5 prioritized action plan

While Chapter 4 identifies types of best management practices that can be used in the Duck Creek watershed, this chapter presents specific recommended action items developed jointly by the watershed stakeholders and the consultant planning team. This chapter begins by describing the implementation partners (Section 5.1), followed by recommended action items that presented in three sections. The General Recommendations (5.2) provide suggestions that should be applied watershed-wide and may also apply to large sites. The Site Specific Action Plan (5.3) presents detailed recommendations for specific problem areas within the watershed as identified during the inventory and assessment. The Information and Education Plan (5.4) specifically identifies the recommended actions that will likely need more outreach and education in order to be implemented.

As a reminder, it should be stressed that correcting watershed hydrology to reduce the volume and rate of stormwater runoff is a critical key to addressing watershed problems and improving watershed resources. Restoring a more natural watershed hydrology can help address the root of these problems without significant investment of limited funding and resources. In addition to correcting watershed hydrology, the most important conclusions based on the watershed assessment are summarized here.

1. The Duck Creek system exhibits rapid increases and decreases in water flow, level and velocity, which reduces water quality, reduces the quality of stream habitat, and destabilizes the stream channel, causing erosion of streambanks and damage to stormwater infrastructure.

2. Streambank erosion occurs along many reaches and requires immediate attention. Stormwater discharge points should be examined and repaired or remediated to reduce their impact on streambank erosion.

3. Water quality is impacted primarily by sediment, bacterial contamination, chlorides, high phosphorous concentrations, and other typical urban watershed non-point source pollutants.

4. Preserving and restoring the watershed green infrastructure system, including the floodplain, is critical for improving water quality and other watershed resources. Natural area restoration measures include controlling invasive species, thinning the forest canopy, and restoring natural hydrology.

5. The stream channel and riparian corridor require preservation and restoration to a natural condition. Proper management of this corridor includes halting yard waste and debris dumping and restoring a wide buffer of native vegetation.

6. The municipalities, residents, businesses, landowners, and other organizations and agencies within the watershed lack the coordination, communication, and development standards necessary to improve watershed resources.

7. Monitor and evaluate watershed plan implementation and physical watershed conditions to gauge progress towards watershed goals.

5.1 IMPLEMENTATION PARTNERS

Throughout the action plan tables and narrative, responsible parties are suggested for taking the lead or providing a supporting role in plan implementation. This section presents the responsible parties as well as a brief description of their roles. Table 5.1.1 provides a concise reference or key for the list of implementation partners that follows.

Quad City Watershed Planning Committee / Duck Creek (QCWPC/DC)

The QCWPC-DC, composed of watershed stakeholders, organizes, coordinates and advises implementation partners on watershed planning methods and issues, demonstration project selection, and technical assistance. The QCWPC-DC is responsible for coordinating the implementation of the watershed plan.

Academic Institutions (AI)

Education has been identified as a priority and necessary component of the Watershed Plan. The Iowa State University Extension: Scott County has programs and staff in place to educate citizens on best management practices

for watersheds, native plantings and alternative gardening and landscaping methods. Scott Community College and St. Ambrose University are also equipped with educational resources and personnel to provide assistance with educational programming.

Bi-State Regional Commission (BSRC)

www.bistateonline.org (309) 793-6300

BSRC serves as a forum for intergovernmental cooperation and delivery of regional programs and assists member local governments in planning and project development. BSRC can provide technical assistance and resources when implementing recommendations from the Quad City Watershed Plan and write grants for member counties and municipalities.

Corporate Business and Landowners (CBL)

The active participation of CBLs in the planning process can lead to significant positive impacts on the quality of the Duck Creek watershed. Businesses can become involved by retrofitting existing facilities, managing their grounds, roof runoff, and parking lots to reduce runoff volume and pollutant loadings, and sponsoring watershed events. With an up front commitment from the CBL community, new development can also be designed to minimize runoff and pollutant loadings.

Davenport Water Pollution Control Plant / Sewer Division of Davenport Public Works (DWCP/SDDPW)

www.cityofdavenportiowa.com (563) 326-7923

The CDWPCP is a municipal government entity that provides wastewater treatment service for watershed communities. The SDDPW maintains the sanitary sewer system in the watershed.

