA RIVER	NO TREATMENT
9630501	0064785	1/31/2019	NORTH WINNESHIEK SCHOOL	3495 NORTH WINN ROAD	DECORAH	IA	52101	*SEMI-PUBLIC*	MINOR	NORTH WINNESHIEK COMM.SCHOOL DISTRICT	3495 NORTH WINN ROAD	DECORAH	IA	Winneshiek	UPPER IOWA RIVER	WASTE STABILIZATION LAGOON

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IOWA MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4S)

The Iowa DNR, as an extension of the U.S. EPA, requires many of its communities and universities to obtain a permit for their Municipal Separate Storm Sewer Systems (MS4), a regulation which requires enhanced stormwater management to reduce the impact on water quality.

The Iowa DNR defines an MS4 as a "conveyance or system of conveyances," such as sewers, streets, curbs, roads, gutters, and storm drains. The system constitutes an MS4 if it is owned or operated by a public body that discharges water, and is designed or used for conveying or collection stormwater. These do not include combined sewer systems or part of a publicly owned treatment works. Since 1990, operators of MS4 in medium and large cities (population over 100,000) need NPDES permits for their stormwater discharges MS4 (phase I). Under phase II of the program, small cities also need to address stormwater discharges.[15]

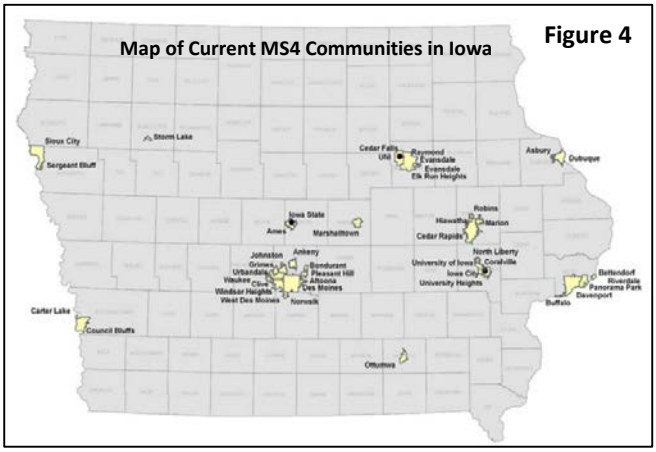
[14] "List of Individual NPDES Permits in Iowa." Iowa Department of Natural Resources. 1 April 2015. <http://iowadnr.gov>

[15] "Guidance on Section 319 Grant Funding Eligibility for Projects within Designated Municipal Separate Storm Sewer Systems (MS4)." Iowa Department of Natural Resources. 16 December 2008. <http://iowadnr.gov>

Figure 4 shows all current MS4 communities in Iowa.[16] The criteria for determining these MS4 communities or institutions include a combination of:

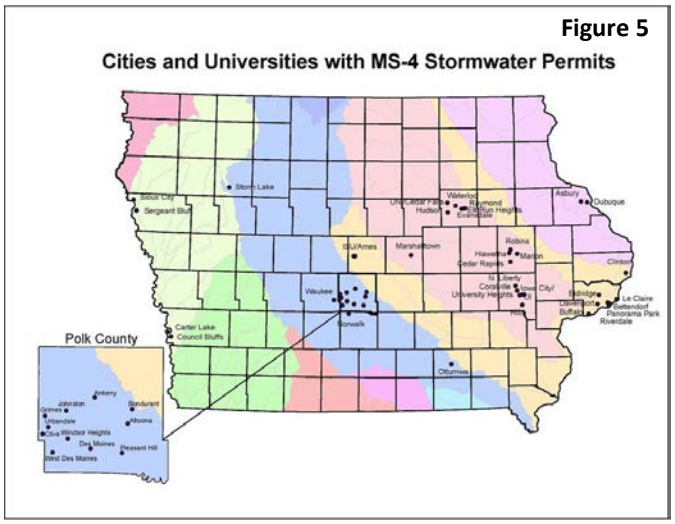
- Population
- Proximity to large, urbanized areas
- Water quality of receiving streams[17]

The MS4 community designation is an ongoing process by the Iowa DNR, in which additional communities are permitted each year as water quality worsens and population increases.



PROACTIVE PLANNING FOR DECORAH

The City of Decorah is not currently an MS4 community with permit requirements, but is likely to be regulated as such in the coming years. The Upper Iowa River, into which Decorah's stormwater flows, is an impaired water body (see Chapter 3). Figure 5 shows Iowa MS4 communities by watershed, demonstrating the relationship between impaired watersheds and MS4 designations.[18]



There are already two MS4 communities in Decorah's watershed, indicating the potential for Decorah to be included. Although Decorah is not near other urbanized areas, its own population is nearing the urbanized threshold of approximately 10,000 people.

MS4 HISTORY AND REQUIREMENTS

Phase II of the MS4 program began in 1999 to regulate small MS4 communities in and near urbanized areas to obtain permits for their stormwater discharges. As of 2014, there are 750 communities with Phase I MS4 designation (two in Iowa), and 6,700 communities with Phase II MS4 designation in the U.S.[19]

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16 "Municipal Separate Storm Sewer System (MS4)." U.S. EPA. 26 November 2014. <water.epa.gov>.

17 "Municipal Separate Storm Sewer System NPDES Permits." Iowa DNR. <http://iowadnr.gov>

18 "Cities and Universities with MS-4 Stormwater Permits." Iowa Storm Water Education Program. 2015. <http://iowastormwater.org>.

19 "Municipal Separate Storm Sewer System (MS4)." U.S. EPA. 26 November 2014. <water.epa.gov>.

The U.S. EPA allows states to implement their own program as long as the state program is as stringent as or more stringent than the national program. According to the U.S. EPA, those with an MS4 permit are required to:

1. Apply for NPDES permit coverage
2. Develop a stormwater management program which includes at least six control measures(see below)
3. Implement the stormwater management program using appropriate stormwater management controls, or best management practices (BMPs)
4. Develop measurable goals for the program
5. Evaluate the effectiveness of the program

The six aforementioned minimum control measures include:

1. Public Education and Outreach
2. Public Participation and Involvement
3. Illicit Discharge Detection and Elimination*
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention and Good Housekeeping[20]

The MS4 requirements emphasize public involvement, program development, integrating stormwater management into city functions, construction regulations, and monitoring of discharges. This Stormwater Management Plan attempts to address these control measures required by the EPA, including recommendations for best management practices (BMPs) and an evaluation structure, and *excluding illicit discharges.

The development and implementation of the Plan involved extensive public and city input, and its implementation and evaluation processes rely on continued input and education. The water quality monitoring program we setup will assist in detecting and eliminating harmful stormwater discharges. The construction and stormwater ordinances will incorporate stormwater management into all city maintenance and require greater infiltration in new developments. Adopting this plan as part of a proactive approach to stormwater management will allow the City of Decorah to be better prepared for the future regulation.

[20] "Small MS4 Stormwater Program Requirements." U.S. EPA. 14 July 2014. <water.epa.gov>.

PART 1

INTRODUCTION

CHAPTER 2

PROJECT DESCRIPTION

PROJECT DESCRIPTION

The purpose of *The Decorah Stormwater Management Plan* is to recommend strategies for the integrated planning of stormwater management in Decorah and to determine a funding mechanism to implement appropriate best management strategies. The City of Decorah's current stormwater infrastructure is insufficient for handling the detrimental effects of increasingly extreme rainfalls and subsequent flooding. We conducted numerous analyses to identify the state of stormwater management and water quality in Decorah, as well as engaged the local community, City staff, and stormwater experts to identify areas of the city in need of improvement.

Based on these analyses and feedback, we identified areas where stormwater infiltration should be improved, the practices that should be used to mitigate flooding and water contamination, and the associated costs of these projects. We recommend a funding mechanism that the City of Decorah can use to fund improved stormwater management practices implemented by public and private sector actors, as well as ordinances the City can use to comprehensively regulate stormwater management.

PROBLEM STATEMENT

Like many Iowa communities, the City of Decorah has experienced water quantity issues in the face of record-setting floods, as well as water quality problems in their source water and surrounding water bodies. As climate change brings more extreme weather events, the City seeks to address these issues proactively. Decorah needs a systematic management strategy and sustainable funding source for its stormwater improvement projects.

The problem for this project was identified based on discussions with staff from the City of Decorah and Winneshiek County, preliminary project research, and recommendations from the following documents:

- Decorah WE CAN: Stormwater Existing Conditions Report and Policy Recommendations for Sustainability in Decorah, 2010
- City of Decorah Comprehensive Plan, 2011
- Sustainable Decorah Strategic Plan, 2010
- Decorah Water Supply- Source Water Protection Plan, 2014

RESEARCH QUESTIONS AND GOALS

What is the current state of stormwater management in Decorah?

- Goal 1. Investigate and map the existing stormwater infrastructure system in Decorah
- Goal 2. Measure the urban water quality contribution from Decorah to the Upper Iowa River

How can Decorah best manage its stormwater runoff to improve water quality in Old Dry Run Creek and the Upper Iowa River, and to reduce water quantity issues causing ponding and flooding?

- Goal 3. Identify Susceptible Stormwater Areas
- Goal 4. Identify Stormwater Mitigation Areas and recommend best management practices

How can Decorah sustain a stormwater management plan?

- Goal 5. Recommend funding mechanisms
- Goal 6. Integrate stormwater management into municipal ordinances

GOALS AND METHODOLOGY

The six goals determine the methodologies we used for the project. To achieve each goal, we devised a series of analytical steps and outputs. The results of the analysis and answers to the research questions collectively led to the final recommendations. The following is an overview of the methodologies used to achieve each goal.

GOAL #1

Investigate and map the existing stormwater infrastructure system in Decorah.

METHODOLOGY

Traditional stormwater infrastructure, including storm inlets and pipes, captures runoff and carries it away from homes and into the Upper Iowa River. This infrastructure does not allow for stormwater infiltration, and thus carries many contaminants to the river. Additionally, some parts of Decorah do not have adequate infrastructure to handle increased capacities of water which can result in ponding issues. In order to inform where best management practices should be located to improve infiltration and to have a better understanding of where infrastructure was underdeveloped, our goal was to work with the City of Decorah, Winneshiek County, and Luther College to determine the previously unknown state of stormwater infrastructure in Decorah. To achieve this goal, we created a comprehensive stormwater infrastructure map that includes pipes and intakes throughout Decorah.

GOAL #2

Measure the urban water quality contribution from Decorah to the Upper Iowa River

METHODOLOGY

Water quality testing has been conducted in the Upper Iowa River for many years, but testing in the urban areas of Decorah was relatively limited. With the help of Luther College faculty and students, water samples were collected and tested to identify the state of water quality in, upstream and downstream of Decorah and its contaminants that end up in the Upper Iowa River. These water quality measurements were compiled in a database for the City to use as a baseline to measure the effectiveness of future stormwater management initiatives and investments. Identifying contaminants also helped to inform recommendations for management practices that aimed to, for instance, infiltrate certain pollutants or retain sediments.

GOAL #3

Identify Susceptible Stormwater Areas

METHODOLOGY

Based on the infrastructure and water quality assessments, we identified areas susceptible to stormwater ponding or water quality degradation in each sub-watershed drainage basin within the city. We developed a set of criteria using maps we generated and collected City staff and community input to obtain additional evidence about the location of susceptible stormwater areas. We

distinguished between susceptible areas on public and private lands in order to prioritize projects that can be implemented by the municipality on public lands.

GOAL #4

Identify Stormwater Mitigation Areas and respective best management practices

METHODOLOGY

For public lands in each Susceptible Stormwater Areas, we identified Best Management Practices (BMPs) to improve stormwater quality and quantity most effectively and cost-efficiently. We also provided cost estimates for implementing each practice and the anticipated amount of infiltration, runoff prevention and pollutant removal. For private lands, we recommend cost-sharing with private landowners interested in mitigating stormwater runoff.

GOAL #5

Recommend a funding mechanism

METHODOLOGY

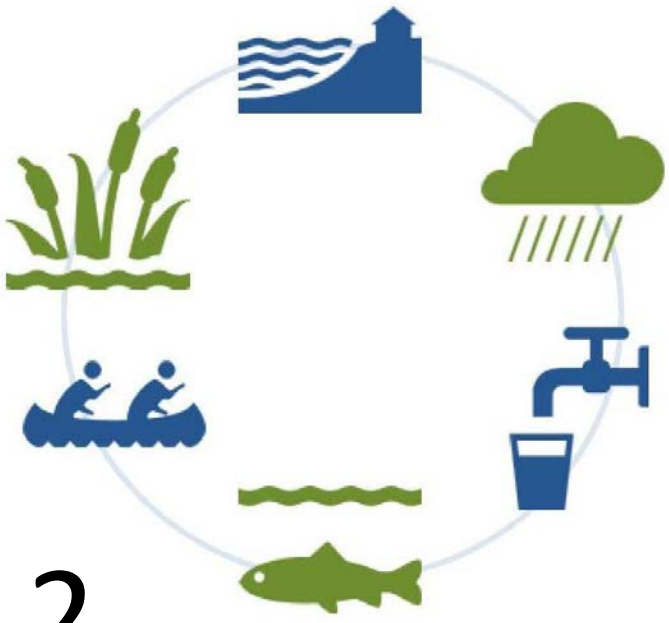
In order to implement the best management practices and thus improve systematic stormwater management throughout Decorah, funding is required. We developed four different options of utility fees that Decorah can use to fund stormwater management, and we recommend one utility fee model that is most equitable and administratively feasible. We also recommended grants and loans that the City can use to fund stormwater management practices. The combination of these funding mechanisms provides Decorah with a sustainable source of funding for short-term and long-term stormwater management projects and infrastructure maintenance.

GOAL #6

Integrate stormwater management into municipal ordinances

METHODOLOGY

Decorah's existing municipal ordinances are relatively lax for regulating stormwater management. We identified regulations that the City could use to comprehensively improve stormwater management. We recommend a municipal ordinance that requires onsite stormwater retention for new subdivisions, a stream easement ordinance, and a stormwater utility ordinance.



PART 2

SUSCEPTIBILITY AREAS

CHAPTER 1

WATER QUALITY ASSESSMENT

WATER QUALITY ASSESSMENT OVERVIEW

The first phase of the project involved identifying Decorah's stormwater quantity and quality problems, as well as existing infrastructure and problem areas. Based on this evidence, we tailored mitigation and adaptation solutions to address those issue. To identify precisely the stormwater problems of Decorah, we conducted one community engagement session and two technical assessments. The following section presents the methods used for each of these assessments and for determining the Stormwater Susceptible Areas.

WATER QUALITY ASSESSMENT PURPOSE

We conducted a water quality assessment for Decorah to establish a water quality baseline and to understand the city's specific stormwater contribution to water quality in the Old Dry Run Creek and Upper Iowa River. Examining urban water quality in Decorah can also help identify problem areas that are contributing low water quality. We partnered with Luther College students and faculty to create an urban water quality monitoring program for Decorah to capture specific contributions from different parts of the city. Rural area testing sites are useful as a baseline and for final impact comparison.

WATER QUALITY ASSESSMENT TEST SITES

Test sites were selected along the Upper Iowa River and Dry Run Creek to assess water quality in the UIR prior to entering the urban area, in the middle of the urban area, and downstream of the urban area (see Figure 6). The first upstream test site (Site A) in the Upper Iowa River serves as the baseline because it reflects only contributions from the rural areas. Those results can be compared to the results from the mid- and downstream urban test sites to determine the urban contribution to contamination of the Upper Iowa River. Similarly, the Old Dry Run Creek test sites are set up throughout the urban stream in order to illustrate any difference in water quality levels as the stream moves through the urban area and into the Upper Iowa River. Notable differences between up- and downstream site results could point to specific problem areas of the city for pollution.

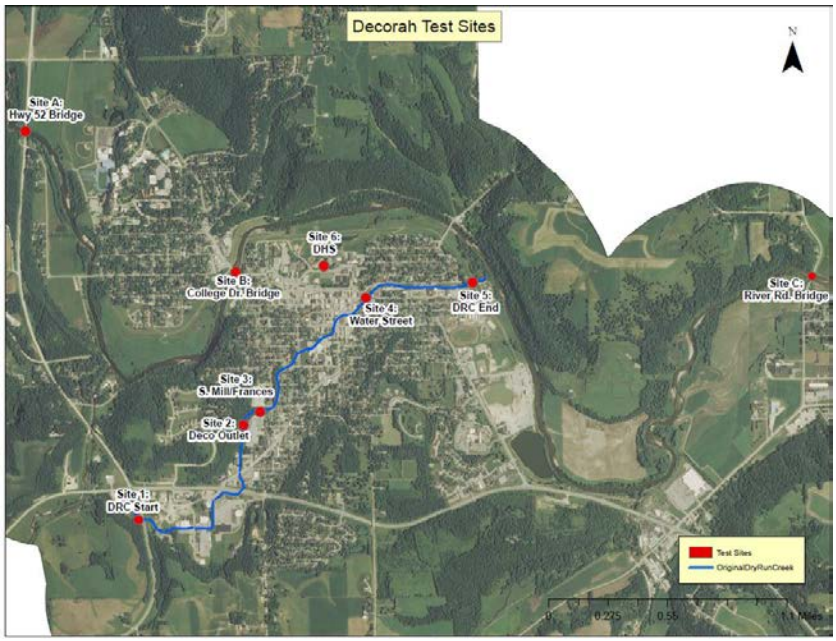


Figure 6: Water Quality Test Sites

A sixth urban test site (Site 6) at the Decorah High School wetland was selected due to its location at the lowest point of one of the city's sub-watersheds. The stormwater runoff in this sub-watershed flows away from Dry Run Creek and towards the Upper Iowa River. Stormwater infrastructure directs runoff towards the high school wetland where it is to captured and filtered before entering

the river. Water quality as the water enters the wetland therefore reflects the quality of the stormwater runoff generated by this urban sub-watershed.

WATER QUALITY INDICATORS

The water quality indicators were chosen based on existing urban and rural water monitoring practices in Iowa, recommendations from the U.S. EPA, and expertise from Luther College faculty. The indicators for the program include: nitrates, temperature, E. coli, specific conductivity, chloride, biological oxygen demand, and dissolved oxygen. All current results are only from the fall season and occurred during only non-rain events. During the fall, some indicators in the Upper Iowa River, such as nitrates and E. coli, are noticeably lower than the ODRC and lower than they would otherwise be in the spring due to farming activity in the upper watershed.

WATER QUALITY MONITORING METHODS

The Decorah urban water quality-monitoring program includes water sampling in the spring, summer, and fall at the nine test sites showed in Figure 1. Water samples are typically not taken during the winter months due to cold temperatures and frozen water bodies. The water quality analysis in this report includes only results from testing in the fall of 2014. If stormwater management policies are implemented in Decorah, this monitoring program will document changes in water quality and quantity resulting from new initiatives and policies.[1]

Water temperature, conductivity, and dissolved oxygen were all measured using a YSI handheld oxygen/conductivity/temperature meter. An YSI Ecosense pH pen was used to measure water acidity. Turbidity was measured using a Hach 2100P turbidimeter. E. coli analysis was performed at Luther College according to EPA method 1603 (US Environmental Protection Agency 2006). Nitrate and Biological oxygen demand (BOD) were both conducted by the Decorah Wastewater Treatment Plant certified lab according to established methods.[2]

[1] Full testing results and water quality indicator standards can be found in Appendix A.

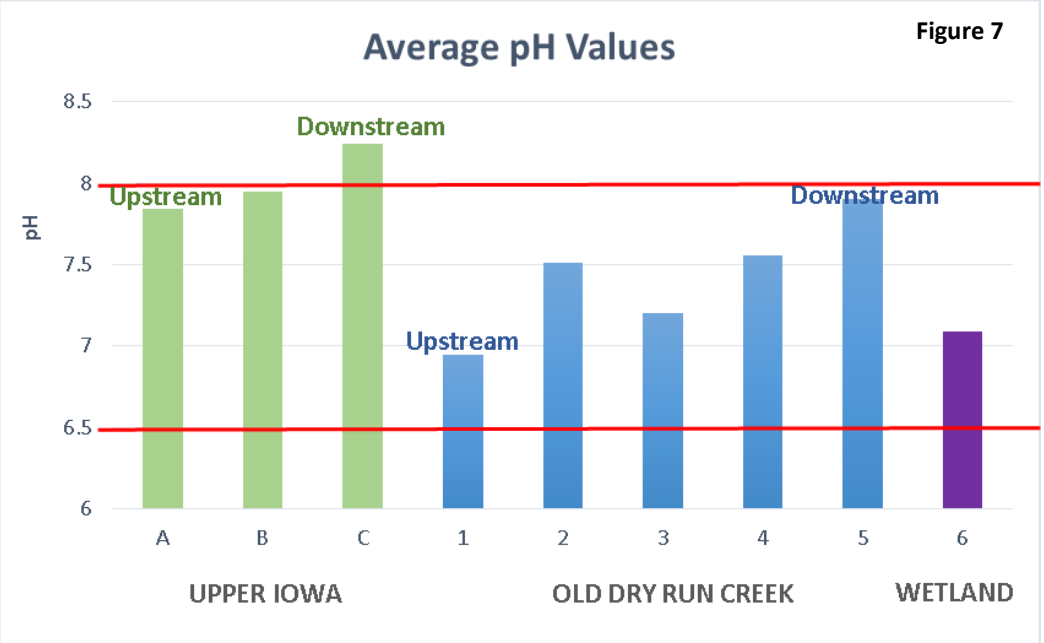
[2] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Quality Monitor. Decorah, Iowa.

ACIDITY (PH)

Measuring the *pH* (acidity) of water indicates the concentration of hydrogen ions present, ranging from very basic (0) to very acidic (14) with 7 as the neutral point. Most freshwater has a pH of 6.5 to 8.5. The pH of water determines the quality of habitat for aquatic life. The majority of aquatic life thrives best in the range 6.5 to 8.0, like trout species commonly found and fished around Decorah. A pH outside of this range stresses the ability of organisms to live and reproduce, which leads to decreases in stream diversity and resiliency. The U.S. EPA indicates that one of the causes of acidity changes is urban wastewater discharge or stormwater. The type of rock surrounding the water body and the extent of acid rain can also affect acidity. It is important to note that the abundance of limestone rock in Iowa tends to contribute to slightly higher pH readings in water quality assessments.[3]

The average pH of all the test sites was about 7.6, which falls in the required range of 6.5-9.0 for freshwater bodies (see Figure 7). Additionally, no single testing event at any site exceeded the threshold range. These results indicate that there are no pressing concerns in terms of water acidification, but spring and summer test results are needed to confirm these conclusions. These preliminary results also indicate that the acidity of the urban stream is supportive of trout species.

Figure 7



[3] "Water Monitoring and Assessment: Chapter 5 Water Quality Conditions." *U.S. Environmental Protection Agency*. 6 March 2012. <http://water.epa.gov>.

TEMPERATURE

Temperature is an important indicator of water quality because it affects the chemistry of the water and the type of organisms that can live in the water body. Some animals are very sensitive to water temperature and extreme changes can result in increased mortality rates. In Decorah, trout fishing is a major activity. Trout can only live in cool streams.[4]In Old Dry Run Creek, colder temperatures are important to maintain organisms, like trout, that thrive in cold waters. Table 3 on the following page illustrates the complex temperature requirements for selected freshwater fish species.[5] Temperature also affects how much oxygen is in the water; cooler water has more oxygen than warmer water. Stream banks with dense vegetation and canopy cover can help maintain the cooler water temperatures.

Aside from seasonal change, the U.S. EPA cites urban stormwater as one of the factors that can increase the temperature of water bodies as stormwater runs off from parking lots, roofs, and other impervious surfaces common in urban areas. Other factors of stream temperature include vegetation along the stream bank (shade cools the water) and the temperature of in-stream permitted water discharges from Deco Products Company.

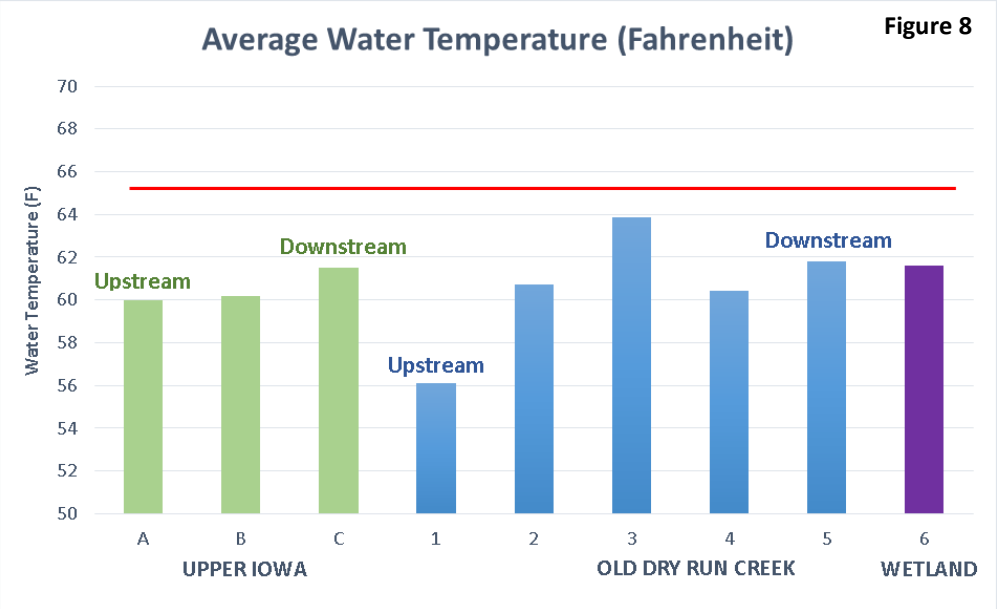


Figure 8

Temperature increases slightly as the creek moves through the urban area by about 5 degrees Fahrenheit (see Figure 8). This indicates a potential urban heat effects on stormwater. The biggest contributor to temperature increase in the urban stream is the warm water discharge from Deco Products Company, which does have an NPDES permit. However, there are also continued temperature increases downstream of Deco, which could point to an overall urban heat effect on the stream.

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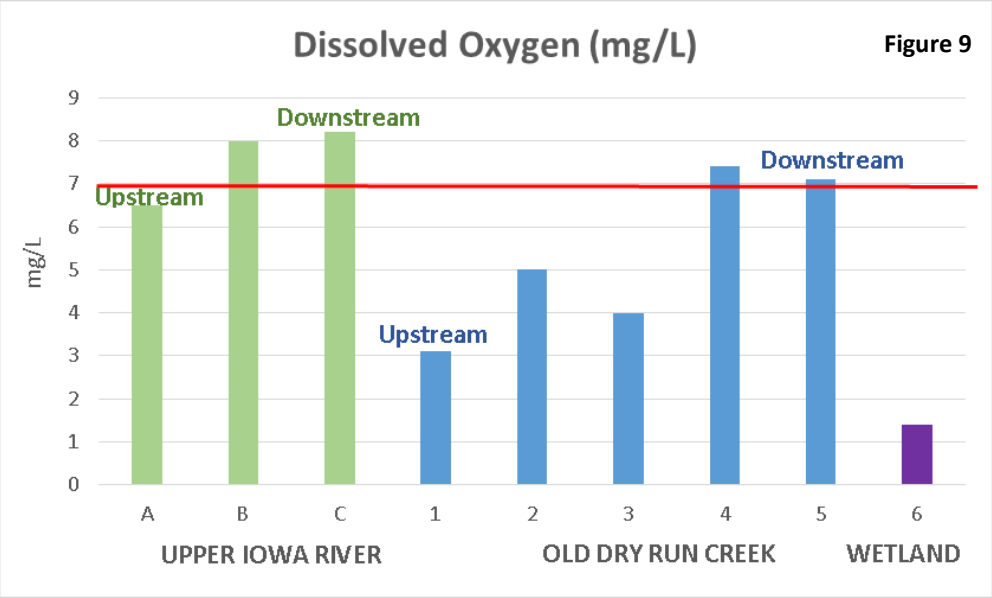
[4] "Water Monitoring and Assessment: Chapter 5 Water Quality Conditions." *U.S. Environmental Protection Agency*. 6 March 2012. <http://water.epa.gov>.

[5] U.S Department of Agriculture Stream Corridor Restoration Manual. 1998.

EPA standards for warm water discharges into cold-water streams require that "No heat shall be added to streams designated as cold water fisheries that would cause an increase of more than 2 degrees Celsius. The rate of temperature change shall not exceed 1 degrees Celsius per hour. In no case shall heat be added in excess of that amount that would raise the stream temperature above 20 degrees Celsius." Implications of current creek temperatures for freshwater fish will be explored further in future testing events following complete seasonal testing results.

Table 5.5 Maximum average temperatures for growth and short-term maximum temperatures for selected fish (C and F)				
Species	Max weekly average temp for growth (juveniles)	Max temp for survival of short exposure (juveniles)	Max weekly average temp for spawning (a)	Max temp for embryo spawning (b)
Atlantic Salmon	20 (68)	23 (73)	5 (41)	11 (52)
Bluegill	32 (90)	35 (95)	25 (77)	34 (93)
Brook trout	19 (66)	24 (75)	9 (48)	13 (55)
Common carp	-	-	21 (70)	33 (91)
Channel fish	32 (90)	35 (95)	27 (81)	29 (84)
Largemouth bass	32 (90)	34 (93)	21 (70)	27 (81)
Rainbow trout	19 (66)	24 (75)	9 (48)	13 (55)
Smallmouth bass	29 (84)	-	17)63)	23 (73)
Sockeye salmon	18 (64)	22 (72)	10 (50)	13 (55)
a - optimum or mean of the range of spawning temperatures reported for the species				
b - upper temperature for successful incubation and hatching reported for the species				
c - upper temperature for spawning				
U.S. EPA Chapter 5 Water Quality Conditions, (Brungs and Jones 1977)				Table 3

DISSOLVED OXYGEN AND BIOLOGICAL OXYGEN DEMAND (BOD)



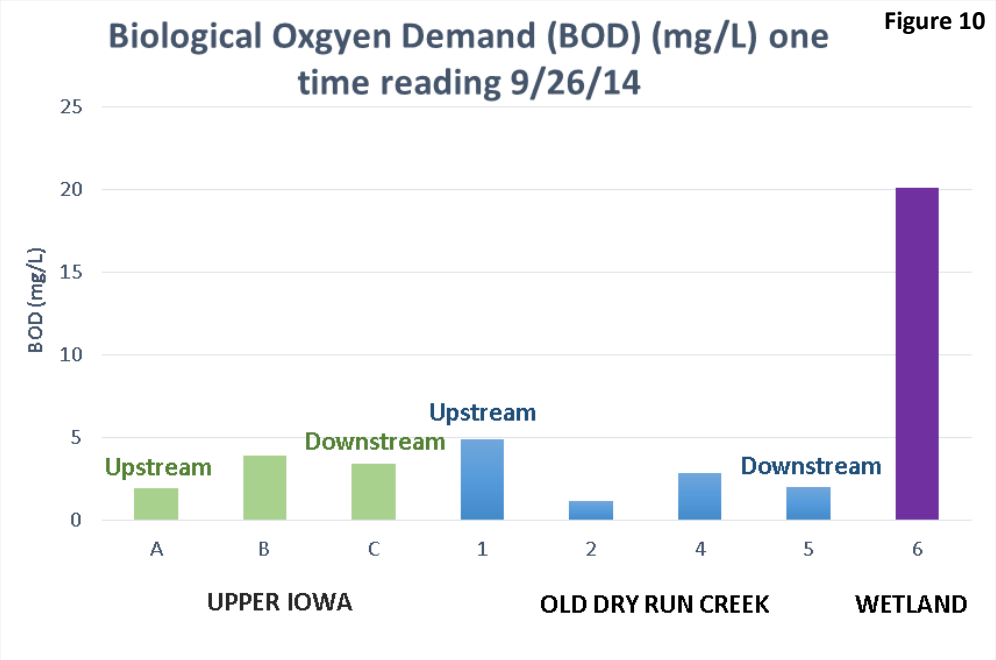
The presence of oxygen in stream water is also important to ecosystem functioning. It is related to temperature, as well as other indicators like turbidity. Oxygen levels are higher in water that is flowing and lower in slow or standing water. Urban streets and rural farms both produce stormwater runoff that can deplete the amount of oxygen in streams and rivers.[6] Oxygen presence in water is measured as dissolved oxygen (DO) and biochemical oxygen demand (BOD). Dissolved oxygen standards for aquatic life are detailed in Table 4.

[6] "Water Monitoring and Assessment: Chapter 5 Water Quality Conditions." *U.S. Environmental Protection Agency*. 6 March 2012. <http://water.epa.gov>.

Only two urban sites currently meet cold water fish standards of 7 mg/L (figure 9). The sampling results show that BOD is higher in the Upper Iowa River than in the urban stream (figure 10). This is logical given that there is more organic material flowing down the river, cooler temperatures, and higher flow to dissolve more oxygen. The high school pond is unique in the urban area for similar reasons. The wetland is artificial and is accumulating large quantities of biomass and organic matter, resulting in high BOD. The first urban site at the origin of the ODRC is similarly high due to the low flow and high organic matter. The high school wetland is also unique for very low dissolved oxygen, which is again logical given that there is essentially no flow in the sitting pond.[7]

Dissolved Oxygen	Aquatic Life	Table 4
0-2 mg/L	Not enough oxygen to support life	
2-4 mg/L	Only a few fish and aquatic insects can survive	
4-7 mg/L	Good for many aquatic animals, low for cold water fish	
7-11 mg/L	Very good for most stream fish	

Figure 10



TURBIDITY

Turbidity measures water clarity, or how much light can pass through the water because of suspended materials. Measuring turbidity levels serves as a proxy for the sediment load in the stream. The color and temperature of water is also affected by turbidity; suspended particles both decrease sunlight and increase water temperature because the particles absorb heat. When light is unable to pass through the water, the process of photosynthesis is reduced, which results in less oxygen produced by organisms and lower DO. Most organisms have trouble living in this type of oxygen-depleted and cloudy environment.

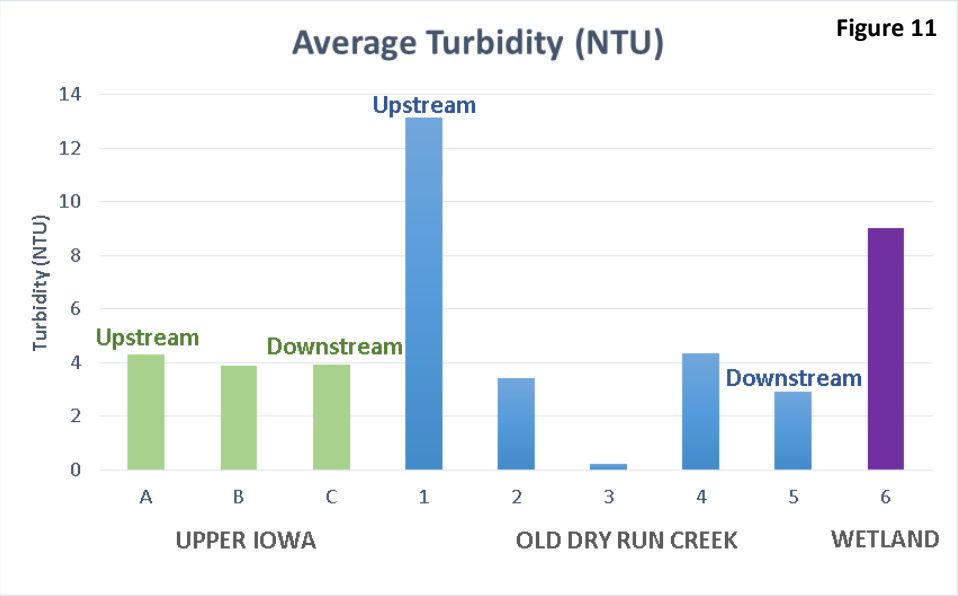
According to the EPA, turbidity is an important indicator to measure the impact of stormwater runoff from sources like agriculture, construction, erosion and other point discharges. Although turbidity is

[7] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Quality Monitor. Decorah, Iowa.

not necessarily an important indicator for human recreational health, it reflects the inability of developed land around the water body to infiltrate stormwater runoff. Large sediment loads are likely coming into the stream from rainwater running across eroding soil or impervious surfaces. Increased turbidity is particularly evident after rainfall events in developed watersheds, like Decorah's, which have a large amount of impervious surfaces; water flows more quickly and in greater amounts in these areas, taking sediment from urban areas and eroding stream banks.[8]

While there are not strict standards for turbidity, the trends across different test sites can be examined to understand where the highest sediment loads are carried into the stream. The two most turbid sites are at the most upstream urban location and at the high school, which collects stormwater runoff from a large impervious area of the city (figure 11). These results may also reflect the fact that there is more standing water at both these locations. Stormwater runoff from the bluffs at the ODRC origin likely carries sediment from the slopes into the Site 1 testing area. The high school wetland is an important location since it collects runoff from impervious surfaces, and will serve as a key point from which to measure any changes from improved stormwater management and potentially less impervious surface in that area.

Figure 11



NITRATES

Nitrates are vital nutrients for plant growth and survival, as a form of nitrogen, but excessive levels of nitrates can lead to significant problems for water quality. Dramatic plant growth and changes in the variety of organisms occur from the accelerated eutrophication, which can be deadly to aquatic life in general. As a result, temperature and oxygen levels are altered. Nitrates also dissolve more quickly in water than phosphorus and other nutrients, and are therefore better indicators to use to identify pollution and determine its source in dry weather conditions. Nitrates are not necessarily harmful in terms of recreating in the water body, but are indicative of other pollution issues.

[8] Ibid.

Nitrates in the nutrient-dense freshwater that runs into the Mississippi River from fertilized fields after spring rains are one of the main contributors to the "Dead Zone" in the Gulf of Mexico. Resulting algae blooms consume available oxygen, leading to hypoxia in the ocean and loss of aquatic life. Eastern Iowa water bodies flow eastward into the Mississippi and contribute to this nutrient load. Nitrate standards are only established for water bodies that are used for drinking water (Class "C" potable water supplies), which cannot exceed 10 mg/L. Common sources of nitrates into streams and rivers include fertilizer runoff from cropland and urban lawns, animal manure, and discharges from certain industrial facilities.[9]

The fall results for nitrate levels suggest that the urban creek is not a significant nitrate contributor to the Upper Iowa River (figure 12). However, Decorah's wells are fed by water from the Upper Iowa River, and further results from test sites A, B, and C in the Upper Iowa will indicate how rural contribution in the spring during farming activity may indicate contamination issues for the nearby drinking water wells.

Contamination of these wells is already a concern in the City of Decorah, but nitrate levels at this time of year do not exceed 10. These test sites are related less to urban stormwater runoff than to rural runoff, and serve as the baseline from which to measure the urban contribution downstream. Further tests for both rain and non-rain events are needed to determine trends. For example, results for nitrate levels in the urban DRC may look very different when lawns are fertilized and after a rain event.[10]

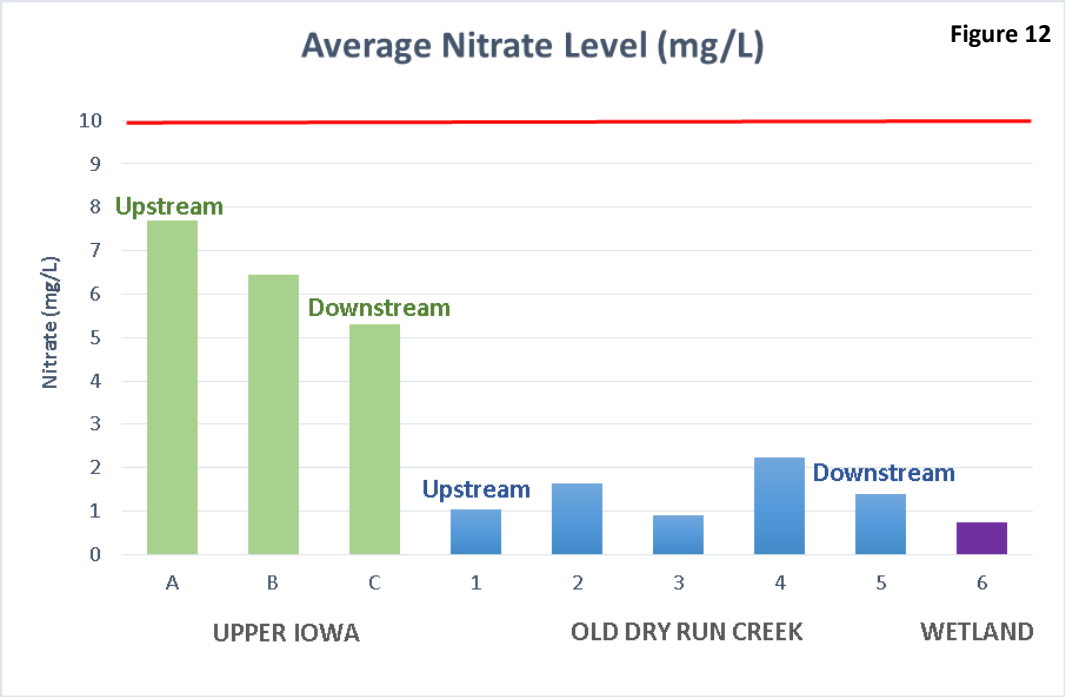


Figure 12

[9] "Water Monitoring and Assessment: Chapter 5 Water Quality Conditions." *U.S. Environmental Protection Agency*. 6 March 2012. <http://water.epa.gov>.

[10] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Quality Monitor. Decorah, Iowa.

CONDUCTIVITY

Conductivity measures "the ability of water to pass an electrical current" (EPA 2012). The proportion of organic and inorganic compounds present in the water have different properties that affect conduction of electric currents. Inorganic dissolved solids (nitrates, chloride) can carry either negative or positive charges. Organic compounds, like oils, are not good conductors. Temperature also affects conductivity, which is higher in warmer water.

Stream conductivity can be affected by discharges and stormwater in urban areas, and industrial areas can have very high conductivity. The geology around the water flow, or around the groundwater inflow, can affect conductivity, with rocks like granite having low conductivity in water. Conductivity levels determine which species of fish or other organisms are able to live in a stream or river.[11] Testing results are shown in Figure 13.

Ideal conductivity levels for aquatic life diversity in freshwater streams should be between 150 and 500 µS/cm. The average of all test sites from fall sampling was 489, just below the maximum threshold. However, four of the sites had at least one sampling event with conductivity levels above the maximum threshold. Streams often reach up to 1,500 µS/cm conductivity levels, so the Old Dry Run Creek is not abnormal. If Decorah is interested in establishing fishing recreationally in the creek, the ODRC may not yet have the water quality to support those activities. High conductivity could be the result of high flows of potentially warm and polluted urban stormwater.