Developers & Homebuilders (DH)

The practices of developers can significantly impact a watershed. Developers should be encouraged or required to employ sustainable development techniques such as conservation subdivision development and other practices described in the Best Management Practice Toolbox. Homebuilders should use BMPs during the construction process, especially those related to soil erosion and sedimentation control. Failure to use BMPs, or improper use, can lead to soil erosion and other pollutant discharges.

Federal Emergency Management Agency (FEMA)

www.fema.gov (800) 621-FEMA

FEMA is the principal federal agency involved in flood mitigation and flood disaster response. Among its duties, FEMA is responsible for the National Flood Insurance program, helps municipalities develop and enforce floodplain ordinances, develops floodplain maps, and administers funding for flood mitigation plans and projects.

Golf Courses (GC)

Golf courses are important potential sites for the use of BMPs, primarily due to their location along the stream and their potential impact as sources of pollutants and their contribution as a green infrastructure element. Golf courses can help reduce pollutant loadings, especially nutrients, as well as runoff volume by incorporating BMPs into their golf course management programs.

Iowa American Water Company (IAW)

www.amwater.com/iaaw (563) 468-9201

IAW treats water from the Mississippi River for drinking water for communities in the Duck Creek watershed. They constantly test the water quality of the river and ground water sources.

Iowa Department of Agriculture and Land Stewardship (IDALS)

www.agriculture.state.ia.us (515) 281-5321

IDALS is responsible for a wide range of programs that affect the quality of water in Iowa. They offer technical assistance to agriculture and urban landowners concerning stormwater management and conservation practices and offers funding for watershed improvements.

Iowa Department of Natural Resources (IADNR)

www.iowadnr.com (515) 281-5918

Several offices within the IDNR provide services that will be valuable to the implementation of the Duck Creek Watershed Plan for issues related to flooding and floodplain management, water quality improvement, and flora and fauna enhancement. The IDNR has authority to regulate construction in floodplains and floodways to promote the protection of life and property from floods and to the orderly development and wise use of flood plains. Any person who desires to conduct any practices within a floodplain that could have a potential effect on the watershed or water body must obtain permits from the IDNR. The IDNR is currently conducting a T.M.D.L. (Total Maximum Daily Load) for Duck Creek. The T.M.D.L will identify sources of E. coli bacteria and best locations for projects that improve water quality in the creek. The IDNR also offers funding for watershed projects and other projects related to habitat restoration.

Iowa Department of Natural Resources IOWATER (IADNR IOWATER)

www.iowater.net (515) 205-8587

IOWATER seeks to protect and improve Iowa's water quality by raising citizen awareness about Iowa's watersheds, supporting and encouraging the growth and networking of Iowa's volunteer water monitoring communities, and promoting water monitoring activities as a means of assessing and understanding Iowa's aquatic resources. IOWATER's data provides indications of current water quality status and serves as an evaluation measure for the Quad City Watershed Plan.

Iowa Department of Transportation (IADOT)

www.iowadot.gov (515) 239-1101

IADOT is responsible for the planning, construction and maintenance of portions of the transportation network that covers the Duck Creek watershed. Incorporation of best management practices and sustainable management measures into IADOT projects can lead to improvements in the environmental quality of the watershed.

Iowa Environmental Protection Agency (IAEPA)

www.epa.gov/region7 (913) 551-7003

The IAEPA provides technical assistance and funding for watershed projects and programs. They also give monies and responsibilities to the IADNR.

Interstate Resource Conservation and Development (IRCD) www.interstatercd.org (309) 764-1486

IRCD provides technical expertise and education on conservation, development, management, and responsible use of natural resources to landowners and land managers, county and local governments and local organizations. Areas of expertise include streambank stabilization and soil erosion/sediment control, wetland and habitat restoration, community planning, environmental education, agricultural conservation, water quality protection, nonpoint source pollution, stream health, conservation planning and natural resource maps and reports.

IRCD offers funding assistance and cost share programs for projects that relate to rural economic development; natural resources management; community and social services; and environmental education.