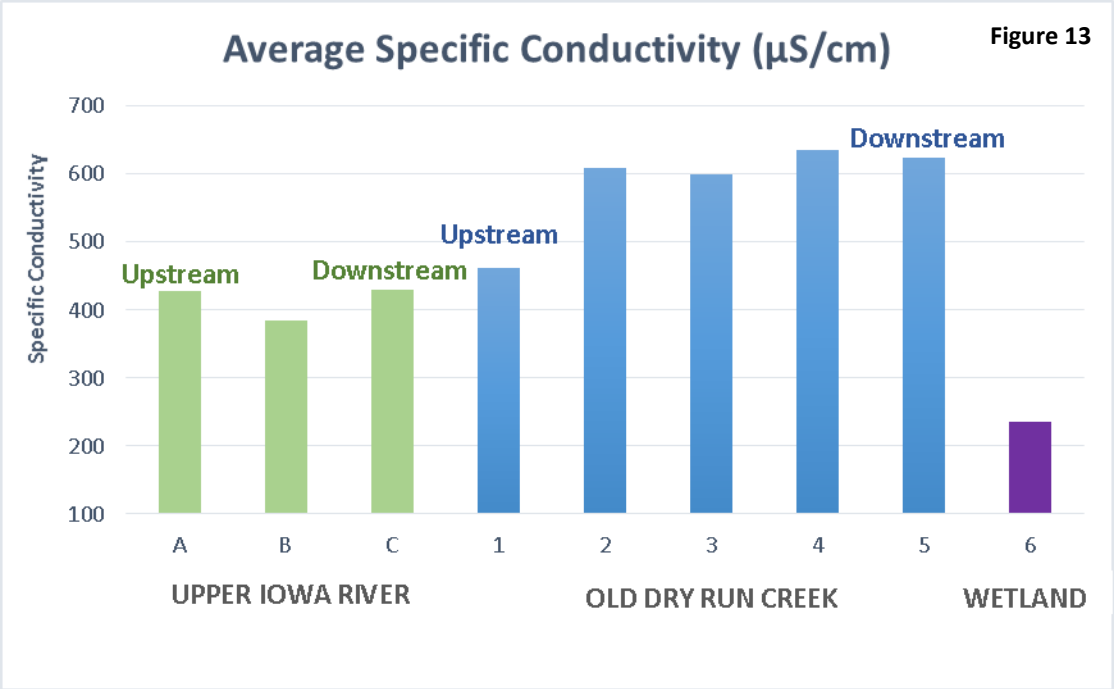


Figure 13

ESCHERICHIA COLI (E. COLI BACTERIA)

E. coli (Escherichia coli) is a bacteria found in animal and human feces, and its presence in water bodies can indicate possible contamination from sewage in stormwater or discharges and animal

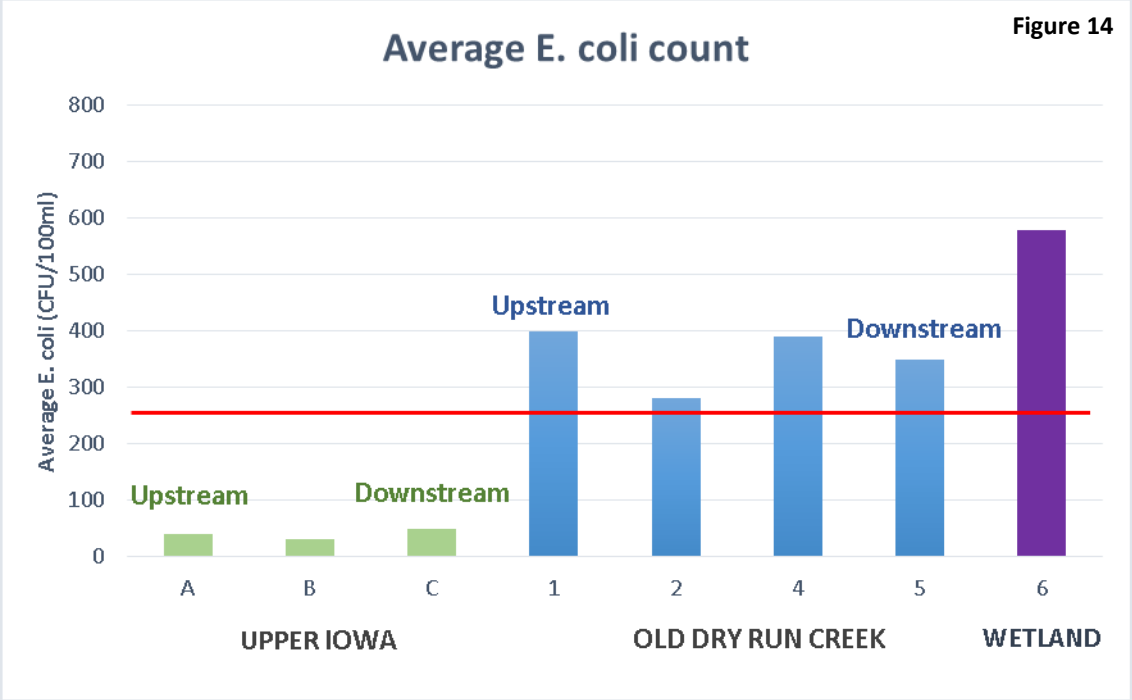
[11] Ibid.

operations. It is one of the most common indicators used to test fecal bacteria, and it is important to try to identify whether the source is human or animal. The presence of E. coli itself indicates that other disease-causing bacteria are also likely to be present, which can be harmful to human and animal health. There are strict E. coli standards for water bodies used for recreation, listed in the table 5 below.[12] E. coli contamination in water bodies can be from sources like stormwater runoff, wastewater treatment plants, and animal manure.[13]

E. coli* (organisms/100 ml water)	Class A1 (Primary Contact Recreational Use)		Class A2 (Secondary Contact Recreational Use)		Class A3 (Children's Recreational Use)	
Table 5	Geometric Mean	Sample Maximum	Geometric Mean	Sample Maximum	Geometric Mean	Sample Maximum
	126	235	630	2880	126	235

The average E. coli count for all the test sites was 234.5 organisms per 100 ml water, which is just below the strictest allowed sample maximum of 235 for class A1 and A3 recreational use (figure 14). However, five of the sampling sites had at least one sample that exceeded the sample maximum. The results from E. coli samples in the Upper Iowa River are reflective of entering the fall and winter season. Based on results from previous rural testing around Decorah, these results are much lower than they typically would be in the spring and summer.

Figure 14



These results show that fall and winter E. coli levels are higher in the urban area than the rural area. This suggests that there are different sources of E. coli going into the stream and river. The source of E. coli to the Upper Iowa River tends to be from livestock fecal material. However, these preliminary results indicate that the urban area might have a steadier, lower E. coli contribution of its own because it is a smaller area and has a higher level of endemic wild life, birds and pet fecal matter. The

[12] "Revisions to Chapter 61 – Iowa Water Quality Standards." U.S. Environmental Protection Agency. 19 July 2011. <http://water.epa.gov>

[13] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Monitor. Decorah, Iowa.

Upper Iowa River also has many more inflows into it, so it is getting significantly diluted, whereas the urban spring has minimal inputs and is not getting diluted. Further spring season sampling will speak to the differences in E. coli levels between urban and rural runoff.[14]

CHLORIDE

Chloride is an inorganic negative ion that originates from salts. Natural sources of chloride include weathering bedrock and soils, and groundwater. Manmade salts increasingly contribute to higher chloride levels in water bodies, including road salts, chlorinated drinking water, and water softeners. These salts are washed into streams by urban stormwater and treated wastewater. Salts are increasingly used in the U.S. on impervious surfaces like roads and parking lots during the winter, as in Decorah. Freshwater organisms are not suited for salty waters, and can't survive in water with even 1 part per million salinity.[15] [16] Chloride results can be found in Figure 15.

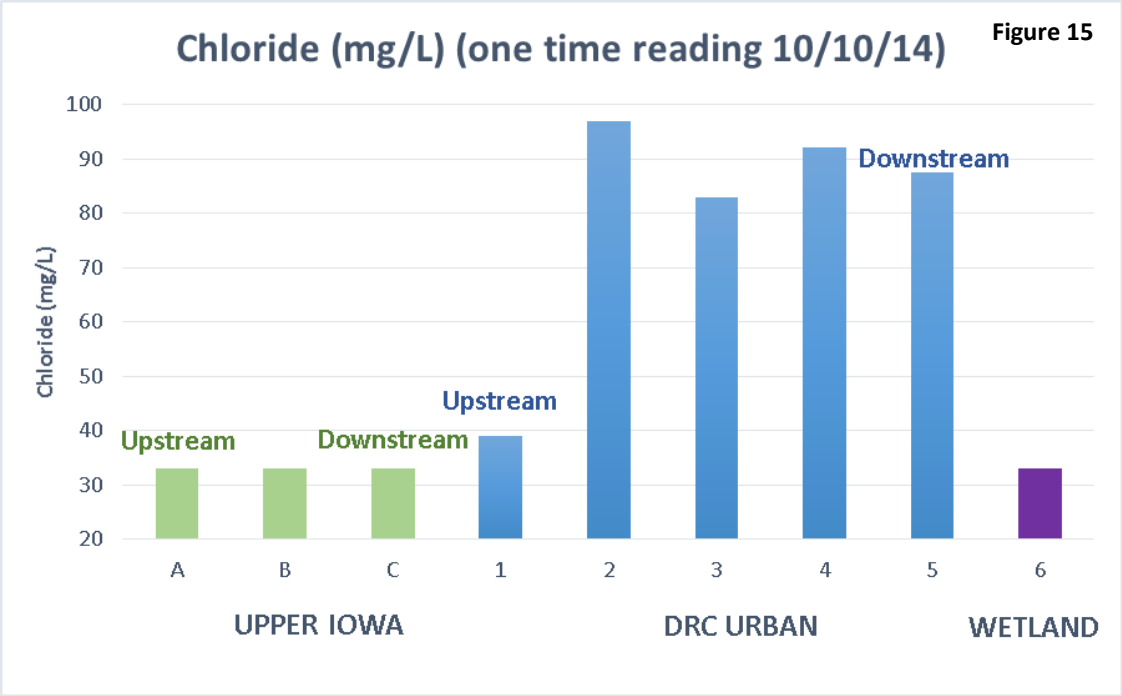


Figure 15

In the two years of Luther College's water quality sampling program in the rural area around Decorah, there have rarely been measureable chloride readings in the rural samples.[17] In the first samples taken from the urban environment, higher chloride readings showed up immediately. Chloride readings in the Upper Iowa River all read at 33 because this is the lowest reading limit available, indicating that chloride levels are all likely very low in the river under these conditions and at this

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[14] Ibid.

[15] "Water Quality Standards Review: Chlroide, Sulfate and Total Dissolved Solids." *Iowa Department of Natural Resources*. 9 February, 2009. http://iowadnr.gov

[16] "National Water-Quality Assessment Program: Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial Aquifer System, Northern United States." *U.S. Geological Survey*. Scientific Investigations Report 2009-5086. 2009: U.S. Geological Survey, Reston, Virginia.

[17] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Quality Monitor. Decorah, Iowa.

time of year. The high school wetland also reads at this level for the same reasons. However, ODRC chloride levels are higher. The consistent levels at testing sites in the urban area are likely the result of an accumulation of concentrated salt use on black top.[18] These results do indicate that there is a small but noticeable stream chloride contribution unique to the urban area.

CONCLUSIONS

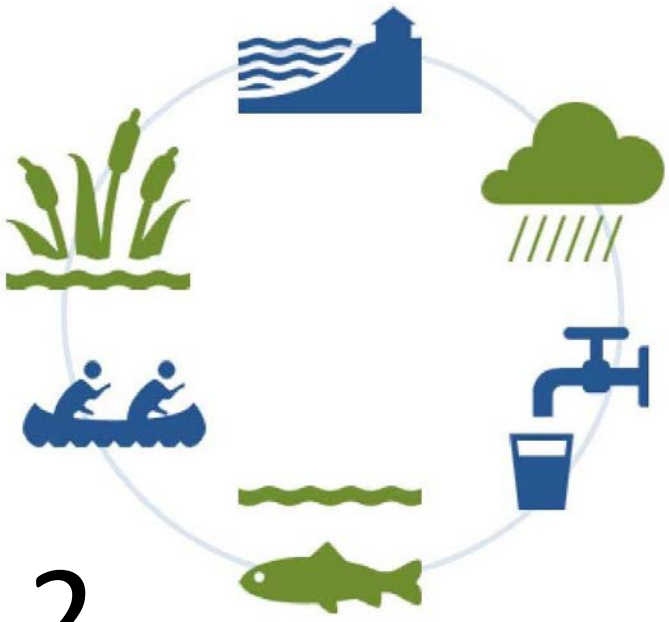
Overall, preliminary results indicate that there are different sources of pollution in both urban and rural areas. Given that the Old Dry Run Creek is essentially fed only by rain and stormwater, we can make more definitive conclusions when analyzing potential pollution sources to the stream.

The fall results indicate that there may be significant urban chloride contributions to the stream and river, given that there are historically no chloride readings in the rural areas. Chloride in stormwater runoff is most likely from street salts and cars. The tests also indicate a potential urban heat contribution to the stream, as the temperature increases incrementally moving downstream in Old Dry Run Creek. Stormwater heats up as it moves across impervious surfaces that retain heat from the sun and runoff that warms on impervious surfaces. There can also be warm water contributions from industry outlets into the stream indicate if this is the case.

Preliminary results also show a small but significant contribution of E. coli from the urban area to the stream, with a few test sites showing E. coli levels above the safe standard. E. coli most often comes from pet waste in urban areas, but can potentially indicate other issues with septic systems or sewer leakage. Public education about proper pet waste disposal may help reduce some of these levels. There will likely be differences by season that will speak more to these sources after more testing periods. Future rain-event testing will highlight major urban and rural pollutants; what is sitting on the streets will move quickly into the stream in larger quantities.[19]

[18] Interview with Jodi Enos-Berlage. Professor of Biology at Luther College and Primary Water Quality Monitor. Decorah, Iowa.

[19] Ibid.



PART 2

SUSCEPTIBLE AREAS

CHAPTER 2

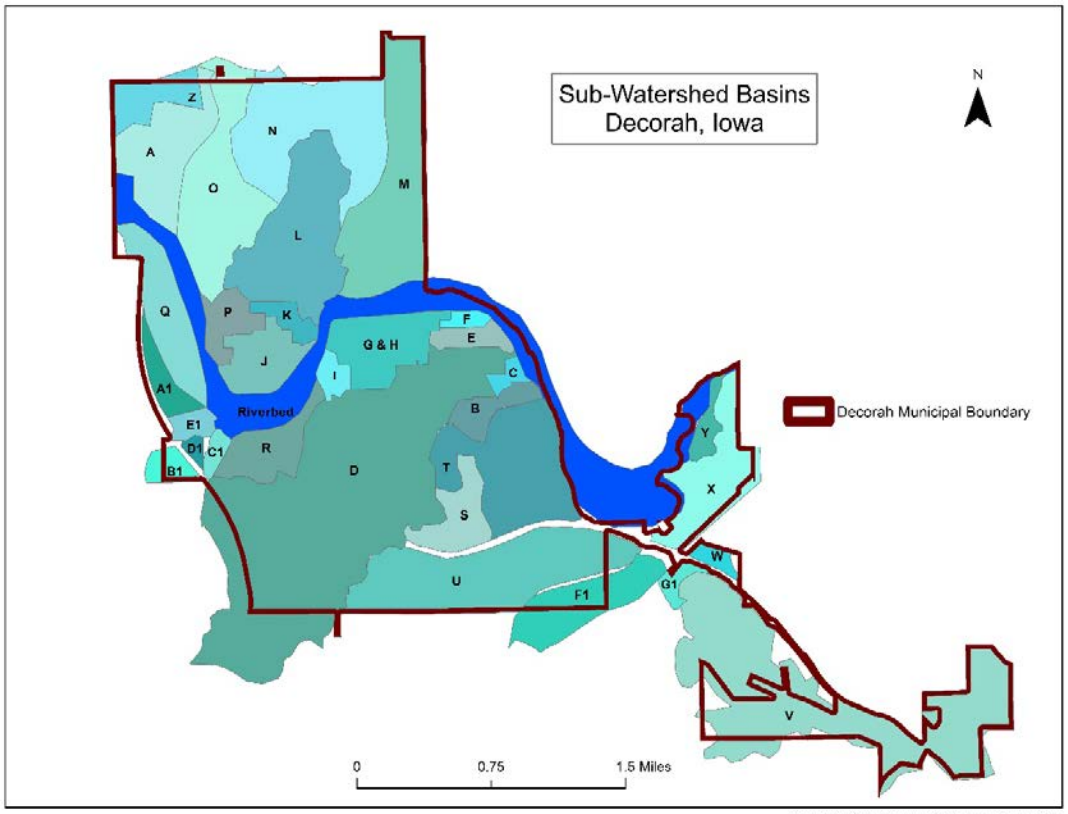
WATER QUANTITY ASSESSMENT

STORMWATER FLOW ASSESSMENT

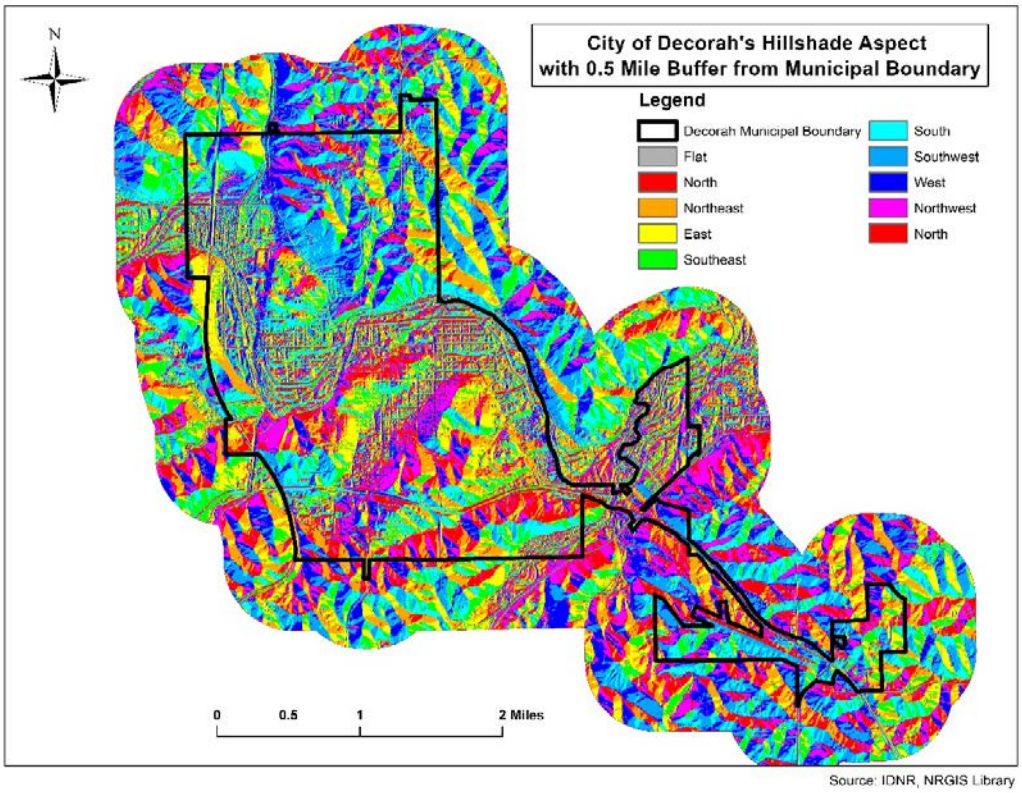
Once rain sheds off of a rooftop, a parking lot and rolls down a hill, the flow of stormwater across the urban landscape is influenced by the topographic characteristics of the area, by the land uses within that area, and by the degree of perviousness of land surfaces. A sub-watershed basin is created by the topographic features of an area, wherein steeper slopes determine the direction water flows (East, West, etc.). We use a sub-watershed framework to understand the movement of stormwater across Decorah's landscape. Map 1 shows the sub-watershed basins of Decorah.

This level of analysis highlights the localized impacts of stormwater runoff and offers a smaller scale at which issues can be identified precisely. Initial maps provided by the city engineering staff, Erdman Engineering P.C, included nine larger 'drainage basins', including those originally engineered by the Army Corp of Engineers when the levees were built. The Army Corp of Engineers specifically designed certain areas near the levee where flooding could occur and discouraged the city from building in these area. While these drainage basins provided an initial basis for analysis, further delineation of sub-watershed boundaries were created in ArcGIS by manually digitizing lines along the highest contoured edge of the slope layer. This layer was then used in the watershed flow analysis to designate priority sub-watersheds where stormwater is expected to be particularly problematic. In order to assess the topographic characteristics, we utilize GIS layers to generate slope calculations

Map 1 Sub-watershed basin map of Decorah



Map 2 Decorah's Hillshade Aspect shows the cardinal direction of water flow runoff.



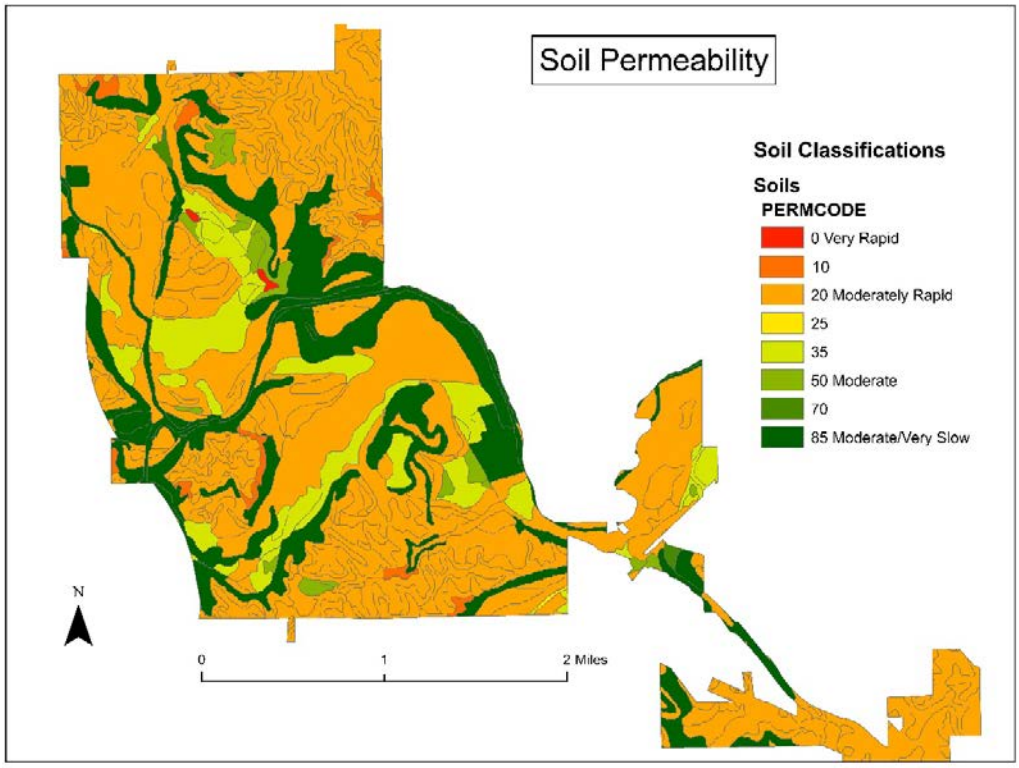
for the area. Decorah's Hillshade Aspect was generated from the slope calculations.[1] This displays slopes visually by shading shaded topographic characteristics based on the sun as a source of light and provides a visual guide for understanding water runoff movement (Map 2).

Soil characteristics are key to understanding the movement of water as it moves not only laterally across the landscape, but also vertically down through the soil. Soil that allows water to infiltrate more slowly may contribute to ponding; therefore, understanding the types of soil in Decorah was a necessary step in our investigation. For our purposes, soil data was downloaded from the NRGIS library and clipped to the Decorah municipal boundary (Map 3).

Decorah's soil permeability code classifications calculated in inches per hour:
Impermeable .....less than 0.0015 in
Very slow .....0.0015 to 0.06 in
Slow .....0.06 to 0.2 in
Moderately slow .....0.2 to 0.6 in
Moderate .....0.6 inch to 2.0 in
Moderately rapid ..... 2.0 to 6.0 in
Rapid ..... 6.0 to 20 in
Very rapid..... more than 20 in

[1] More detailed ArcGIS processes for Runoff Flow Assessment & topographic methodologies are located in Appendix B.

Map 3 Soil Permeability or the speed at which water moves through the soil horizon.



Source: NRGIS Library, Iowa Department of Agriculture, Winneshiekk County Soil Survey

STORMWATER INFRASTRUCTURE ASSESSMENT

Incorporated throughout these sub-watershed basins are stormwater drain pipes, curbed gutters, and drain inlets, all of which characterize a formal network of stormwater infrastructure. More generally, as stormwater runs off on the urban landscape, a portion of the water that does not infiltrate is captured by stormwater infrastructure (intakes, pipes, culverts etc.). There are two types of stormwater management strategies:

1. Structural, or "hard" practices, use pipes, culverts and levees to quickly direct water flow away from an affected area
2. Non-Structural, or "soft" practices, focus on infiltrating water runoff before it moves downstream or downhill, such as rain gardens, bioswales, detention basins

We focus largely on non-structural Best Management Practices (BMPs) to mitigate stormwater because they are more cost effective and sustainable. BMPs include practices such as rain gardens, bioswales, and detention basins that collect and slow stormwater down to improve infiltration rates. According to the IDALS Urban Conservationists and the EPA, on-site infiltration practices are best suited for urban areas that are spatially limited and have high impact on nearby waterways.[2] Many

[2] EPA. *Incorporation Environmentally Sensitive Development into Municipal Stormwater Programs.* http://water.epa.gov/polwaste/npdes/stormwater/upload/region3_factsheet_lid_esd.pdf . EPA uses the term 'Low Impact Development' of LID interchangeably with infiltration practices.

of these BMPs will be discussed further in this project including several available resources for siting and implementing them. We also assessed the municipality's hard infrastructure because it conveys stormwater throughout the city and is necessary to mitigate flooding during heavy rain events. For the purposes of this report, publicly owned land was distinguished from private land as land ownership affects what strategies can be implemented, and where proposed public stormwater BMPs would be located.

EXISTING BEST MANAGEMENT PRACTICES

Decorah already has existing Best Management Practices in place. These practices indicate potential for future public and private support for our recommendations.

WATER STREET PARK/ NORM SMITH PLAZA KIOSK

The Water Street Park/Norm Smith Plaza Kiosk is adjacent to the Oneota Food Coop and on the corner of Water Street and River Street (Figure 15). This project was completed in late 2011 and uses permeable pavers to infiltrate water on site, as well as incorporating native landscaping. Community donations and grants from Iowa Great Places, the Winneshiek County Community Foundation, and the Self Supporting Municipal Improvement District made this project possible.[3]

Figure 15 Water Street Park Permeable Paver Patio

DECORAH HIGH SCHOOL WETLAND AREA

Much of Decorah's downtown stormwater runoff is directed to flow into the Decorah High School's wetland area. This wetland is a remnant from the original Upper Iowa River before the levees were constructed in the 1940s and is connected to a culvert in the levee that is mechanically operated for flood protection.Figure 16 shows the original site plan for the development of the wetland.

Figure 16 Decorah High School Wetland area

[3] The Decorah Newspapers. "Water St. Park Event Tonight." Website. July, 7, 2011. http://decorahnews.1upprelaunch.com/main.asp?SectionID=2&SubSectionID=10&ArticleID=25664

WALMART DETENTION BASINS

According to a 2002 Court of Appeals decision that overturned the original city council issuance of a landfill permit to the Walmart Supercenter located off of Old Stage Road, Walmart was forced to implement stormwater retention basins onsite due to their location within a floodplain (Figure 17).[4] At Aerial footage has indicated 2 detention basins exist near the Upper Iowa River and adjacent to the Wal-Mart parking structure.

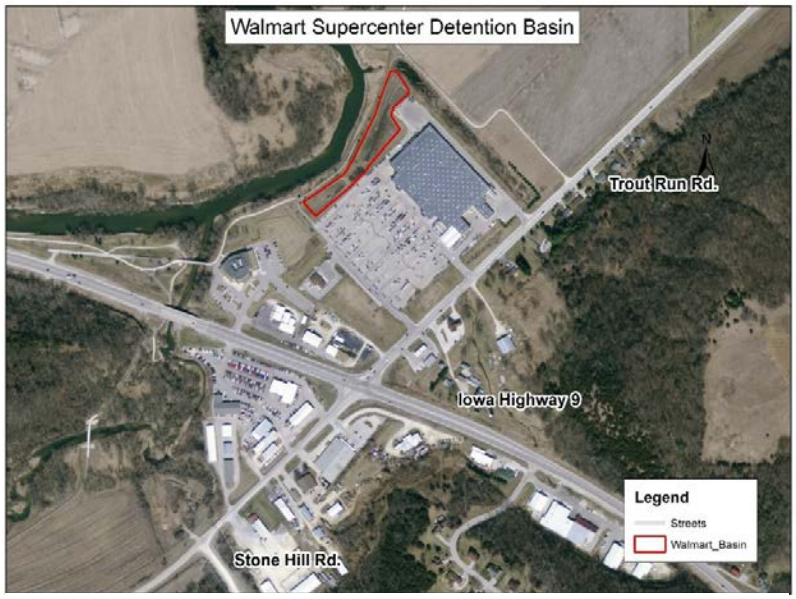
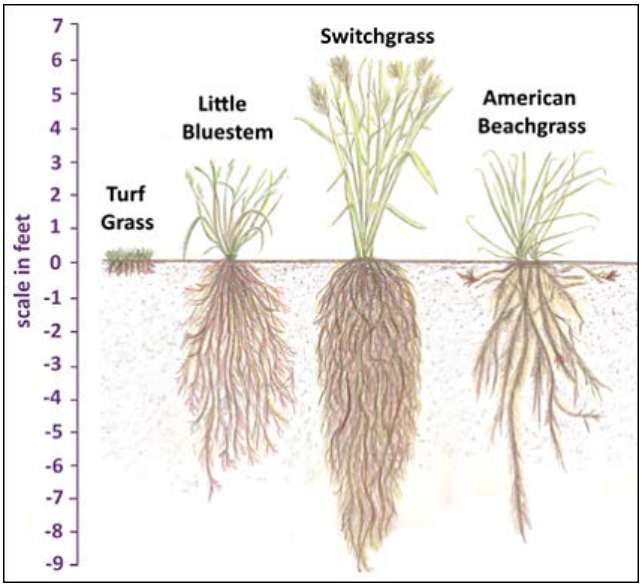


Figure 17 Walmart Supercenter's Detention Basins

DECORAH'S COMMUNITY PRAIRIE

In 2001 the City of Decorah began planting what would turn into a 36-acre prairie reconstruction area within the floodplain of the Upper Iowa River. Re-introducing native prairie plants to Iowa's landscape is essential to recharging aquifers and improving water quality and quantity issues due to the deep root structures of prairie plants (Figure 18)[5]. These roots retain soil, which decreases rates of erosion, infiltrate water to greater depths, and slow water moving across the surface, which reduces turbidity and sediment deposition. In addition to planting local prairie species, the city also included a butterfly garden and continues to provide mowed walkways with limestone boulders and

Figure 18 A comparison of root depth between turf grass and native prairie grasses, such as Little Bluestem.



[4] Holland, Rue v. City Council of Decorah and Wal-Mart Stores, Inc. 2-058/00-2113 (Court of Appeals of Iowa 2002)

[5] http://www.mass.gov/eea/images/czm/stormsmart/factsheets/3-7-425.png

birdhouses placed throughout the prairie garden. Community members volunteer to help remove invasive plants and to learn more about the prairie ecosystem.

LUTHER COLLEGE

24,600 ft² Permeable Pavement Parking Lot

Using a $86,000grant from the Department of Natural Resources in 2010, Luther College replaced its Facilities Services' 24,600 ft² parking lot with a permeable paving surface that has a "design life of 50 years and is expected to function for at least 20 years with minimal maintenance" (Figure 19).[6] Luther College sustained over $2 million in flood-related damages in the 2008 and began

Figure 19 Luther College permeable paver parking lot. Source: Google Maps

implementing non-structural practices as part of a series of measures aimed at flood prevention and control.

Rain Garden and Green Roof at Sampson Hoffland Laboratories

Built in 2008, the Sampson Hoffland Laboratories building is a LEED Gold-certified building with a rain garden located behind the building that infiltrates all of the rooftop rain (figure 20)[7]. The rain garden was planted with native sedges, grasses, and wildflowers, including Oak Savanna trees.[8] Additionally, a 1500 ft² Green Roof contains a mix of drought-tolerant plants that retain some rainwater before it reaches the garden below.

Figure 20 Sampson Hoffland Laboratory green roof.

[6] Holland, Rue v. City Council of Decorah and Wal-Mart Stores, Inc. 2-058/00-2113 (Court of Appeals of Iowa 2002)

[7] http://www.decorahnews.com/archived-stories/2014/07/8692.html

[8] Sierra Club. "Luther College: Campus Sustainability Data Collector". Page 13. April 14, 2013. http://vault.sierraclub.org/sierra/201309/coolschools/pdfs/luther-college-ia.pdf

Stormwater Retention/ Detention Ponds

There are several retention/detention ponds on Luther's campus. There is one located at the Center for the Arts Building, which collects water from the nearby parking lot and street. Another detention pond is located on the northern side of campus that collects stormwater from the Regents Center parking lot and Baker Road.[9]

Rain Barrels

Figure 21 Luther College encourages rain barrels.

The use of rain barrels throughout campus provides Luther College with a mechanism for watering gardens and lawns without relying on groundwater resources. The Facilities Services building has a 2500-gallon rain barrel (figure 21[10]) that collects water explicitly for campus plant and tree watering.[8]

All existing practices are mapped in Figure 22 below.

Figure 22 Locations of the aforementioned existing Best Management Practices.

9 Ibid.

10 http://lc-sustainability-house.blogspot.com/2012/09/rain-barrels.html

STORMWATER INFRASTRUCTURE METHODOLOGY

An investigation of existing municipal infrastructure was an important starting point to identify how stormwater is conveyed through the urban landscape. We assessed Decorah's stormwater infrastructure by:

- Incorporating the experience of the City of Decorah's Street department for flood control and street maintenance
- Amending/updating current infrastructure maps with ArcGIS software (figure 23)
- Ground-truthing and crowd-sourcing stormwater data through a 'retrofittability' analysis of storm drains with Luther College students and staff

CITY OF DECORAH STREET DEPARTMENT

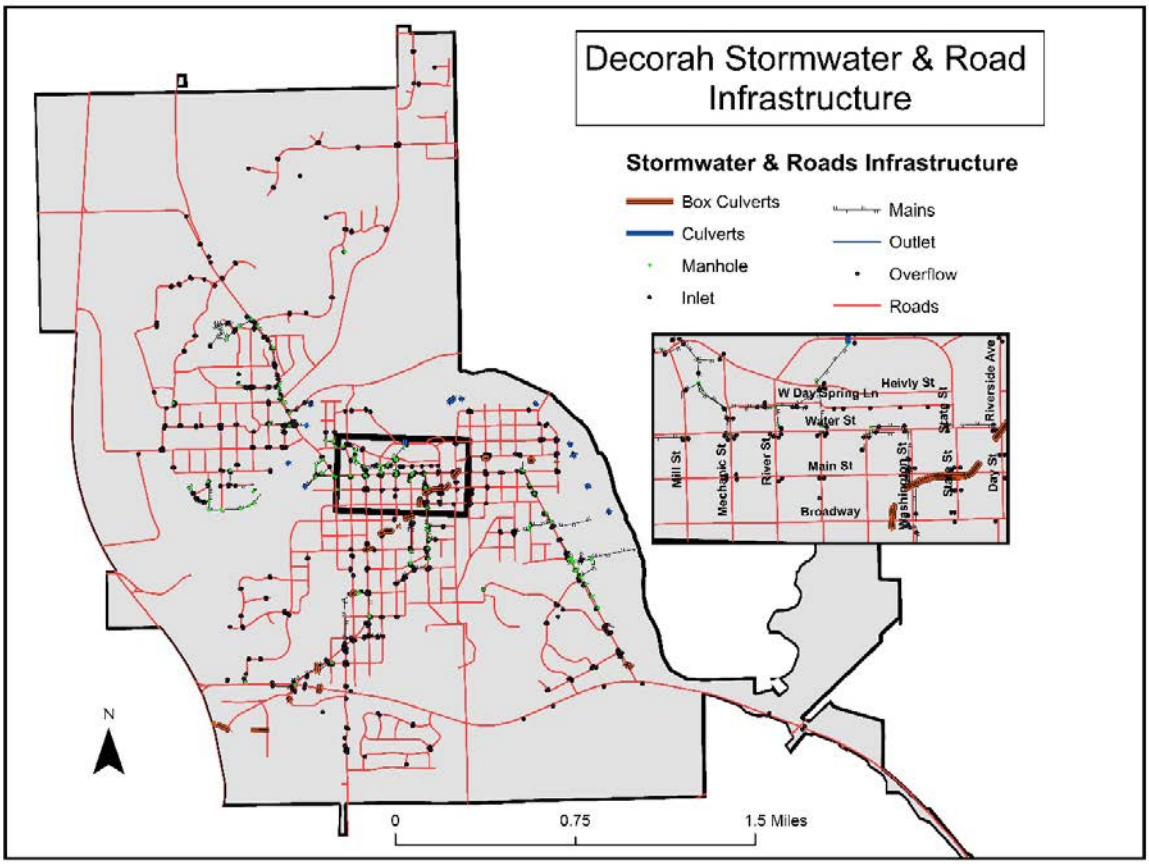
Discussions with city staff indicated that Decorah's stormwater infrastructure was largely unknown or unmapped except for renovated sections that began near the downtown area in the early 1990's. The underground network of pipes and culverts were assumed to be roughly 100 years old, with little knowledge of their condition. Erdman Engineering, a local engineering firm that has led the repair and replacement of small sections of Decorah's stormwater network, provided our group with a preliminary infrastructure map. This map was then transformed from the engineer's Computer Aided Design (CAD) format into a Geographic Information System (ArcGIS) format by County GIS staff in order to produce an infrastructure layer. This map was given to the City's Street department, and personnel provided experiential knowledge regarding areas prone to flooding during heavy rain events, neighborhood streets that consistently experience water inundation above sidewalks, and where certain infrastructure placement has caused backups in stormwater service.

Figure 23 Authors meeting with Kevin Nelson from the Street Department and Jon Lubke from the Winneshiek County GIS department to discuss Decorah's stormwater infrastructure.

AMENDING/UPDATING CURRENT INFRASTRUCTURE MAPS WITH ARCGIS SOFTWARE

Using the information provided by the City Street department, we worked with Winneshiek County GIS personnel to remotely digitize and manually update the map using ArcGIS software and the Google Street View tool. We located existing manhole covers, storm drain inlets and culverts and produced a more comprehensive ArcGIS stormwater infrastructure layer for Decorah (Map 4). This layer not only includes the location of specific infrastructural elements, but in some cases also includes the size of pipes and culverts provided by Erdman Engineering from their recent projects.

Map 4 Decorah's Updated stormwater infrastructure map.



STORMWATER RETROFITTABILITY WITH LUTHER COLLEGE STUDENTS & IDALS

The goal for incorporating a stormwater retrofittability analysis of drain inlets is to assess where there are opportunities to infiltrate stormwater before it enters the infrastructural system and eventually into the Upper Iowa River. More specifically, this process informs the location of potential locations for non-structural stormwater practices, where stormwater can be retained, infiltrated and filtered before it enters structural drains/culverts/pipes. For this part of the analysis, we relied on Luther College students in Dr. Laura Peterson's *ENVS 175: Introduction to GIS* class. Students received a stormwater 'retrofittability' training from Iowa Department of Agriculture and Land Stewardship's (IDALS) urban conservationist Amy Bouska. They learnt about urban stormwater runoff, soil health, and different techniques for retaining stormwater before it reaches drains and rivers. Students taught how to classify storm drains by examining the surrounding area around the drain and its potential for improved stormwater infiltration. Students were charged with determining whether there was sufficient permeable surface around the drain to allow for non-structural practices (e.g.,

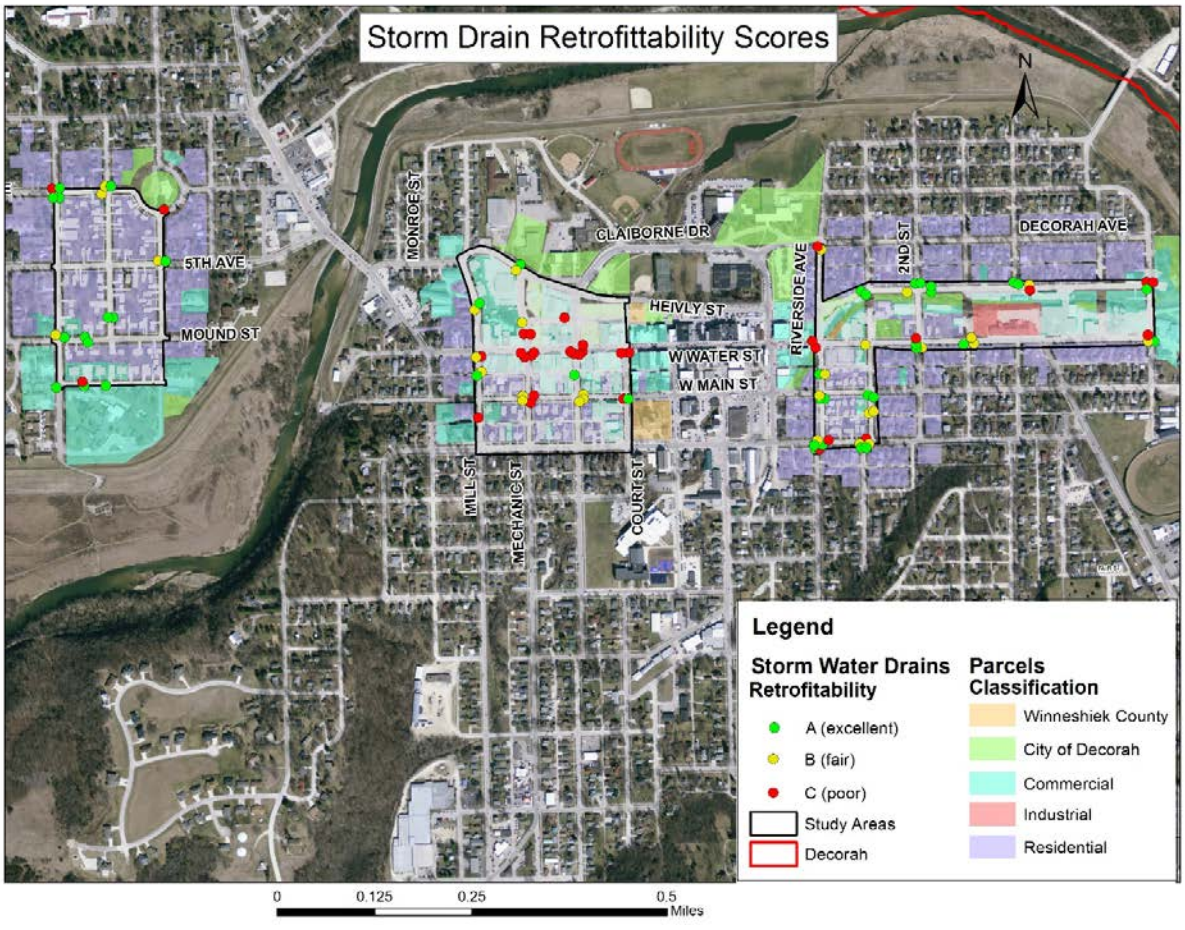
rain gardens, bioswales) to be placed with a curb cut-in to direct the water. Students were shown pictures of each practice in the classroom and then taken in the field to test their knowledge. Each drain was assessed and placed into one of three categories (A, B, or C) and ranked by their ability to be retrofitted with non-structural, infiltration-based practices: A. Classified as a site that is easy to retrofit; B. Classified as a site that has moderate potential to be retrofitted; and C. Classified as a site that is very difficult to retrofit. Criteria for each category were based on size of the retrofittable area, and capacity for water to be directed to the area, such as the ability for a curb cut-ins to be installed.

Students were also encouraged to take pictures to provide additional ground-truthing to each site. The resultant GPS location, retrofittability scores, and any additional comments made by the students created a retrofittability layer in a classroom-generated ArcGIS map (Map 5). This analysis identified areas where bioretention cells (rain gardens or bioswales) could be placed in the public-right-of way to infiltrate stormwater before it enters the stormwater infrastructure, therefore lowering the load on this aging and sometimes insufficient infrastructure.

The main general findings are:

1) The downtown area near Heivly St. has gaps in infrastructure
2) The northwest side near the levee has undersized pipes and limited infrastructure
3) Old Dry Run Creek serves as a collection point for much of central Decorah's stormwater infrastructure

Map 5 Luther College students' storm drain retrofittability map.



STORMWATER INFRASTRUCTURE FINDINGS

Gathering all of the input from City Staff and Luther students, and ground-truthing certain aspects of these findings, we were able to specify particular areas that present stormwater infrastructure challenges. These findings are important for determining Decorah's susceptible stormwater areas and inform our subsequent analysis. The following provide more detailed descriptions of our findings.

HEIVLY STREET AREA

The downtown area along Heivly St. is an area where infrastructure is missing between Mechanic St. and River St., which causes stormwater to collect in the street. City Street and Engineering Staff are aware of this issue and indicated that this area that is on the agenda as a potential/future Capital Improvements Project. Additionally, all of the stormwater in the downtown area between Mechanic St. and Court St. is piped down into the High School wetland area, before it is let out to the Upper Iowa River through a mechanized culvert pipe in the levee. The stormwater collected in this area potentially carries oil, sediment, salt, and contaminants from the downtown area's sidewalks, parking lots, and streets into the Upper Iowa River, making it an ideal site for stormwater remediation.

In their site suitability analysis, Luther College students indicated a few areas where bio-retention cells could be placed near storm drains. Once these were ground-truthed and vetted by Wayne Peterson, an Urban Conservationist with the Iowa Department of Agricultural Land Stewardship, and Corey Meyer, a watershed coordinator with the Winneshiek County Soul and Water Conservation District, it was evident that these areas had inadequate coverage for curb cut-in rain gardens.

NORTHWEST AREA

Decorah's northwest area (see adjacent image)[11], bordering the levee, is known for flooding during significant rain events. This is partly due to its low-lying slope, but can also be attributed to the under-sized pipes that carry stormwater down Ohio St. and Mound St. City Staff, who indicated this area as one that is susceptible to ponding, particularly when the river is high and stormwater outlet cannot be opened, noted that this infrastructure is undersized. The stormwater infrastructure directly to the north of this area along Iowa Avenue runs perpendicular (from Riverview Dr. to College Dr.) to this area, eventually reaching College Dr. and connecting to a larger storm water pipe that leads to the Upper Iowa River. Considering the uphill location of this stormwater infrastructure, we consider this an area for implementing best management practices.

In addition, this area is largely residential, with a mix of single family and multi-family housing. Luther College students indicated several areas where curb cut-in retention cells could be located in

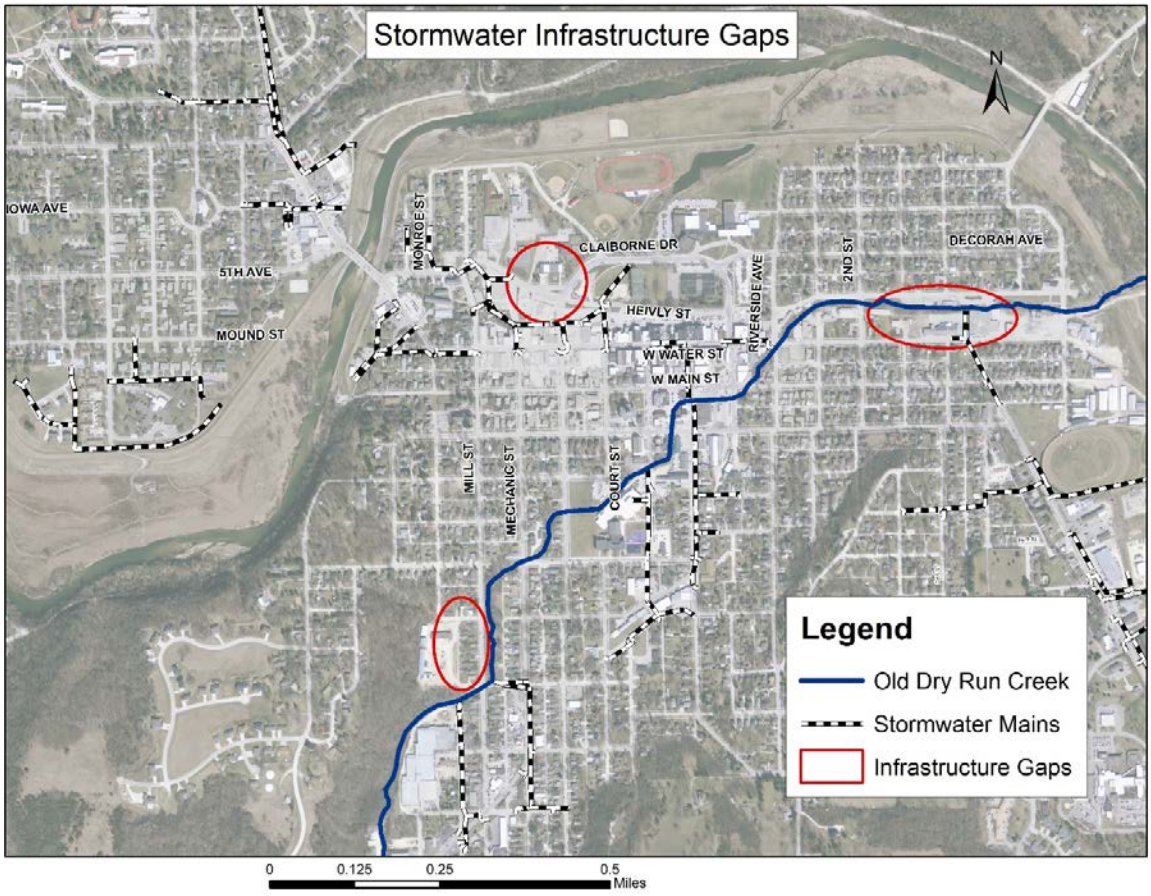
[11] Google Maps.

the public right-of-way near storm drains along Iowa Avenue. The sidewalks with mature trees and grassy right-of-way spaces also make this an attractive area for stormwater practices.

OLD DRY RUN CREEK

Old Dry Run Creek has a much smaller flow than before it was diverted west of town. Decorah grew around and above the stream and directs all of the nearby storm drains to flow directly into the stream. The stream flows in large culverts throughout the downtown, beginning on Winnebago St. and through State St. Several stormwater pipes are indicated on the map. They were ground-truthed during two stream tour events. In one instance 1959, presumably the date of the stormdrain pipe construction was etched on the side of the wall, indicating a growing city and its need to develop on top of the creek. The presence of Old Dry Run Creek throughout the center of Decorah is a clear connection between the city and the Upper Iowa River, a connection that is hidden by culverts and marked by numerous stormwater intakes.

Map 6 Stormwater Infrastructure analysis highlights a few areas where infrastructure is undersized or absent.



While restoring the creek requires a separate analysis due to its size and subsequent stormwater intakes, we focused on three areas where infrastructure was undersized or absent (Map 6):

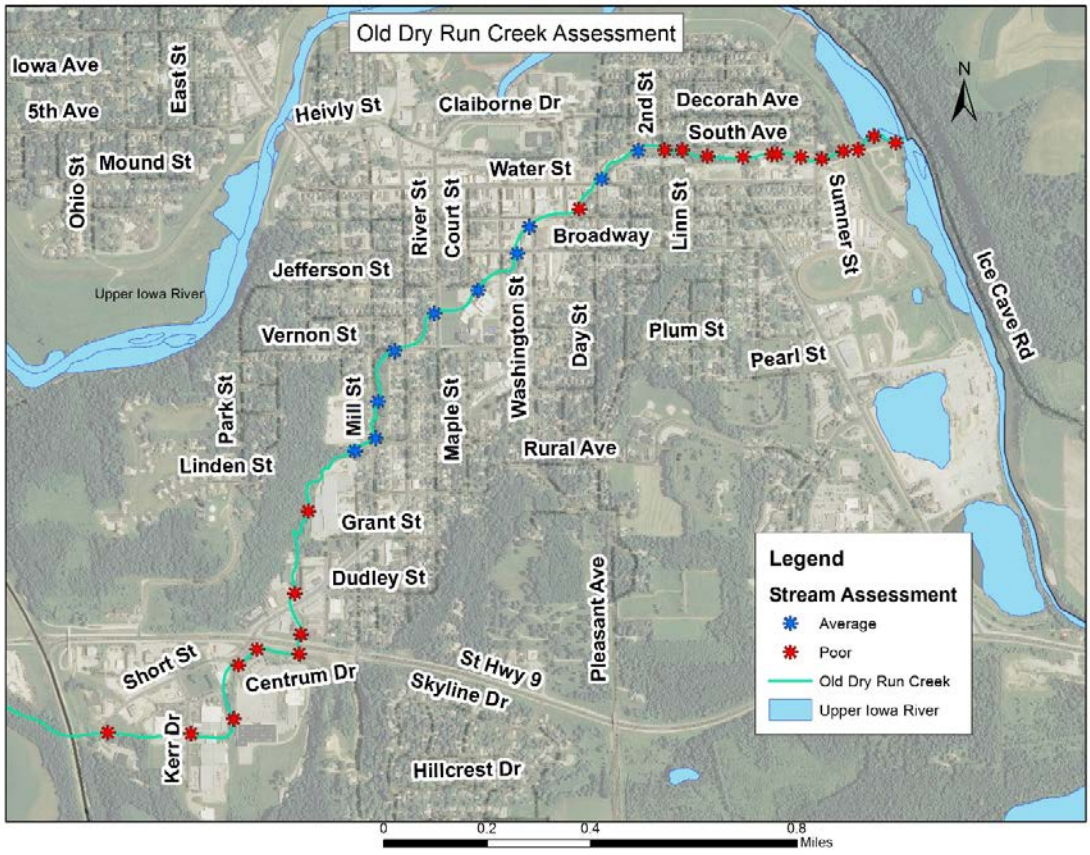
1) The South Mill Street Area, where several community members indicated stormwater issues

2) River Street near the Decorah Middle School, before a large section of the creek runs underneath the soccer field
3) East Water Street (referred in this report as the Northeast Redevelopment Area), an area along the northeast end of the creek where redevelopment is planned and which could incorporate several stormwater infiltration practices before the creek reaches the river

Luther College students identified several areas in the residential neighborhoods near the proposed E. Water St. redevelopment site where bioretention cells could be implemented. These practices, however, are outweighed by the need for more direct remediation along the creek itself given the large amounts of open space adjacent to the creek in this area. By focusing on stream remediation, stabilization of the stream bank will provide water quality and quantity benefits.

In addition to analyzing areas adjacent to Old Dry Run Creek, Romeo Abraham, another Urban and Regional Planning graduate student at The University of Iowa, conducted a Rapid Assessment of Stream Conditions Along Length (RASCAL) stream assessment (Map 7). This assessment starts from up-stream to down-stream and notes the near-stream and in-streams conditions of waterbodies and changes in conditions along sections of the stream. A hand-held GPS unit and surveyors scale were used to conduct the stream assessment that captured various aspects of the state of ODRC.

Map 7 Old Dry Run Creek RASCAL assessment results.



The assessment of the creek was based on three Iowa DNR rankings for in-stream habitat which are Excellent, Average, and Poor.

- Excellent ranking of a stream section refers to a large number of riffles, deep pools, aquatic species (fish and insects), logs, fallen trees, and overhanging vegetation.

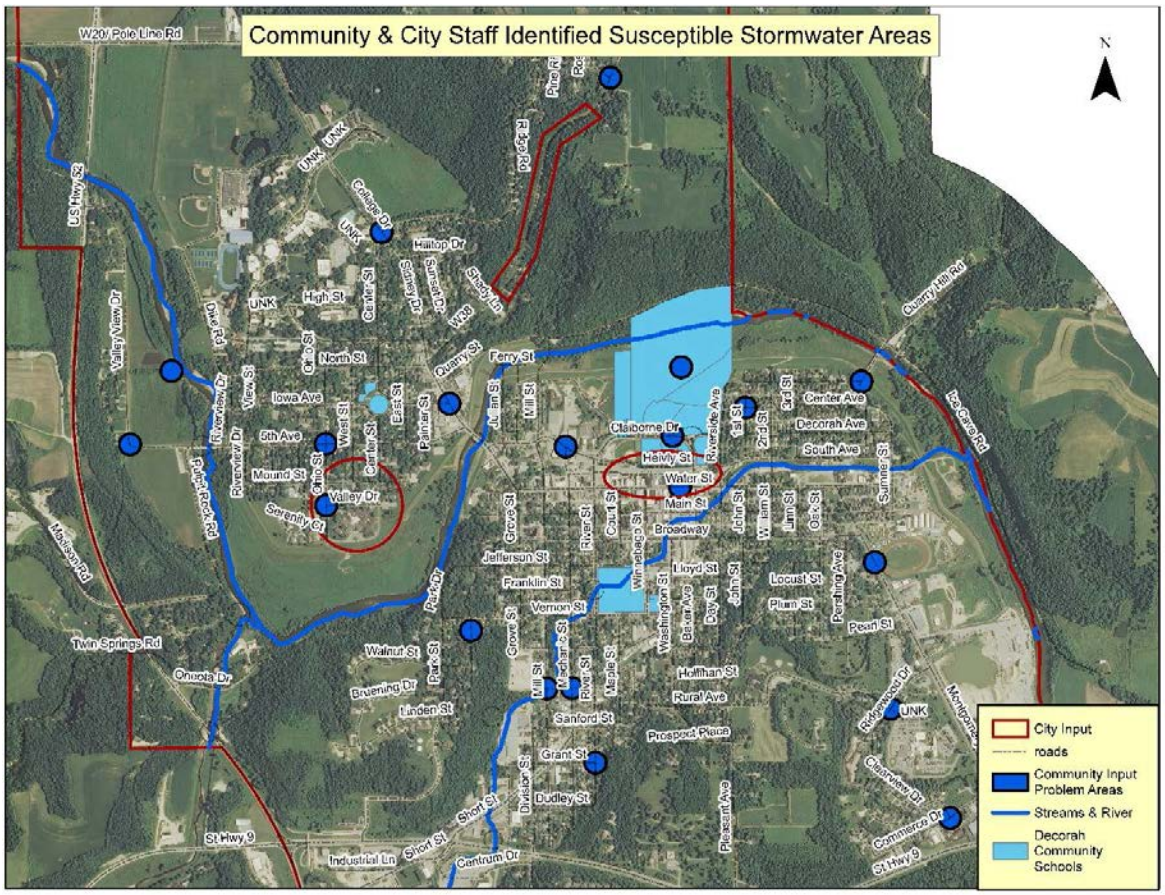
- Average ranking of a stream section has some examples of deep pools, riffles, clear water, aquatic vegetation and insects, fallen trees.
- Poor ranking of in-stream habitat referred to the portion of the creek with very few examples of aquatic insects and fish, riffles, and pools.

The ODRC did not result in a finding of any stream sections with an 'Excellent' ranking and several sections that qualified for a 'Poor' ranking. The areas with poor stream results were incorporated into our finalized analysis that aims to remediate stream bank erosion and poor water quality.

SUSCEPTIBLE STORMWATER AREAS

In this section, the topographic, hydrologic, and infrastructural mapping elements, as well as community and City staff input are analyzed to identify areas that have the potential for stormwater accumulation and improved management practice.

Map 8 Sub-watershed spatial analysis result for susceptible stormwater areas. Areas highlighted in red indicate areas with high levels of risk for stormwater ponding and water inundation during rain events.

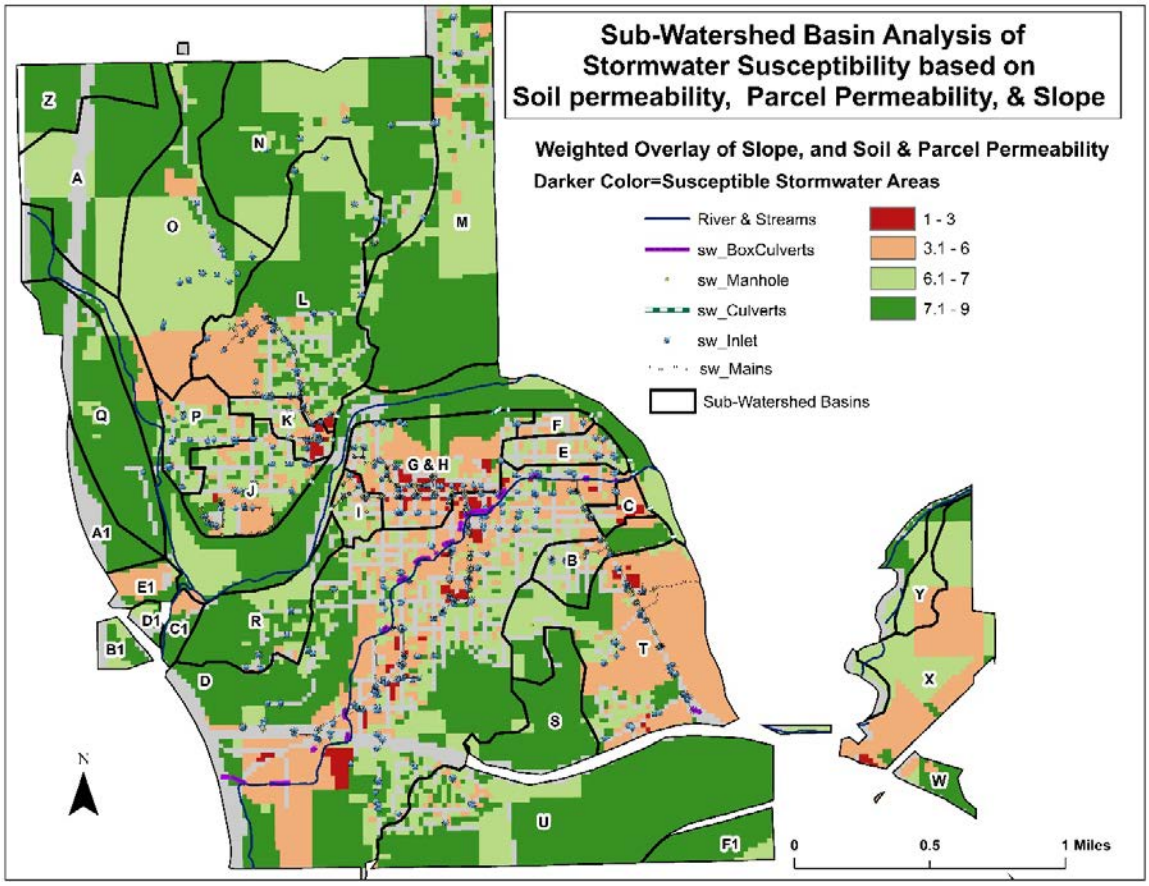


To identify the areas in which potential and actual stormwater issues arise, a series of maps were created using ArcGIS. Utilizing sub-watershed basin areas as a framework, we created a layer for each stormwater susceptibility criteria: slope, soil permeability, and parcel-level permeability. We overlaid each layer and weighted them using the Weighted Overlay tool in ArcGIS to locate potential susceptible stormwater ponding areas. This tool allowed for the creation of a new layer that gave more 'weight' to areas that could potentially create ponding or pooling of water along these three

criteria: 1) areas that have low-slope; 2) areas with limited soil infiltration; and 3) more impermeable surfaces, such as parking lots, roads, and sidewalks (Map 8). The Weighted Overlay tool helps solve a multi-criteria problem (criteria such as soil, slope, and permeable surface ratings) by re-classifying values into a common evaluation scale based on 'weighted' parameters.[12]

To enhance the accuracy of this data analysis, we discussed the Stormwater Susceptibility map with City and Luther students to help determine where relevant storm drain retrofits could take place. We also integrated the public input gathered during the November 14th Community Meeting and the results from the online and paper survey. We designed a survey consisting of 20 questions to identify problem areas and solutions for stormwater management in Decorah. The survey was distributed in paper form at the community open house on November 14, 2014, online (from November 14 to December 5, 2014) via the City of Decorah's Facebook page, the City Manager's email contact list, and decorahnews.com.

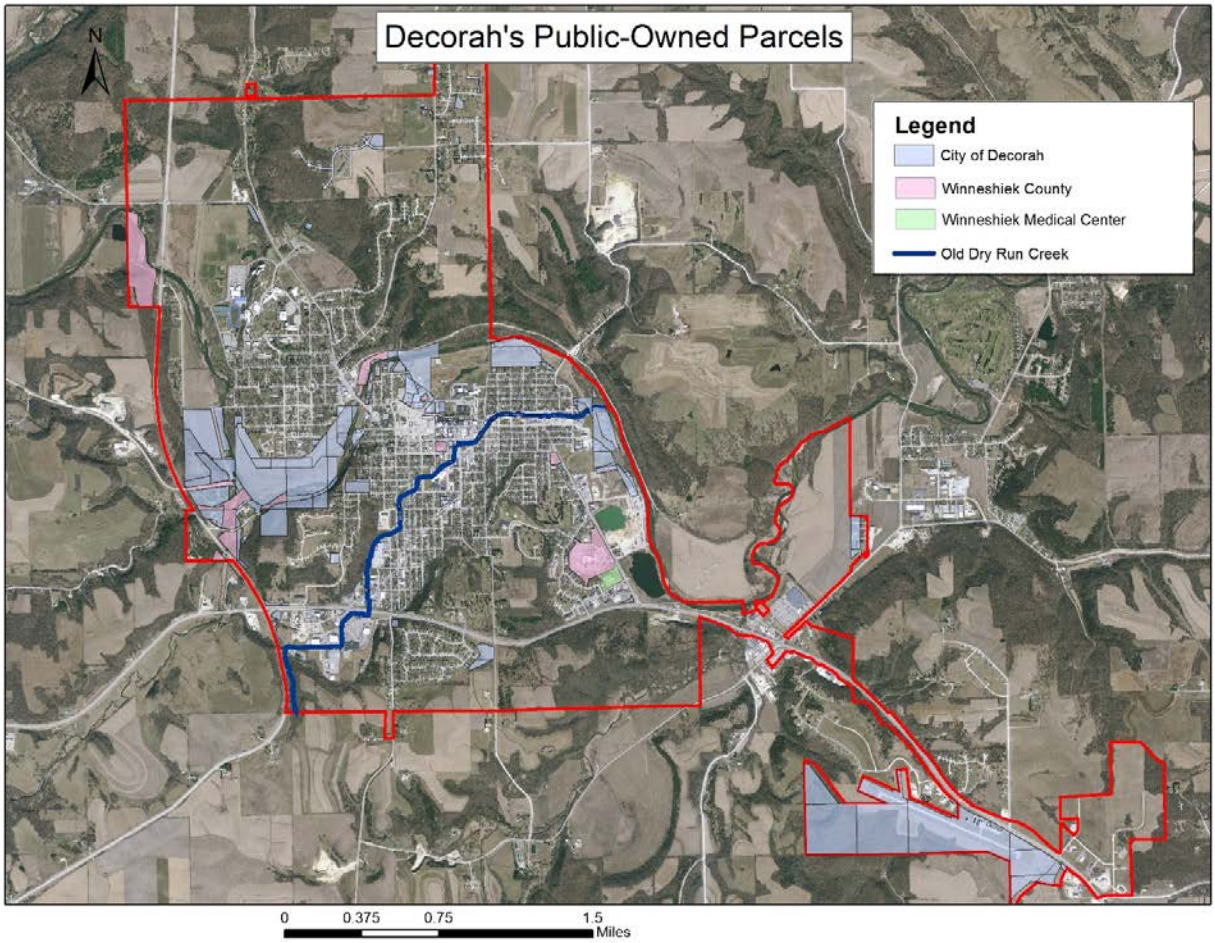
Map 9 Community members and city staff input results for locating susceptible stormwater areas.



All citizen and city staff input were manually translated to the corresponding area in ArcGIS to create a visual representation of all reported susceptible stormwater areas (Map 9).

[12] More specifically, each cell in a given raster layer was categorized and multiplied by weight of importance, with 'one' being the least desirable characteristics (low soil permeability, low slope, and a high percentage of impermeability) and 'nine' equating more desirable characteristics.

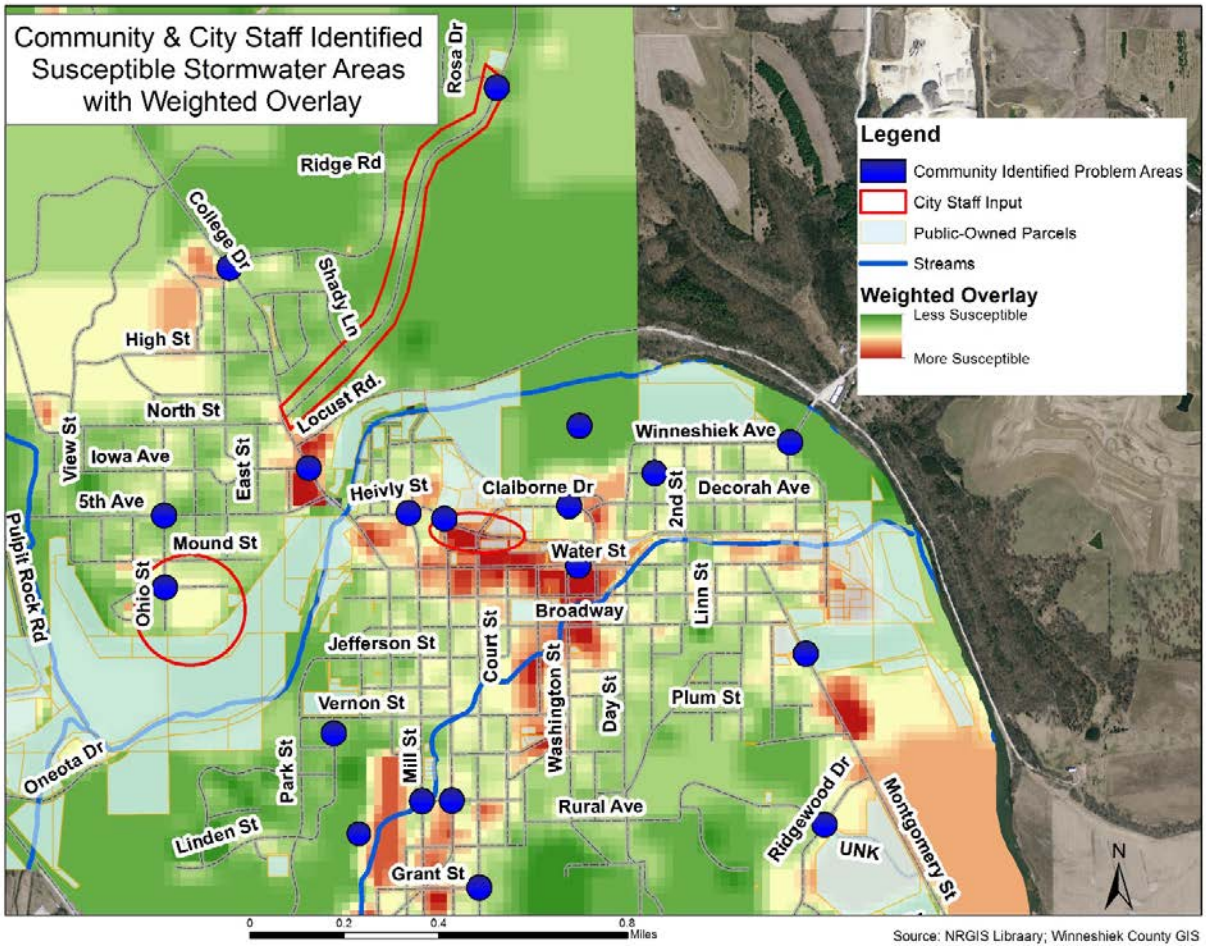
Map 10 Decorah's publicly-owned property

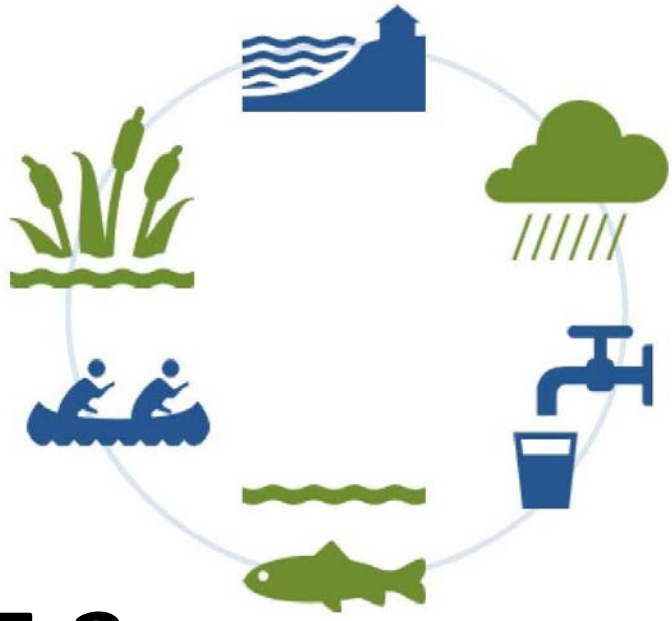


In order to address the previously identified stormwater runoff issues, priority will be given to areas located near public-owned property, where stormwater BMPs could be implemented. Utilizing ArcGIS, we created a map of the parcels owned by the City of Decorah and Winneshiek County (Map 10).

Aggregating all of the information into one map (City Staff & community input, susceptible stormwater areas, and publicly-owned land), a visual guide was created that assisted us in directing our stormwater management plan (Map 11). This map identifies where stormwater is likely to pond and create stormwater issues, verifies the remotely-derived spatial analysis, and indicates where publicly-owned areas can enable prioritization of stormwater BMPs. The next step in this analysis discusses the resultant stormwater mitigation areas where BMPs can be implemented for improved stormwater infiltration.

Map 11 All aggregated data highlights areas where stormwater ponding is likely and where publicly-owned property lends itself to prioritized BMP implementation.





PART 3

MANAGEMENT STRATEGY

CHAPTER 1

MITIGATION AREAS

STORMWATER MITIGATION STRATEGIES

Once the Susceptible Stormwater Areas were identified and subsequent community information was incorporated, we generated Stormwater Mitigation Strategies. The strategies were developed based on 1) best feasible locations for mitigation and 2) Best Management Practices (BMPs) for each location. BMPs were selected based on their infiltration, filtration, and pollutant removal potential as determined by the Stormwater Management Manual of the Iowa Department of Natural Resources.[1] A decision matrix for to determining which BMPs should be selected for a potential site is included in Appendix D.

IDENTIFYING LOCATIONS/ SITES FOR STORMWATER MITIGATION

Given the Susceptible Stormwater Areas identified, we identified five locations/sites where stormwater management practices could be implemented to have the greatest infiltration and contaminant removal impacts:

1. Sites uphill, upstream, or on-site of previously identified Susceptible Stormwater Areas
2. Sites where stormwater infrastructure can be retrofitted to include best management practices
3. Sites with sufficient publicly-owned space for BMP implementation, including right-of-ways

SELECTING BEST MANAGEMENT PRACTICES

The criteria for selecting specific stormwater management practices were based on public preferences expressed in the community survey and public meetings and the professional expertise of urban conservationists from the Iowa Department of Agriculture and Land Stewardship, Winneshiek County Soil and Water Conservation District personnel, and staff from the Northeast Iowa Resource Conservation & Development office.

The criteria for selecting stormwater mitigation sites and practices are:

1. Size of Area. The type of best management practice is constrained by the square footage of the site.
2. Stormwater Infrastructure. For some practices, the sites should be located near infrastructure, such as curb cut-in bioretention practices that infiltrate stormwater prior to its entry into an existing storm drain. In the absence of infrastructure, a practice can be located uphill or upstream of the problem area to capture and infiltrate runoff and avoid accumulation downhill.
3. Slope Characteristics. Certain practices are more effective in higher or lower-sloped landscapes. Rain gardens are best suited for lower-sloped or flat surfaces and bioswales are more commonly used on higher-sloped land.

[1] IDNR. Stormwater Management Manual. http://www.iowadnr.gov/Environment/WaterQuality/WatershedImprovement/WatershedBasics/Stormwater/StormwaterManual.aspx

4. Visibility. Some mitigation sites may be located in or adjacent to highly trafficked areas, such as roads, playgrounds or parks. These sites could serve as long-term educational opportunities highlighting the presence and value of stormwater mitigation. These sites require additional aesthetic considerations.
5. Budget. The cost of each project is considered to recommend feasible and financially responsible funding strategies. In order to calculate the cost of each practice, we used the Center for Neighborhood Technology's (CNT) "Green Values National Stormwater Calculator" that is recommended by the EPA. For each BMP installed at a particular site, this tool calculated 1) the percentage decrease in site impermeability; 2) the percentage of captured runoff; and 3) the percentage change in construction and maintenance costs based on the total life-cycle of the practice.[2]
6. Old Dry Run Creek flows through much of Decorah's urban center, therefore it should be seen as an amenity that provides the vital environmental service of conveying stormwater away. Therefore, we focus our analysis on proposing a comprehensive maintenance strategy that includes the city acquiring a 10-foot area on each side of the creek. This will allow the city to have an organized maintenance plan aimed at stream bank re-naturalization and stabilization.

PUBLIC PROJECTS

The following public projects are those we have selected for prioritized implementation. These projects are an essential part of the mitigation plan that focuses on establishing stormwater BMPs in areas where runoff can be infiltrated on-site. This will improve stormwater quality and water quantity.

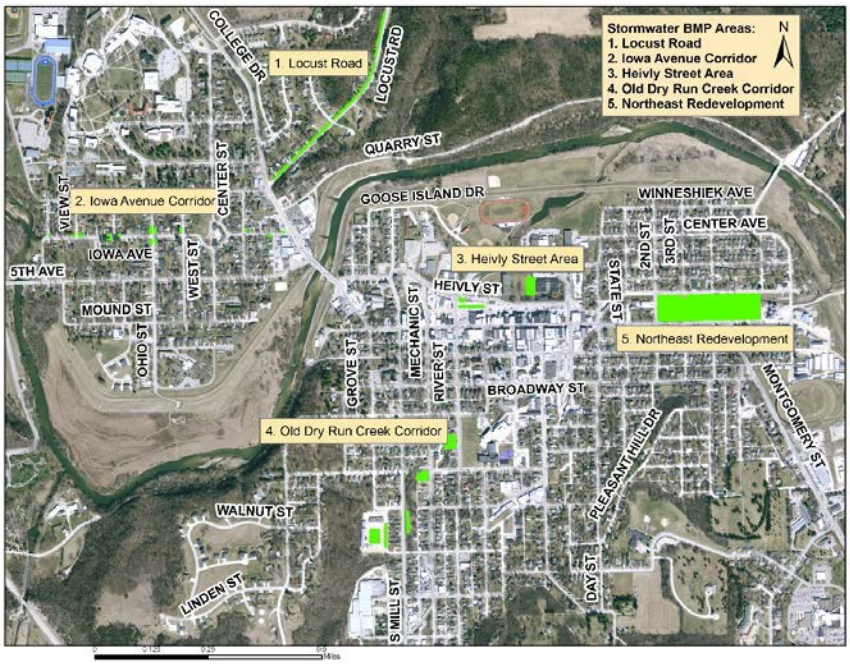
We separately address these five areas (Map 12):

1. Locust Road
2. Iowa Avenue Corridor
3. Heivly Street Area
4. Old Dry Run Creek Corridor
5. Northeast Redevelopment

Each of these public projects incorporated extensive spatial analysis as well as on-the-ground vetting in order to provide the most accurate solutions for Decorah's stormwater runoff issues. Each subsequent section leads with a project description, specific recommendations, infiltration information, cost estimates, and proposed timeline.

[2] The CNT calculator, "compares green infrastructure (commonly referred to as Low Impact Development) performance, costs, and benefits to conventional stormwater practices". (National Green Values Calculator Methodology, http://greenvalues.cnt.org/national/downloads/methodology.pdf)

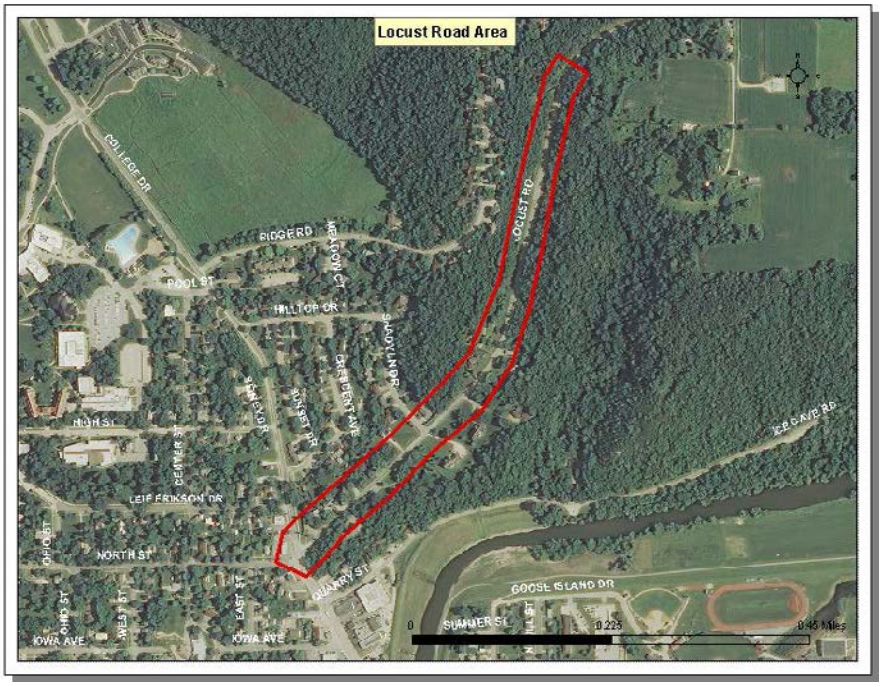
Map 12: Public projects provide stormwater mitigation solutions



1 LOCUST ROAD – BIOSWALES

Locust Road runs north to south between College Avenue and Laurel Drive (Figure 24). The Decorah City Council Street Committee is currently investigating a Capital Improvements Project that would amend the road surface as well as install a sidewalk/trail. A former county highway, this road is in need of extensive remediation to bring it up to city code and does not currently have stormwater infrastructure located alongside the road. We recommend that the city install a bioswale along the western side of Locust Road with curb cut-ins and dam checks.

Figure 24 Locust Road Area



Recommendation: Install curb cut-in bioswales in-line with the proposed stormwater infrastructure along Locust Rd.

Locust Road is a gradually sloping road with 10-15 foot public right-of-ways, which make it ideal for the implementation of bioswales. This plan proposes the placement of bioswales between the roadway and the sidewalk on the western side of Locust Road with curb cut-ins (Figure 25). The eastern side of the Locust Road has highly sloped ridges and established trees that make it less ideal for installing the bioswale practice. The design of the curb cut-ins act similarly to traditional curb and gutter applications; but diverted to the bioswales instead of letting it flow down to the stormwater intake at the bottom of the hill.

In addition to the curb cut-ins, the installation of rock dam checks will decrease water flow and increase infiltration time. This practice will reduce the runoff rate and remove heavy metals, nutrients, and fine sediments from the stormwater before it reaches the Upper Iowa River. The use of native plants will increase the capacity for the practice to infiltrate water given their long root structures.

Figure 25 Locust Road bioswale section from Shady Lane to College Drive.

BMP Practice: Bioswales

Bioswales are conveyance channels engineered to capture and treat the water quality volume for a drainage area (Figure 26[3]). Berms and/or check dams are installed perpendicular to the flow path promote settling and infiltration. [4] Bioswales are noted for their ability to infiltrate suspended solids often found on top of the roadway surfaces and their efficient filtration of metals (figure 27[5]).

Figure 26 Bioswale cross-section to highlight the details of this practice.

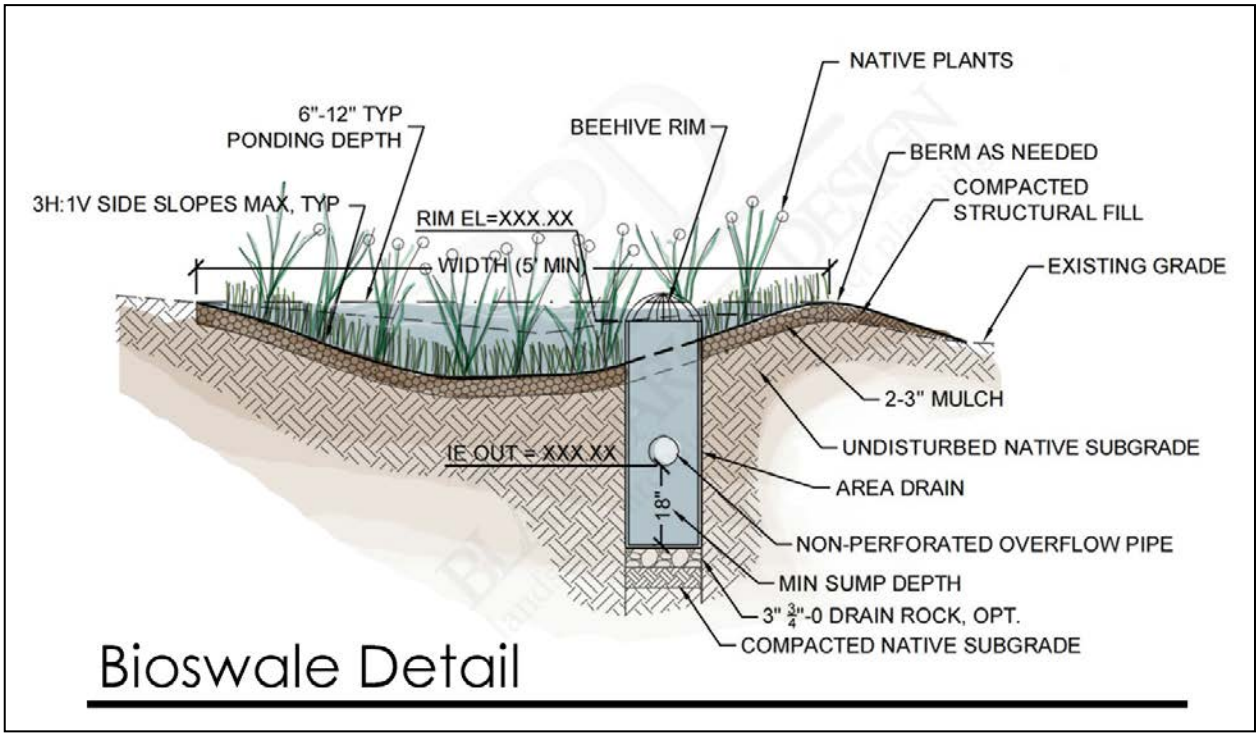


Figure 27 Picture of dam checks alongside a road. This slows stormwater runoff in order to maximize infiltration capacity.

[3] http://www.blairparkerdesign.com/wordpress/sustainable-site-design/

[4] Iowa Stormwater Management Manual. Section 2E-5 Bioswales. Ibid.

[5] http://www.esf.edu/ere/endreny/GICalculator/BioswaleIntro.html

Table 6 Infiltration benefits for installing bioswales per the Iowa Stormwater Management Manual.

INFILTRATION BENEFITS			
LOW=<30% **MEDIUM**=30-65% **HIGH**= 65-100%			
	Low	Medium	High
Suspended Solids			X
Nitrogen	X	X	
Phosphorous	X		
Metals			X
Bacteriological	*	*	*
Hydrocarbons	*	*	*

* Insufficient Data

Expected infiltration impacts

On average practices impacted each site by: decreasing site impermeability by 14.3%, increasing captured runoff percentages by a factor of 8 times the original ability to infiltrate stormwater if the bioswale were not there.

Estimated Project Cost: The Iowa Roadway Living Trust Grant

Projected Timeline: Years 2-4

Figure 28 Locust Rd. rendering with bioswale and dam checks located in between the proposed train and roadway. Source: Huyen Lee

IOWA AVENUE – BIORETENTION CELLS/RAINGARDENS

The Iowa Avenue area is located on the north side of Decorah and across the Upper Iowa River. This area is characterized by residential houses, both single family and multi-family in nature. Iowa Avenue runs east to west from College Ave. to Riverview Dr. The area to the south gently slopes toward the levee and Upper Iowa River, with storm drain inlets located on both sides of Iowa Ave. The stormwater infrastructure located underneath this street collects stormwater and carries it to the east, linking up with larger pipes that run alongside College Dr. and eventually drain to the river. This site is ideal for implementing bioretention cells with curb cut-ins to allow stormwater to infiltrate and remediate roadside pollutants before draining into the storm drain. There are 15 bioretention cells that are recommended for this area, based on our stormwater mitigation analysis (Figure 29).

Figure 19 Iowa Avenue Corridor bioretention cells.

Recommendation: Install curb cut-in bioretention cells/raingardens in-line with current stormwater infrastructure along Iowa Avenue.

For this area, we recommend a series of 15 bioretention cells, and more specifically, raingardens. Rain gardens are a subset of practice of bioretention cells which can range from large basins to backyard practices.

BMP Practice: Bio-retention Cells/Rain gardens

Bio-retention Cells/Rain gardens are shallow, landscaped stormwater basins that utilize engineered soils and vegetation to capture and treat stormwater runoff. Runoff may be returned to the conveyance /storm sewer system, or allowed to partially or fully infiltrate into the soil. [6] The Iowa Stormwater Management Manual indicates that bioretention practices, such as raingardens, significantly improve stormwater quality. Table 7 below shows the ability for rain gardens and other forms of bioretention cells to filtrate high levels of metals, bacteria, and hydrocarbons that are typically found in fuel sources or emitted from tailpipes and engine wear. Given the nature of a curb cut-in design, this information highlights the potential benefits for infiltrating stormwater before it is released into a storm drain (Figure 30[7]).

Table 7 Infiltration benefits listed in the Iowa Stormwater Management Manual

INFILTRATION BENEFITS			
LOW=<30% **MEDIUM**=30-65% **HIGH**= 65-100%			
	Low	Medium	High
Suspended Solids		X	
Nitrogen		X	
Phosphorous	X		
Metals		X	X
Bacteriological			X
Hydrocarbons			X

Figure 30 Curb cut-ins direct the stormwater flow into the bioretention cell for infiltration before being directed into the storm drain located sub-surface.