Municipalities (M)

Davenport: www.ci.davenport.ia.us (563) 326-7763

Bettendorf: www.bettendorf.lib.ia.us (563)344-4000

Municipalities, specifically Davenport and Bettendorf, (i.e. local elected officials and local agency staff) have the principal responsibility for land use and development planning, establishing legislative and administrative policies, adopting ordinances and resolutions, setting zoning standards, establishing the annual budget, appropriating funds, and setting tax rates. There are also opportunities to make others aware of the watershed management planning process through local government newsletters and presentations at board meetings, which are often televised on local cable television networks. Municipalities are therefore crucial to watershed protection efforts. By partnering with municipalities and encouraging the adoption of sustainable zoning and development practices, a watershed protection group can check the increase of water quality impairments. Municipalities are also a key part of any watershed protection

strategy because they are responsible for the enforcement of local land use and development ordinances.

Non Profit Organizations (NPO)

NPO's such as River Action, Partners of Scott County Watersheds, Keep Iowa Beautiful, Living Lands and Waters, Iowa Natural Heritage Foundation, and the Natural Land Institute can partner on educational programming on watersheds and grant writing for watershed improvement projects.

Private and Residential Landowners and Homeowners Associations (PRL)

The activities of residential landowners, often unknowingly, can have a significant impact of the quality of a watershed. Practices such as excess lawn fertilization, connection of downspouts to the sewer system, or destruction of riparian buffers can be significant sources of nonpoint pollution. Watershed protection efforts should educate residents on the consequences of their actions and present alternatives. More positively, political pressure from local residents on municipal or county officials can lead to increased emphasis on watershed protection. And many local residents play important roles in watershed planning and protection efforts.

Scott County (SC)

www.scottcountyiowa.com (563) 326-8611

The Duck Creek Watershed is in Scott County and the county plays a role in land use planning, development, natural resource protection and conservation, environmental health and resident health. Parts of the Duck Creek watershed are unincorporated county areas and therefore fall under the jurisdiction of Scott County. Working with the Scott County and its conservation, planning and development, and health departments can help ensure that Duck Creek watershed incorporates responsible conservation practices, sustainable land use planning, and public health policies.

Scott County Conservation Department and Board (SCCD/B)

www.scottcountyiowa.com/conservation (563) 328-3280

The SCCB's mission, which is carried out by the department, is to improve the quality of life and promote and preserve the health, welfare, and enjoyment for the citizens of Scott County and the general public by acquiring, developing, operating, and preserving the historical, educational, environmental, recreational and natural resources of the County. The SCCD/B could provide assistance in watershed improvement and enhancement projects that help meet the goals of the board.

Scott County Health Department (SCHD)

www.scottcountyiowa.com/health (563) 326-8618

The SCHD includes environmental health services, which includes water quality in connection with drinking water wells and onsite wastewater treatment systems (septic systems) for existing and planned development. These services include inspections, sampling, and enforcement of regulations. Ensuring these systems are functioning and planned properly is vital to keeping bacteria and other harmful waste out of Duck Creek.

Scott County Natural Resources Conservation Service (NRCS) / Soil and Water Conservation District (SCSWCD)

(563) 391-1403 ext. 3

NRCS and SCSWCD provide technical expertise and education on conservation, development, management, and responsible use of natural resources to landowners and land managers, county and local governments and local organizations. Areas of expertise include streambank stabilization and soil erosion/sediment control, wetland and habitat restoration, community planning, environmental education, agricultural conservation, water quality protection, nonpoint source pollution, stream health, conservation planning and natural resource maps and reports. NRCS and SCSWCD offer funding assistance and cost share programs for urban storm water best management and agricultural conservation practices.

Scott County Planning and Development (SCPD)

www.scottcountyiowa.com/planning (563) 326-8643

SCED is responsible for current and future land uses in all unincorporated areas of Scott County. SCED, through the adoption of a comprehensive development plan and enforcement of the county's zoning, building code, subdivision and floodplain development ordinances, is able to regulate all non-agricultural land uses in the unincorporated areas. Parts of the Duck Creek watershed are unincorporated county areas and therefore fall under the jurisdiction of Scott County. The SCED can ensure responsible and sustainable future and current land use and development.

Scott County Waste Commission (SCWC)

www.wastecom.com (563) 381-1300

The mission of the SCWC is to provide environmentally sound and economically feasible solid waste management for Scott County. The waste commission encompasses the Scott County landfill, recycling center, household hazardous material program and electronic demanufacturing facility. These services provide an environmentally safe disposal and recycling of waste which keep such wastes out of local waterways. Keep Scott County Beautiful-I Live is a local 501 (c)(3) non-profit organization started by the SCWC. The program has an educational focus centered empowering individuals to take greater responsibility for enhancing their community environment.