Expected infiltration impacts

- On average, practices impact each site by: decreasing site impermeability by 1.7%, increasing captured runoff percentages by 79.5%

Estimated Project Cost for 15 bioretention cells/raingardens: $148,312*

Projected Timeline: Years 4 to 7

*Does not include cost of in-line connection to existing infrastructure

#3 HEIVLY STREET – BIORETENTION CELLS AND PERMEABLE PAVEMENT

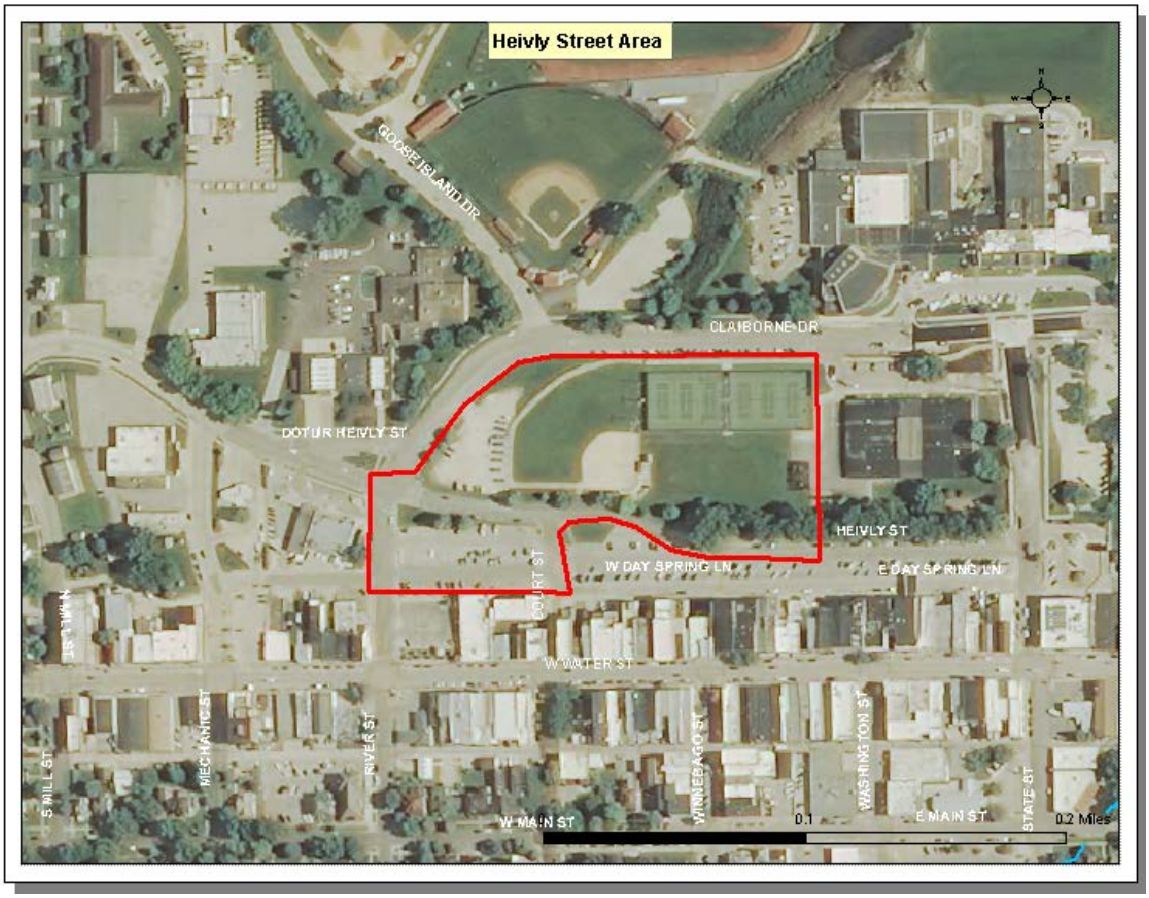
The Heivly Street area encompasses all of Heivly Street from N. Mechanic Street to Court Street, including the parking lots and right-of-ways along the street and the proposed

[6] Iowa Stormwater Management Manual. Section 2D-3-BMP Types and Applications. http://www.iowadnr.gov/Environment/WaterQuality/WatershedImprovement/WatershedBasics/Stormwater/StormwaterManual.aspx

[7] http://www.6sqft.com/2000-more-bioswales-will-help-nyc-absorb-stormwater/

elementary school site to the north (Figure 31). This area is primarily impervious surfaces and, as a result, has significant problems with stormwater ponding and carries stormwater pollutants into the wetlands near Decorah High School. The area of Heivly Street located near the Viking Theater experiences some of the most significant ponding problems due to inadequate hard infrastructure. This will require hard infrastructure solutions and capital improvements. On the remaining areas of Heivly Street there is the opportunity to use soft infrastructure practices like permeable paving and bioretention cells that infiltrate stormwater runoff, minimize ponding and stop pollutants from reaching the wetland.

Figure 21: Heivly Street Area



Recommendation: Introduce a "parking lot diet" to the parking lot located west of River Street and south of Heivly Street that includes a bio-strip.

The public parking lot adjacent to Heivly Street (below the Oneota Food Coop) is a public lot with a large amount of impervious surface. We recommend a "parking lot diet" be incorporated in planned improvements on Heivly Street by reorienting parking spaces and implementing infiltration practices to capture stormwater runoff before it hits Heivly Street. The parking lot diet would be similar to road diets, where the number of lanes are reduced to accommodate a median, bike lanes, or parking. This would include modifying the two parking lot driving lanes to be one-way, creating diagonal instead of vertical parking spaces, and installing a filter strip between the center facing parking stalls. The one-way lanes and vertical parking spaces provide for the same number of parking spaces as before while also creating a space for an infiltration strip in the middle of the parking lot. We also recommend that the city install a large bioswale on the wide green space

between the bottom of the parking lot and the Heivly Street curb as a second stormwater catchment area after the filter strip to reduce pooling on Heivly Street. The bioswale can be landscaped with short but attractive native plantings that adhere to city street viewing requirements and are aesthetically appealing.

Recommendation: Install a bioswale on the southeastern corner of River Street and Heivly Street.

The corner of River Street and Heivly Street has a relatively large amount of underutilized grass space that would be a good location for a bioswale. We recommend implementing a swale approximately 2,000 square feet in size that would infiltrate stormwater running off the River Street hill. This bioswale is estimated to infiltrate approximately 6.77 times as much stormwater runoff as conventional practices.

Recommendation: Cost-share with the Decorah Community School District to install onsite stormwater management practices at the new John Cline Elementary School location on Heivly Street.

John Cline Elementary School is planning to relocate from its current site immediately west where the existing baseball diamonds are located. When the school is built, the City should work with the school district to ensure that stormwater management practices are included onsite of the school to capture water created by the addition of impervious surfaces at the school itself and the land uses uphill of the school. Recommended practices include the installation of a permeable paver parking lot, a bioretention cell demonstration site, a green roof, and native prairie landscaping.

BMP Practice: Permeable Pavement Systems

Figure 32 : Permeable pavement system

Permeable pavement systems are designed for impervious surfaces such as parking lot infrastructure (Figure 32[8]). With permeable pavers, large areas can absorb many of the metals and suspended solids emitted from cars and trucks (Table 8). Some studies have shown that interlocking concrete blocks can reduce stormwater runoff pollutants such as nitrite, phosphorous, metals and ammonium.[9] Additionally, Section 2J-1 of the Iowa Stormwater Management Manual indicates that permeable pavement systems can have a beneficial impact on cold water streams, "Permeable pavement can help lower high stormwater runoff temperatures commonly associated with impervious surfaces. Stormwater pools on the surface of conventional pavement, where it is heated by the sun and the hot pavement surface. By rapidly infiltrating rainfall, permeable pavement reduces stormwater exposure to sun and heat".[10]

8 http://chesapeakestormwater.net/training-library/stormwater-bmps/permeable-pavers/

9 James, W., 2002: Green roads: Research into Permeable Pavers. *Stormwater*, (March/April), 48-50.

10 Ibid. Page 4.

Table 8 Infiltration benefits for permeable paver systems.

INFILTRATION BENEFITS			
LOW=<30% **MEDIUM**=30-65% **HIGH**= 65-100%			
	Low	Medium	High
Suspended Solids			X
Nitrogen			X
Phosphorous		X	
Metals			X
Pathogens		X	

BMP Practice: Filter Strips

As a vegetated practice, filter strips provide bio-filtering of stormwater runoff as it is slowed down across the surface of the vegetation (figure 33 [11]). Typically, this practice is used to manage runoff from residential sites, parking areas, and adjacent to paved roadways. It is best to incorporate this practice with other practices in order to maximize their effectiveness.[12]

Figure 33 Image of a bioswale adjacent to a roadway to infiltrate the stormwater runoff.

Table 9 shows the effectiveness of installing filter strips to mitigate suspended solids, metals, and some nutrients from draining into the storm drain pipes directly.

Table 9 Infiltration benefits for filter strips.

INFILTRATION BENEFITS			
Low<30% **Medium**= 30-65% **High=** 65-100%			
	Low	Medium	High
Suspended Solids			X
Nitrogen	X	X	
Phosphorous	X		
Metals			X

Expected infiltration impacts:

- On average practices impacted each site by: decreasing site impermeability by 29.6%, increasing captured runoff percentages by a factor of 21 times more effective than without the practices in place.

[11] http://www.rhynelandscape.com/ projects/community-college-landscape/

[12] ISMM. Part 2D. BMP Types and Applications. *Vegetated Practices.* Ibid.

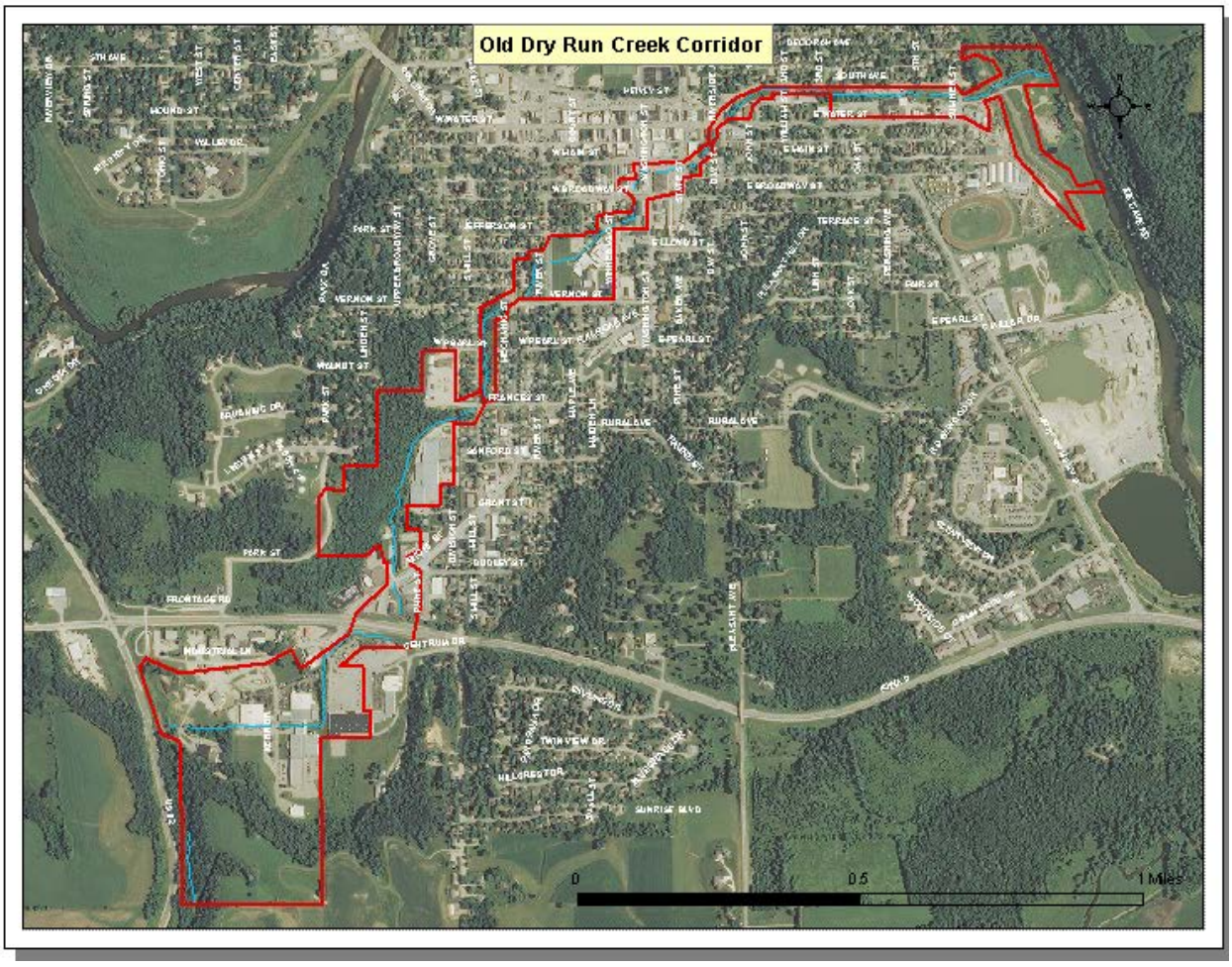
Estimated Project Cost: $74,100

Projected Timeline: Year 8

OLD DRY RUN CREEK CORRIDOR – PAVER SYSTEMS, BIORETENTION, AND FILTER STRIPS

The Old Dry Run Creek Corridor (Figure 34) describes the approximately 2.8 miles of Old Dry Run Creek that runs through Decorah and the properties immediately adjacent to it. Old Dry Run Creek serves both as a natural drainage way for many of Decorah's sub-watersheds and as a feature that integrates nature into the urban areas of Decorah. The creek therefore provides many environmental, recreational, and aesthetic benefits to the city. In order to protect this natural resource and to truly make it an amenity to the community, maintenance of Old Dry Run Creek and the areas surrounding it is required, as well as access to the stream for Decorah residents.

Figure 33: Old Dry Run Creek Corridor



Recommendation: Voluntarily acquire the stream zones along Old Dry Run Creek.

In order to have consistent and thorough maintenance of the creek, we recommend that the City acquire Old Dry Run Creek and land on either side of the creek, called the stream zone. We generally recommend that the City acquire 10 feet of land on each side of the stream, but the City should identify on a parcel-by-parcel basis how much land is adequate to perform routine

maintenance. Acquisition should only be done with the voluntary consent of the landowners and with full compensation for the appraised value of the land to be acquired.

In addition to maintenance, stream zone acquisition will allow public access to the stream. Old Dry Run Creek is a beautiful natural feature in the heart of Decorah and should be treated as an amenity to the community. All stream zones acquired by the City along Old Dry Run Creek for maintenance will also allow public access.

BMP Practice:

Uniform Stream Bank Management/ Establishing Riparian Buffer

According to the Iowa Stormwater Management Manual, riparian buffer strips consist of vegetation that grows along the stream (Figure 35[13]). These areas may be constructed with engineered materials or with natural vegetation (Figure 36[14]). Riparian buffers are generally located perpendicular to the stream flow.

Figure 34 Example of a stream bank riparian buffer zone.

[13] http://www.fondriest.com/news/data-shows-urban-stream-restorations-fall-short-water-quality-goals.htm

[14] http://www.pwconserve.org/graphics/places/restoration_cloverdale_0104.jpg

Figure 35 A riparian buffer can also be constructed out of engineered materials as shown here.

Recommendation: Voluntarily obtain maintenance easements on at least 10 feet of land on each side of Old Dry Run Creek when land acquisition is not a viable option.

If landowners are not amenable to stream zone acquisition, we recommend that the City obtain rights to the land through a maintenance easement that would allow the City to do routine maintenance to the stream but still allow the landowner's to retain all other rights to their properties. Similarly to land acquisition, we recommend at least a 10-foot easement on each side of the stream, voluntary landowner consent, and full compensation based on appraisal.

Recommendation: Acquire Priority 1 Access Areas within the first year of implementing a stormwater utility fee and Priority 2 Access Areas within five years of implementing a stormwater utility fee.

We recommend that stream zone be acquired to allow for City maintenance and public access. We recommend that stream zones identified as Priority 1 be acquired within the first year of implementing the stormwater utility fee and Priority 2 stream zones acquired within five years of fee implementation.

Recommendation: Acquire the properties in the Old Dry Run Creek Corridor located in areas designated for pocket parks for use as public open space.

In addition to the 10-foot buffer on each side of the stream required for maintenance, we recommend that the City also acquire the properties identified in the map below to allow for the creation of community open space (Figure 37). The proposed open space recommendations are detailed below in the recommendations for pocket parks.

Figure 36: Pocket Park Locations

Recommendation: Develop a community park located on Mechanic Street and River Street in the Old Dry Run Creek Corridor.

Pocket parks are small areas of open space that are intended to serve residents of the neighborhoods surrounding them. We recommend the establishment of two pocket parks in the Old Dry Run Creek Corridor – one located on Mechanic Street and one located on River Street across from Decorah Middle School. These parks would include features like benches and walking paths, as well as bioretention cells along the creek that would both infiltrate stormwater and be aesthetically pleasing (Figure 38[15]). The park located on Mechanic Street would be approximately 46,800 square feet in size and and the park on River Street would be approximately 115,920 square feet in size. These parks will open up the creek and allow the community to learn about stormwater and appreciate this natural amenity flowing through their urban neighborhoods.

[15] http://moodle.dasd.org/file.php/41/wcp-fishing-deck-6-24-2005-_1_.jpg

Figure 37: A deck leading out to a stream is an inviting pocket park that provides access to the waterway and a relaxing view.

Recommendation: Encourage private commercial landowners in the Old Dry Run Creek Corridor to apply for cost-share funding to implement permeable paver parking lots.

Many of the areas along the Old Dry Run Creek Corridor are commercial areas with impervious paved surfaces, particularly parking lots (Figure 39[16]). Due to the proximity of these impervious surfaces to Old Dry Run Creek, it is very easy for stormwater to runoff from these surfaces into the stream, carrying with it pollutants from cars and other sources. We recommend that the City encourage private commercial landowners along the Corridor to apply for cost-share funding to remove their existing parking lots and replace them with permeable paving. Permeable paving would allow for greater infiltration of stormwater, thus minimizing runoff into Old Dry Run Creek. Landowners who apply permeable paving to their properties could qualify for a reduction of their stormwater utility fee.[17]

Figure 38 Permeable paver parking lot.

[16] http://farm7.static.flickr.com/6114/7018798371_d83119728f_m.jpg

[17] See Part 2- Chapter 3. Recommendations, Utility Fee to learn more about fee exemptions.

Recommendation: Restore and re-naturalize the stream banks along Old Dry Run Creek.

In addition to routine maintenance, the City should perform a one-time complete restoration of the entire length of the stream. This would include methods to stabilize stream banks, planting of vegetated buffers around the stream, and removal of debris from the water and surrounding riparian zone. Stabilizing of stream banks will help to prevent future erosion, particularly should flooding situations occur due to heavy rains and increased stormwater runoff. The installation of vegetated buffers around the stream will protect the stream from runoff from surrounding land uses. Some of the areas identified as Priority 1 Access Areas would be ideal locations for stream buffers due to the potential pollution caused by surrounding land uses.

Recommendation: Perform routine maintenance on Old Dry Run Creek.

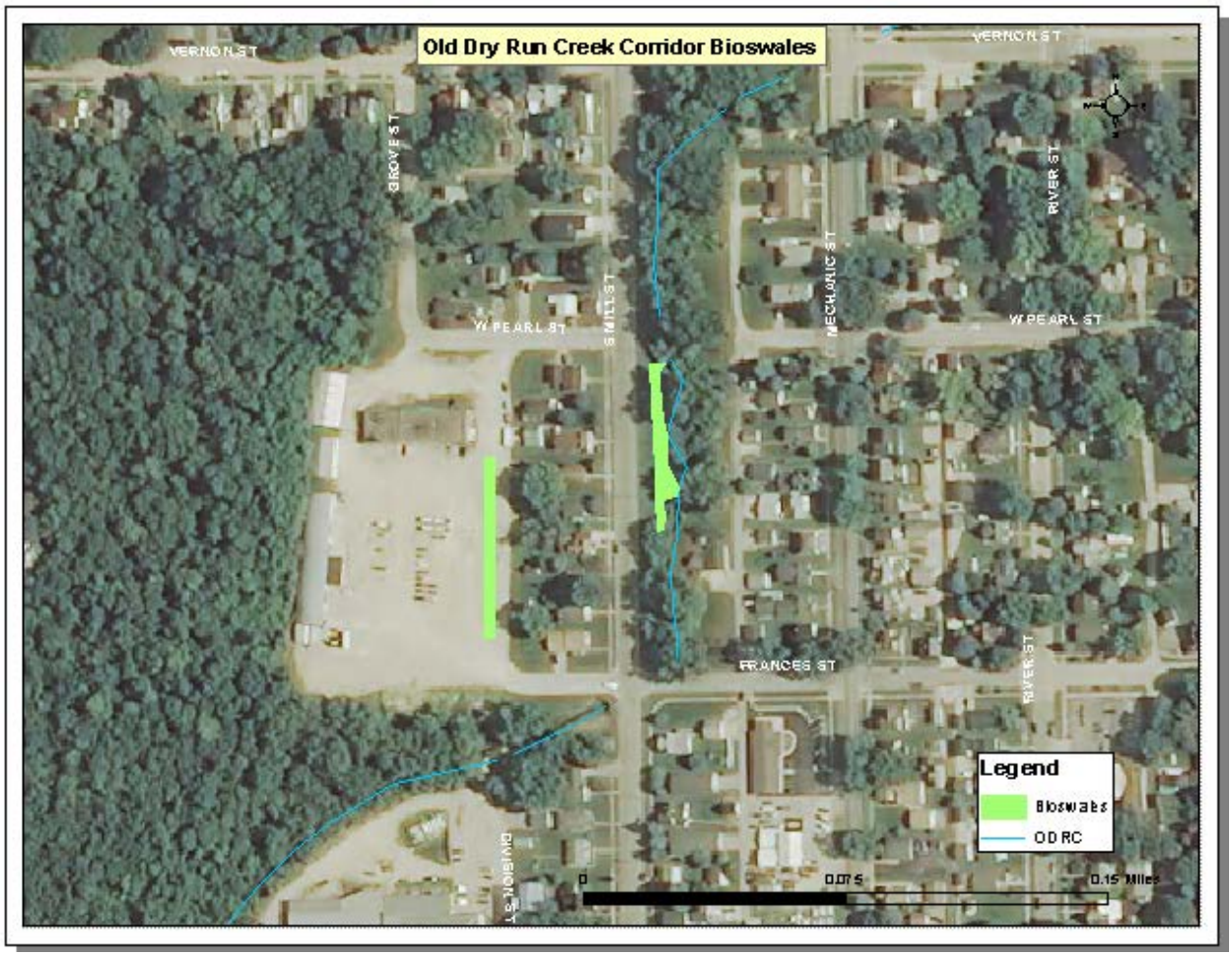
Maintaining Old Dry Run Creek requires clearing of fallen debris, preventing erosion from stream banks, and repairing retaining walls and culverts. In some cases, maintenance may even include deconstruction of retaining walls and other engineered practices in favor of re-naturalizing of the stream and the slopes surrounding it. Once the stream zone is acquired or easements obtained, the City should perform routine maintenance to prevent erosion, minimize blockages, repair retaining walls, etc.

Recommendation: Install a bioswale at the alley south of Pearl Street and west of Mill Street, and along Old Dry Run Creek along Mill Street.

We recommend placing a bioswale between the parking lot located at 707 S. Mill Street and the alley located south of Pearl Street and west of Mill Street. Property owners to the west of the alley have reported severe ponding in their yards despite stormwater infrastructure being present on the site. Installing a bioswale strip would help to capture some of the stormwater runoff. This bioswale is recommended to be approximately 3,900 square feet in size which would infiltrate 13.76 times as much runoff as conventional practices.

We also recommend installing a bioswale (Figure 40) along the length of the west side of Old Dry Run Creek along Mill Street north of Frances Street. There is currently no development immediately adjacent to the creek along the west side of the creek, and thus there is ample room for implementing a bioswale that would capture and infiltrate stormwater before it enters the stream. The bioswale is recommended to be approximately 4,500 square feet in size and infiltrate 5.68 times as much runoff as conventional practices.

Figure 40: ODRC Bioswale



Expected infiltration impacts

On average practices impacted each site by: *decreasing* site impermeability by 10.7%, *increasing* captured runoff percentages by 972.5%,

Estimated Project Cost: $143,000

Projected Timeline: Years 1 to 4

STREAM ZONE ACCESS

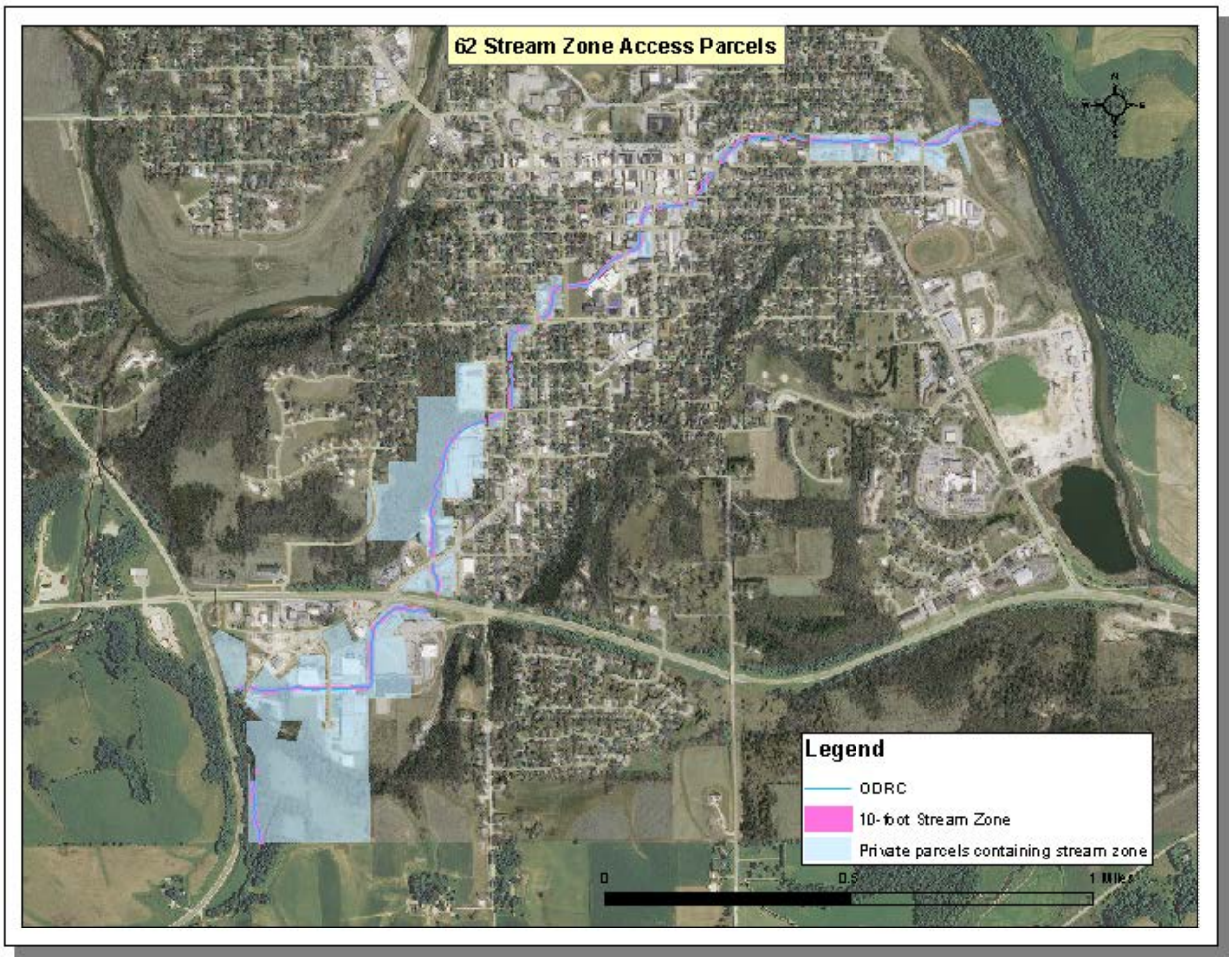
We identified a 10-foot area on both sides of the stream which we refer to as the "stream zone."[18] The 10-foot zone on each side of the stream was determined to be an adequate size for doing routine maintenance of the stream. This determination was verified by the previously discussed RASCAL assessment which reported that 65 percent of the riparian zones along the stream were less than 10 feet wide. On some parcels the 10-foot stream zone may not be sufficient for maintenance or public access due to the topographic or other physical conditions of the property and a wider 10-foot buffer zone may be appropriate. In other cases the features of the property, including vertical retaining walls, may not require a full 10-foot zone. The appropriate width of the

[18] More detailed information on the spatial analysis for determining the stream buffer calculations can be found in Appendix C.

stream zone should be determined on a parcel-by-parcel basis, though 10-feet is a recommended minimum.

The stream zone intersects 92 parcels in Decorah, of which 62 parcels are subject to stream zone acquisition (Figure 41); 30 parcels are already publicly owned.

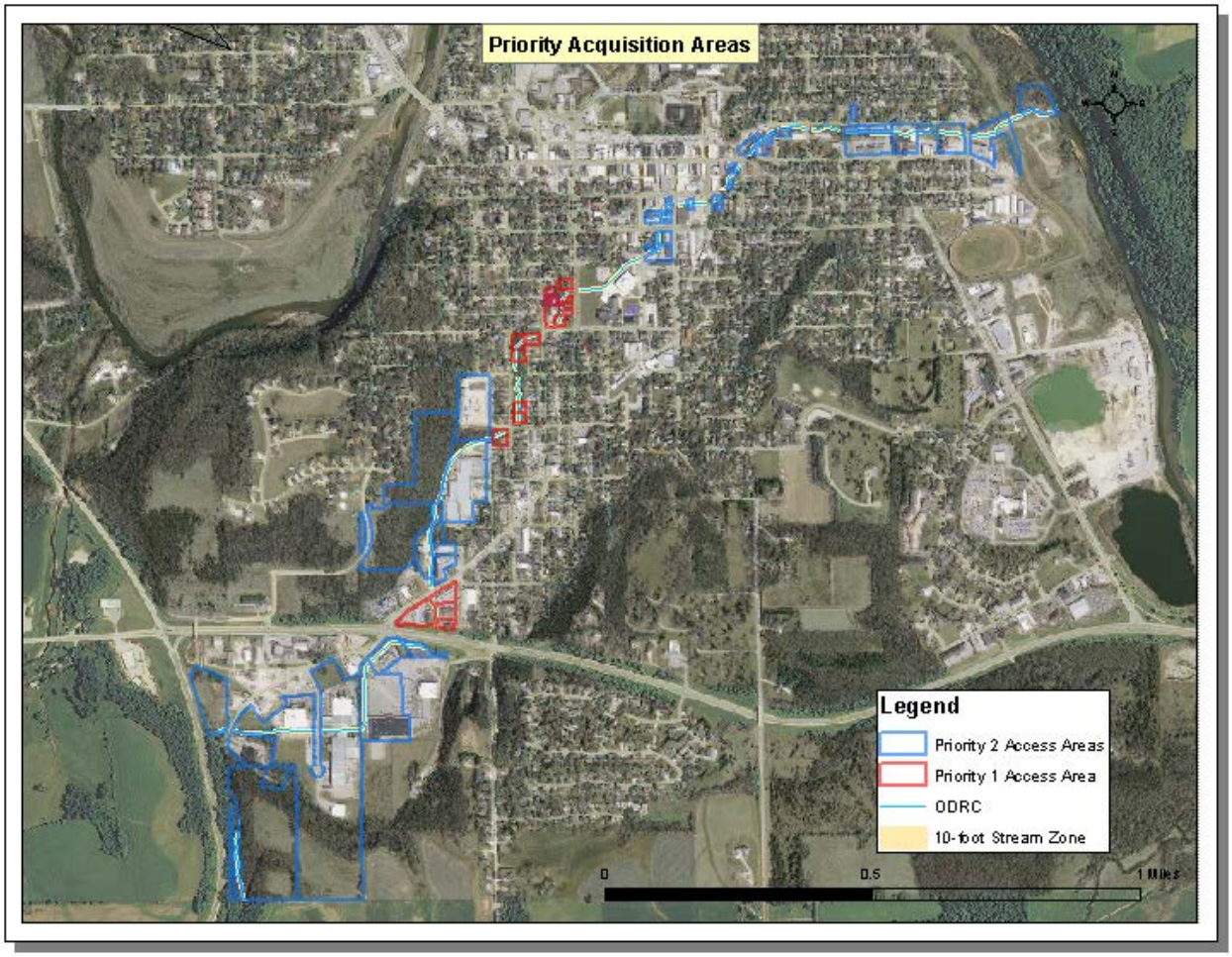
Figure 41: Stream Zone Access Parcels



We also determined priority access areas; Priority 1 Access Areas (Figure 42) are those that should be purchased within the first year of implementing the stormwater utility fee and Priority 2 Access Areas are the remaining portions of Old Dry Run Creek that should be purchased within the first five years of fee implementation. The Priority 1 areas were selected based on the following criteria:

- Adjacency to portions of Old Dry Run Creek already owned by the City
- Appropriate for public open space
- In need of stream buffers from surrounding land uses
- Relative ease of implementing best management practices

Figure 42: Priority Acquisition Areas



The Priority 1 Access Areas include 19 parcels that contain the stream zone and should be acquired in the first year of implementing the stormwater utility fee. The first Priority 1 Area is along Old Dry Run Creek on Mill Street and northwest to River Street. This area already contains publicly-owned portions of the stream and is a good location for public open space and bioretention cells for stormwater infiltration. The second Priority 1 Area is located south of Short Street behind the Kwik Stop Gas Station. This portion of the stream lies between a gas station, car wash, and other commercial uses that could impact water quality in the stream and is a good location for vegetated stream buffers. Priority 1 Access Areas could also include properties not shown on this map if landowners approach the City to have their land voluntarily acquired for the purpose of maintenance.

The Priority 2 Acquisition Areas include the remaining 41 parcels that contain the stream zone. They should be acquired in the first five years of implementing the stormwater utility fee. The acquisition schedule for these parcels should be determined by the City based on stream impairment.

The estimated costs of acquiring the stream zone on all 62 parcels over the next five years is approximately $73,500. The median cost to acquire a stream zone on a given parcel is $360.

The costs of acquiring the stream zone in Priority 1 Access Areas shown in the map above are estimated at approximately $23,150. This figure assumes that the stream zone on two additional properties per year (not indicated in the map above) may be acquired in the first year as Priority 1

at the median cost of $360 per parcel. The estimated costs of acquiring Priority 2 Access Areas is approximately $50,350 (Table 10).

Table 10: Priority Area Costs

	Total Estimated Cost	Number of Parcels
Priority 1 Acquisition Areas	$23,150	19 + 2
Priority 2 Acquisition Areas	$50,350	41
Total	$73,500	62

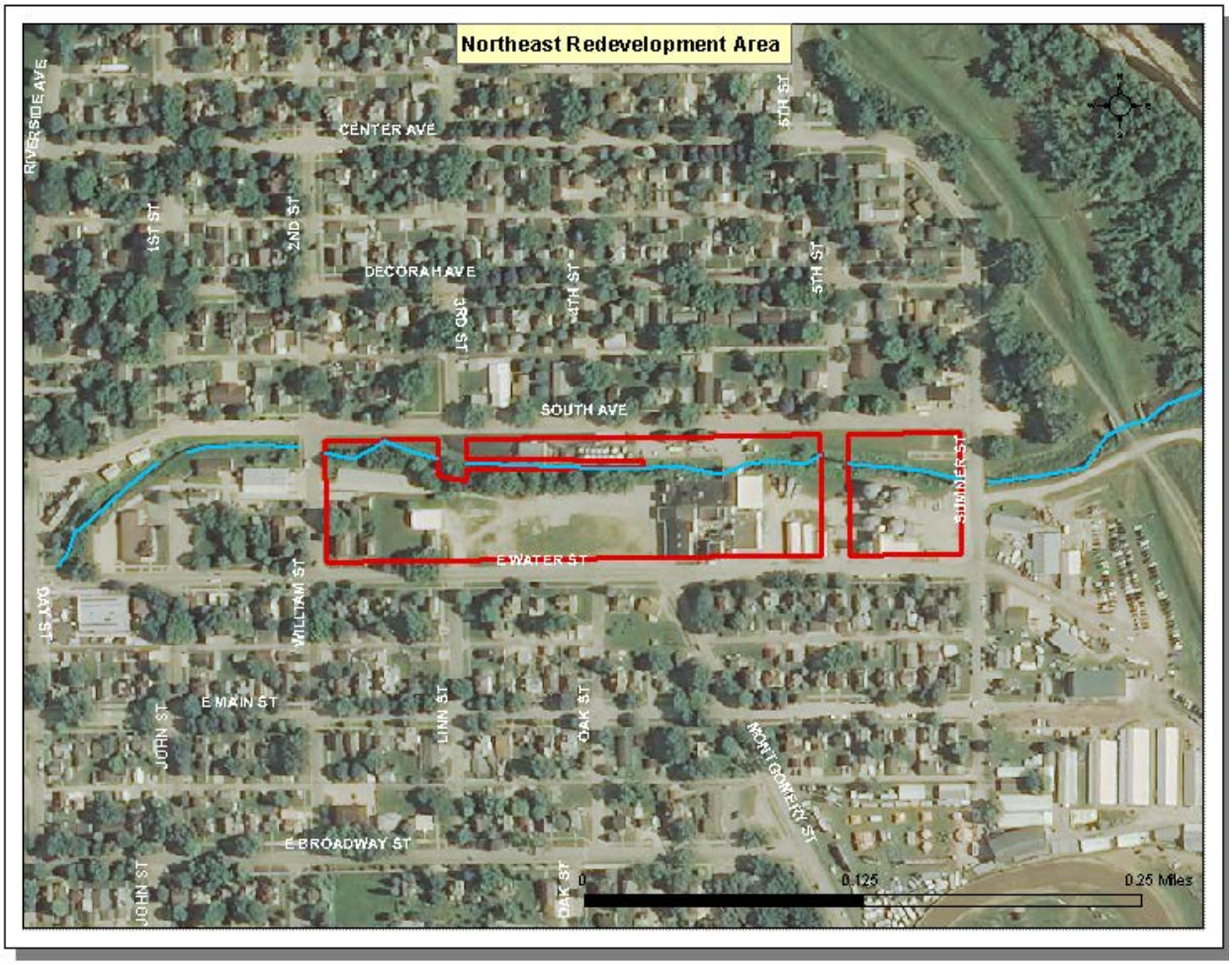
These prices are estimates.[19] Land should be surveyed by a land surveyor and valued by a professional appraiser to find the precise cost of land acquisition. The costs of land surveying are estimated at $800 per parcel. The costs of purchasing easements would be lower than the cost of acquiring the stream access zones. The value of the easements should be calculated by a professional appraiser if the City pursues obtaining easements.

[19] See Part 2 – Management Plans Chapter 1. Methodology for cost calculations for land acquisition.

NORTHEAST REDEVELOPMENT AREA

The Northeast Redevelopment Area is bounded by South Avenue to the north, Sumner Street to the east, Water Street to the south, and 2nd Street to the east with Old Dry Run Creek running through the center of the area (Figure 43). This site currently contains industrial uses, including an old dairy*, that are no longer operating. To make better use of the land along this area, and to be more consistent with the surrounding neighborhoods, the City of Decorah has expressed interest in redeveloping this area. Old Dry Run Creek runs through the center of this proposed redevelopment causing concern for the future of the stream. There are opportunities with new development to prevent stormwater runoff, improving the water quality of the creek and preventing ponding that could be associated with increased impervious surfaces in the new development. Rather than covering the creek or hiding it behind new buildings, Old Dry Run Creek could be highlighted and marketed as a valuable amenity to this area and the entire Decorah community.

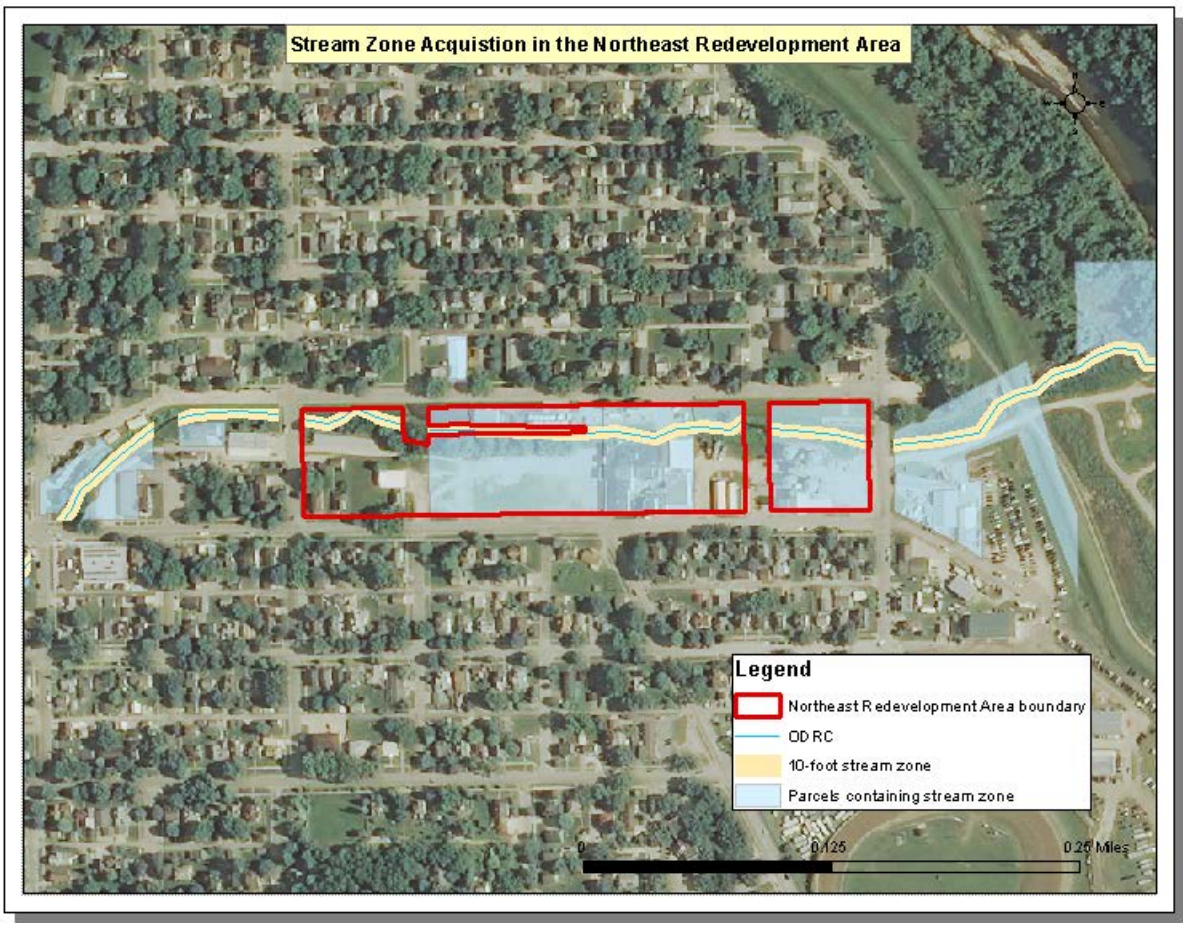
Figure 43 Northeast Redevelopment Area overview.



Recommendation: Use a Conditional Zoning Agreement to require the stream zone be granted to the City for use as public open space when the properties in the Northeast Redevelopment Area are rezoned should no ordinance be in place to require an easement.

Similarly to the rest of the Old Dry Run Creek Corridor, public acquisition and easement obtainment along this section of Old Dry Run Creek is recommended to provide maintenance for and public access to the creek (Figure 44). However, because this area is slated for future redevelopment, the City could obtain a stream buffer easement using a stream buffer easement ordinance. Should an ordinance not be in place at the time of redevelopment of this area, we recommend that the City acquire the stream zone through a condition to the rezoning of the properties rather than purchasing the land around the stream on these properties.[20] Essentially this requirement is for the future developer to grant the land to the City for use as public open space. The City would then assume responsibility for the maintenance of the stream and the surrounding public park space. The stream zones for acquisition in the Northeast Redevelopment Area are Priority 2 Acquisition Areas.[21]

Figure 44 Stream Acquisition Area



[20] Iowa State Code allows Planning and Zoning Commissions and City Councils to require conditions to the approval of rezoning applications with the written consent of the property owner. (reference)

[21] See Part 2 – Chapter 3. Recommendations, Old Dry Run Creek Corridor for more on land acquisition along Old Dry Run Creek.

Recommendation: Extend Trout Run Trail into the urban area of Decorah along Old Dry Run Creek.

Figure 45 An example of a Creekside trail that could be extended to Trout Run Trail.

The Trout Run Trail extends around the border of Decorah along the levy and is located just 400 feet from this site. We recommend extending Trout Run Trail into the urban area of Decorah along Dry Run Creek to approximately 2nd Street. This connection would allow residents living in the neighborhoods near the creek and in the rest of the Decorah community to have an entry point from the city to the trail, figuratively drawing the connection between the urban Old Dry Run Creek and the Upper Iowa River (Figure 45[22]).

Recommendation: Use native plantings to beautify Old Dry Run Creek.

Figure 46 Native plantings provide a quiet respite near a stream.

The portion of these properties north of Old Cry Run Creek is an ideal area for a public park with access to the stream (Figure 46[23]). We also recommend that the creek along this area be restored and that native plantings be implemented to both improve water infiltration and to beautify the area, making it a functional and attractive asset to the Decorah community.

Recommendation: Design new development so as to protect and enhance Old Dry Run Creek.

New development in the Northeast Redevelopment Area should be done in such a way as to emphasize Old Dry Run Creek. The creek is a beautiful natural feature that should be emphasized in this corridor rather than covered and treated as a nuisance. Examples of stream-oriented design could include putting in sidewalks along the stream, installing a pedestrian bridge over the stream, and orienting the fronts of buildings towards the stream to encourage interaction between

[22] http://www.cornellplantations.org/gallery/2383

[23] http://www.lucioledesign.com/blog/wp-content/uploads/2013/05/2307_StreambankFO.jpg

residents and Old Dry Run Creek (Figure 47). The creek should be both protected from the changing land uses and promoted as a natural amenity to the area.

Figure 47A residential development in Iowa City utilizes the natural beauty of the stream as an asset and provides residents direct access. Source: Authors.

Recommendation: Require on-site stormwater infiltration practices for new development.

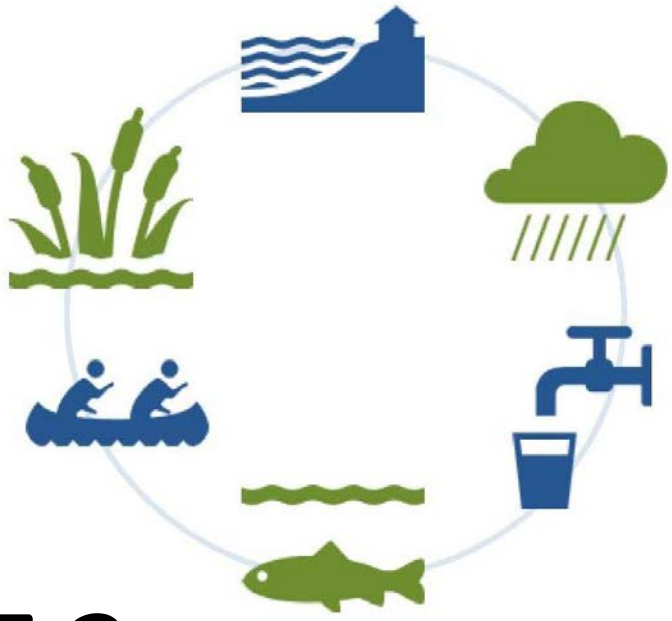
In addition to designing any new development in this area to emphasize Old Dry Run Creek, managing stormwater runoff into the creek should also be a top priority. New development is likely to include increased impervious surfaces, including parking lots and rooftops that will increase the amount of stormwater runoff that could contaminate Old Dry Run Creek. We recommend that future development on these properties include on-site stormwater management methods to infiltrate water before it runs into the creek. These methods could include permeable paver parking lots, rain gardens or bioswales along Water Street, and buffers along Old Dry Run Creek.

Expected infiltration impacts

- We did not calculate infiltration impacts given the uncertain direction of development

Estimated Project Cost: Undetermined

Projected Timeline: Open



PART 3

MANAGEMENT STRATEGY

CHAPTER 2

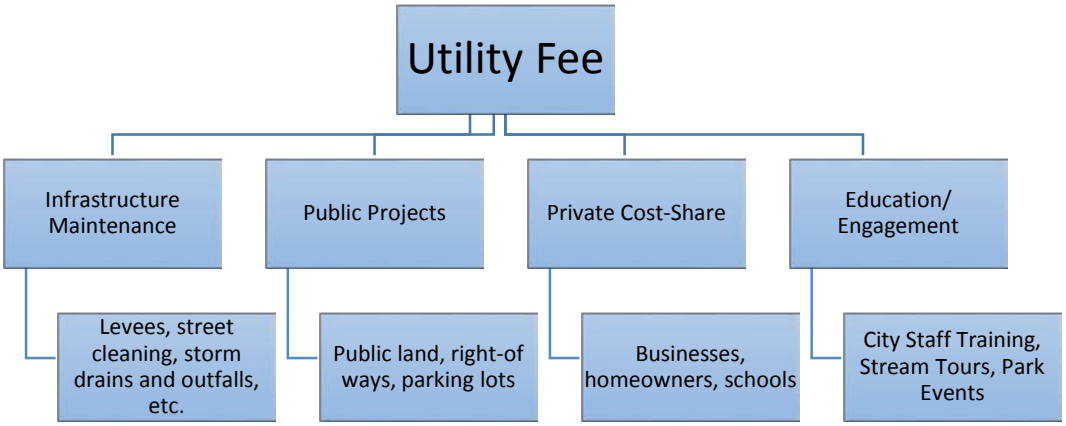
STORMWATER UTILITY FEE

STORMWATER UTILITY FEE RECOMMENDATIONS

Recommendation 1: Adopt a stormwater utility fee following the $5.00 Equivalent Residential Unit (ERU) model provided in the Stormwater Management Plan.

We recommend the Equivalent Residential Unit (ERU) utility model because it is the most feasible administratively and is based on the existing water meter structure broken up by zoning type. Our Utility Fee Survey also indicated that the public was most willing to pay a $5.00 monthly fee. We modeled the fee at $5.00 and concluded that it would be sufficient to generate the necessary funds for maintenance and projects.[1]

Recommendation 2: Allocate generated stormwater funding into four budget components: public stormwater projects, private cost-share, maintenance, and education.



Recommendation: Seek applicable grants as outlined in the Stormwater Management Plan for large-scale projects like those in the Capital Improvements Plan.

Some public stormwater projects will be too large in scope and thus too costly to be funded solely with the stormwater utility fee. We recommend that the City apply for applicable grant funding from the state and federal governments for these large-scale projects.[2]

Recommendation: Provide fee reductions for residents that implement stormwater best management practices on their property based on the criteria outlined in the Stormwater Management Plan.

Decorah residents that implement stormwater best management practices on their private properties contribute to the City's goals of infiltrating stormwater and thus should be able to reduce their monthly utility fee.

Recommendation: Waive the stormwater utility fee for residents that qualify for low-income housing or other social welfare programs.

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1 See Appendix for an example budget with funding generated from the stormwater utility fee.

2 See Part 3 Ch. 2 Utility Fee for more information about available grant funding.

Decorah residents that can prove that they do not have adequate means to pay the monthly stormwater utility fee should be able to have their fee waived.

Recommendation: Distribute private cost-share funding based on availability of funds, a designated funding period, and the number of applicants on a first-come first-serve basis.

We recommend that cost-share funding be included in the stormwater utility fee budget to help private landowners with the costs of implementing stormwater best management practices on their properties.

UTILITY FEES BACKGROUND

Stormwater management can be funded by municipal general funds, but is often low-priority compared to other city services. Stormwater projects receive the most attention and funding after flooding or extreme weather events. Yet, this reactionary approach is unsustainable for cities facing the increasingly frequent and extreme effects of climate change.[3] Relying on general funds is also inequitable since the cost of stormwater management for the impervious areas of private property is not connected to property taxes assessments. Furthermore, many large contributors to stormwater runoff, those with large amounts of impervious area, are often tax-exempt properties, such as schools, churches, and government buildings.[4]

We recommend implementing a stormwater fee in order to correct this inequity of flooding and water quality costs. Stormwater utility fees are very common in Iowa and serve as a sustainable source of funding for municipal projects and cost-share programs. The utility fee should be based on actual impervious area contributions to accurately attribute the costs of stormwater quality and quantity impacts from individual properties.

Stormwater utilities have already been implemented in other northeast Iowa communities like Decorah. The City of Dubuque is a pioneer in the state for stormwater management and is currently an MS4 community. The residential utility fee rate in Dubuque is $5.98, and the non-residential is $5.98 per 2,917 square feet of impervious surface. Charles City has adopted a stormwater utility fee regardless of the fact that they are not yet an MS4 community. The city has a slightly smaller population as Decorah, and they apply a flat $4.00 fee to all water meters in Charles City. Like Decorah, both of these communities are situated on a river. All three communities enjoy the benefits of river recreation, but also have to deal with the impact of stormwater and flooding.

UTILITY FEE DEVELOPMENT METHODOLOGY

Four alternative stormwater utility models were investigated based on the city's unique size and characteristics and its goals for stormwater improvement. We used existing stormwater utility models from other Iowa communities of similar population size (3,000-15,000), utility models in MS4-designated Iowa communities, and a community survey to determine the appropriate fee

[3] "Funding Stormwater Programs." *United States Environmental Protection Agency, New England*. EPA 901-F-09-004. April 2009.

[4] Ibid.

amount and fee structure for Decorah. Three of the alternatives are based on EPA-recommended fee structures, and the fourth is a Sub-Watershed Basin model devised specifically for Decorah.

All models include an option for fee discounts, which would apply to low-income residents and parcels with stormwater infiltration practices (pre-existing or installed in the future). Fee discounts are commonplace in utility fees structures to enhance acceptance of the program and to incentivize better management practices on private lands – although they also add administrative work.[5] All Utility Fee options are assessed and paid on a monthly basis.

COMMUNITY FEE INPUT

The community engagement events conducted during spring of 2015 raised public awareness about the importance of managing stormwater, opportunities for improving stormwater management in Decorah and the potential for implementing a utility fee. We engaged the community in dialogue about problem areas, best ways to address stormwater problems, and whether a fee was a preferred way to fund these problems. To better determine receptiveness to a stormwater utility fee, we surveyed Decorah residents to see if they would be willing to pay a monthly fee. Seventy-three residents responded to the survey and 58 percent indicated that they would be willing to pay a monthly of between $4 and $6 (Figure 48). Of the residents that were willing to pay a fee, the $5 utility fee was preferred (Figure 49).

Figure 48

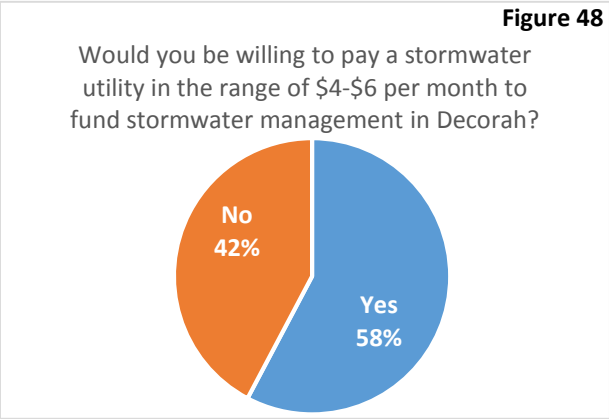
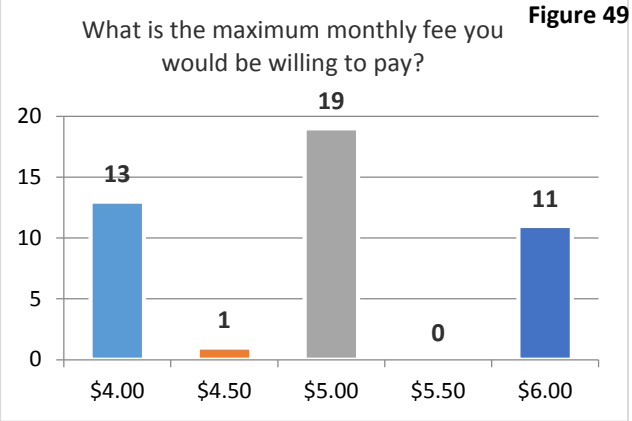


Figure 49



UTILITY FEE STRUCTURES AND BUDGET

EQUIVALENT RESIDENTIAL UNIT (ERU) MODEL

The Equivalent Residential Unit (ERU) method is based on the average proportion of pervious area on a parcel in each zoning category. With this method, single family zones are used to set a base fee (1 ERU) with increasing fees for other zones with more imperviousness. Payments are proportional to the parcel's pervious to impervious area ratio. The single-family residential ERU unit (footprint) becomes the baseline for the other zonal categories. Average permeability is calculated for

[5] All fee calculations were made in ArcGIS using similar tools and processes as those for generating parcel permeability, in addition to using Python script coding to generate field calculations in the attribute table.

multifamily residential, commercial, and industrial zones and compared to the baseline single-family residential ERU to determine how many ERU's those zones represent in terms of permeability.

EXAMPLE:

Single Family = 30% imperviousness = 1 ERU = $5.00 base fee

Commercial = 40% imperviousness = 1.1 ERU = $5.50 fee

(10% more imperviousness, 10% added to base fee)

Figure 50 **Equivalent Residential Unit (ERU)**

Zone	Meters	% Impervious	ERU
Residential (base)	2,396	33.05	1
Industrial/Commercial	359	42.55	1.14
Institutional	65	56.10	1.34

Figure 51 **Equivalent Residential Unit (ERU)**

Zone	Fee/mo ($)	Funds/Yr ($)
Residential (base)	**$4.00**	$115,008
Industrial/Commercial	$4.56	$19,664
Institutional	$5.38	$4,194
	Total	**$138,866**
Residential (base)	**$5.00**	$143,760
Industrial/Commercial	$5.71	$24,580
Institutional	$6.72	$5,243
	Total	**$173,583**
Residential (base)	**$6.00**	$172,512
Industrial/Commercial	$6.85	$29,496
Institutional	$8.07	$6,291
	Total	**$208,300**

MODEL STRENGTHS AND WEAKNESSES

The ERU method is the most commonly used stormwater utility; the EPA reports that 80 percent of utilities follow this model. When adopting a new utility for a community, the ERU model is advantageous for public understanding because there is a relatively clear connection between stormwater and impervious surfaces. Fees are calculated separately for each zoning category.

However, the ERU model can be inequitable since fees are based on zonal-level rather than parcel-level permeability, assessing the same fee for all parcels within that zone regardless of individual differences in property area.

INTENSITY OF DEVELOPMENT (ID) MODEL

The Intensity of Development (ID) method charges a fee based on the percent impervious category a property falls into and the square footage of the property. The fee is based on parcel size and permeability. A baseline fee per 1,000 square feet, recommended by the EPA, is established for each separate ID category based on degree of permeability. Each parcel is assessed a fee based lot size and the parcel's ID category's rate. [6]

EXAMPLE 1:

Square feet: 14,569

% Impervious: 30%

Fee Category: $1.50

Fee = (14,569/1,000) *$0.75 = **$10.93**

EXAMPLE 2:

Square feet: 5,710

% Impervious: 30%

Fee Category: $1.50

Fee = (5,710/1,000) * $0.75 = **$4.8**

Figure 52 Intensity of Development (ID)

Category	Fee/1,000 sq. ft	Generated
<20%	$0.75	$ 20,385
20-40%	$1.50	$ 11,601
40-60%	$2.25	$ 6,373
60-80%	$3.00	$ 3,742
>80%	$3.75	$ 101,544
Average	**$4.82**	
	Total	**$143,644**

MODEL STRENGHTS AND WEAKNESSES

The ID model provides more personalized fee calculations based on the actual permeability of each parcel. It is more equitable because parcels with the same amount of permeability will pay the same fee, regardless of if they are a business or a home, for example. However, for the sake of simplicity, parcels are grouped into broad categories of percent permeability. This means that those parcels on the lower end of the category pay the same amount as those on the higher end of the category, which may be seen as inequitable. Parcels may move from one category to another as owners increase or reduce imperviousness. Thus, administrative oversight and monitoring would be required.

[6] "Funding Stormwater Programs." *United States Environmental Protection Agency, New England*. EPA 901-F-09-004. April 2009.

EQUIVALENT HYDRAULIC AREA (EHA) MODEL

The Equivalent Hydraulic Area model applies a parcel-by-parcel fee based on a flat-rate charge for each percent of impervious surface on a property.[1] The permeability map is used to determine each parcel's percent permeability, and a fee is assessed by $0.05 per percent imperviousness regardless of parcel type or size. The maximum fee is therefore $5.00 for a completely impervious parcel.

The EHA model determines fees specific to permeability on individual parcels, charging the same rate for each incremental increase in imperviousness. However, the fee requires initial administrative work to determine all parcels' permeability and fees. As the examples below demonstrate, parcels with different square footage but the same proportion of impervious surfaces would pay the same utility fee, given that the model is based purely on impervious surface ratio.

Equivalent Hydraulic Area (EHA) $0.10 x % impervious Figure 53	
Range	$1.85-$5.01
Average	$3.35
Total	**$132,921**

EXAMPLE 1:

Square feet: 14,569

% Impervious: 30%

Flat Rate: $0.10 per 1% impervious

Fee = 30 * $0.10 = **$3.00**

EXAMPLE 2:

Square feet: 5,710

% Impervious: 30%

Flat Rate: $0.10 per 1% impervious

Fee = 30 * $0.10 = **$3.00**

[1] "Funding Stormwater Programs." *United States Environmental Protection Agency, New England*. EPA 901-F-09-004. April 2009.

SUB-WATERSHED UNIT (SWU)

In the Sub-Watersehd Unit model, fees differ based on average impermeability of a sub-watershed compared to the average impermeability for the entire city of Decorah.[2] Instead of using parcel-level data, the SWU groups areas in Decorah based on sub-watersheds, which addresses specific stormwater characteristics for more localized management strategies. The SWU model is based on the average percent perviousness of the City of Decorah, which was calculated to about 50 percent (49.89 percent). An average percent perviousness was generated for each sub-watershed basin (figure 54) and compared to the City baseline, creating a ratio of percent permeability for each sub-watershed to that of the city. Essentially, the more permeable the sub-watershed basin is compared to the municipal average, the greater the discount residents receive. Increased stormwater management and permeability is therefore incentivized on the sub-watershed and neighborhood level.

EQUATION

SWU Fee = Base Fee + (Base Fee*((Watershed Average – Municipal Average)/(Municipal Average))

EXAMPLE:

Base Fee = $5.00

Basin Average = 60% impermeable

Municipal Average = 50% impermeable

Fee = $5.00 + ($5.00 * ((0.6 – 0.5) / 0.5) = $6.0

Figure 54

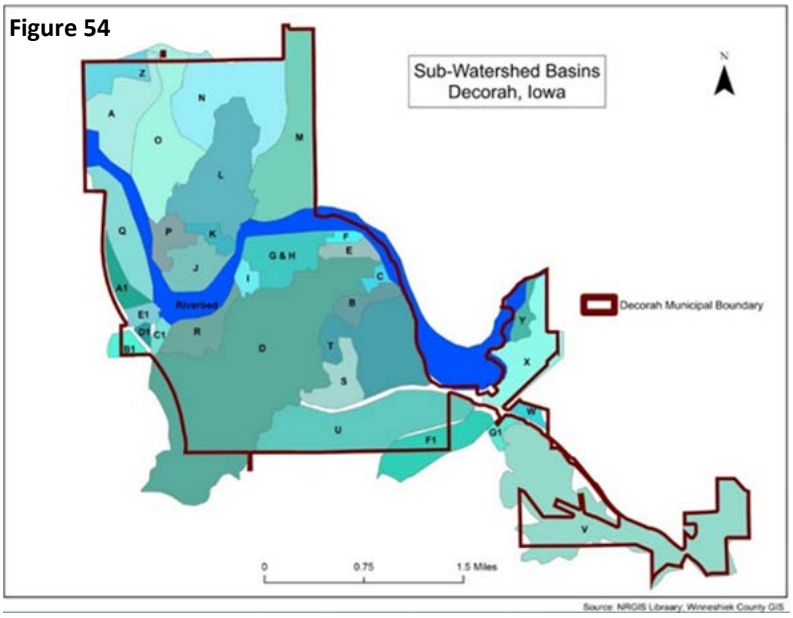


Figure 55

Sub-Watershed Unit (SWU)	
Base	$4.00
Average	$4.96
Total	**$196,957**
Base	$5.00
Average	$6.20
Total	**$246,196**
Base	$6.00
Average	$7.44
Total	**$295,435**

[2] "Funding Stormwater Programs." *United States Environmental Protection Agency, New England*. EPA 901-F-09-004. April 2009.

MODEL STRENGTHS AND WEAKNESSES

The sub-watershed model is the only model that uses watersheds as units of analysis. It gets to the heart of the stormwater runoff issue, which is unique to each sub-watershed area. Using sub-watersheds could be seen as more equitable since it takes into account each area's unique permeability, slopes, and characteristics.

However, the stormwater fee calculated will be different in each sub-watershed. Residents will pay different stormwater fees simply because they live in different sub-watersheds, and this may be perceived as inequitable. In addition, the average permeability of city and of each sub-watershed may change in the future, which will alter all fee calculations. Calculation methods are simple enough, but this will create new administrative requirements.

BUGET COMPONENTS

The budget will be divided into four components: public projects, private cost-share, maintenance, and education. The *public projects* portion might include projects like the permeable paver public park in central Decorah, a new wetland in one of the city's public parks, or using permeable pavers for a street capital improvements project. This component of the fund is geared toward soft stormwater management practices like rain gardens, wetlands, or permeable pavers. Problem areas can often be addressed easily with things like retrofitted stormwater drains or bioswales on the slopes above a ponding area.

The second component of the stormwater management fund provides *cost-share* for voluntary stormwater retention practices in the City of Decorah. These funds would be available to property owners who have ongoing stormwater issues on their property like flooding or ponding. Contractors would work with property owners to provide design specs, costs, and plans to the city to minimize administration work load. A standard city application would be submitted with all necessary information. Iowa communities often set an upper dollar limit or percentage of the project cost they will match, whichever is less. Property owners are responsible for obtaining any other necessary permits. The property owner is responsible for maintenance and implementation, but the city will need to monitor the practice if it is included in a fee discount.

Infrastructure maintenance is currently funded by the city's general funds. Maintenance does not have a specific line in the budget, and it receives funds from a variety of sources. City funds are stretched, and funding for stormwater management is not necessarily consistent or secure from year-to-year. The utility fee will provide a sustainable, long-term source of funding for things like maintenance of the levee and improvements to hard stormwater infrastructure. Problems on city streets in front of homes and businesses due to inadequate infrastructure can be more immediately addressed with this component if necessary. The stormwater utility fund will remove the infrastructure maintenance cost from the general fund to free up approximately $70,000 each year for the city to use for other necessary projects or functions.

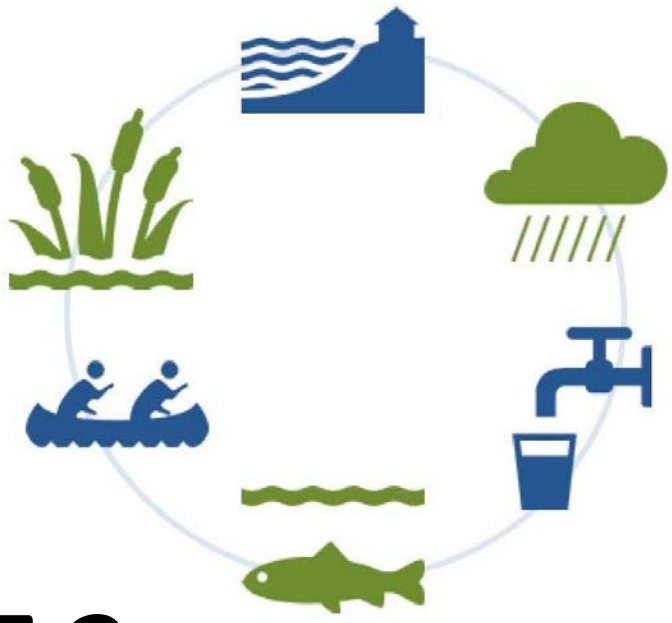
The *education* fund will go toward continued creek tours, park events, and other public activities to engage community members with the creek and their stormwater contributions. The fund can also contribute to city staff training to be able to do in-house stream bank clearing and maintenance.

FEE REDUCTION

We recommend that residents submit a signed receipt from a licensed engineer or contractor to the Stormwater Management Committee to confirm the legitimacy of their implemented stormwater practice to receive a flat reduction of (to be updated) to their monthly stormwater utility fee. Projects that qualify for a fee reduction must be (to be updated). The fee reduction should be permanent for the landowners for as long as they live at the property on which the management practice was installed or for up to five years.

LOW-INCOME REDUCTION

We recommend that residents fill out an application to be submitted to the Stormwater Management Committee that proves the fee would be a substantial financial burden. We recommend that residents that qualify for low-income housing or other social welfare programs, like SNAP, should automatically qualify for a fee waiver.



PART 3

MANAGEMENT STRATEGY

CHAPTER 3

PLANNING TOOLS

The two most pertinent stormwater clauses in Decorah's City Code are:

16.04.170.N.2.

Where a subdivision is traversed by a watercourse, drainage way, channel or stream, there shall be provided a stormwater easement or drainage right-of-way conforming substantially with the lines of such watercourse, and further width for construction, or both, as will be adequate to convey stormwater runoff from, a one hundred-year storm event. The stormwater easement will not be less than the minimum required by the conservation and open space (COS) chapter of Title 17.

16.04.180.F.

Adequate provisions shall be made for the disposal of stormwaters, subject to the approval of the council and to the supervision of the city engineer.

These Code regulations are relatively ineffective at requiring onsite retention of stormwater; stormwater mitigation practices are only required where there already exists a watercourse or stream and disposal of stormwaters can be satisfied with the construction of sewers to carry water away from the site. Decorah could benefit from stricter policies, namely a post-construction stormwater ordinance, that require onsite stormwater detention in all new subdivisions, regardless of the presence of existing waterways. This will help to capture and infiltrate water onsite caused by the increase of impervious surfaces rather than simply draining water via storm sewers to other locations.

Recommendation: Adopt a post-construction stormwater ordinance that requires onsite stormwater detention consistent with MS4 regulations.

When new developments are built, impervious surfaces, including building rooftops, streets, and sidewalks, are increased, thus generating more stormwater runoff and increased stress on stormwater infrastructure. One method cities can use to minimize the detrimental effects of increasing impervious surface is a post-construction ordinance that requires new developments to implement onsite stormwater retention. These retention methods could include permeable paving, wetlands, bioswales, detention ponds, or other stormwater best management practices as specified in the Iowa DNR Stormwater Manual. These requirements can minimize stress on city stormwater infrastructure and improve water quality by allowing it to infiltrate the soil before running off into nearby water bodies.

Post-construction ordinances are required by the EPA for MS4 communities; Decorah is not an MS4 community yet, but due to its proximity to the impaired Upper Iowa River, it could be designated as an MS4 community in the near future. We recommend that Decorah implement a post-construction stormwater ordinance requiring onsite water detention prior to MS4 designation to better prepare the community for the requirements of MS4 and to generally minimize stormwater runoff from new

developments. Twenty-eight communities and two counties in Iowa currently have post-construction stormwater ordinances requiring onsite detention.[1]

Two model post-construction stormwater ordinances can be found in Appendix F.

Recommendation: Adopt a stream buffer easement ordinance that requires developers to grant an easement to the City for new development located along Old Dry Run Creek.

The majority of the areas located along Old Dry Run Creek through Decorah are already developed, but there are some areas along the creek where this opportunity for future development, including the Northeast Redevelopment Area. We recommend that the City adopt a stream buffer easement ordinance that would require developers of new subdivisions along Old Dry Run Creek to grant the city an easement along the stream. Stream buffer easement ordinances are intended to minimize pollution to water bodies, reduce impervious surfaces near the stream, prevent erosion, and generally protect the stream habitat. These easements would allow the City to maintain the stream and provide vegetated buffers, prevent new developments from disrupting the stream banks, and minimize stormwater runoff into the stream. This ordinance would save the City from having to acquire land or obtain easements from individual property owners along Old Dry Run Creek in redevelopment or new development areas.

A model stream buffer easement ordinance can be found in Appendix F.

Recommendation: Adopt a stormwater utility ordinance to initiate a stormwater utility fee for Decorah.

We recommend that Decorah adopt a stormwater utility ordinance to initiate the stormwater utility fee. This ordinance will define the City's purpose for implementing a stormwater utility fee, describe how funding will generally be allocated, explain the fee rate structure, and describe requirements for fee exemptions.

A model stormwater utility ordinance can be found in Appendix F.

[1] See Appendix * for the Iowa Storm Water Education Program's summary table of the contents of stormwater ordinances in Iowa communities.

PART 3

MANAGEMENT STRATEGY

CHAPTER 4

IMPLEMENTATION, EDUCATION, AND EVALUATION

IMPLEMENTATION RECOMMENDATIONS

Recommendation: Adopt the stormwater management plan.

This stormwater management outlines a systematic approach to addressing present and future stormwater issues. We recommend adopting this plan to provide guidelines for identifying problems areas and implementing infiltration practices that will improve water quality in Old Dry Run Creek and the Upper Iowa River and minimize the occurrence of ponding in the city. The stormwater management plan strategies and timelines can be found in Table 11 on the following page.

Recommendation: Establish a Stormwater Management Committee.

We recommend that Decorah establishes a Stormwater Management Committee consisting of representatives from the City, City Council, Luther College, residents of the Decorah community, and members of the existing Decorah Water Supply Source Water Protection Committee. The committee would review applications for private cost-share funding, as well as applications for low income exemptions to the fee and reductions of the fee for residents who install best management practices. The committee would also be responsible for reviewing water quality data and evaluating whether the utility fee should be altered in the future. The ultimate goal of the Committee is to ensure the implementation of the stormwater management plan.

Recommendation: Continue to identify susceptible stormwater areas and implement stormwater management practices to address these problems.

The stormwater management plan should be a living document that is updated as future problems are identified and new strategies for infiltrating stormwater are developed. The plan as it is presented recommends practices that will help to mitigate immediate problems with contamination and ponding in Decorah, but increasingly severe rain events that are predicted in the future coupled with deteriorating hard infrastructure will likely result in the identification of new problems in the future. The Stormwater Management Committee should actively continue to fund and implement infiltration projects that will address these future problems.

Table 11: Implementation Schedule

Project Area	Practice	Location	Dimension (sq ft.)	Budget	Timeline
Locust Road					
	Bioswale	Phase 1	42,550	$ 638,280	Undetermined
	Bioswale	Phase 2	42,550	$ 638,280	Undetermined
	Bioswale	Phase 3	42,550	$ 638,280	Undetermined
Total			127,650	$ 1,914,840	
Iowa Avenue					
	Bio-retention Cell	College Dr.	2,880	$ 57,600	Year 3
	Bio-retention Cell	East St.	1,944	$ 38,880	Year 3
	Bio-retention Cell	Elm Ct. #1	2,220	$ 44,400	Year 3
	Bio-retention Cell	Elm Ct. #2	2,220	$ 44,400	Year 3
	Bio-retention Cell	Lutheran Church	2,220	$ 44,400	Year 3
	Bio-retention Cell	Ohio St. #1	9,240	$ 184,800	Year 4
	Bio-retention Cell	Ohio St. #2	6,600	$ 132,000	Year 4
	Bio-retention Cell	Ohio St. #3	5,160	$ 103,200	Year 4
	Bio-retention Cell	Ohio St. #4	4,080	$ 81,600	Year 4
	Bio-retention Cell	Painter St.	3,360	$ 67,200	Year 4
	Bio-retention Cell	Riverview Dr.	1,512	$ 30,240	Year 5
	Bio-retention Cell	View St. #1	2,880	$ 57,600	Year 5
	Bio-retention Cell	View St. #2	1,920	$ 38,400	Year 5
	Bio-retention Cell	View St. #3	1,800	$ 36,000	Year 5
	Bio-retention Cell	West St.	6,840	$ 136,800	Year 5
Total			54,876	$ 1,097,520	3 Years
Heivly Street					
	BioStrip	River St. Parking Lot	26,880	$ 537,600	Year 6
	Bioswale		24,000	$ 480,000	Year 7
	Criblock Permeable	John Cline Elementar	205,200	$ 1,641,600	Undetermined
Total			256,080	$1,017,600*	2 Years
ODRC Corridor					
	Bioswale	S. Mill Btwn Pearl St.	36,000	$ 720,000	Year 6
	Criblock Permeable	UPS Parking lot	171,000	$ 1,368,000	Year 7
	Bioswale	Pearl St. Alley UPS Pa	48,600	$ 972,000	Year 7
	Native Planting/ Pu	Pocket Park1	46,800	$ 234,000	Year 1
		Pocket Park2	115,920	$ 579,600	Year 2
	Stream maintenanc	ALL EASEMENTS	725,148	$ 73,493	Years 1-5
Total			972,468**	$2,579,093*	7 Years
Northeast Redevelopment					
	Native Planting/ Pu	E. Water St. Btwn	63,500	$ 317,500	Undetermined
	Trail extension	Williams St. &	TBD	TBD	

EDUCATION RECOMMENDATIONS

We created several opportunities for promoting dialogue with the community while developing the management plan. The following are community engagement methods that were used to educate the public and inform our project.

ENGAGEMENT EVENTS

A community open house was held on November 14, 2014 to learn more about the community's experiences with stormwater. Community members were invited to learn about the project, to share their experiences with flooding and/or stormwater, and to identify areas in Decorah that are most in need of attention. Approximately 20 people attended the open house. Many of the participants brought photos and anecdotal evidence of problems with stormwater in the city, which greatly informed the development of our Susceptible Areas Map. Participants also completed a survey (see below). Results from this survey are discussed throughout the report and can be found in Appendix E.

We screened the documentary "Lost Rivers," a documentary about rediscovering rivers buried beneath cities, at the annual Oneota Film Festival on March 6, 2015. The film aims to increase awareness of urban streams and to inspire residents to pay more attention to urban local natural resources. Much like many of the cities depicted in the film, Decorah has a great natural amenity in Old Dry Run Creek, which has been buried and forgotten over time. The screening allowed residents to realize the possibilities for Old Dry Run Creek's improvements. The film was followed by a panel discussion led by our group and partners from the City of Decorah. Approximately 60 people attended the film screening.

We additionally worked with Luther College Professor of Dance Jane Hawley and her Movement Fundamentals dance class that raised public awareness about water issues through an interpretive dance performance called "Body of Water" that was seen by over 300 people in the community during the weekend of March 6-8, 2015. This performance meshed art and science in ways that reached a diverse audience. We made maps and displays of our report findings and recommendations that were shown at the event, as well as handouts that informed community members about how they could improve stormwater management on their properties.

Figure 56 Stream Tour Event

As a way to raise further awareness about the project and residents' engagement with water in Decorah, we led a guided walking tour of Old Dry Run Creek on March 28, 2015 (Figure 56). The tour was an opportunity for residents to walk in the stream and through culverts under city streets to learn how the creek and stormwater are managed. The creek tour served as a public awareness tool to teach members of the community about the importance of stormwater management. Community members on the tour also informed the project by sharing their

ideas for best management practices along the stream. Seventeen people, including seven children, participated in the creek tour.

SURVEYS

In November 2014 we distributed a survey consisting of 20 questions intended to help us identify problem areas and solutions for stormwater management in Decorah. There were 54 responses to this survey which were used to determine the location of Susceptible Areas. Results from this survey can be found in Appendix E. The survey was distributed in several manners:

- Paper form at the community open house on November 14, 2014
- Online (from November 14 to December 5, 2014) via the City of Decorah's Facebook page, the City Manager's email contact list and decorahnews.com.
- The second survey was distributed in March 2015 and intended to interpret the community's receptiveness to paying a stormwater utility fee. This survey consisted of 14 questions to gauge community receptiveness to a stormwater utility fee in Decorah. It was distributed in a variety of ways:
- Paper form at the Body of Water Performance on March 7, 2015 and at the Creek Tour on March 28, 2015
- Link to online survey at Oneota Film Festival on March 7, 2015, via the City of Decorah's Facebook page and decorahnews.com and in water utility bills to one third of the Decorah for the April 1, 2015 billing cycle

This survey was open online from March 1 to April 16, 2015. There were 73 total responses to the survey, which informed the final recommendations for the implementation of the stormwater utility fee. Results of this survey can be found in Appendix E.

LUTHER COLLEGE INVOLVEMENT

Students and faculty from Luther College were tremendous community partners. Luther College Professor of Biology Jodi Enos-Berlage and students conducted the majority of the water sampling necessary to assess urban water quality in Decorah. Dr. Another group of Luther students in Professor of Geology Laura Petersen's introductory GIS class used GPS to identify stormwater intakes, and conducted site assessments and classifications for each of these intakes to help us decide which best management practices would be most appropriate. Engaging the Luther community allowed students and faculty to become actively involved in helping to improve their community, and provided essential information that will continue to be employed in the upcoming years.

RECOMMENDATIONS

To be a successful stormwater program, engagement and education must continue. Providing accessible information to community members can help to justify the stormwater utility fee and make visible the projects that the City is undertaking. Stormwater is not a commonly understood subject, and educating the public about how stormwater impacts them and their environment can encourage more people to take action in minimizing their stormwater impacts. It is additionally important to continue gathering information and doing analyses that will inform future decision-making for stormwater plans.

Recommendation: Develop a website for stormwater information for residents, updates on projects, and sharing of water quality data.

We recommend that the City develop a website to provide information about stormwater to Decorah residents and other Iowa communities. The website could include guidance on implementing stormwater management practices on private properties, updates on the City's progress with public stormwater projects, and data from water quality testing sites.

Recommendation: Conduct regular outreach activities to raise awareness about stormwater runoff and other water-related issues.

In addition to information sharing via the website, we also recommend that the City have outreach events, like rain barrel sales and creek tours that raise awareness in the community about the effects of stormwater runoff and other water-related issues. Partnerships with Luther College faculty and students are encouraged for sharing information.

Recommendation: Encourage City staff to attend stormwater management training.

In addition to educating the public, it is also important to educate City staff that will be working to maintain Old Dry Run Creek and stormwater best management practices throughout Decorah. We recommend that City staff be encouraged to attend stormwater training sessions and conferences. These trainings will help City staff to learn more about maintaining best management practices, as well as provide ideas for new practices and solutions to future stormwater problems in Decorah.

Recommendation: Label storm drains and add signs to discourage water pollution.

We recommend that Decorah label all storm drains with plaques that discourage dumping and subsequently prevent water pollution. Signs to discourage people from throwing pet waste into the streams should also be included along Old Dry Run Creek (Figure 57[1]).

Figure 57 Stream Drain Labeling

Recommendation: Continue to update the stormwater infrastructure map as new development occurs or existing stormwater infrastructure is identified.

[1] http://www.brandeis.edu/ehs/waste/water.html

The preliminary spatial analysis conducted in this report (Part 1) resulted in the development of a comprehensive map for Decorah's stormwater infrastructure. All infrastructure that has been identified to date has been added to the map, including storm drain inlets and pipes. We recommend that this map be continually updated and digitized as new development and thus new infrastructure occurs, or if more existing stormwater infrastructure is identified.

Recommendation: Conduct a study to determine the quality of existing stormwater infrastructure.

Much of Decorah's stormwater infrastructure was installed in the early 1900s and has not been evaluated in recent years. This analysis would show where pipes are leaking or undersized and can help the City to identify areas where infrastructure should be updated in the future.

Recommendation: Purchase building footprint layer from ESRI to improve accuracy of impervious surface calculations.

In some cases the lack of available data for this report prevented more accurate analyses. In particular, building footprint data was not available for use in GIS to calculate impervious surfaces. Though the analysis conducted is suitable for the basis of the report, more accurate findings could be acquired with better information. We recommend that the City purchase the building footprints layer from ESRI (GIS Software Company) for use by the Winneshiek County GIS department to more accurately calculate the amount of impervious surfaces in Decorah.[2]

Recommendation: Conduct a hydrology study to more accurately determine the infiltration impacts of best management practices.

In addition to a lack of information, the skillsets of the authors were sometimes not adequate to conduct more advanced studies that would be better completed by engineers or hydrologists. We recommend that a hydrology study be conducted to determine how much the recommended best management practices infiltrate stormwater runoff. This study would help to determine which best management practices are resulting in the highest amount of stormwater infiltration and can locate other areas where these practices could best be implemented.

[2] The cost for this data is approximately $0.35 per parcel plus an additional $0.40 per parcel for change detection which shows changes in buildings over time. The estimated cost for the entire necessary dataset is $5,000 for 6,667 parcels.

EVALUATION RECOMMENDATIONS

No plan can be successful if it is adopted and not evaluated to determine successes and failures. Evaluation of the stormwater plan and the utility fee ensures that changes can be made over time to Decorah's stormwater management strategies to best reflect the needs of society and the natural environment.

Recommendation: Continue water quality monitoring at the locations specified in the stormwater plan and add new locations as necessary.

In concurrence with the drafting of this report, water quality data has been periodically collected along Dry Run Creek, in the Upper Iowa River, and in the wetlands near Decorah High School. We recommend that water quality monitoring at these sites be continued and recorded over time, and that new testing locations be added if there is particular concern for pollutants in a given area.

Recommendation: Periodically measure the differences in water quality over time to determine effectiveness of stormwater management practices at reducing pollution levels.

We also recommend that this data be observed over time and the differences in pollutant levels be measured. Ideally the stormwater management practices recommended in this plan will help to reduce water pollution caused by stormwater runoff over time. Evaluation of the water quality data will help to inform where future best management practices should be implemented or which policies should be considered to minimize water pollution.

Recommendation: Conduct periodic surveys of Decorah residents to determine if stormwater management practices are sufficiently reducing stormwater ponding issues.

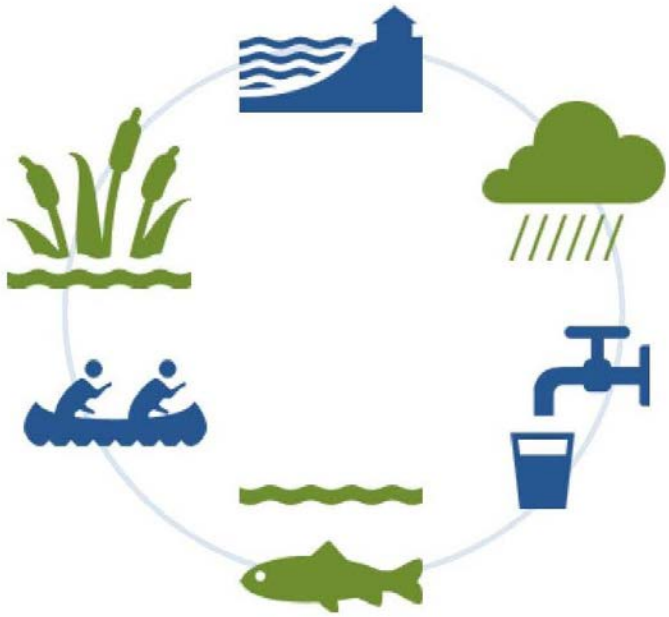
To determine how much of an impact stormwater infiltration practices are having on eliminating ponding issues, we recommend that the City conduct periodic surveys of Decorah residents. The intention of the stormwater management practices is to infiltrate stormwater and thus minimize the amount of standing water that occurs in residents' yards, basements, and paved areas. Surveying residents would allow the City to determine if the practices are alleviating these problems or if additional intervention is necessary to minimize ponding.

Recommendation: Reevaluate the stormwater utility fee every 2-3 years and adjust funding based on demographic changes, demand for public and private projects, and demand for maintenance.

The budget in this report shows estimates of how funding raised by the stormwater utility fee can be allocated over the next several years, however the actual budget and implementation plan are likely to change and develop over time. To ensure that funding is adequate for public projects, private cost-share, maintenance, and education, the utility fee should be evaluated and adjusted every 2-3 years. Adjustments should be made to reflect demographic changes in Decorah, demand for public and private projects, and demand for maintenance.

Recommendation: Consider the alternative fee models presented in this stormwater plan for future stormwater utility fees.

If it is decided that the fee should be altered, we recommend that the Stormwater Management Committee consider the alternative fee models presented in this stormwater plan to provide a fee that is administratively feasible and socially equitable.



APPENDIX A

WATER QUALITY ASSESSMENT

DEFINITIONS

Chapter 61: Water Quality Standards. U.S. Environmental Protection Agency. 23 February, 2011. <http://epa.gov>.

(1) Primary contact recreational use (Class "A1"). Waters in which recreational or other uses may result in prolonged and direct contact with the water, involving considerable risk of ingesting water in quantities sufficient to pose a health hazard. Such activities would include, but not be limited to, swimming, diving, water skiing, and water contact recreational canoeing.

(2) Secondary contact recreational use (Class "A2"). Waters in which recreational or other uses may result in contact with the water that is either incidental or accidental. During the recreational use, the probability of ingesting appreciable quantities of water is minimal. Class A2 uses include fishing, commercial and recreational boating, any limited contact incidental to shoreline activities and activities in which users do not swim or float in the water body while on a boating activity.

(3) Children's recreational use (Class "A3"). Waters in which recreational uses by children are common. Class A3 waters are water bodies having definite banks and bed with visible evidence of the flow or occurrence of water. This type of use would primarily occur in urban or residential areas.

(4) Cold water aquatic life—Type 1 (Class "B(CW1)"). Waters in which the temperature and flow are suitable for the maintenance of a variety of cold water species, including reproducing and nonreproducing populations of trout (Salmonidae family) and associated aquatic communities

(5) Cold water aquatic life—Type 2 (Class "B(CW2)"). Waters that include small, channeled streams, headwaters, and spring runs that possess natural cold water attributes of temperature and flow. These waters usually do notsupport consistent populations of trout (Salmonidae family), but may support associated vertebrate and invertebrate organisms.

(6) Warm water—Type 1 (Class "B(WW-1)"). Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native nongame fish and invertebrate species. These waters generally include border rivers, large interior rivers, and the lower segments of medium-size tributary streams.