U.S. Army Corps of Engineers (USACE)

www.mvr.usace.army.mil (309)794-4200

USACE plays a major role in wetland protection and regulation through Section 404 of the Clean Water Act, which requires USACE to administer permit applications for alterations to wetlands. The USACE Rock Island district provides assistance flood risk management, regulation of aquatic resources and environmental protection and restoration.

U.S. Department of Agriculture (USDA)

www.usda.gov (202)720- 4357

USDA's Farm Services Agency (FSA) has several programs that support watershed protection and restoration efforts. Under the Conservation Reserve Program (CRP), farmers receive annual rental payments, cost sharing, and technical assistance to plant vegetation for land they put into reserve for 10 to 15 years. The Conservation Reserve Enhancement Program (CREP) targets state and federal funds to achieve shared environmental goals of national and state significance. The program uses financial incentives to encourage farmers and ranchers to voluntarily protect soil, water, and wildlife resources. The Grassland Reserve Program (GRP) uses 30-year easements and rental agreements to improve management of, restore, or conserve up to 2 million acres of private grasslands. The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands.

U.S. Environmental Protection Agency (USEPA)

www.epa.gov (202) 272-0167

The USEPA oversees the environmental protection efforts of the IEPA and is the ultimate source for Section 319 and other environmental improvement programs. Section 404 of the Clean Water Act, which regulates the dredging and filling of wetlands, is jointly administered by USEPA and the U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service (USFWS)

www.fws.gov/midwest/RockIsland (309)757-5800

The USFWS provides technical assistance to local watershed protection groups. It also administers several grant and cost-share programs that fund wetland and aquatic habitat restoration. The USFWS also administers the federal Endangered Species Act and supports a program called Endangered Species Program Partners, which features formal or informal partnerships for protecting endangered and threatened species and helping them to recover. These partnerships include federal partners as well as states, tribes, local governments, nonprofit organizations, and individual landowners.

Table 5.1.1 Implementation Partners

Acronym	Responsible Party	General Responsibility
QCWSPC / DC	Quad City Watershed Planning Committee-Duck Creek	Facilitate planning, funding, design of implementation of the Quad City Watershed Plan-Duck Creek
AI	Academic Institutions	Assist with implementation of education plan
BSRC	Bi-State Regional Commission	Planning and technical assistance, grant writing
CBL	Corporate Business and Landowners	Grounds management and maintenance, employee education
DWPCP/ SDDPW	Davenport Water Pollution Control Plant/Sewer Division of Davenport Public Works	Maintain sanitary sewer infrastructure
DH	Developers and Homebuilders	Land development, stormwater management system design and construction
FEMA	Federal Emergency Management Agency	National Funding Insurance Program, floodplain mapping and enforcement, and mitigation funding
GC	Golf Courses	Grounds management and maintenance, employee education
IAWC	Iowa American Water Company	Water monitoring
IDALS	Iowa Department of Agriculture and Land Stewardship	Technical and financial assistance
IDNR	Iowa Department of Natural Resources	Natural area preservation and management, research, technical and financial assistance
IDNR IOWATER	Iowa Department of Natural Resources (IOWATER)	Water monitoring
IDOT	Iowa Department of Transportation	Road and highway planning, construction and maintenance
IEPA	Iowa Environmental Protection Agency	Funding assistance and regulation
IRCD	Interstate Resource Conservation and Development (IRCD)	Provide natural resource management, technical and financial assistance
M	Municipalities of Davenport and Bettendorf	Land use development, technical and financial support, and drainage system management
NPO	Non Profit Organizations	Assist with implementaion of education plan, grant witting and submittal for watershed improvement projects and programs
PRL	Private and Residential Landowners	Land management and maintenance including stream channels and riparian corridors
SC	Scott County	Land use planning for unincorporated areas, natural resources, drainage system management
SCCD/B	Scott County Conservation Department and Board	Land and natural resource management
SCHD	Scott County Health Department	Monitor, manage, and provide technical support for water resources
NRCS / SWCD	Scott County Natural Resources Conservation District/Soil and Water Conservation District	Provide natural resource management, technical and financial assistance
SCPD	Scott County Planning and Development	Responsible land use planning and management in unincorporated areas
SCWC	Scott County Waste Commission	Environmentally sound waste disposal, education
USACE	United States Army Corps of Engineers	Water protection, regulation and restoration
USDA	United States Department of Agriculture	Agricultural and natural resource technical and financial assistance
USEPA	United States Environmental Protection Agency	Management, regulation and restoration of water resources
USFWS	United States Fish and Wildlife Service	Threatened and endangered species, technical and funding assistance for habitat restoration