(7) Warm water—Type 2 (Class "B(WW-2)"). Waters in which flow or other physical characteristics are capable of supporting a resident aquatic community that includes a variety of native nongame fish and invertebrate species. The flow and other physical characteristics limit the maintenance of warm water game fish populations. These waters generally consist of small perennially flowing streams.

(8) Warm water—Type 3 (Class "B(WW-3)"). Waters in which flow persists during periods when antecedent soil moisture and groundwater discharge levels are adequate; however, aquatic habitat typically consists of nonflowing pools during dry periods of the year. These waters generally include

small streams of marginally perennial aquatic habitat status. Such waters support a limited variety of native fish and invertebrate species that are adapted to survive in relatively harsh aquatic conditions

(9) Lakes and wetlands (Class “B(LW)”). These are artificial and natural impoundments with hydraulic retention times and other physical and chemical characteristics suitable to maintain a balanced community normally associated with lake-like conditions.

(10) Human health (Class “HH”). Waters in which fish are routinely harvested for human consumption or waters both designated as a drinking water supply and in which fish are routinely harvested for human consumption.

(11) Drinking water supply (Class “C”). Waters which are used as a raw water source of potable water supply. Waters which are designated as Class “C” are to be protected as a raw water source of potable water supply

General water quality criteria. The following criteria are applicable to all surface waters including general use and designated use waters, at all places and at all times for the uses described in 61.3(1)“a.”

a. Such waters shall be free from substances attributable to point source wastewater discharges that will settle to form sludge deposits.

b. Such waters shall be free from floating debris, oil, grease, scum and other floating materials attributable to wastewater discharges or agricultural practices in amounts sufficient to create a nuisance.

c. Such waters shall be free from materials attributable to wastewater discharges or agricultural practices producing objectionable color, odor or other aesthetically objectionable conditions.

d. Such waters shall be free from substances attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life.

e. Such waters shall be free from substances, attributable to wastewater discharges or agricultural practices, in quantities which would produce undesirable or nuisance aquatic life.

f. The turbidity of the receiving water shall not be increased by more than 25 Nephelometric turbidity units by any point source discharge.

g. Cations and anions guideline values to protect livestock watering may be found in the “Supporting Document for Iowa Water Quality Management Plans,” Chapter IV, July 1976, as revised on November 11, 2009.

h. The Escherichia coli (E. coli) content of water which enters a sinkhole or losing stream segment, regardless of the water body’s designated use, shall not exceed a Geometric Mean value of 126 organisms/100 ml or a sample maximum value of 235 organisms/100 ml. No new wastewater discharges will be allowed on watercourses which directly or indirectly enter sinkholes or losing stream segments

WATER QUALITY STANDARDS

Chapter 61: Water Quality Standards. U.S. Environmental Protection Agency. 23 February, 2011. <http://epa.gov>.

Class A1: Primary Contact Recreational Use

Class A2: Secondary Contact Recreational Use

Class A3: Children's Recreational Use

Class “C” waters: Waters which are designated as Class “C” are to be protected as a raw water source of potable water supply

Chloride (mg/L)	Drinking water standard	Aquatic life standard (average)	Aquatic life standard (max)					
	250	230	860					
	Class B Use Designations							
	B(CW1)	B(CW2)	B(WW-1)	B(WW-2)	B(WW-3)	B(LW)	C	HH
Chloride - chronic	389	389	389	389	389	389	-	-
Chloride - acute	629	629	629	629	629	629	-	-

	Class B Use Designations							
Dissolved O2 (mg/L)	B(CWI)	B(CW2)	B(WW-1)	B(WW-2)	B(WW-3)	B(LW)	C	HH
Minimum value for at least 16 hours of every 24-hour period	7	7	5	5	5	5	-	-
Minimum value at any time during every 24-hour period	5	5	5	4	4	5	-	-

	Class B Use Designations							
	B(CWI)	B(CW2)	B(WW-1)	B(WW-2)	B(WW-3)	B(LW)	C	HH
Nitrate (mg/L)	-	-	-	-	-	-	10	-

	Class A Waters	Class B Waters
pH	6.5-9.0	6.5-9.-0
	Maximum change to water	Maximum change to water
pH waste discharge	0.5	0.5

	Cold Water Fisheries
Temperature	No heat shall be added to streams designated as cold water fisheries that would cause an increase of more than 2 degrees Celcius. The rate of temperature change shall nto exceed 1 degrees Celsisu per hour. In no case shall heat be added in excess of that amount that would raise the stream temperature

Table 5.5 Maximum average temperatures for growth and short-term maximum temperatures for selected fish (C and F)

Species	Max weekly average temp for growth (juveniles)	Max temp for survival of short exposure (juveniles)	Max weekly average temp for spawning (a)	Max temp for embryo spawning (b)
Atlantic Salmon	20 (68)	23 (73)	5 (41)	11 (52)
Bluegill	32 (90)	35 (95)	25 (77)	34 (93)
Brook trout	19 (66)	24 (75)	9 (48)	13 (55)
Common carp	-	-	21 (70)	33 (91)
Channel fish	32 (90)	35 (95)	27 (81)	29 (84)
Largemouth bass	32 (90)	34 (93)	21 (70)	27 (81)
Rainbow trout	19 (66)	24 (75)	9 (48)	13 (55)
Smallmouth bass	29 (84)	-	17)63)	23 (73)
Sockeye salmon	18 (64)	22 (72)	10 (50)	13 (55)
a - optimum or mean of the range of spawning temperatures reported for the s				
b - upper temperature for successful incubation and hatching reported for the s				
c - upper temperature for spawning				
U.S. EPA Chapter 5 Water Quality Conditions, (Brungs and Jones 1977)				

0-2 mg/L: not enough oxygen to support life.
2-4 mg/L: only a few fish and aquatic insects ca
4-7 mg/L: good for many aquatic animals, low f
7-11 mg/L: very good for most stream fish

Dissolved Oxygen	Aquatic Life
0-2 mg/L	Not enough oxygen to support life
2-4 mg/L	Only a few fish and aquatic insects can survive
4-7 mg/L	Good for many aquatic animals, low for cold water fish
7-11 mg/L	Very good for most stream fish

Biological Oxygen Demand/Dissolved Oxygen			
Table 5.3 Maximum dissolved oxygen concentrates vary with temperature			
Temp (Celsius)	**DO (mg/l)**	**Temp (Celsius)**	**DO (mg/l)**
0	14.6	23	8.56
1	14.19	24	8.4
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.16
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.41
19	9.26	42	6.22
20	9.07	43	6.13
21	8.91	44	6.04
22	8.72	45	5.95
U.S. EPA Chapter 5 Water Quality Conditions			

URBAN WATER QUALITY DATABASE

INDICATOR	TIME	Weather	TEST SITE											
Temperature (Celsius)	**Test Date**	**Rain event**	**HW 52**	**College Dr.**	**River Rd**	**Case IH/beginning**	**S. Mill/Frances**	**Deco Drain**	**Water St.**	**DRC end**	**HS**			
	9/26/2014	N	19.5	18.8	19.6	14.9	17.9	-	18.6	20.2	20.6			
	10/10/2014	N	11.6	12.5	13.2	11.9	14	17.7	13	12.9	12.3			
												AVERAGE	**STANDARD**	
Average			15.55	15.65	16.4	13.4	15.95	17.7	15.8	16.55	16.45	15.93889	varies	
E. coli (CFU/100 ml)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/19/20104	N	37	83	49	223	-	-	-	365	-			
	9/26/2014	N	42.5	61	64	644	472	-	302	504	416			
	10/10/2014	N	51	5	43	160	90	0	500	190	760			
												AVERAGE	**STANDARD (A1, A3)**	**AQUATIC LIFE**
Average			43.5	49.67	52	342.33	281	0	401	353	588	234.5	235	230
Dissolved O2 (mg/L)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	10/10/2014	N	6.5	8	8.2	3.1	5	4	7.4	7.1	1.4			
												AVERAGE	**STANDARD**	
Average			6.5	8	8.2	3.1	5	4	7.4	7.1	1.4	5.633333	n/a	
Specific conductivity (µS/cm)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/26/2014	N	445	430	460	483	620	-	670	630	230			
	10/10/2014	N	410	340	400	440	600	600	600	600	240			
												AVERAGE	**STANDARD**	
Average			427.5	385	430	461.5	610	600	635	615	235	488.7778	n/a	
Chloride (mg/L)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
Note: Lowest indicator threshold reading = 33	10/10/2014	N	33	33	33	39	97	83	92	87.5	33			
												AVERAGE	**DRINKING WATER**	
Average			33	33	33	39	97	83	92	87.5	33	58.94444	250	
Nitrate (mg/L)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/26/2014	N	10.2	7	5.7	0.6	1.2	-	3	1	0.4			
	10/10/2014	N	5.2	5.9	4.9	1.5	2.1	0.9	1.5	1.8	1.1			
												AVERAGE	**DRINKING WATER**	
Average			7.7	6.45	5.3	1.05	1.65	0.9	2.25	1.4	0.75	3.05	10	
BOD (mg/L)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/26/2014	N	2.4	4.7	5.4	6.9	1	-	3.6	2.5	11.3			
	10/10/2014	N	1.5	3.2	1.5	2.9	1.3	-	2.1	2.9	1.9			
												AVERAGE	**STANDARD**	
Average			1.95	3.95	3.45	4.9	1.15	-	2.85	2.7	6.6	3.44375	varies	
pH	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/26/2014	N	8.16	8.27	8.24	7.1	7.74	-	7.89	8.23	7.07			
	10/10/2014	N	7.53	7.62	8.24	6.79	7.28	7.2	7.22	7.58	7.11			
												AVERAGE	**STANDARD**	
Average			7.845	7.945	8.24	6.945	7.51	7.2	7.555	7.905	7.09	7.581667	6.5-9.0	
Turbidity (NTU)	**Test Date**	**Rain event**	**HW 52**	**College**	**River Rd**	**Case**	**S. Mill/Frances**	**Deco Drain**	**Water**	**DRC end**	**HS**			
	9/19/2014 [1]	N	5.94	7.6	7.15	9.2	-	-	-	4.89	-			
	9/19/2014 [2]	N	5.95	6.68	6.5	8.75	-	-	-	4.75	-			
	9/26/2014	N	5.69	4.6	4.83	2.3	3.89	-	6.5	3.91	8.3			
	10/10/2014	N	2.88	3.2	3.05	3.31	2.95	0.2	2.15	1.87	9.74			
												AVERAGE	**STANDARD**	
Average			5.115	5.52	5.3825	5.89	3.42	0.2	4.325	3.855	9.02	4.7475	n/a	

Appendix B

STORMWATER FLOW SPATIAL ANALYSIS

RUNOFF FLOW ASSESSMENT

Utilizing the Iowa Department of Natural Resources Geographic Information Systems (NRGIS) Library several County-level GIS layers were accessed, including a Digital Elevation Model (DEM) at 3-meter resolution. DEMs provide a contoured representation of the elevation surfaces that offer a basis for deriving watershed runoff characteristics. This layer was then transformed to provide hydrologic analysis using slope, directional hillshade aspects, and flow accumulation characteristics. The following section provides greater detail into the hydrologic analysis of Decorah's water flow.

TOPOGRAPHIC METHODOLOGY

SLOPE

The Slope tool in ArcGIS generates changes in elevation based on the raster data of the DEM cell values across neighboring cells, and in this case slope was calculated in degrees of slope or 'degrees of difference' across cell values. The degrees of slope generate a scale of elevation that is similar to a topographic map and succinctly characterize the changes in grade along the contoured layer. This layer is useful in determining where stormwater would naturally flow once rain hits the surface of the ground.

HILLSHADE ASPECT, FLOW DIRECTION, & FLOW ACCUMULATION

This information was processed utilizing Flow Direction and Flow Accumulation tools, which create collector lines and highlight places where water would be expected to gather or pool. The rest of this paragraph could go in appendix or footnote. If so, merge this last sentence with the para above, Flow Direction is an ArcGIS tool that initially transforms the Hillshade Aspect information and calculates the direction of flow across the geometric network of cells given its directional assignment. The last step in this process layers the flow and direction of water across the sloped terrain and processes them using the ArcGIS Flow Accumulation tool, which results in "collector lines" that indicate where water would accumulate.

SOIL

In order to obtain accurate soil permeability information, the permeability code field ("PERMCODE") was analyzed.1 This field contained the rate (inches/hour) at which soil facilitates the movement of air or water down through the soil profile.

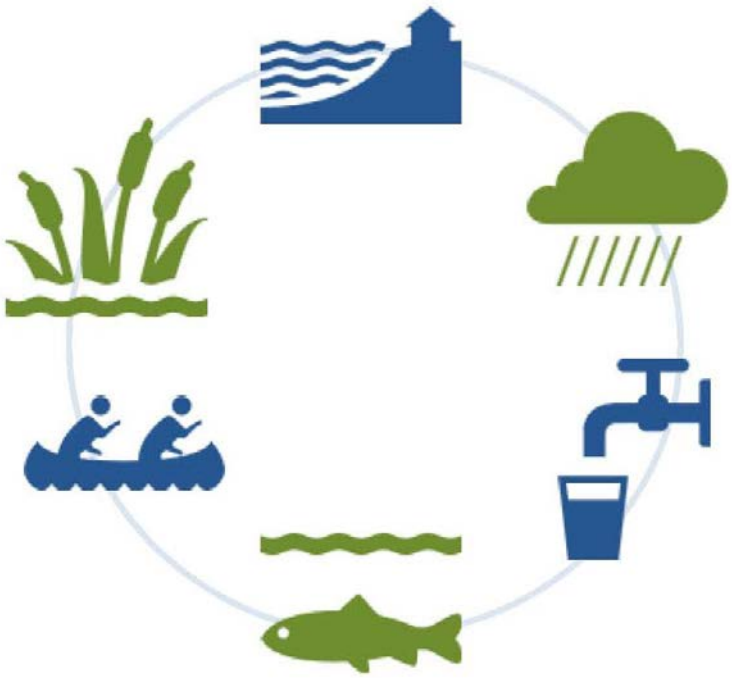
SUSCEPTIBLE STORMWATER AREAS

Parcel-level data was secured from the NRGIS Library under Winneshiek County data and added in order to provide a finer resolution to this analysis. This information included parcel data for city and county-owned land, which was clipped and transformed into a new layer labeled 'public land'. This layer assisted in quickly identifying which areas could be pursued for public projects.

Without access to building footprint data, the calculation for parcel-level permeability was calculated using the Isocluster ArcGIS tool. Isocluster is a spatial analysis tool that clusters similar cells, or in this

[1] NRCS "Soil Survey of Winneshiek County, Iowa. Part 1: Physiography, Drainage, and Geology." http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/iowa/IA191/0/Winneshiek_IA_1.pdf

case pixel colors, according to their color reflection from 2011, 6m-resolution digital ortho-imagery. This process captured darker colors, such as green treetops and grass, as separate from the lighter, more reflective areas, such as rooftops and parking areas. Road data was separated and then rejoined to the dataset in order to more accurately take into account the roadway's blacktop color. Then this data was merged and reclassified into 2 categories: 0= impermeable color reflection and 1= permeable color reflection. By generating 0-value and 1-value categories, the use of the Zonal Statistics tool aggregates all of the clustered pixels and calculates their amount within a certain zone, in this case parcel-level data. This process created a new attribute table field that contained the percent permeability of each parcel.

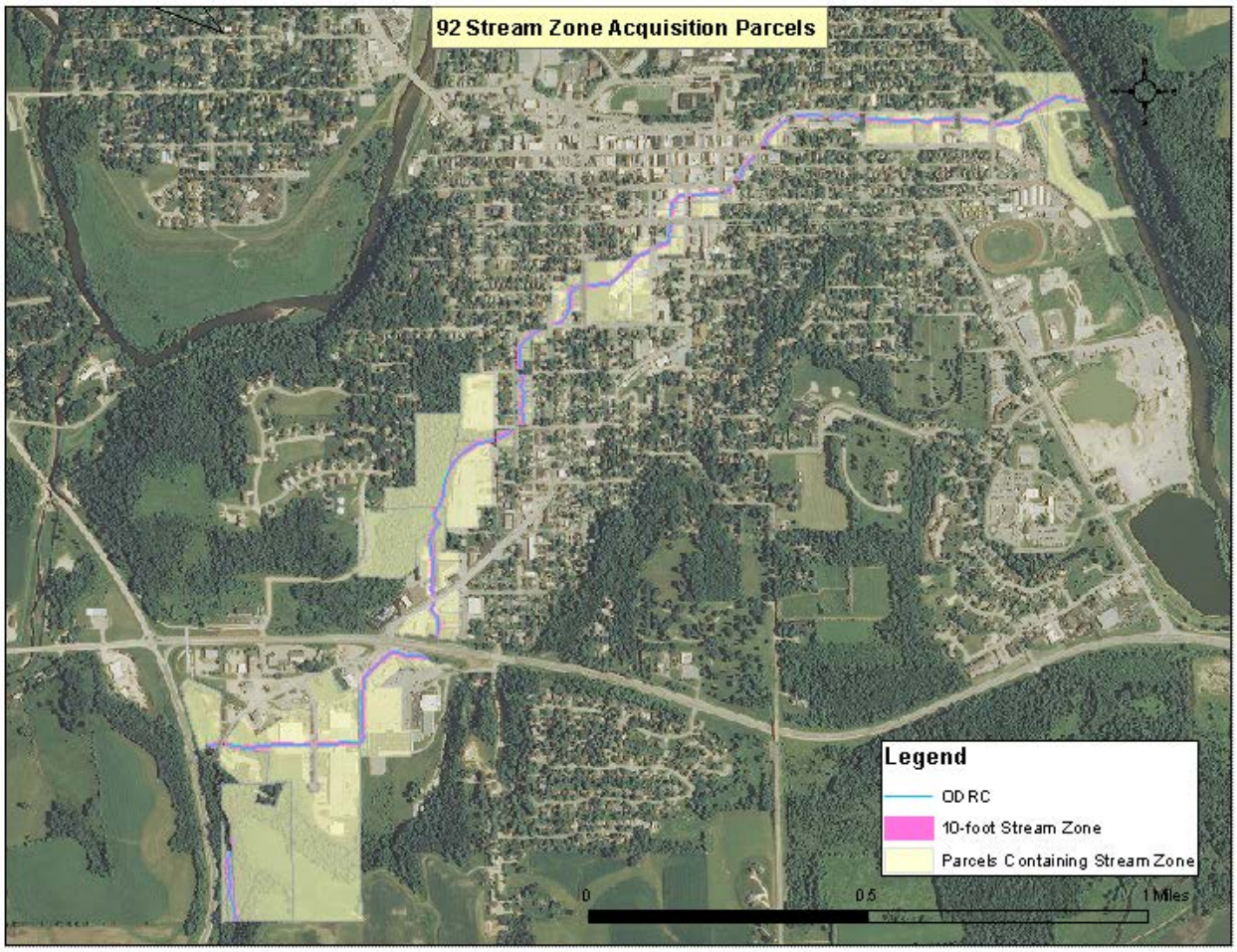


Appendix C

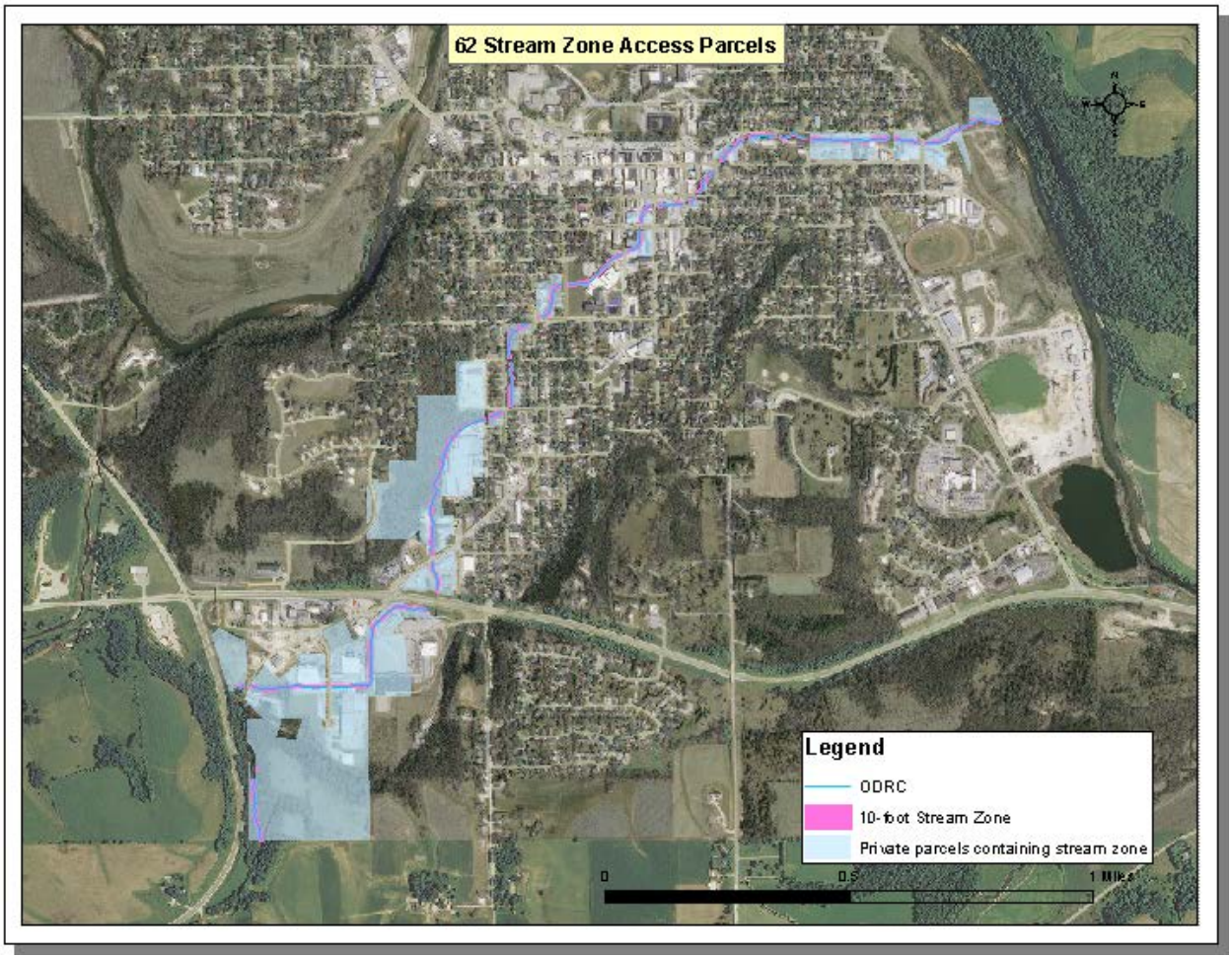
STREAM BUFFER SPATIAL ANALYSIS

STREAM BUFFER ANALYSIS

We roughly estimated the costs of acquisition along Old Dry Run Creek using GIS and information from the Winneshiek County Assessor Office. The centerline of Old Dry Run Creek was created using aerial imagery in GIS and then a 5-foot buffer around the stream centerline was created using the "buffer" tool in GIS, which resulted in showing the stream at an estimated 10-foot width. We then put a 10-foot buffer around the stream to show an area that would be sufficient for maintenance and entitled the area including the creek and the 10-foot buffer as the "stream zone." Ten feet on each side of the stream was chosen because it was an adequate size for maintenance and because a RASCAL stream analysis conducted by a project partner indicated that approximately 65 percent of the riparian zones along the stream were less than 10 feet wide. The 10-foot stream buffer was intersected with the parcel data from Winneshiek County which showed there were 92 parcels in Decorah that contain Old Dry Run Creek or portions of the 10-foot zone.



Of the 92 parcels that contained Old Dry Run Creek or the 10-foot zone, the 60 privately owned parcels were used to calculate the costs of stream zone acquisition. The remaining 32 were removed from the calculations because they are owned by the City of Decorah, Winneshiek County, Decorah Public School District, or other entity that would not be subject to land acquisition.

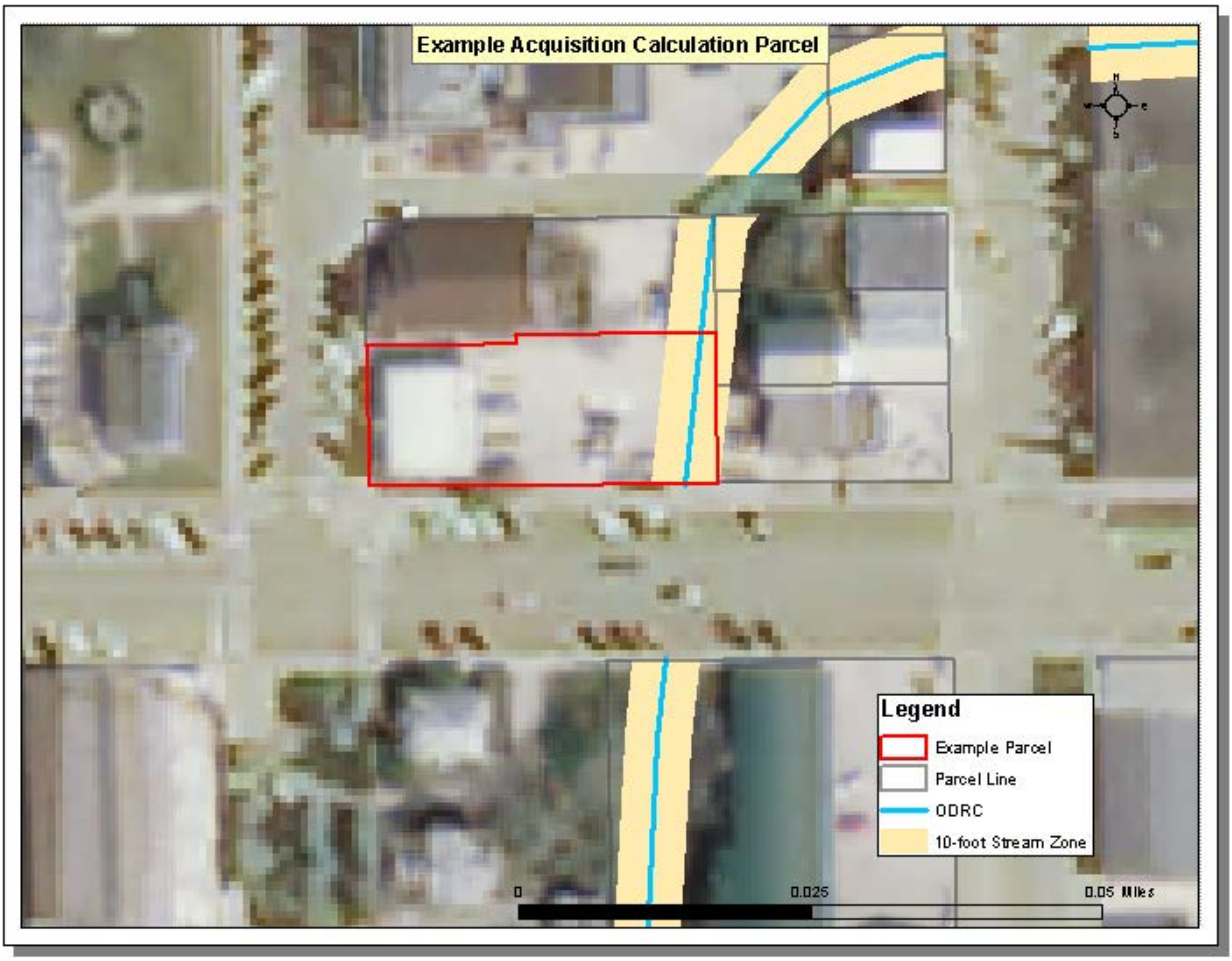


To calculate the acquisition costs for these 62 parcels, the total area of the stream buffer that was within a parcel was divided by the total land area of that parcel. This gave us the percentage of the parcel that would be acquired. This percentage was multiplied by the land value of the parcel and weighted based on the following scheme used by Winneshiek County for valuing land:

- Front quarter of parcel (based on the primary street the parcel faces) = 40 percent of parcel land value
- Second quarter of parcel = 30 percent of parcel land value
- Third quarter of parcel = 20 percent of parcel land value
- Back quarter of parcel = 10 percent of parcel land value

For instance, for the parcel below the calculation for the cost of stream zone acquisition would be:

(Area of stream buffer/Total parcel area) x (Land value x ((Percent of stream in zone in back quarter x 0.1))

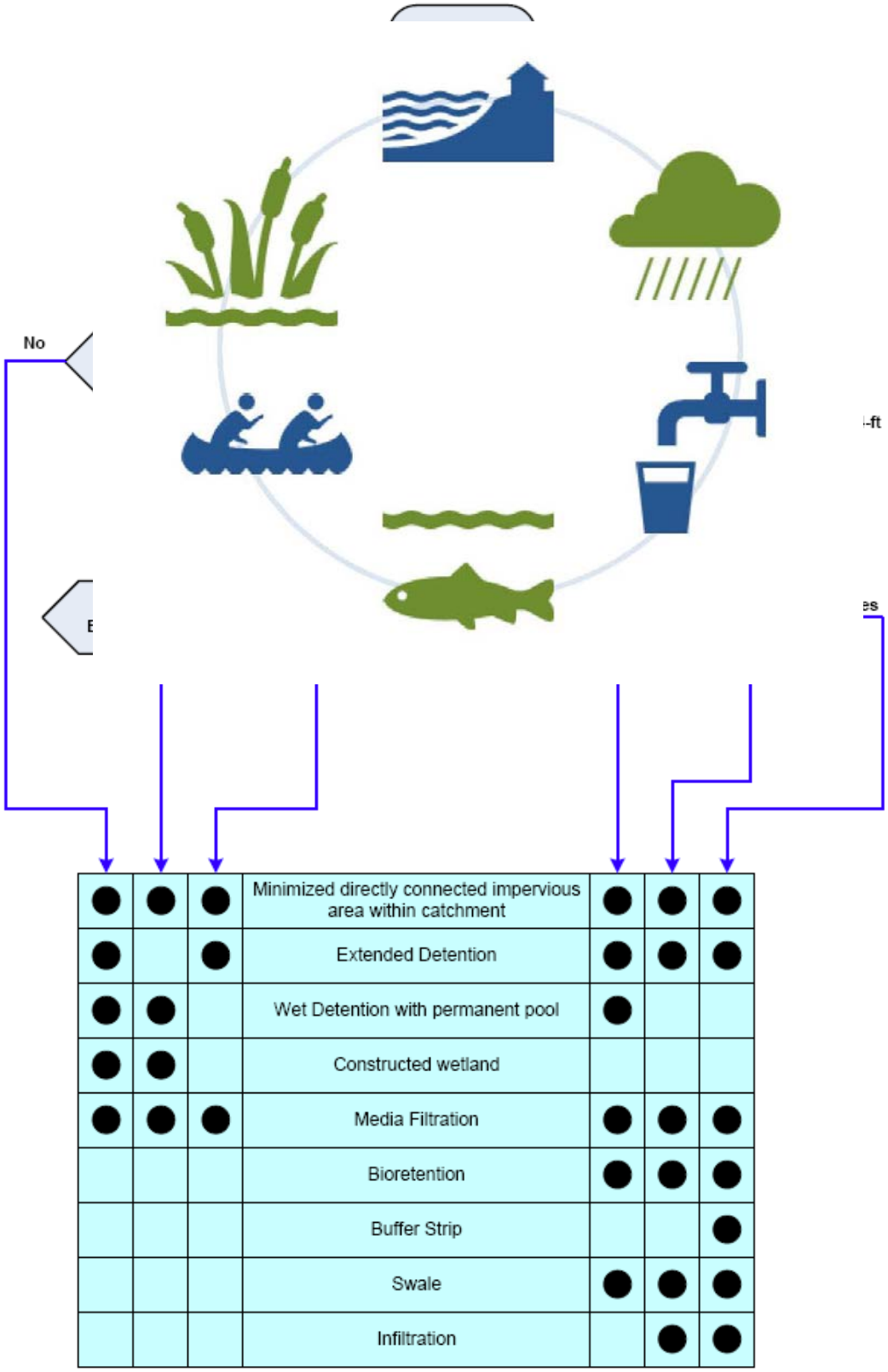


In this parcel, 100 percent of the stream zone runs through the back quarter of the parcel so the cost is 10 percent of the total land value for the stream buffer area.

Appendix D

BMP SITE DESIGN MATRIX

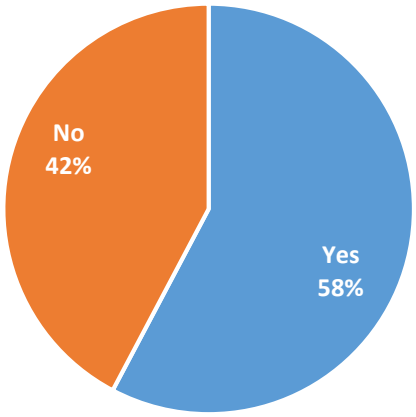
Figure 1 Decision-making matrix for selecting BMPs. Source: Iowa Stormwater Management Manual. Section 2D-3--Structural Controls. 11



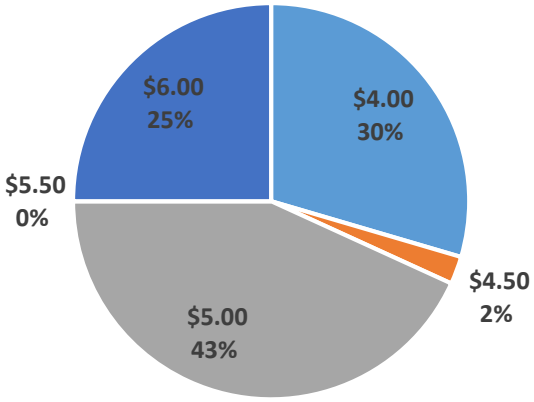
Appendix E

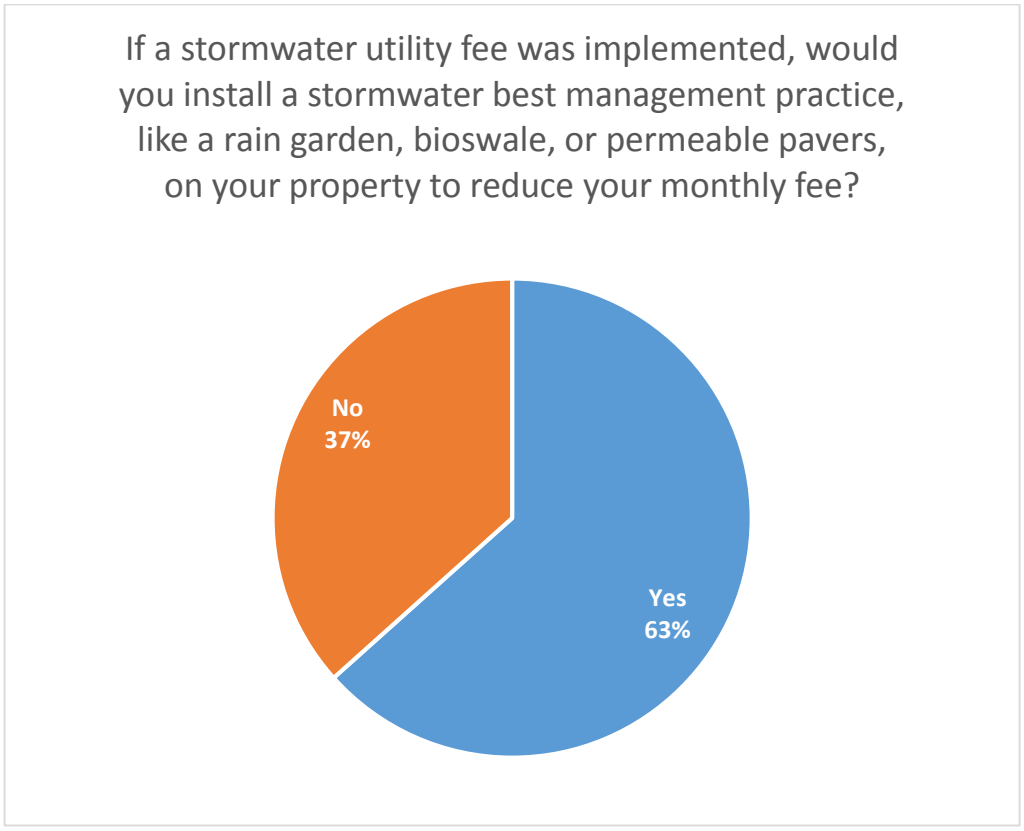
STORMWATER UTILITY FEE

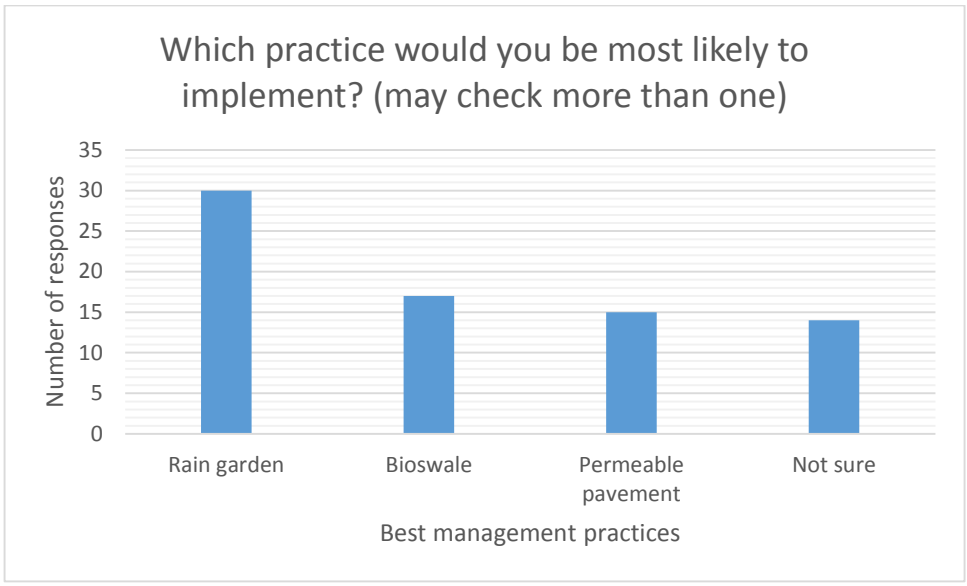
Would you be willing to pay a stormwater utility in the range of $4-$6 per month to fund stormwater management in Decorah?

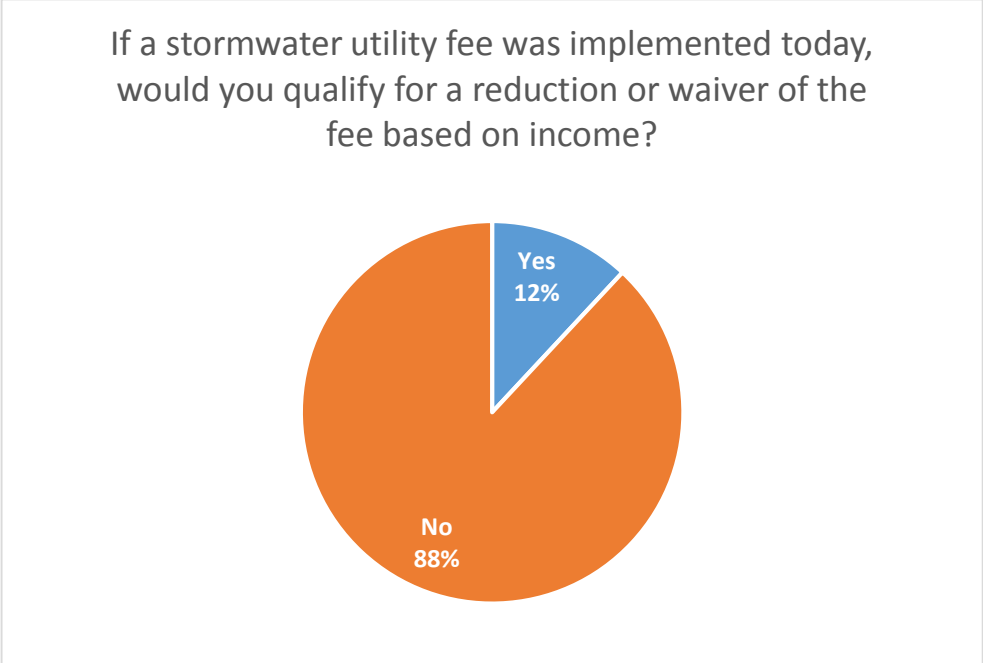


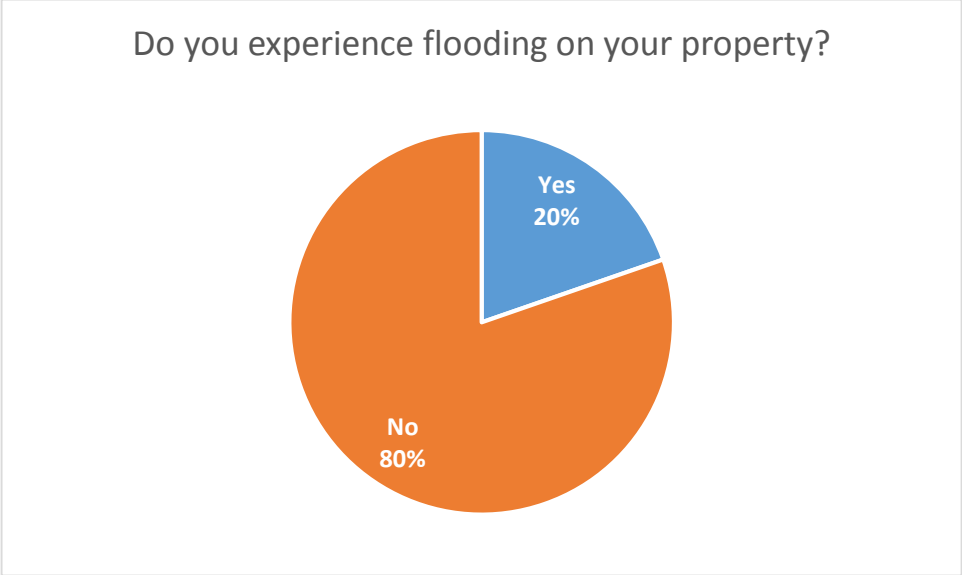
What is the maximum monthly fee you would be willing to pay?




If a stormwater utility fee was implemented, would you install a stormwater best management practice, like a rain garden, bioswale, or permeable pavers, on your property to reduce your monthly fee?
No 37%
Yes 63%


Which practice would you be most likely to implement? (may check more than one)
Number of responses
35
30
25
20
15
10
5
0
Rain garden
Bioswale
Permeable pavement
Not sure
Best management practices





What is the nearest intersection to your home?
main, williams
Broadway and Grove
Rural Ave. and Maiden Lane
W. Rural Ave. and Maiden Lane
Locust and Laurel Dr.
Riverside and South Ave.

Mill and Broadway
Washington and Railroad
4th st and center ave
Oak & East Broadway
Mound and center
Valley View and Pulpit Rock
College Dr and Ridge Rd
montgomery
Iowa Ave and college drive
South Ave. and Sumner St.
Claiborne
East and Iowa
Pearl Street and Linden Street
Leif Erikson/ College Dr
Broadway-Oak
Fair St & Moen St
Mechanic and 5th
Water st. And College Drive
E. Broadway & Linn St.
Center Street and Leif Erickson Ave.
Day Street and Pearl Street
Center St & High St
Locust and Shady Lane

Maple/Sanford
Broadway
Day and Pleasant Hill
college drive locust road
franklin st
hilltop and college
Park & Walnut
Mill and Jefferson
Pinecrest and Locust RD
Fifth Avenue & Western
Center & 3rd
East Broadway & Day Street
5th Ave and College Drive
Locust and Highland
South ave
Broadway and John
5th avenue
Crescent Ave and Sunset Drive
River Rd and 252nd St
valley view drive and highway 52
Riverside Ave and Decorah Ave
Winneshiek and Second
Riverview and Iowa Avenue

Ridge Rd and College Dr.
ohio and 5th
Pearl Street and Mechanic Street

Other comments
No more fees.
paying high property tax and cant afford any more
Why didn't the City apply for Fed/State funds to correct flooding problems in 2008 like other cities did. To me, it sounds like the city wants to give the water department personnel ANOTHER BIG RAISE.
No need for additional fees & taxes for something not necessary.
Decorah must work on reducing fees rather than creating new fees. We along with many others are considering moving outside the city limits so that we can reduce our city fees/ taxes. Look at all of the building just outside the. It's limits. They receive the benefit of the city, but do not have to pay the taxes and/ or fees.
A city rain barrel program might also be a good use of funds and a great way to capture water for landscape/garden use and reduce water flowing off of a property. The city could use funds generated from the fee to offset the cost of a well constructed/attractive barrel plus some educational material.
I live on top of the hill and would be willing to install something to slow the water down and allow it to soak in to the ground
i can see the concern and why it could be a good thing however this city charges enough for the "good" it provides without actually doing so. if you want to implement such a thing then it should be done at those that want it done expense
Call this what it is another Tax, not subject to any levy limitation. What current levy does this replace? . I Currently do most of things that you request.
Would need help designing a rain garden and how to do it!
Home Assessment Values increased significantly over the past 3 years. The increased funds raised from this tax revenue should be considered to fund these projects.
While we don't have flooding as such, the stormwater runoff from the 600 and 500 blocks of East Broadway (and Oak Street) comes right down the hill in a river past our houses in the 400 block.
We have had flooding/drainage problems in our backyard and the two houses behind us have the same issue. The city installed tile to drain the water away. The tile drained so much that they ended up

burying the tile underground farther than just dumping to the street. It now empties into the storm drain on College Drive.
I'm more concerned with the poor condition of our city streets.
Air quality and road damage from industrial gravel truck traffic through neighborhoods and speeding on Quarry Hill and Whitetail roads. Pollution from truck traffic through downtown near schools and Water St.-we need to ban truck thru-traffic from downtown for the sake of tourists and residents.
No additional tax measures should be taken. Taxes/fees are too high and increasing. Wages are not!
This would really help with isolated and minor flooding events as well.

Iowa Stormwater Fee Rates and Descriptions[2]

City	Population	Residential Fee	Other Fees 1	Other Fees 2
Algona	5,741	$2.50/mo	$7.50/mo school, church, commercial	$12.50/mo other
Bondurant	3,860	$2.50/mo	$2.50/mo	-
Boone	12,633	1 ERU = $2.00/mo up to 6,000 square ft.	1 ERU = $2.00/mo. Up to 3,000 square ft.	-
Carroll	10,103	$3.00/mo	$25/mo schools, $10/mo Church, $3/mo commercial	Max fee at $50
Charles City	7,812	$4.00/mo	$4.00/mo	-
Clive	15,000	$4.00 residential, ERU = 3,667 square ft.	$4.00 commercial, ERU = 3,667 square ft.	-
Decorah	8,089	-	-	-
DeWitt	5,049	$2.50/mo	$6.00/mo commercial, education, government, religious	-
Forest City	4,362	$5.00/mo	$8.30/mo	-
Hiawatha	6,694	$1.50/mo	$2.00/mo	-
Le Mars	9,826	$4.00/mo	$7.00/mo non-residential	-

[2] "Iowa Stormwater Utilities." *Iowa Stormwater Education Program*. March 2011. <http://iowastormwater.org>.

Sioux Center	6,327	$2.00/mo	$2.00/mo	-
Storm Lake	10,076	$3.00/mo, 1 ERU per unit	$2.75/ERU (2750 square ft.) school, church, commercial	-
Waukee	13,790	1 ERU = 2,973 square ft. $4.25/ERU single, townhomes, duplex	$4.25/ERU/mo.	-
AVERAGE	**8,526**	**$2.95**	**$5.63**	-

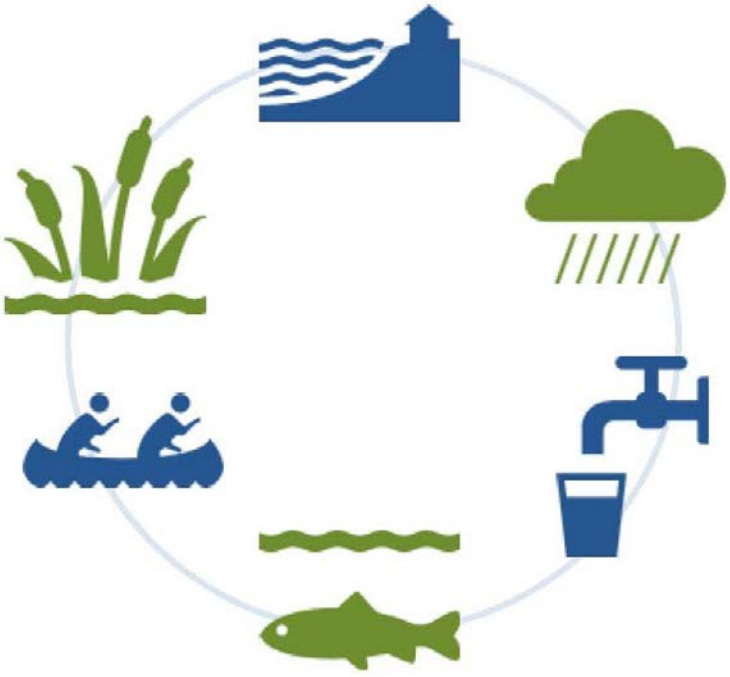
Sub-Watershed Unit (SWU) Fee			
A $1.87	D1 $1.57	K $2.53	S $2.47
A1 $1.53	E $2.41	L $1.87	T $2.42
B $2.37	E1 $1.77	M $1.83	U $1.79
B1 $1.54	F $2.30	N $1.87	V $1.69
C $3.01	F1 $1.30	O $1.87	W $2.74
C1 $1.69	G & H $3.51	P $1.93	X $2.70
D $2.47	I $2.51	Q $1.53	Y $2.70
D1 $1.57	J $2.18	R $1.48	Z $1.52

PRELIMINARY BUDGET RESULTS

Year 1			Year 2			Year 3		
Priority easements land purchase (14)	$40,315	14 parcels	Clearing and planting (9 priority parcels)	$79,550	(9 of 14)	Park 1 development	$20,000	
Easement surveying (14)	$11,200	14 parcels x $800/parcel	Park 1 and 2 extra land purchase	$13,342		Park 2 development	$20,000	
Clearing and planting (5 priority parcels)	$44,194	(5 of 14)				Easement purchase (4)	$8,222	land
						Easement surveying (4)	$3,200	
						Easement (4) clearing and planting	$35,356	
Stormwater Maintenance	$67,550		Stormwater Maintenance	$67,550		Stormwater Maintenance	$67,550	
Education	$2,500		Education	$2,500		Education	$2,500	
TOTAL	$165,759		TOTAL	$162,942		TOTAL	$156,828	
Stormawter Fund	$173,583		Stormawter Fund	$173,583		Stormawter Fund	$173,583	
Cost share (carry over)	$7,824		Cost share (carry over)	$10,641		Cost share (carry over)	$16,755	

Year 4			Year 5			Year 6		
Easement purchase (28)	$58,000	land	Easement purchase (14)	$29,000		Mill Street bioswale	$45,000	4500 sq ft @ 20/sqft @50% cost share
Surveying (28)	$22,400		Surveing (14)	$11,200		West bioswale construction (5)	$16,480	1648 sq ft @50% cs
Clearing and planting (28)	N/A	city maintenance	Clearing and planting (14)	N/A	city maintenance			
			West bioswale construction (5)	$16,480	1648 sq ft @50% cs			
Stormwater Maintenance	$67,550		Stormwater Maintenance	$87,000		Stormwater Maintenance	$87,000	
Education	$2,500		Education	$5,000		Education	$5,000	
TOTAL	$150,450		TOTAL	$148,680		TOTAL	$153,480	
Stormawter Fund	$173,583		Stormawter Fund	$173,583		Stormawter Fund	$173,583	
Cost share (carry over)	$23,133		Cost share (carry over)	$24,904		Cost share (carry over)	$20,104	

Year 7			Year 8		
S. Mill street alley bioswale	$38,449	3845 sq ft @$20/sq ft @50% cs	Hevily street parking lot bic	$42,051	2100 sq ft @$20/sq ft @50%cs
West bioswale construction	$16,480	1648 sqft @50% cs	Heivly street parking lot bic	$32,000	1600 sq ft @$20/sq ft @50%cs
Stormwater Maintenance	$87,000		Stormwater Maintenance	$87,000	
Education	$5,000		Education	$5,000	
TOTAL	$146,929		TOTAL	$166,051	
Stormawter Fund	$173,583		Stormawter Fund	$173,583	
Cost share (carry over)	$26,655		Cost share (carry over)	$7,532	



Appendix F

PLANNING TOOLS

CITY OF DECORAH NATURAL AREA AND STREAM BUFFER EASEMENT

THIS DEED FURTHER WITNESSETH that in consideration of the premises and the sum of X Dollars ($X), cash in hand paid, the receipt and sufficiency of which are hereby acknowledged, Owners do hereby grant and convey unto the City, its successors and assigns, a Natural Area and Stream Buffer Easement (the **"Buffer Easement"**), as designated on the Plat. The purpose of the Buffer Easement shall be to achieve the water quality protection goals of the Decorah Stormwater Management Plan, including, without limitation, control and/or reduction of non-point source pollution, limitation of land disturbance, minimizing discharge of pollutants to wetlands, limiting construction related disturbance, preservation of indigenous vegetation and tree cover, maximizing the use of sheet flow and flow length through vegetated areas, location of concentrated development away from streams and drainage ways, increasing pollutant removal efficiency, and, in general, reducing the impacts of pervious and impervious surface runoff upon environmental features such as rivers, streams, floodplain, wetlands, and steep slopes. To achieve such goals, the Owners agree that the Buffer Easement shall be subject to the following conditions:

(i) The Buffer Easement shall not be disturbed during project construction, except for temporary impacts due to mitigation or reforestation projects;

(ii) The limits of land disturbance on the Property shall be shown clearly on the plans and shall be delimited in the field by means of conspicuous signs or other such means;

(iii) The Buffer Easement shall be protected in its natural state, which shall include the erection and maintenance of conspicuous signs or other such clearly recognizable devices for the purposes of permanently marking the boundaries of the Buffer Easement, provided however, that, when necessary to protect the intent and function of the easement or to protect persons and property from injury or damage, as determined in consultation with the City Forester, invasive growth, hazard trees and trees and other vegetation damaged or infected by insects, disease, flood or other natural disasters may be removed in accordance with sound forest management practices;

(iv) Any use or activity within the Buffer Easement, including installation of private drives, shall not disturb any existing indigenous vegetation and tree cover, undisturbed nontidal wetlands, undisturbed lands within the regulated floodplain, and undisturbed steep slopes exceeding 25%;

(v) The hydrology of the Property shall not be significantly changed;

(vi) Notwithstanding anything herein to the contrary, the easement granted hereby is limited to the area designated as a Natural Area and Stream Buffer Easement on the Plat.

(vii) The City and its agents shall have full and free use of said easements for the purposes named, and shall have all rights and privileges reasonably necessary to the exercise of the easements including the right of access to and from the easements and right to use adjoining land where necessary; provided, however, that this right to use adjoining land shall be exercised only during periods of actual construction or maintenance, and further, this right shall not be construed to allow the City to erect any building or structure of a permanent nature on such adjoining land.

(viii) The owner of fee title to any property on which a Buffer Easement is hereby granted shall be responsible for compliance with the conditions as set forth above, for maintenance of the Buffer Easement and for the perpetual protection of the Buffer Easement in its natural state for water quality protection purposes and in accordance with the said conditions, unless such responsibility shall have been given to its successors or to an owner's association under the provisions of any declaration of covenants, conditions, and restrictions heretofore or hereafter recorded; it being intended that such responsibilities shall not be a personal obligation but shall run with the land.

EXAMPLE ORDINANCE
POST-CONSTRUCTION STORMWATER MANAGEMENT

PURPOSE.

1. The U.S. EPA's National Pollutant Discharge Elimination System ("NPDES") permit program ("Program") administered by the Iowa Department of Natural Resources ("IDNR") requires that cities meeting certain demographic and environmental impact criteria obtain from the IDNR and NPDES permit for the discharge of stormwater from a Municipal Separate Storm Sewer System (MS4).
2. As a condition of an MS4 Permit, the City is obliged to develop, implement, and enforce a program to address stormwater runoff from new construction and reconstruction projects for which State NPEDS General Permit #2 stormwater permit coverage is required, by adopting a POST-CONSTRUCTION STORMWATER MANAGEMENT ORDINANCE designed:

    a) To require water quality and quantity components be considered in the design of new construction and implemented when practical;

    b) To promote the use of stormwater detention and retention, grass swales, buffer strips, and proper operation and maintenance of these facilities;

    c) To allow use of bio-retention swales and riparian buffers where practical and the soils and topography are suitable to ensure such measures will be effective in accomplishing the purpose of the Ordinance;

    d) To prohibit construction activities from commencing until the plans for post-construction runoff controls have been submitted to the City;

    e) To allow the City to have the ability to access private property for the purpose of enforcement procedures to promote compliance with the State NPDES General Permit #2, which require post-construction compliance by Applicants ("Applicants").

3. No state or federal funds have been made available to assist the City with inspections, monitoring and/or enforcing the Program

4. Terms used in this Ordinance shall have the meanings specified as follows.

a. "Applicant" means any person, firm, or entity applying for a permit to develop, grade, or construct within the corporate limits of the City.

b. Terms used in this chapter shall have the meaning specified in the Program.

PROCEDURE FOR POST-CONSTRUCTION.

1. Each Applicant who is required to have coverage under General Permit No. 2 for a site, shall install post-construction stormwater management facilities as set forth herein and as approved by the City during site plan, platting, or construction plans.
2. Each Applicant or its successor person(s) or entity shall be responsible for maintaining all stormwater management facilities as approved by the City.
3. For sites equal to or greater than one acre, each Applicant must provide to the City as- built plans detailing dimensions and elevations as well as a certification that stormwater management facilities were built as part of the approved development that includes the site. For sites less than one acre that are part of a common plan of development and for which the Applicant establishes that stormwater management facilities were or will be built to address all properties (either collectively or individually) within the development, each Applicant must provide to the City a copy of the Notice of Discontinuation for General Permit No. 2 applicable to the property.
4. Each Applicant must include in their site design those stormwater management facilities
5. that will convey drainage through the property to one or more detention and/or treatment areas such that no development shall cause downstream property owners, water courses, channels, or conduits to receive stormwater runoff from the proposed development site at a peak flow rate greater than that allowed by the policy or standard in effect at the time of approval of the development, unless such requirement s are waived by the City. Nothing contained herein shall prohibit the City from changing the policies or standards in the future, nor from requiring the site to comply with the new requirements.
6. Each Applicant shall comply with all other applicable City, state or federal permit requirements as they apply to the City or to the property.
7. At the discretion of the City, the applicant may satisfy the post-construction stormwater management requirements by ensuring the conveyance of the stormwater discharge from the property to a regional detention facility. For the purposes of this Ordinance, a "regional detention facility" shall be wet or dry detention basins, which are designed to accept stormwater runoff from two or more sites that are required to obtain a state NPDES General Permit No. 2 and that otherwise complies with all city, state, or federal permit requirements, as they apply to stormwater management requirements for those sites.

MAINTENANCE AND REPAIR OF STORMWATER UTILITIES.

1. Prior to the issuance of any permit that has a stormwater management facility as one of the requirements of the permit, the Applicant or owner of the site must execute a maintenance easement agreement that shall be binding on all subsequent owners of land served by the stormwater management facility. The agreement shall provide for access to the facility at reasonable times for periodic inspection by the City, or its contractor or agent, to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this Ordinance. The easement agreement shall be recorded by the City in the land records.
2. Maintenance of all stormwater management facilities shall be ensured through the creation of a formal maintenance covenant that must be approved by the City and recorded into the land record at the time of final plat approval. As part of the covenant, a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the sto1mwater management facility. The covenant shall also include plans for periodic inspections by the Applicant, owner, or assigns to ensure proper performance of the facility.
3. The City shall be permitted to enter and inspect any property subject to regulation under this section as often as is necessary to document maintenance and repair needs and deter mine compliance with the requirements of this Ordinance. If a Responsible Party owning, controlling or possessing a property has security measures that require identification and clearance before entry to its property, such Responsible Party shall make the necessary arrangements to allow access by the City. By way of specification but not limitation:

    a) A Responsible Par ty shall allow the City reading access to all parts of the property for purposes of inspection, examination, and copying of records related to compliance with this Ordinance.

    b) Any temporary or permanent obstruction that obstructs the safe and easy access to property to be inspected and shall be promptly removed by the Responsible Party at the written or oral order of the City and shall not be replaced. The costs of clearing such access shall be home by the Responsible Party.

    c) An unreasonable delay in allowing the City to access to a property is a violation of this chapter.

4. Parties responsible for the operation and maintenance of a stormwater management facility, shall make records of the installation and of all maintenance and repairs, and shall retain said records. Copies of the as-built plans and records of all self-inspections, maintenance, and repairs, shall be kept on-site and shall be made available to the City during inspection of the facility and at other reasonable times upon request.

5. In the event that a stormwater management facility is found by the City to be non-compliant with the plans as submitted and approved or is found to be in need of maintenance, the Responsible Party will be notified in writing of such deficiencies. Upon receipt of such notice, the responsible party shall have fifteen (15) days to correct such deficiencies. After proper notice and if the Responsible Party fails to make the repairs or perform the maintenance, the City may have such work performed and assess the owner(s) of the facility for the cost of repair work and any penalties; and the cost of the work shall be a lien on the property, or prorated against the beneficial users of the property, and may be placed on the tax bill and collected as ordinary taxes by the City. In addition, easements and covenants recorded upon the applicant's property shall provide mechanisms for the establishment of a lien by the City for any and all costs incurred by the City pursuant to this chapter to aid in efficient and cost effective collection of sums so expended, including, but not limited to attorney's fees associated with collection.

ENFORCEMENT.

1. Violations of any provision of this chapter may be enforced by civil action including an action for injunctive relief. In any civil enforcement action, administrative or judicial, the City shall be entitled to recover its attorney fees and costs from a person who is determined by a court of competent jurisdiction to have violated this chapter.
2. Violation of any provision of this chapter may also be enforced as a municipal infraction with the meaning of Section 364.22 of the Iowa Code or Chapter X of the Decorah City Code.
3. Enforcement pursuant to this section, shall be undertaken by the City Administrator upon the advice and consent of the City Attorney.

(Ordinance No. X)

STORMWATER UTILITY MODEL ORDINANCE

ORDINANCE NO._____

ORDINANCE AMENDING THE CODE OF ORDINANCES, CITY OF _____ _____, BY ADDING CHAPTER _____, "STORMWATER MANAGEMENT AND DRAINAGE SYSTEMS UTILIITY"

Section 1. THE CODE OF ORDINANCES, CITY OF _____ _____, is hereby amended to add CHAPTER "STORMWATER MANAGEMENT AND DRAINAGE SYSTEMS UTILIITY," in the form attached hereto.

Section 2. Repealer Clause. All ordinances or parts of ordinances in conflict herewith are hereby repealed.

Section 3. Severability Clause. If any section, provision or part of this ordinance shall be adjudged invalid or unconstitutional, such adjudication shall not affect the validity of the ordinance as a whole or any section, provision or part thereof not adjudged invalid or unconstitutional.

Section 4. Effective Date. This ordinance shall be effective from and after the final passage, approval and publication as provided by law.

PASSED AND APPROVED this _____day of _____, 20_____.

(SEAL)

_____
Mayor

ATTEST:

_____
City Clerk

APPROVED AS TO FORM:

_____
City Attorney[3]

[3] This model ordinance was developed by Iowa Association of Municipal Utilities staff and is furnished as a drafting guide for attorneys representing governmental subdivisions in Iowa. CAVEAT: THIS MODEL ORDINANCE SHOULD NOT BE ADOPTED WITHOUT CONFIRMING INDEPENDENT LEGAL RESEARCH BY AN ATTORNEY LICENSED TO PRACTICE LAW IN IOWA. LOCAL CIRCUMSTANCES WILL VARY SIGNIFICANTLY FROM

I, _____, City Clerk of the City of _____ _____, Iowa, do hereby certify that the foregoing ORDINANCE was passed and approved by the City Council of the City of _____ _____Iowa, on the _____day of _____, 20_____, and was published in the _____, a newspaper of general circulation in the said City of _____, on the _____day of _____, 20_____.

Dated this _____day of _____, 20_____.

_____
City Clerk

JURISDICTION TO JURISDICTION. CONSIDERATION OF SUCH AN ORDINANCE CALLS FOR CAREFUL ANALYSIS AND DETERMINATION OF A NUMBER OF CRITICAL POLICY ISSUES BY THE GOVERNING BODY OF THE JURISDICTION.

Chapter [ ] STORMWATER UTILITY

Sections:

1.1 Purpose and Objective.

(a) The purpose of this Article is to establish a policy and procedure for managing and controlling the quantity and quality of stormwater runoff, within the city limits of [INSERT CITY], Iowa. The management shall include the establishment of a stormwater utility to provide revenues for whatever aspects of this requirement are deemed appropriate by the City.

(b) The city finds, determines and declares that the stormwater drainage system provides benefits and services to all property within the city limits. Such benefits include, but are not limited to: the provision of adequate systems for collection, conveyance, detention, treatment and release of stormwater for quality and quantity management that minimize impacts on receiving waters.

(c) In order to manage additions and improvements to the city stormwater systems, the City must have adequate and stable funding for its stormwater management program operating and capital investment needs.

1.2 Creation of a Stormwater Management and Drainage Systems Utility.

(a) The function of the Stormwater Management and Drainage Systems Utility [hereinafter referred to as "stormwater utility"] within the [LIST DEPARTMENT] is to provide for the safe and efficient capture of stormwater runoff, mitigate the damaging effects of stormwater runoff, correction of stormwater problems, to fund activities of stormwater management, and include design, planning, regulations, education, coordination, construction, operations, maintenance, inspection and enforcement activities.

(b) There is hereby established a stormwater utility within the City of [INSERT CITY], Iowa which shall be responsible for creating revenue for stormwater management throughout the City's corporate limits, and shall provide for the management, protection, control, regulation, use, and enhancement of stormwater systems and facilities. Such utility shall be under the operational direction of the [INSERT UTILITY DIRECTOR]. The corporate limits of the City, as increased from time to time, shall constitute the boundaries of the stormwater utility district.

(c) The City shall establish a Stormwater Utility Fund in the City budget and accounting system, separate and apart from its General Fund, for the purpose of dedicating and protecting all funding applicable to the purposes and responsibilities of the utility.

1.3 Definitions.

"City" City of [INSERT CITY]

"Adjustment" means a modification in a nonresidential customer's stormwater service fee for certain activities that impact stormwater runoff or impact the City's costs of providing stormwater management.

"Director" means the director of the Stormwater Utility.

"Detached Dwelling Unit" shall mean developed land containing one structure which is not attached to another dwelling and which contains one or more bedrooms, with a bathroom and kitchen facilities, designed for occupancy by one family. Detached dwelling units may include houses, manufactured homes, and mobile homes located on one or more individual lots or parcels of land.

"Equivalent Residential Unit" (ERU) shall mean the average impervious area of a detached dwelling unit property within the City, and shall be used as the basis for determining stormwater service charges to detached dwelling unit properties. [INSERT SQUARE FEET OF IMPERVIOUS AREA] shall be equivalent to 1 ERU. (*This is usually obtained by averaging single family resident's impervious area using such tools as GIS maps and associated software.)*

"ERU Rate" The dollar value periodically determined and assigned to each ERU as a charge for stormwater management services, expressed as [INSERT DOLLAR AMOUNT] per ERU.

"Impervious Area" The number of square feet of hard-surfaced areas which either prevent or resist the entry of water into soil surface, as it entered under natural conditions as undeveloped property, and/or cause water to run off the surface in greater quantities or at an increased rate of flow from that present under natural conditions as undeveloped property. This includes but is not limited to roofs, roof extensions, patios, porches, driveways, sidewalks, pavement, athletic courts, and semi-impervious surfaces such as gravel which are used as driveways or parking lots.

"Occupant" shall mean the person residing or doing business on the property. In a family or household situation, the person responsible for the obligation imposed shall be the adult head of the household. In a shared dwelling or office situation, the adult legally responsible for the management or condition of the property shall be responsible.

"Owner" shall mean the legal owner(s) of record as shown on the tax rolls of [INSERT CITY], except where there is a recorded land sale contract, the purchaser thereunder shall be deemed the owner.

"Stormwater" means stormwater runoff, snowmelt runoff, and surface runoff and drainage.

"Storm Sewer" means a sewer, which carries stormwater, surface runoff, street wash waters, and drainage, but which excludes sanitary sewage and industrial wastes, other than permitted discharges.

"Service Charges" shall mean the periodic rate, fee or charge applicable to a parcel of developed land, which charge shall be reflective of the service provided by the [INSERT CITY] stormwater utility. Service charges are based on measurable parameters which influence the stormwater utility's cost of providing services and facilities, with the most important factor being the amount of impervious area on each parcel of developed land.

"Stormwater Drainage System" means all man-made facilities, structures, and natural watercourses owned by the city of [INSERT CITY], used for collection and conducting stormwater to, through, and from drainage areas to the points of final outlet including, but not limited to, any and all of the following: conduits and appurtenant features, canals, creeks, catch basins, ditches, streams, gullies, ravines, flumes, culverts, siphons, streets, curbs, gutters, dams, floodwalls, levees, and pumping stations.

"Stormwater Management" means the tasks required to control stormwater runoff using stormwater management systems, to protect the health, safety, and welfare of the public, and comply with relevant state and federal regulations.

"Stormwater Management Systems" address the issues of drainage management (flooding) and environmental quality (pollution, erosion, and sedimentation) of receiving rivers, streams, creeks, lakes, ponds, and reservoirs through improvements, maintenance, regulation and funding of

plants, works, instrumentalities and properties used or useful in the collection, retention, detention, and treatment of stormwater or surface water drainage.

“Stormwater Utility” means the utility established under this Section for the purpose of managing stormwater and imposing charges for the recovery of costs connected with such stormwater management.

“Surface Water” means water bodies and any water temporarily residing on the surface of the ground including lakes, reservoirs, rivers, ponds, streams, puddles, channelized flow and runoff.

“Undeveloped Property” describes land in its unaltered natural state or which has been modified to such minimal degree as to have a hydrologic response comparable to land in an unaltered natural state shall be deemed undeveloped. Undeveloped land shall have minimal concrete pavement, asphalt, or compacted gravel surfaces or structures which create an impervious surface.

“Water Course” A natural overland route through which water passes, including drainage courses, streams, creeks, and rivers.

Additional Definitions

These definitions are not found in this model ordinance but could be added to local ordinances when needed to clarify the meaning of specific words.

“Developed Agricultural Properties” means a lot or parcel of real estate used as a “farm,” which may contain one or greater dwelling units and/or other building structures but does not include undeveloped properties.

“Developed Property” means property altered from its natural state by the construction or installation of a structure or more than [INSERT AMOUNT OF IMPERVIOUS SURFACE] feet of impervious surface thus increasing the amount of rainwater or surface water runoff.

“Exempt Property” includes public streets, alleys and sidewalks; all undeveloped properties.

“Ground Water” means sub-surface water or water stored in pores, cracks, and crevices in the ground below the water table.

“Nonresidential properties” means all properties not encompassed by the definition of residential shall be defined as nonresidential. Nonresidential properties shall include: apartment building properties; condominiums properties; mobile home parks; commercial property; industrial property; institutional property; governmental property; churches; hospitals; schools; transient rentals; parking lots; federal, state and local properties; and any other property not mentioned in the lists of properties.

“Residential Property” means all single-family and duplex properties within the city of [INSERT CITY].

"Stormwater Facilities" means various stormwater and drainage works that may include inlets, pipes, pumping stations, conduits, manholes, energy dissipation structures, stream channels, outlets, retention/detention basins, infiltration practices and other structural components.

"User" means the owner and/or occupant of any developed property within the limits of [INSERT CITY], and shall mean any person who uses property which maintains connection to, discharges to, or otherwise receives services from the City for stormwater management. The occupant of any habitable property is deemed the user. If the property is not occupied, then the owner shall be deemed the user.

1.4 Stormwater Utility Fund.

(a) Funding for the stormwater utility's activities may include, but are not limited to: stormwater service charges; stormwater permits and inspection fees; other funds or income obtained from federal, state, local, and private grants, or loans.

(b) All service charges and all sources of revenue generated by or on behalf of the stormwater utility shall be deposited in a stormwater utility fund and used exclusively for management of the stormwater utility.

1.5 Stormwater Utility Budget.

The City shall adopt an operating and capital budget for the stormwater utility each fiscal year. The budget shall set forth revenues for such fiscal year and estimated expenditures for operations, maintenance, improvements, replacement and debt service.

1.6 Rate Structure and Stormwater Service Charge.

Any property, lot, parcel of land, building or premises that is tributary directly or indirectly to the stormwater system of the city, shall be subject to a charge based upon the quantity of impervious area situated thereon. This charge is not related to the water and/or sewer service and does not rely on occupancy of the premises to be in effect. All properties having impervious area within the city of [INSERT CITY] will be assigned an equivalent residential unit (ERU) or a multiple thereof, with all properties having any impervious area receiving at least one ERU, which shall be considered the base rate.

Establishment of Equivalent Residential Unit (ERU) rate and stormwater utility charge[4]:

[4] The rate information provided is to be used as general guidance. Each community must evaluate their billing infrastructure and program needs and establish rates accordingly.

1. For the purpose of this Ordinance, an ERU is equivalent to [INSERT SQUARE FEET] of impervious area.

2. Determination of Stormwater Utility Fee.

   a. The stormwater utility fee for single-family residential shall be 100% of the ERU rate.

      The rate shall be based on the following schedule:

      Fiscal year 2010-2011= $/month
      Fiscal year 2011-2012= $/month
      Fiscal year 2012-2013= $/month
      Fiscal year 2013-2014= $/month

      The monthly rate for each fiscal year thereafter shall be determined by resolution of the city council prior to July 1st of each year.

   b. The stormwater utility fee for multi-family residential shall be:

      Fiscal year 2010-2011= $/ERU/month
      Fiscal year 2011-2012= $/ERU/month
      Fiscal year 2012-2013= $/ERU/month
      Fiscal year 2013-2014= $/ERU/month

      The monthly rate based for each fiscal year thereafter shall be determined by resolution of the city council prior to July 1st of each year.

      The number of ERUs on each property shall be determined by the stormwater utility.

      OR, (INSERT %) of the ERU rate multiplied by the number of individual dwelling units on the property.

   c. The stormwater utility fee for commercial and industrial shall be:

      Fiscal year 2010-2011= $/ERU/month
      Fiscal year 2011-2012= $/ERU/month
      Fiscal year 2012-2013= $/ERU/month
      Fiscal year 2013-2014= $/ERU/month

      The monthly rate based for each fiscal year thereafter shall be determined by resolution of the city council prior to July 1st of each year.

      The number of ERUs on each property shall be determined by the stormwater utility.

OR, A base rate of one ERU plus (INSERT amount) multiplied by the numerical factor obtained by dividing the total impervious area of the property by the number of square feet in one ERU.

1.7 Powers of Director of the Stormwater Utility.

Stormwater service charges incurred pursuant to this ordinance may be collected by the stormwater utility director or designee who is also responsible for the regulation, collection, rebating and refunding of such stormwater charges.

1.8 Powers and Duties of the City.

The City shall have the following powers, duties, and responsibilities with respect to the stormwater utility:

(a) Administer the design, construction, maintenance and operation of the utility system, including capital improvements designated in the comprehensive drainage plan.

(b) Acquire, construct, lease, own, operate, maintain, extend, expand, replace, clean, dredge, repair, conduct, manage, and finance such facilities, operations, and activities, as are deemed by the City to be proper and reasonably necessary for a system of storm and surface water management. These facilities may include, but are not limited to, surface and underground drainage facilities, storm sewers, watercourses, ponds, ditches, and such other facilities relating to collection, runoff, treatment and retention as will support a stormwater management system.

(c) The City shall separately account for the stormwater utility finances. The stormwater utility shall prepare an annual budget, which is to include all operation and maintenance costs and costs of borrowing. The budget is subject to approval by the City Council. Any excess of revenues over expenditures in a year shall be retained in a segregated fund, which shall be used for stormwater utility expenses in subsequent years. Stormwater utility fees collected shall be deposited in the stormwater utility fund and shall be used for no other purpose.

1.9 Responsibility for the Stormwater Management and Drainage System.

(a) The City stormwater management and drainage system consists of all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage ways, channels, ditches, swales, storm sewers, culverts, inlets, catch basins, pipes, head walls and other structures, natural or man-made, within the political boundaries of the City of [INSERT CITY] which control and/or convey stormwater through which the City intentionally diverts surface waters from its public streets and properties. The City owns or has legal access for purposes of operation, maintenance and improvements to those segments of this system which

(1) are located within public streets, rights-of-way, and easements;

(2) are subject to easements of rights-of-entry, rights-of-access, rights-of-use, or other

permanent provisions for adequate access for operation, maintenance, and/or improvement of systems and facilities; or

(3) are located on public lands to which the City has adequate access for operation, maintenance, and/or improvement of systems and facilities. Operation and maintenance of stormwater systems and facilities which are located on private property or public property not owned by the City of [INSERT CITY] and for which there has been no public dedication of such systems and facilities for operation, maintenance, and/or improvement of the systems and facilities shall be and remain the legal responsibility of the property owner.

(b) It is the intent of this section to protect the public health, safety and general welfare of all properties and persons in general, but not to create any special duty or relationship with an individual person or to any specified property within or without the boundaries of the City of [INSERT CITY]. The City of [INSERT CITY] expressly reserves the right to assert all available immunities and defenses in any action seeking to impose monetary damages upon the City, its officers, employees and agents arising out of any alleged failure or breach of duty or relationship as may now exist or hereafter be created.

1.10 Requirements for On-site Stormwater Systems, Enforcement and Inspections.

(a) All property owners and developers of developed real property within the City of [INSERT CITY] shall provide, manage, maintain, and operate on-site stormwater systems sufficient to collect, convey, detain, and discharge stormwater in a safe manner consistent with all City, State, and Federal laws and regulations.

(b) Pursuant Iowa Code Section 364.12(3) or successor section of the State Code, any failure to meet this obligation may constitute a nuisance and may be subject to an abatement action filed by the City. In the event a nuisance is found to exist, which the owner fails to properly abate within such reasonable time as allowed by the City, the City may enter upon the property and cause such work as is reasonably necessary to be performed, with the actual cost thereof assessed against the owner in the same manner as a tax levied against the property. The City shall have the right, pursuant to the authority of this section, for its designated officers and employees to enter upon private and pubic property owned by entities other than the City, upon reasonable notice to the owner thereof, to inspect the property and conduct surveys and engineering tests thereon in order to assure compliance.

1.11 Right to Appeal.

Any customer who believes the provisions of this chapter have been applied in error may appeal in the following manner:

(a) An appeal must be filed in writing with the City of [INSERT CITY] City Manager. In the case of service charge appeals, the appeal shall include a survey prepared by a registered

Iowa land surveyor or professional engineer containing information on the total property area, the impervious surface area and any other features or conditions which influence the hydrologic response of the property to rainfall events.

(b) Using the information provided by the appellant, the City Manager shall conduct a technical review of the conditions on the property and respond to the appeal in writing within thirty (30) days.

(c) In response to an appeal, the City Manager may adjust the stormwater service charge applicable to a property in conformance with the general purpose and intent of this chapter.

(d) A decision of the City Manager which is adverse to an appellant may be further appealed to the City Council within thirty (30) days of receipt of notice of the adverse decision. Notice of the appeal shall be served on the City Council by the appellant, stating the grounds for the appeal. The City Council shall schedule a public hearing within thirty (30) days. All decisions of the City Council shall be served on the appellant by registered mail, sent to the billing address of the appellant.

(e) All decisions of the City Council shall be final.

1.12 Billing and Collection.

(a) A storm water service charge bill may be sent through the United States mail or by alternative means, notifying the customer of the amount of the bill, the date the payment is due, and the date when past due. Failure to receive a bill is not justification for non-payment. Regardless of the party to whom the bill is initially directed, liability for payment of the stormwater management charge attributable to that property shall be joint and several as to the owner and occupant.

(b) All comprehensive stormwater service charges are due and payable thirty days after the date of billing.

(c) A penalty of five percent shall be added to a comprehensive stormwater service charge when the charge is not paid in said thirty days.

OR A one and one-half percent (1.5%) per month late charge shall be billed based on the unpaid balance of any storm water utility service charge that becomes delinquent.

OR Each stormwater service charge rendered under or pursuant to this chapter is hereby made a lien upon the corresponding lot, parcel of land, building or premises that are tributary directly or indirectly to the stormwater system of the city, and, if the same is not paid within sixty days of invoice date, it shall be certified to the county treasurer, who shall place a lien on said property as allowed by law and be collected in the same manner as property taxes.

(d) Certification. The director shall certify to the [INSERT CITY FINANCE OFFICER] any comprehensive stormwater service charge, which is owed after a sixty-day payment period. All certified service charges constitute a lien upon the premises served by the stormwater system for which the service charges were made and shall be collected in the same manner as property taxes. Failure to send or receive a bill for comprehensive stormwater service charge is not a defense to the collection of the service charges.

(e) Suits for collection shall be commenced by the City in the Iowa District Court for [INSERT COUNTY] County. No lien shall be imposed for delinquent collections unless a judgment is first obtained from a court of competent jurisdiction. The City may employ any lawful means to collect funds owed, and is not restricted to filing a lawsuit.

(f) The stormwater utility service charge may be billed on a common statement and collected along with other city utility services, usually on a quarterly basis.

1.13 Adjustments to Stormwater Service Charges.

Increase adjustments (debit) can be made to nonresidential service charges by property owners adding additional impervious area such as rooftops, parking lots, driveways and walkways.

1.14 Exemptions and Credits Applicable to Stormwater Service Charges.

All public or private property shall be subject to stormwater utility service charges except as provided in this Ordinance below. A stormwater utility service charge formula is available in the office of the stormwater utility. The following areas are exempt from stormwater utility service charges:

1. Undeveloped property as defined in this Ordinance.

2. Streets, alley ways, and highways in the public and private domain are exempt from utility service charges or connection fees.

3. Railroad rights-of-way (tracks) shall be exempt from stormwater service charges. However, railroad stations, maintenance buildings, or other developed land used for railroad purposes shall not be exempt from storm water service charges.

Component	Altoona	Ames	Asbury	Bondurant	Cedar Falls	Cedar Rapids	Clinton	Clive
City Code Chapter	149	5B	153	102	2718	72	53	872
Iowa Stormwater Management Manual Referenced	Yes	Yes	Asbury PCSWBMP	No	Yes	No	No	Yes
Unified Sizing Criteria (specifically)	No	Yes	Yes	No	Yes	No	No	No
Size of Storm Referenced (if no USC)	Peak Flow	USC	USC	Peak Flow	USC	None	Peak Flow	Peak Flow
SUDAS Referenced	Yes	No	No	No	No	Metro Area Standards	No	Yes
Other Plan Referenced	*PCSWMP*	*SWPMA*	*PCSWM*	*GP#2*	*SWMP*	*SWMP*	*SWMP*	*PCSWMP*
Plan Components Defined	*No*	*Yes*	Yes	No	Yes	No	*Yes*	*No*
Natural Resource Inventory	No	Yes	Yes	No	Yes	No	No	No
Technical Soils Assessment	No	Yes	Yes	No	w/infiltration	No	No	No
Stream Buffer Easement	No	Yes	No	No	No	No	No	No
Easements, Other	No	Drainage	None		No	No	Drainage	None
Performance Guarantee Requirements for BMPs	No	Yes	Yes	No	Yes	No	No	No
Inspection Required	Yes, no time	Annual	Annual	Periodic	Annual	No	Yes, City	Annual
Maintenance Required	Yes	Yes	Yes / 2 years / Bond Needed	Yes	Yes / Bond Needed	Yes/ Private Basins	Yes	Yes
Maintenance Form / **E**asement or **A**greement	None	Agreement	Easement	Easement	Agreement	No	None	No
Maintenance, **R**epair or **L**andscape Plan	None	Yes	M & R	M Covenant	M & R Agreement	No	None	part of PCSWMP
Responsible **P**arty for Inspection & Maintenance	PO / City	As part of plan	PO	RP*	PO	PO	PO	PO
City reserves right to inspect	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Recordkeeping of same	3 years	3 years	10 years	Yes, No time	25 years	None	None	3 years
Option to dedicate stormwater practiecs to city	No	Yes	Yes	No	No	Yes	Yes	No
Alternatives if can't meet minimums (Waivers)	ADOCE RD	ADOCE	ADOCE	ADOCE RD	ADOCE RD	None	None	ADOCE RD
Enforcement, during construction								
City Reserves Right to Correct and Assess Fee	Yes	No	Yes	Yes	Yes	No	No	Yes
Order to Comply	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Stop Work Order	No	No	Yes	No	Yes	No	No	Yes
Municipal Infraction	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Appeals Process	No	Under Construc.	Yes	No	Yes	No	No	Yes
Hold on Occupancy Permit until stormwater released	No	No	No	No	No	No	No	No
*PO - Property Owner								
*RP - Responsible Party								

Minimum Measure #5: Post-Construction Stormwater Management in New Development and Redevelopment

40 CFR 122.34(b)(5)

(5) Post-construction stormwater management in new development and redevelopment.

(i) You must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into your small MS4. Your program must ensure that controls are in place that would prevent or minimize water quality impacts.

(ii) You must:

(A) Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for your community;

(B) Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State, Tribal or local law; and

(C) Ensure adequate long-term operation and maintenance of BMPs.

(iii) Guidance: If water quality impacts are considered from the beginning stages of a project, new development and potentially redevelopment provide more opportunities for water quality protection. EPA recommends that the BMPs chosen: be appropriate for the local community; minimize water quality impacts; and attempt to maintain pre-development runoff conditions. In choosing appropriate BMPs, EPA encourages you to participate in locally-based watershed planning efforts which attempt to involve a diverse group of stakeholders including interested citizens. When developing a program that is consistent with this measure's intent, EPA recommends that you adopt a planning process that identifies the municipality's program goals (e.g., minimize water quality impacts resulting from post-construction runoff from new development and redevelopment), implementation strategies (e.g., adopt a combination of structural and/or non-structural BMPs), operation and maintenance policies and procedures, and enforcement procedures. In developing your program, you should consider assessing existing ordinances, policies, programs and studies that address stormwater runoff quality. In addition to assessing these existing documents and programs, you should provide opportunities to the public to participate in the development of the program. Non-structural BMPs are preventative actions that involve management and source controls such as: policies and ordinances that provide requirements and standards to direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space (including a dedicated funding

source for open space acquisition), provide buffers along sensitive water bodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation; policies or ordinances that encourage infill development in higher density urban areas, and areas with existing infrastructure; education programs for developers and the public about project designs that minimize water quality impacts; and measures such as minimization of percent impervious area after development and minimization of directly connected impervious areas. Structural BMPs include: storage practices such as wet ponds and extended-detention outlet structures; filtration practices such as grassed swales, sand filters and filter strips; and infiltration practices such as infiltration basins and infiltration trenches. EPA recommends that you ensure the appropriate implementation of the structural BMPs by considering some or all of the following: pre-construction review of BMP designs; inspections during construction to verify BMPs are built as designed; post-construction inspection and maintenance of BMPs; and penalty provisions for the noncompliance with design, construction or operation and maintenance. Stormwater technologies are constantly being improved, and EPA recommends that your requirements be responsive to these changes, developments or improvements in control technologies.

MODEL POST-CONSTRUCTION STORMWATER RUNOFF CONTROL ORDINANCE

ORDINANCE NO._____

ORDINANCE AMENDING THE CODE OF ORDINANCES, CITY[5] OF DECORAH, BY ADDING CHAPTER ____, "POST-CONSTRUCTION STORMWATER CONTROL"

Section 1. THE CODE OF ORDINANCES, CITY OF DECORAH, is hereby amended to add CHAPTER ____"POST-CONSTRUCTION STORMWATER CONTROL," in the form attached hereto.

Section 2. Repealer Clause. All ordinances or parts of ordinances in conflict herewith are hereby repealed.

Section 3. Severability Clause. If any section, provision or part of this ordinance shall be adjudged invalid or unconstitutional, such adjudication shall not affect the validity of the ordinance as a whole or any section, provision or part thereof not adjudged invalid or unconstitutional.

Section 4. Effective Date. This ordinance shall be effective from and after the final passage, approval and publication as provided by law.

PASSED AND APPROVED this ____day of _____, 20____.

_____
Mayor

(SEAL)

ATTEST:

_____
City Clerk

APPROVED AS TO FORM:

_____
City Attorney[6]

I, _____, City Clerk of the City of Decorah, Iowa, do hereby certify that the foregoing ORDINANCE was passed and approved by the City Council of the City of _____ _____Iowa, on the _____day of _____, 20___, and was published in the _____, a newspaper of general circulation in the said City of _____, on the _____day of _____, 20___.

Dated this _____day of _____, 20____.

_____
City Clerk

[5] IMPORTANT NOTE: For drafting purposes, this ordinance has been prepared for adoption by a city; however, with appropriate modifications it may serve as a model for other governmental subdivisions as well.

[6] This model ordinance is furnished as a drafting guide for attorneys representing governmental subdivisions in Iowa that are subject to NPDES Permit Program requirements. CAVEAT: THIS MODEL ORDINANCE SHOULD NOT BE ADOPTED WITHOUT CONFIRMING INDEPENDENT LEGAL RESEARCH BY AN ATTORNEY LICENSED TO PRACTICE LAW IN IOWA. LOCAL CIRCUMSTANCES WILL VARY SIGNIFICANTLY FROM JURISDICTION TO JURISDICTION. CONSIDERATION OF SUCH AN ORDINANCE CALLS FOR CAREFUL ANALYSIS AND DETERMINATION OF A NUMBER OF CRITICAL POLICY ISSUES BY THE GOVERNING BODY OF THE JURISDICTION.