5.2 GENERAL RECOMMENDATIONS

The following recommendations and Best Management Practices should be considered for installation throughout the watershed and as general guidance for all watershed stakeholders and plan implementers. They are provide for the use, benefit, and consideration of the community-at-large and are not intended to create or imply any burden, expectation, or commitment on the part of any specific property owners, special interest groups, or governmental entities. Implementation of this watershed plan and the improvement of watershed resources are ongoing, incremental, and long-term processes. Continuous research and investigation should be conducted to stay current with watershed conditions and resources. Likewise, this watershed plan should be updated regularly to accommodate changes in watershed conditions and resources and to reflect projects and plan implementation.

These recommendations are organized using a combination of land use (residential, agricultural, etc.), landscape position (stream corridors), and administrative standards. Many of the recommended BMPs are described in greater detail in Chapter 5, the Watershed Best Management Toolbox. The recommended ordinance standards are intended to apply to new development and substantial redevelopment and private and public projects in incorporated and unincorporated areas of the watershed.

5.2.1 AGRICULTURAL AREAS

A significant acreage of agricultural land and uses remain in the watershed, primarily in the western half. Agricultural land use and management can have an impact on water quality and watershed resources due to the regular disturbance of the soil, which can lead to erosion of topsoil, and the application of agricultural chemicals such as fertilizers and pesticides. The general recommendations are intended to reduce the impact of agricultural land management on watershed resources. Recommendations regarding livestock and feedlots refer primarily to the management of animal waste to prevent runoff into the creek system and maintaining exclusion zones to prevent livestock from accessing the streams. General recommendation actions for agricultural areas areas are listed in Table 5.2.1.1.

Table 5.2.1.1 Agricultral Area General Recommendations

AGRICULTURAL AREAS

1. Install Agricultural Land Management BMPs Within Agricultural Land Uses Where Appropriate and Feasible:
   a. Implement conservation tillage
   b. Implement contour farming on land with a slope greater than 3%.
   c. Reduce input of agricultural fertilizers and pesticides, and/or use GPS linked equipment to apply appropriate amounts of chemicals for conditions on a per acre basis.
   d. Install filter strips and 50' buffers / grassed swales along drainageways, along creeks, and around depressional and wet / wetland areas.
2. Prevent Livestock from Accessing Streams, Lakes, and Wetlands: Install livestock exclusion fencing along stream corridors, lakes, and wetlands to prevent livestock from entering streams, trampling the banks and providing direct input of animal waste. Bridges/culverts may be provided where necessary to provide stream crossings.
3. Implement Feedlot BMPs: install Best Management Practices specifically designed to address waste runoff from pens and pastures.

5.2.2 URBAN & URBANIZING AREAS

As described in the introduction and the watershed inventory, stormwater runoff from urban and urbanizing areas is one of the primary sources of water quality impairment. The causes and sources of water quality problems in the Duck Creek watershed are primarily urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to urban. These changes have included modification of the stream channel, floodplain, wetlands, riparian corridor, and other water resource-related landscape features. Other changes are the result of the increased watershed impervious cover (e.g., paving, concrete, rooftops) that has led to an increase in the volume and rate of runoff in the watershed.

The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. This erosion causes increased levels of Total Suspended Solids that settle out in the lower gradient reaches and impair aquatic habitat. The efficient stormwater system also causes decreased baseflows during the drier summer and fall months, which can result in low dissolved oxygen levels that impair aquatic habitat. Salt applied to roads for snow and ice control are also impairing water quality.

To improve this situation, the use of stormwater best management practices and low impact development should be required in all new development and encouraged in areas that are already developed. Drainage and detention in existing developed areas also should be retrofitted to better control runoff rates and to improve water quality. Natural hydrologic regimes and drainage systems should be preserved and/or restored to the extent practicable to reduce the impact of development and hydrologic modification on water quantity and quality and to help achieve aquatic habitat objectives.

All landowners and stakeholders within the watershed can contribute to water quality improvement by managing land and property to prevent or remove pollutants from the landscape before they can be washed into the stream. Management and maintenance of the stormwater management system is primarily the responsibility of municipalities, including both the conveyance system (pipes and drainage swales) and detention ponds, unless management of these features has been assumed by a homeowners association or other party. The implementation of green infrastructure best management practices (BMPs) is the responsibility of all landowners (for existing development) and developers and homebuilders (for new development). However, municipalities must require or encourage these practices to be installed. Preservation of remaining natural drainage and storage (green infrastructure) features of the landscape is the responsibility of municipalities.

General recommendation actions for urban and urbanizing areas are listed in Table 5.2.2.1.

Table 5.2.2.1 Urban & Urbanizing General Recommendations

URBAN AND URBANIZING AREAS

4. Implement Development Standards and Ordinances: where not already in place, stormwater ordinances should be implemented to address increases in runoff volumes, rates, and pollutant loads associated with construction activities and the addition of impervious cover. See the Stormwater Standards Recommendations below.

5. Utilize Conservation and Low Impact Development Practices: To meet stormwater standards, conservation development and Low Impact Development principles and practices should be utilized to protect sensitive natural resources, minimize new impervious area, and filter and infiltrate stormwater runoff. A number of strategies and BMPs are described below. Figures within the Watershed BMP Toolbox illustrate how the BMPs can be integrated into residential and commercial land uses. Also see the Stormwater Standards recommendations below.

    a. Modify the site development planning and approval process, including zoning and subdivision standards, to encourage watershed-friendly development practices and designs that protect watershed resources and water quality. Municipalities may consider the adoption of overlay or special area standards for areas with sensitive resources. Investigate site soil and infiltration characteristics to aid in BMP selection. Examples may include:

        i. Reduce minimum street widths to those necessary to carry the expected average traffic volume rather than the maximum traffic volume.

        ii. Use alternative parking lot designs including:

            - ensure that the number of spaces built reflects actual, everyday demand rather than infrequently needed maximums;
            - reduce the dimensions of the compact car parking spaces and provide preferred parking locations for these vehicles;
            - convert parking lot islands and landscaping to depressed bioretention areas;
            - allow shared parking between adjacent facilities with alternating times of parking needs (e.g., a church and an office building).

        iii. Allow permeable paving practices for plazas and pedestrian areas, parking, driveways and low volume traffic streets.

        iv. Install rain gardens, bioswales, and naturalized detention basins to slow, filter, and infiltrate stormwater runoff.

        v. Allow reduced street setbacks, frontages, and lot sizes in areas where riparian or sensitive natural areas need protection and to reduce the impervious surface area for streets and driveways.

        vi. Allow conservation design development to reduce the disturbed area and preserve green infrastructure (open land) for infiltration and treatment of runoff.

        vii. Investigate incentive programs for developers to implement conservation and low impact development planning and design practices and techniques (as described in the Watershed Management Toolbox). These incentives could include expedited permitting and review procedures, density bonuses, tax credits, cost-share, or fee reductions for early projects that serve as demonstrations and free technical assistance.

6. Minimize Disturbance and Provide Soil Erosion and Sediment Control During Construction:

    a. Minimize soil compaction, clearing and mass grading to only where absolutely necessary to build and provide access to structures and infrastructure (site fingerprinting). Avoid clearing and grading in or immediately adjacent to water resources and steep slopes.

    b. During construction protect and retain existing vegetation to decrease concentrated flows, maintain site

Table 5.2.2.1 Urban & Urbanizing General Recommendations (continued)

hydrology, and control erosion.

c. Limit soil exposure by phasing construction so that only a portion of the site is disturbed at any one time to complete the needed building in that phase. Other portions of the site should not be cleared and graded until necessary to begin those phases of development or construction.

d. Stabilize / revegetate exposed and disturbed soils including soil stockpiles within 7 days after disturbance with seeding, mulch cover, erosion control blankets, or other stabilization practices, unless the site will be worked on within that time period. Topsoil stockpiles can be reapplied as a soil amendment to reestablish vegetation following construction.

e. Install, inspect and maintain soil erosion and sediment control measures such as erosion blanket, filter strips, silt fences and sedimentation basins weekly and after each rainfall exceeding 0.5 inches as required by NPDES construction site standards.