This second version of a model ordinance was created by the Iowa Association of Municipal Utilities, Iowa Stormwater Education Program. The original was created in 2007 by the same organization through a committee with funding provided by IDNR 319 funds.

CHAPTER ____, POST-CONSTRUCTION STORMWATER MANAGEMENT

Section 1. General Provisions

1.1. Findings of Fact

1.1.1 The U.S. E.P.A.'s National Pollutant Discharge Elimination System ("NPDES") permit program (Program) administered by the Iowa Department of Natural Resources ("IDNR") requires that cities meeting certain demographic and environmental impact criteria obtain from the IDNR an NPDES permit for the discharge of storm water from a Municipal Separate Storm Sewer System (MS4) (MS4 Permit).[7] The City of Decorah (City) will be subject to the Program and will be required to obtain an MS4 Permit.

1.1.2 As a condition of the City's MS4 Permit, the City will be obliged to adopt and enforce a POST-CONSTRUCTION STORMWATER CONTROL ordinance.

1.1.3 No state or federal funds have been made available to assist the City in administering and enforcing the Program. Accordingly, the City shall fund its operations under this ordinance entirely by charges imposed on the owners or developers of properties which are made subject to the Program by virtue of state and federal law, and/or other sources of funding established by a separate ordinance.[8]

1.1.4 Land development and associated increases in impervious cover alter the hydrologic response of local watersheds resulting in increased stormwater runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition. This stormwater runoff contributes to increased quantities of water-borne pollutants. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of stormwater runoff from development sites.

1.1.5 Therefore, City establishes this set of City stormwater requirements to provide reasonable guidance for the regulation of stormwater runoff for the purpose of protecting local water resources from degradation. It is determined that the regulation of stormwater runoff discharges from land development and other construction activities in order to control and minimize increases in stormwater runoff rates and volumes, soil erosion, stream channel erosion, and nonpoint source pollution associated with stormwater runoff, is in the public interest and will prevent threats to public health and safety.

1.1.6 The determination of appropriate minimum stormwater management standards (standards) and the development of effective best management practices (BMPs) to achieve those standards requires technical expertise that may not always be readily available within City's own staff. Moreover, it is important that such standards and BMPs be reasonably consistent across the state so that property owners and developers are not confronted with myriad variations depending upon the location

[7] Statewide stormwater program information can be found:
http://www.iowadnr.gov/InsideDNR/RegulatoryWater/NPDESStormWater.aspx

[8] A city may choose to create a stormwater utility in conjunction with a stormwater fee ordinance as a means of providing a source of funding in addition to or in lieu of the administrative cost recovery mechanism suggested herein.

of development. The "Iowa Stormwater Management Manual"[9] published by the Iowa Department of Natural Resources establishes guidelines consisting of unified sizing criteria, stormwater management designs and specifications and BMPs. City hereby finds and declares that the guidelines provided for in the Iowa Stormwater Management Manual, and in future editions thereof, should be and are hereby adopted as the stormwater management standards of City as well as any City supplemental standards. Any BMP installation that complies with the provisions of the Iowa Stormwater Management Manual, or future editions thereof, at the time of installation shall be deemed to have been installed in accordance with this ordinance.

1.2. Purpose: The purpose of this ordinance is to adopt as City's standards the guidelines established in the Iowa Stormwater Management Manual (hereinafter collectively City's "stormwater requirements" or "standards") in order to protect and safeguard the general health, safety, and welfare of the public within this jurisdiction. This ordinance seeks as well to meet that purpose through consideration of the following objectives:

1.2.1 minimize increases in stormwater runoff from development within the city limits and fringe area in order to reduce flooding, siltation, increases in stream temperature, and streambank erosion, and maintain the integrity of stream channels;

1.2.2 minimize increases in nonpoint source pollution caused by stormwater runoff from development which would otherwise degrade local water quality;

1.2.3 minimize the total annual volume of surface water runoff which flows from any specific development project site after completion to not exceed the pre-development hydrologic regime to the maximum extent practicable; and

1.2.4 reduce stormwater runoff rates and volumes to predevelopment rates as specified, soil erosion and nonpoint source pollution, wherever possible, through establishment of appropriate minimum stormwater management standards and BMPs and to ensure that BMPs are properly maintained and pose no threat to public safety.

1.3. Applicability

1.3.1 This ordinance shall be applicable to all subdivision or site plan applications meeting the minimum square foot applicability criteria of §1.3.2, unless eligible for an exemption or granted a waiver by City under Section 4 of this ordinance. The ordinance also applies to land disturbance activities that are smaller than the minimum square foot applicability criteria specified in §1.3.2 if such activities are part of a larger common plan of development that meets the minimum square foot applicability criteria of §1.3.2, even though multiple separate and distinct land development activities may take place at different times on different schedules. In addition, all plans must also be reviewed by local environmental protection officials to ensure that established water quality standards will be maintained during and after development of the site and that post construction runoff levels are consistent with any local and regional watershed plans.

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[9] The Iowa Department of Natural Resources (IDNR) developed the Iowa Stormwater Management Manual. The manual includes guidelines for stormwater quality and quantity management that can be adopted in part or in whole by local jurisdictions. This model ordinance is drafted to adopt the manual in its entirety.

1.3.2 City stormwater requirements must be met for development to be approved. City stormwater requirements apply to any development disturbing X[10]or more square feet of land, and to any development disturbing less than said number of square feet of land if the amount of impervious cover created exceeds X square feet. The following activities are exempt from this ordinance:

1.3.2.1 Any logging and agricultural activity which is consistent with an approved soil conservation plan or a timber management plan prepared or approved by the (appropriate agency), as applicable.

1.3.2.2 Additions or modifications to existing single family structures.

1.3.2.3 Developments that do not disturb more than X square feet of land provided they are not part of a larger common development plan.

1.3.2.4 Repairs to any stormwater BMPs deemed necessary by City.

1.3.3 When a site development plan is submitted that qualifies as a development as defined in Section 2 of this ordinance, decisions on permitting and appropriate on-site BMPs shall be made in accordance with the Iowa Stormwater Management Manual. Final authorization of all development and redevelopment projects will be determined after a review by City.

1.4 Use Better Site Design to preserve natural areas, reduce impervious cover, distribute runoff and use of pervious surface for treatment of stormwater runoff. More information can be found at www.cwp.org. This shall include the following:

1.4.1 Protection and restoration of open space by conserving existing natural areas, reforestation, re-establishment of prairies, wetland restoration, establishment or protection of stream, shoreline, and wetland buffers and re-establishment of a native vegetation into the landscape;

1.4.2 Reduction of impervious cover by reducing new impervious surfaces, minimizing street width, parking space width, driveway length, and sidewalk width;

1.4.3 Distribute and minimize runoff by utilizing vegetated areas for stormwater treatment as well as direct impervious runoff to vegetated areas or treatment areas such as roofs and parking lots, and encourage infiltration and soil storage of runoff through grass channels, bioswales, bioretention cells and rain gardens etc. Plant vegetation that does not require irrigation beyond natural rainfall.

1.4.4 Capture and store runoff for irrigation.

1.5. Compatibility with Other Permit and Ordinance Requirements.

1.5.1 It is intended that this ordinance be construed to be consistent with previously adopted City Code CHAPTER X CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL, and CHAPTER X ILLICIT DISCHARGE TO STORM SEWER SYSTEM".[11]

1.5.2 The requirements of this ordinance should be considered minimum requirements, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law,

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[10] Federal law mandates that this ordinance apply to land disturbance activities of at least one acre (43,560 square feet) or more. *See* Storm Water Phase II Final Rule (www.epa.gov/npdes/regulations/phase2.pdf). For sites less than the threshold number of square feet specified immediately above but which nevertheless create a substantial new amount of impervious cover (e.g., 5000 square feet of impervious cover), local officials may wish to make the guidelines apply. In any event, the number specified in this §1.3.2 must coincide with the number of square feet specified in §1.3.2.3 and in the definition of "development" in §2.

[11] Some cities have chosen to incorporate provisions dealing with (1) construction site erosion and sediment control, and (2) illicit discharges, into existing ordinances controlling site development, subdivision, grading or related matters, rather than adopting separate ordinances dealing with these subjects. Such cities should modify this subsection 1.4 to reference their correct corollary city code provisions.

whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.

Section 2. Definitions. Terms in this ordinance other than those defined below shall have the meanings set out in the Iowa Stormwater Management Manual.

"Applicant" means a property owner or agent of a property owner who has filed an application for a stormwater management permit.

"BMP" means Best Management Practice that are physical practices or structures determined to be the most efficient practices used to reduce pollutant loads and runoff volumes/rates.

"Buffer" means a vegetative area, including desirable trees, shrubs and herbaceous plants that exists or is established to protect a stream, lake or reservoir.

"Building" means any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal, or property, and occupying more than 100 square feet of area.

"**Channel Protection Storage Volume"** means providing for practices that will allow for extended detention of the runoff generated by a 1-year, 24-hour event. This means capturing the runoff volume from a storm of this nature, and slowly releasing it over a period of no less than 24-hours to reduce the rapid "bounce" effect common in many urban streams that leads to downcutting and streambank erosion.

"City Stormwater Requirements" or "standards" mean the guidelines provided for in the Iowa Stormwater Management Manual.

"Concept Plan" means plans that shall be submitted for review during the planning process. It should be showing conceptually where stormwater BMPs will be located and how stormwater will be routed to facilities.

"Dedication" means the deliberate appropriation of property by its owner for general public use.

"Developer" means a person who undertakes land disturbance activities.

"Development" means either:

> land disturbance activity exceeding X square feet on land previously vacant of buildings or largely free of previous land disturbance activity other than traditional agricultural activities;
>
> or land disturbance activity exceeding X square feet in areas where existing land use is high density commercial, industrial, institutional or multi-family residential (a.k.a. "redevelopment").

"Drainage Easement" means a legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

"Enforcement Officer" means that person or persons designated by the City having responsibility for administration and enforcement of this ordinance.[12]

"**Extreme Flood Protection**" means managing the effects of larger storm events (10% to 1% annual recurrence or expressed in the past as the 10-year to 100-year recurrence intervals) on the stormwater management system, adjacent property, and downstream facilities and property. The impacts of these extreme events is accomplished using detention controls and/or floodplain management.

[12] The City should of course specify the title of the designated individual to avoid confusion.

"Fee in Lieu" means a payment of money in place of achieving or exceeding all or part of City stormwater requirements.[13]
"Final Plan" means the final stormwater management plan that should be submitted for final review and should show final design details of BMPs and construction specifications.
"Infiltration-based BMPs" means that at a minimum the water quality volume moves through the soil media to provide filtration and removal of pollutants.
"Iowa Stormwater Management Manual" means the manual developed and updated by the Iowa Department of Natural Resources (IDNR) that contains the unified sizing criteria, design and specification guidelines and BMPs that address stormwater quality and quantity management.
"Land Disturbance Activity" means any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity which bares soil or rock or involves the diversion or piping of any natural or man-made watercourse.
"Landowner" means the legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights in the land.
"Maintenance Agreement" means a legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of storm water BMPs.
"Native Landscaping or Vegetation" means vegetation originating naturally in this region of the state and does not contain noxious or invasive weeds. It is not to be confused with existing vegetation.
"**Stream**" means perennial and intermittent water sources identified through site inspection, and/or an approved city of Ames map, and/or United States Geological Survey (USGS) 7.5 minute series topographical map.
"**Stream Buffer**" means a vegetated strip of land which lies adjacent to a stream and provides such functions as protecting water quality, providing wildlife habitat and storing flood waters and allowing access for repair or maintenance of streambanks and channel.
"Overbank Flood Protection" means providing on-site stormwater detention to limit runoff peak flow rates from the 20% annual recurrence (previously expressed as 5-year recurrence interval) storm event to prevent downstream surcharge of conveyance systems and reduce overbank flooding. At the site development level, this can be accomplished by providing detention practices with multi-stage outlets that control the outflow from these events to pre-settlement conditions (meadow in good condition).
"Predevelopment Condition" based on the pre-settlement condition for the site areas, typically tall-grass native prairie vegetation. Runoff rates and volumes for this condition can be modeled by the using times of concentration and curve

[13] This §2.8, along with §4, are believed to be free of the infirmities recently detected by the Iowa Supreme Court in municipal ordinances dealing with park land and franchise fees. However, the very strict construction that the Court has utilized in recent challenges to municipal ordinances should be taken into account by cities giving consideration to using this model ordinance. The fees or other in-lieu-of requirements of these provisions should be carefully calibrated to manifest a reasonable cost-based relationship to the compliance a developer is seeking thereby to avoid.

numbers based on meadow in good condition for the soils and surface topography at a given site.

"Stormwater Management" means the use of BMPs that are designed in accordance with City stormwater requirements to reduce stormwater runoff pollutant loads, discharge volumes, peak flow discharge rates and detrimental changes in stream temperature that affect water quality and habitat.

"Stormwater Pollution Prevention Plan" (SWPPP) means a plan that is designed to minimize the accelerated erosion and sediment runoff at a site during construction activities and include provisions for additional pollution prevention.

"**Water Quality Volume**" means the runoff resulting from a rainfall depth of 1.25", 90% of the rainfall events in Iowa are of this depth or less. By managing these storms the vast majority of water volume will be treated and many of the "first flush" pollutants of concern will be effectively managed on-site.

Section 3. Permit Procedures and Requirements[14]

3.1. Permit Required. No land owner or developer shall receive any of the building, grading or other land development permits required for land disturbance activities without first meeting the requirements of this ordinance as well as any national, state and other local permits prior to commencing the proposed activity.

3.2. Application Requirements

3.2.1 Unless specifically exempted by this ordinance, any land owner or developer desiring a permit for a land disturbance activity shall submit to City a permit application on a form provided for that purpose.

3.2.2 Unless otherwise exempted by this ordinance, a permit application must be accompanied by the following in order that the permit application be considered:

3.2.2.1 a stormwater management concept plan;

3.2.2.2 a maintenance agreement; and

3.2.2.3 a non-refundable permit review fee.

3.2.3 The stormwater management concept plan and maintenance agreement shall be prepared to meet the requirements of Section 6 of this ordinance, and fees shall be those established by the City annually or more often by separate ordinance or resolution.[15]

3.3. Application Review Fees

3.3.1 The fee for review of any land development application shall be based on the amount of land to be disturbed at the site,[16] and the fee structure shall be established by City, and shall be paid prior to the issuance of any applicable City permits.

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[14] It is not the intention of this model ordinance to suggest that a new, separate permit process is contemplated independent of the COSESCO permit process (or its equivalent). Rather, the committee recommends that the requirements of this POST-CON ordinance and the requirements of the COSESCO ordinance (or its equivalent) be components of a single permitting process.

[15] Cities adopt myriad fees to cover the costs of operations for special activities that benefit specific groups which it would be inappropriate to spread across all taxpayers through property taxes. It is recommended that as part of the normal budget preparation process, cities annually adopt a single ordinance or resolution adjusting all city fees at the same time.

[16] In order for the administration and enforcement of this ordinance to be self-funded, the fees ultimately established should be supported by careful and comprehensive cost accounting studies that take into effect all of the direct and indirect costs to the City, including site inspection costs, for all activities required of the City by the ordinance.

3.3.2 All such revenue shall be credited to a City budgetary category to support the administration of this ordinance.

3.4. Application Procedure

3.4.1 Applications for land disturbance activity permits must be filed for review with City's Office of X[17] on any regular business day.

3.4.2 Permit applications shall include the following:

3.4.2.1 two copies of the stormwater management concept plan,

3.4.2.2 two copies of the maintenance agreement, and

3.4.2.3 any required review fees.

3.4.3 Within X business days of the receipt of a complete permit application, including all documents as required by this ordinance, City shall inform the applicant whether the application, plan and maintenance agreement are approved or disapproved.

3.4.4. If the permit application, stormwater management concept plan or maintenance agreement are disapproved, the applicant may revise the stormwater management concept plan or agreement. If additional information is submitted, City shall have X business days from the date the additional information is received to inform the applicant that the stormwater management concept plan and maintenance agreement are either approved or disapproved.

3.4.5 If the permit application, stormwater management final plan and maintenance agreement are approved by City, all appropriate land disturbance activity permits shall be issued.

3.5. Permit Duration. Permits issued under this section shall be valid from the date of issuance through the date City notifies the permit holder that all stormwater BMPs have passed the final inspection required under permit conditions. [INSERT time limit if needed and in certain cases renewal may be needed after a time limit is exceeded.]

Section 4. Waivers [18]

4.1. Every applicant shall provide for stormwater management as required by this ordinance, unless a written request to the City for a partial waiver of BMPs is granted pursuant to paragraph 4.2 hereof, or unless a written request to the City for a general waiver of BMPs is granted pursuant to paragraph 4.3 hereof.

4.2 Partial Waivers:

4.2.1 A partial waiver of BMPs required by this ordinance may be granted provided that at least one of the following threshold conditions is established by applicant based on authoritative written evidence satisfactory to City; if none of the following threshold conditions can be established, the application must be denied:

4.2.1.1 The proposed development is not likely to impair attainment of the objectives of this ordinance.

[17] This title should be adjusted to reflect the actual name of the city department charged with the duty to administer this ordinance; for purposes of consistency, however, this title shall be used throughout this model ordinance. Some cities may choose to contract with a third party engineer to conduct this review.

[18] "Waivers" of ordinance requirements are inevitably fraught with risks of violation of state and federal "due process" and "equal protection" constitutional provisions. Consistency from case to case supported by very careful and comprehensive administrative guidelines and record making and keeping protocols will make it easier for a city to defend against claims that it has gone easier on one developer than another, but nothing can prevent such claims.

4.2.1.2 Alternative minimum requirements for on-site management of stormwater have been established in a stormwater management final plan that has been approved by City and fully implemented.

4.2.1.3 Provisions are made to manage stormwater by an off-site facility. The off-site facility is required to be in place, to be designed and adequately sized to provide a level of stormwater control that is equal to or greater than that which would be afforded by on-site practices and there is, in City's sole judgment, a responsible entity legally obligated to monitor the performance of and maintain the efficiency of stormwater BMPs in accordance with a written and recorded maintenance agreement.

4.2.2 If the applicant fails to establish at least one of the threshold conditions for granting a partial waiver specified in paragraph 4.2.1 hereof, the application must be denied. However, if the applicant successfully establishes at least one of the threshold conditions for granting a partial waiver specified in paragraph 4.2.1 hereof, the applicant must further establish by authoritative written evidence satisfactory to City that the partial waiver will not result in any one or more of the following impacts to downstream waterways; if a partial waiver would result in any one or more of the following impacts to downstream waterways, the application must be denied:

4.2.2.1 additional deterioration of existing culverts, bridges, dams, other structures; or

4.2.2.2 degradation of biological functions or habitat; or

4.2.2.3 accelerated streambank or streambed erosion or siltation; or

4.2.2.4 increased threat of flood damage to public health, life, property.

4.3 GENERAL WAIVERS:

4.3.1 If City finds that a general waiver is appropriate because implementation of no on-site stormwater BMPs is feasible due to the natural or existing physical characteristics of a site such as shallow bedrock, high groundwater, hotspots or contaminated soil or excessive cost, or that none of the conditions specified in 4.2.1 above can be established to a certainty, or that any one or more of the impacts to downstream waterways specified in 4.2.2 above cannot be entirely averted, the applicant shall execute a binding written agreement to accomplish one or more of the following mitigation measures selected by City:

4.3.1.1 The purchase and donation of privately owned lands, or the grant of an easement to be dedicated for preservation and/or reconstruction of native ecosystems of lands strategically located in the watershed consistent the purposes of this ordinance, of a sufficient quantity to enable City or others to achieve City stormwater requirements with respect to a number of cubic feet of annual stormwater equivalent to the estimated number of cubic feet of annual stormwater that will not achieve City stormwater requirements as a consequence of the waiver.

4.3.1.2 The creation of one or more stormwater BMPs on previously developed properties, public or private, that currently lack stormwater BMPs, having a capacity to achieve City stormwater requirements with respect to a number of cubic feet of annual stormwater equivalent to the estimated number of cubic feet of annual stormwater that will not achieve City stormwater requirements as a consequence of the waiver.

4.3.1.3 Monetary contributions (Fee-in-Lieu) to fund stormwater management activities such as research and studies (e.g., regional wetland delineation studies, stream monitoring studies for water quality and

macroinvertebrates, stream flow monitoring, threatened and endangered species studies, hydrologic studies, monitoring of stormwater BMPs, and stream corridor stabilization practices). The monetary contribution required shall be in accordance with a fee schedule (unless the developer and the stormwater authority agree on a greater alternate contribution) established by City based on the estimated cost savings to the developer resulting from the waiver and the estimated future costs to City to achieve City stormwater requirements with respect to a number of cubic feet of annual stormwater equivalent to the estimated number of cubic feet of annual stormwater that will not achieve City stormwater requirements as a consequence of the waiver. All of the monetary contributions shall be credited to an appropriate capital improvements program project, and shall be made by the developer prior to the issuance of any building permit for the development.

4.3.1.4 Dedication of land or granting of an easement by the applicant of a value equivalent to the cost to City of the construction of an off-site stormwater management facility sufficient to achieve City stormwater requirements with respect to a number of cubic feet of annual stormwater equivalent to the estimated number of cubic feet of annual stormwater that will not achieve City stormwater requirements as a consequence of the waiver. The agreement shall be entered into by the applicant and City prior to the recording of plats or, if no record plat is required, prior to the issuance of the building permit.

Section 5. Stormwater Standards. Unless granted a waiver by City, applicants shall meet the stormwater management standards established in this ordinance

5.1 The following criteria shall be addressed in site design for stormwater runoff to protect surface and groundwater and other natural resources:

5.1.1 Reduce impacts on waterbodies, preserve and replace existing topsoil in an uncompacted manner, preserve vegetation, decrease runoff volume, decrease erosion and sedimentation, decrease flow frequency, duration, and peak runoff rates, increase infiltration, maintain existing flow patterns, store stormwater runoff on-site, and avoid natural channel and steep slope erosion as well as protect in-stream habitat.

5.2 **Soil Quality Management and Restoration Methods** in the Iowa Stormwater Management Manual shall be used on all green spaces that will contain turf and other landscaping. Existing topsoil shall be respreads on-site in an uncompacted manner uniformly across the site.

5.3 **Volume credit** will be given for groundwater recharge as defined in the Iowa Stormwater Management Manual.

5.4 The site shall be designed to **manage the water quality volume of 1.25 inches** by infiltration practices listed in the Iowa Stormwater Management Manual.

5.5 To **protect stream channels**, the site shall be designed to infiltrate or provide 24 hour extended detention of the channel protection volume defined as the 1 year, 24 hour storm using rainfall depth per NOAA Atlas 14.

5.6 Stormwater management shall be provided to limit the post development rate of runoff from the site area during the 5 year (20% AR) through the 100 year (1% AR), 24 hour storm events to the lesser of the following values: (1) runoff rates equivalent to those from a storm event of the same intensity and duration based on predevelopment conditions (pre-settlement surfaces considered when assuming curve numbers and calculating times of

concentration, based on a cover type of meadow in good condition and surface soil types as identified from County Soil Maps) or (2) runoff rates equivalent to those from the 5 year (20% AR) storm event based on conditions which exist as of the date of the proposed improvement plans (based on row crop agriculture cover, contoured in good condition and surface soil types as identified from County Soil Maps; unless otherwise approved by the jurisdiction). For design calculations, use NOAA Atlas 14 to determine rainfall depths based on the site location.

5.7 Provisions shall be made for stream corridor protection through the use of **stream buffers** on both sides of the stream that are at a minimum at least 4 times the height of the stream bank plus whatever additional width is needed to accommodate a constructed flood plain (minimum of 15 feet), sanitary sewers, trails or other infrastructure and accommodate maintenance equipment plus be able to contain the 100 year flow within the limit of the buffer. Drainage ways shall provide adequate space to convey 100 year storm flows [INSERT 500 year storm flows if needed] in a non-erosive manner and in a way that does not cause damage to adjacent structures. They shall be modeled and designed to address future, anticipated growth and land use in the watershed.

Section 6. Requirements for Approval of Stormwater Management Concept Plan and Stormwater Management Final Plan. [19]

6.1 Stormwater Management Concept Plan: No application for development will be accepted unless it includes a stormwater management concept plan detailing in concept how runoff and associated water quality impacts resulting from the development will be controlled or managed.

6.1.1 The stormwater management concept plan shall:

6.1.1.1 be prepared and certified by a licensed professional engineer (PE) or landscape architect; and

6.1.1.2 indicate whether stormwater will be managed on-site or off-site and, if on-site, the general location and type of BMPs, with clear citations to the Iowa Stormwater Management Manual; and

6.1.1.3 include a signed and dated certification under penalty of perjury by the preparer of the stormwater management concept plan that it complies with all requirements of this ordinance and the Iowa Stormwater Management Manual, meets the submittal requirements outlined in the Iowa Stormwater Management Manual, is designed to achieve City stormwater requirements, and that City is entitled to rely upon the certification as due diligence on the part of City.

[19] It is the intention of this model ordinance that the SWPPP, stormwater management concept plan and stormwater management final plan be consistent and perhaps even evolutionary states of a single overall plan to control stormwater pollution and run-off from groundbreaking through the intended life of the BMPs utilized on any site subject to this ordinance. Accordingly, it does not seem prudent to allow differing levels of expertise on the part of those who prepare a SWPPP as opposed to those who prepare a concept plan as opposed to those who prepare a final plan. By requiring that only licensed professional engineers or landscape architects may prepare and certify SWPPPs and concept plans and final plans, it is the hope of the committee that developer costs will thereby be reduced rather than increased because a single professional can (should) be in charge of drafting such plans from beginning to end. However, if a city decides that such consistency is unnecessary, it could require that any one or more of the various documents required by this ordinance be prepared by anyone "credentialed in a manner satisfactory to City."

6.1.2 The stormwater management concept plan shall include sufficient information (e.g., maps, hydrologic calculations, etc) to evaluate the environmental characteristics of the project site, the potential impacts of all proposed development of the site, both present and future, on the water resources, and the effectiveness and acceptability of the stormwater BMPs proposed for managing stormwater generated at the project site. The intent of this conceptual planning process is to determine the type of stormwater BMPs necessary for the proposed project, and ensure adequate planning for management of stormwater runoff from future development. To accomplish this goal the following information shall also be included in the stormwater management concept plan:

6.1.2.1 A soil management plan as defined by the Iowa Stormwater Management Manual shall be provided and include a technical assessment of soils that identifies the soil series and the site limitations based on soils data provided in the Web County Soil Survey hosted by Natural Resources Conservation Service (NRCS). It may only be used if soils have not been highly disturbed. Soil borings shall be included when necessary to confirm suitable site conditions for placement of buildings with basements and related structures, especially in areas with hydric soils and shallow depth to groundwater. If a stormwater BMP depends on the hydraulic properties of soils, then the assessment shall include soil borings and measurements of percolation/infiltration rates. The number and location of required soil borings and/or soil test sites shall be determined based on what is needed to determine the suitability and distribution of soil types present at the location of the BMP. Borings may range from a minimum of 5' to 20' below subgrade depending on the size of the BMP. This information shall be used to provide a summary of the associated risks and potential for adequate drainage related to infiltration practices, groundwater mounding and basement flooding. Consultation with a Certified Professional Soil Scientist, Soil Classifier, or Geotechnical Engineer may be necessary or required.

6.1.2.2 A map (or maps) indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural stormwater management and sediment and erosion BMPs. The map(s) will also clearly show proposed land use with tabulation of the percentage of surface area to be adapted to various uses; off-site and on-site drainage patterns and watershed delineation; the limits of clearing and grading. A written description of the site plan and justification of proposed changes in natural conditions may also be required.

6.1.2.3 Sufficient engineering analysis to show that the proposed BMPs are capable of achieving City stormwater requirements for the site in compliance with this ordinance.

6.1.2.4 A written or graphic inventory of the natural resources at the site and surrounding area as it exists prior to the commencement of the project and a description of the watershed and its relation to the project site. This description should include a discussion of soil conditions, forest cover, topography, wetlands, and other native vegetative areas on the site. Particular attention should be paid to environmentally sensitive BMPs that provide particular opportunities or constraints for development.

6.1.2.5 Landscaping and stabilization shall be accomplished to prevent stormwater violations or impairment of BMPs. In addition, a landscaping

plan must be submitted with the final as-built drawings describing the vegetation stabilization and management techniques to be used at the site after construction is completed. This plan will include the entity responsible for vegetation at the site and practices that will be used to ensure adequate vegetative cover.

6.1.2.6 A written description of the required maintenance burden for any proposed BMPs.

6.1.2.7 City may also require a concept plan to consider the maximum development potential of a site under existing zoning, regardless of whether the applicant presently intends to develop the site to its maximum potential.

6.1.2.8 For development occurring on a previously developed site, an applicant shall be required to include within the stormwater management concept plan BMPs for controlling existing stormwater runoff discharges from the site in accordance with this Ordinance to the maximum extent practicable.

6.1.3 The stormwater management concept plan shall be referred for comment to all other interested agencies, and any comments must be addressed in a stormwater management final plan.

6.1.4 No building, grading, or sediment control permit shall be issued until a satisfactory stormwater management final plan, or a waiver thereof, shall have undergone a review and been approved by City after determining that the plan or waiver is consistent with the requirements of this ordinance.

6.2 Stormwater Management Final Plan Requirements: After review of the stormwater management concept plan, and modifications to that plan as deemed necessary by City, a stormwater management final plan must be submitted to the City for approval.

6.2.1 The stormwater management final plan, in addition to the information included in the stormwater management concept plan, shall:

6.2.1.1 be prepared and certified by a licensed professional engineer (PE) or landscape architect; and

6.2.1.2 indicate whether stormwater will be managed on-site or off-site and, if on-site, the general location and type of practices, with clear citations to the Iowa Stormwater Management Manual; and

6.2.1.3 include a signed and dated certification under penalty of perjury by the preparer of the stormwater management concept plan that it complies with all requirements of this ordinance and the Iowa Stormwater Management Manual, meets the submittal requirements outlined in the Iowa Stormwater Management Manual, is designed to achieve City stormwater requirements, and that City is entitled to rely upon the certification as due diligence on the part of City.

6.2.2 The stormwater management final plan shall also include:

6.2.2.1 A detailed summary of how and why the stormwater management final plan differs, if at all, from the stormwater management concept plan previously submitted.

6.2.2.2 Contact information, including but not limited to the name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected.

6.2.2.3 Topographic Base Map, consisting [INSERT value, may want to consider a minimum of a 1" = 200' topographic base map] of the site which extends a minimum of X feet beyond the limits of the proposed development and

indicates existing surface water drainage including streams, ponds, culverts, ditches, and wetlands; current land use including all existing structures; locations of utilities, roads, and easements; and significant natural and manmade features not otherwise shown.

6.2.2.4 Hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in the Iowa Stormwater Management Manual. Such calculations shall include [MAY WANT TO JUST REFERENCE THE CHECKLIST THAT ACCOMPANIES THIS ORDINANCE] (i) description of the design storm frequency, intensity and duration, (ii) time of concentration, (iii) Soil Curve Numbers or runoff coefficients, (iv) peak runoff rates and total runoff volumes for each watershed area, (v) infiltration rates, where applicable, (vi) culvert capacities, (vii) flow velocities, (viii) data on the increase in rate and volume of runoff for the design storms referenced in the Iowa Stormwater Management Manual, and (ix) documentation of sources for all computation methods and field test results.

6.2.2.5 Along with the soil management plan, include the technical assessment of soils required in the concept plan.

6.2.2.6 A Maintenance and Repair Plan for all stormwater BMPs including detailed maintenance and repair procedures to ensure their continued efficient function. These plans will identify the parts or components of a stormwater BMP that need to be maintained and the equipment and skills or training necessary. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan.

6.2.2.7 A detailed landscaping plan for management of vegetation at the site after construction is finished, including who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved. This plan must be prepared by a licensed landscape architect, landscape designer, or by the soil water conservation district.

6.2.2.8 Proof of permanent recorded Maintenance Easements that will ensure access to all stormwater BMPs at the site for the purpose of inspection and repair. These easements will be recorded with the stormwater management final plan and will remain in effect even with transfer of title to the property.

6.2.2.9 Proof of a recorded Maintenance Agreement binding on all subsequent owners of land served by stormwater BMPs to ensure maintenance and repair in accordance with the specifications of this ordinance.

6.2.2.10 Copies of all existing SWPPPs (as required by the City's COSESCO ordinance) current as of the date of submission of the stormwater management final plan for all construction activities related to implementing any on-site stormwater BMPs.

6.2.2.11 Proof that the applicant has acquired all other applicable environmental permits for the site, or that no other such permits are required, prior to submission of the stormwater management final plan to the City.

6.3 Performance Bond/Security[20]

6.3.1 City shall require the submittal of an installation performance security or bond prior to issuance of a permit in order to insure that the stormwater BMPs are installed by the permit holder as required by the approved stormwater management final plan.

6.3.2 The amount of the installation performance security or bond shall be the total estimated construction cost of the stormwater BMPs approved under the permit, plus 25%. The installation performance security or bond shall contain forfeiture provisions for failure to complete work specified in the stormwater management final plan.

6.3.3 The installation performance security or bond shall be released in full only upon submission of "as built plans" of all stormwater BMPs specified in the stormwater management final plan and written certification by a professional engineer that the stormwater BMPs have been installed in accordance with the approved stormwater management final plan and other applicable provisions of this ordinance. City will make a final inspection of stormwater BMPs to ensure compliance with the approved stormwater management final plan and the provisions of this ordinance. Provisions for a partial pro-rata release of the installation performance security or bond based on the completion of various development stages can be made at the discretion of City.

6.4 Maintenance Performance Security or Bond

6.4.1 City shall also require the submittal of a maintenance performance security or bond prior to issuance of a permit in order to insure that the stormwater BMPs are maintained in an effective state for a minimum of X years.

6.4.2 This maintenance performance security or bond may be released by the City upon a showing satisfactory to the City that:

6.4.2.1 the permit holder has assigned to another boni-fide financially responsible legal entity, such as a home-owners' or similar organization organized under Iowa law, responsibility for maintenance of the stormwater BMPs in an effective state for the balance of the X year period after assignment; and

6.4.2.2 said assignee-legal-entity has fully accepted such responsibility in a written document that qualifies for recording and has been recorded in the county recorder's office under Iowa law; and

6.4.2.3 said assignee-legal-entity posts a substitute maintenance performance security or bond subject to release at the end of the initial X year period upon a further showing by the assignee-legal-entity that the stormwater BMPs are, in City's sole judgment, still reasonably effective.

Section 7. Construction Inspection

7.1 Notice of Construction Commencement: The applicant must notify City in advance before the commencement of construction. Regular inspections of construction of the stormwater BMPs shall be conducted by City or City's designated representative. All inspections shall be documented and written reports prepared that contain the following information:

7.1.1 the date and location of the inspection; and

[20] This section and section 6.4 have been the source of much discussion and some disagreement among committee members, and thus are offered with a caveat. Some on the committee thought the provisions onerous or unnecessary. Others on the committee suggested that such bonding/security provisions are common for street, curb and gutter installations, and sometimes other kinds of infrastructure in developments, and that there is no reason to exempt stormwater management BMP installations. It will be up to each city to determine the advisability of deleting these provisions.

7.1.2 whether construction is in compliance with the approved stormwater management concept plan; and

7.1.3 variations, if any, from the approved stormwater management concept plan.

7.2 If any **violations are found**, the applicant shall be notified in writing of the nature of the violation and the required corrective actions. No added work shall proceed until any violations are corrected and all work previously completed has received approval by City.

7.3 After construction is completed, applicants are required to submit actual **"as built" drawings** satisfactory to City for any stormwater BMPs located on-site. The drawings must show the final design specifications for all stormwater BMPs and must be certified by a professional engineer. A final inspection by City is required before the release of any performance securities can occur.

7.4 Landscaping and Stabilization Requirements

7.4.1 Landscaping and stabilization shall be accomplished to prevent violation of City stormwater requirements or impairment of BMPs.

7.4.2 In addition to the above requirements, a landscaping plan must be submitted with the final as-built drawings describing the vegetative stabilization and management techniques to be used at a site after construction is completed. This plan will explain not only how the site will be stabilized after construction, but who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved. This plan must be prepared by a registered landscape architect, landscape designer, by the local soil water conservation district, or credentialed in a manner acceptable to the city and must be approved prior to receiving a permit.

Section 8. Maintenance and Repair of Stormwater BMPs[21]

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[21] The provisions of this Section §8 contemplate private landowner responsibility for maintenance and repair of stormwater Controls in perpetuity. However, at least two other mechanisms might be considered by cities.

First, the installation, maintenance and repair of stormwater controls could be deemed analogous to however a city currently addresses the installation, maintenance and repair of other municipal infrastructure such as streets, curbs and gutters. Typically, developers are required to install public streets to city specifications and dedicate them to public use under such conditions as a city may require. If a developer chooses to install private streets intended for the private use of landowners served by the private streets which are not be dedicated to the public, then the landowners' collective responsibility for installation, maintenance and repair costs falls to the landowners' association or is guaranteed in some other manner specified by the city to prevent the use of public funds to maintain or repair private infrastructure. However, to the extent that non-maintenance or non-repair of a stormwater control can negatively impact the surrounding environment while non-maintenance or non-repair of a private street detrimentally affects only the landowners served thereby, the city should provide consequences for the failure of maintenance or repair of stormwater controls that would be unnecessary for the failure of maintenance or repair of a private street.

Second, responsibility the installation, maintenance and repair of stormwater controls might be vested in a stormwater utility that would function much like a municipal water, gas or electricity utility. The creation of such a utility is beyond the intended scope of this model ordinance.

8.1 The applicant or owner of every site, or an assignee qualified pursuant to Section 7, shall be responsible for **maintaining as-built stormwater BMPs** in an effective state as determined in the sole judgment of City for X years[22] from and after completion of construction.

8.2 **Maintenance and Repair Easement:** Prior to the issuance of any permit for development involving any stormwater BMP, the applicant or owner of the site must execute a maintenance and repair easement agreement that shall be binding on all subsequent owners of land served by the stormwater BMP. The agreement shall provide for access to the BMP and the land it serves at reasonable times for periodic inspection by City or City's designee and for regular or special assessments of property owners to ensure that the BMP is maintained in proper working condition to meet City stormwater requirements. The easement agreement shall be recorded by City at the expense of the permit holder or property owners.

8.3 **Maintenance Covenants:**

8.3.1 Maintenance of all stormwater BMPs shall be ensured through the creation of a formal maintenance covenant that must be approved by City and recorded prior to the stormwater management final plan approval. As part of the covenant, a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the stormwater BMPs. The covenant shall also include plans for periodic inspections to ensure proper performance of the BMPs between scheduled cleanouts.

8.3.2 City, in lieu of a maintenance covenant, may but is not required to accept dedication of any existing or future stormwater BMP to include City responsibility for maintenance and repair, provided that the maintenance and repair of such element will not impose an undue burden on other City taxpayers who enjoy little if any benefit from the BMP, the BMP meets all the requirements of this chapter, and the dedication includes adequate and perpetual access and sufficient area, by easement or otherwise, for inspection and regular maintenance.

8.4 **Requirements for Maintenance Covenants:** All stormwater BMPs must undergo, at the minimum, an annual inspection to document maintenance and repair needs and ensure compliance with the requirements of this ordinance and accomplishment of its purposes. These needs may include but are not limited to removal of silt, litter and other debris from all catch basins, inlets and drainage pipes, grass cutting and vegetation removal, and necessary replacement of landscape vegetation. Any maintenance or repair needs detected must be corrected by the developer or entity responsible under a written maintenance agreement under Section 6 in a timely manner, as determined by City, and the inspection and maintenance requirement may be increased as deemed necessary to ensure proper functioning of the stormwater BMPs.

8.5 **Inspection of Stormwater BMPs:** Inspection programs may be established on any reasonable basis, including but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of state or federal water

[22] The duration of maintenance and repair obligations should be determined by a city to parallel any such requirements for street, gutter or sewer infrastructure; a duration of twenty-five (25) years is not uncommon.

or sediment quality standards or the NPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in stormwater BMPs, and evaluating the condition of stormwater BMPs.

8.6 **Right-of-Entry for Inspection:** When any new stormwater BMP is installed on private property, or when any new connection is made between private property and a public stormwater management facility, sanitary sewer or combined sewer, the property owner shall grant to City the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection. This includes the right to enter a property when City has a reasonable basis to believe that a violation of this ordinance is occurring or has occurred, and to enter when necessary for abatement of a public nuisance or correction of a violation of this ordinance.

8.7 **Records of Installation and Maintenance and Repair Activities:** Parties responsible for the operation and maintenance of stormwater BMPs shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least years.[23] These records shall be made available to City during inspection of the facility and at other reasonable times upon request.

8.8 **Failure to Maintain Stormwater BMPs:** If a responsible party fails or refuses to meet the requirements of the maintenance covenant or any provision of this ordinance, City, after reasonable notice, may correct a violation by performing all necessary work to place the BMP in proper working condition. In the event that the stormwater BMP becomes a danger to public safety or public health, City shall notify the party responsible for maintenance of the stormwater BMP in writing. Upon receipt of that notice, the responsible person shall have thirty (30) days to effect maintenance and repair of the stormwater BMP in an approved manner. After proper notice, City may assess, jointly and severally, the owner(s) of the stormwater BMP or the property owners or the parties responsible for maintenance under any applicable written agreement for the cost of repair work and any penalties; and the cost of the work shall be a lien on the property, or prorated against the beneficial users of the property, and may be placed on the tax bill and collected as ordinary taxes.

Section 9. Enforcement and Penalties.

9.1 **Violation of any provision of this ordinance** may be enforced by civil action including an action for injunctive relief. In any civil enforcement action, administrative or judicial, the City shall be entitled to recover its attorneys' fees and costs from a person who is determined by a court of competent jurisdiction to have violated this ordinance.

9.2 Violation of any provision of this ordinance may also be enforced as a **municipal infraction** within the meaning of §364.22, pursuant to the City's municipal infraction ordinance.[24]

9.3 **Enforcement pursuant** to this section shall be undertaken by City upon the advice and consent of the City Attorney or other counsel employed by City.

9.4 **Restoration of lands:** Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after

[23] The duration of any records retention requirement should be determined by a city to parallel any such requirements for street, gutter or sewer infrastructure; a duration of twenty-five (25) years is not uncommon

[24] A city may consider various enforcement mechanisms. However, the Iowa Code furnishes cities with a very useful tool called "municipal infractions." If a city adopting this ordinance does not already have a municipal infraction ordinance, one should be seriously considered for reasons which are beyond the scope of this model ordinance.

notice, City may take necessary corrective action, the cost of which shall become a lien upon the property until paid.

9.5 **Holds on Occupation Permits:** Occupancy permits shall not be granted until all stormwater BMPs have been inspected and approved by City.

Section 10. Appeal

10.1 **Administrative decisions** by city staff and enforcement actions may be appealed by the developer or property owner to the city council pursuant to the following rules:[25]

10.1.1 The appeal must be filed in writing with the city clerk within five (5) business days of the decision or enforcement action.

10.1.2 The written appeal shall specify in detail the action appealed from, the errors allegedly made by the enforcement officer giving rise to the appeal, a written summary of all oral and written testimony the applicant intends to introduce at the hearing, including the names and addresses of all witnesses the applicant intends to call, copies of all documents the applicant intends to introduce at the hearing, and the relief requested.

10.1.3 The enforcement officer shall specify in writing the reasons for the enforcement action, a written summary of all oral and written testimony the enforcement officer intends to introduce at the hearing, including the names and addresses of all witnesses the enforcement officer intends to call, and copies of all documents the enforcement officer intends to introduce at the hearing.

10.1.4 The city clerk shall notify the applicant and the enforcement officer by ordinary mail, and shall give public notice in accordance with Chapter 21, Iowa Code, of the date, time and place for the regular or special meeting of the city council at which the hearing on the appeal shall occur. The hearing shall be scheduled for a date not less than four (4) nor more than twenty (20) days after the filing of the appeal. The rules of evidence and procedure, and the standard of proof to be applied, shall be the same as provided by Chapter 17A, Code of Iowa. The applicant may be represented by counsel at the applicant's expense. The enforcement officer may be represented by the city attorney or by an attorney designated by the city council at City expense.

10.2 The **decision of the city council** shall be rendered in writing and may be appealed to the Iowa District Court.

[25] If the city already has rules applicable to the appeal of enforcement actions, the existing process may be incorporated by reference in lieu of the indicated language. The specificity of this provision in terms of time-lines, hearings and decisions are necessary in order to satisfy constitutional principles of due process and equal protection.