7. Provide Stream, Lake, Wetland, and Ravine Buffers: Where new development parcels include stream channels, lakes, wetlands, or ravines require easements or transferal of ownership to a public entity or other organization, such as a land trust, that will manage and maintain the buffer area and its resource appropriately as part of the green infrastructure system.

   a. Permanently restrict development and install natural buffer to a width of 100' from the top of the stream bank or to the 100-year floodplain boundary, whichever is greater.

   b. Where there is no floodplain, preserve and restore a buffer to 100' width on either side of the stream, lake, or wetland.

   c. Along ravines, preserve and restore a minimum 25 foot natural buffer from the top of the ravine.

8. Retrofit Existing Developed Areas to Better Manage Stormwater: For existing developed areas, the following recommendations focus on retrofitting, remediation, and maintenance of the stormwater management system and landscape management activities, and may be considered as appropriate for the level of urban intensity found within this watershed. Stormwater BMPs should be installed to reduce runoff rate and volume and improve the quality of runoff entering the stormwater management system. Stormwater BMPs that may be used include those listed below. Investigate site soil and infiltration potential to help determine whether infiltration BMPs or other types of BMPs are appropriate. Figures within the Watershed BMP Toolbox illustrate how the BMPs can be integrated into residential and commercial land uses.

   a. For living and working spaces (homes, office buildings, hospitals, and other areas with significant areas of impervious surfaces):

      i. When replacing existing pavement, or installing newly paved areas, use pervious or porous pavement or permeable paving blocks for parking lots, emergency access roads, driveways and streets where appropriate to increase infiltration and reduce runoff volumes and pollutant loads.

      ii. Install bioswales, filter strips, and rain gardens within or at the edges of parking lots and other impervious surfaces as construction and reconstruction occurs to capture pollutants and infiltrate runoff.

      iii. Install rain gardens to filter and infiltrate roof runoff from residential and commercial roofs. Rain gardens can be readily incorporated into landscape beds.

      iv. Convert existing swales and open drainage ways to infiltrate runoff with natural landscaping

      v. Utilize naturalized wet bottom or wetland detention basin designs and retrofit existing single function dry bottom detention basins to provide multiple benefits including reduced pollutant loads. Stabilize eroding shorelines using deep-rooted native landscaping; install settling basins upstream of detention to capture

Table 5.2.2.1 Urban & Urbanizing General Recommendations (continued)

sediment in runoff; restrict discharge rates to mimic natural instream flow rates.

vi. Retrofit curb and gutter areas along roadways, parking lots, and other impervious surfaces to allow stormwater to enter swales or other naturalized filtration and infiltration measures such as parking lot and roadside rain gardens to help reduce the volume and rate of runoff and improve water quality. Coordinate permeable or paving or bioswales with parking lot maintenance and replacement to minimize costs. For unsewered areas, swales (drainage ditches) and overland flow paths should be improved as naturalized swales. [Portland photos]

vii. Regularly sweep and maintain streets, parking lots, loading zones, and other large impervious areas and reduce or modify application of de-icing salt, to reduce the flow of particulates, sediment, chlorides, and other pollutants into the streams.

viii. Inspect and monitor all septic and sanitary sewers for leakage and management / maintenance problems. Upon completion of the study, implement recommendations of the TMDL for Duck Creek, which should establish sources of bacterial contamination and identify a strategy and steps for addressing such contamination.

ix. Install sand filters, filtration basins, treatment wetlands, other bioretention practices, or other filtration practices downstream of industrial, commercial facilities and other land uses potentially generating a heavy load of pollutants. Install sand filters, appropriate proprietary water treatment units, or settling basins at the storm sewer inlets in parking lots where retrofitting of bioretention swales and other natural measures are not feasible.

x. Reduce the hydraulic connectivity of impervious surfaces by disconnecting roof downspouts from discharging to impervious areas and instead directing the flow into a lawn or naturally landscaped area, rain garden, filter strip, rain barrel, or dry well. Substitute swale and rain garden systems for curbs and gutters to increase infiltration.

b. For recreational spaces (parks, cemeteries, golf courses, and institutions / campuses with large expanses of turf grass):

i. Reduce mowing in areas not in recreational use

ii. Utilize deep-rooted native vegetation wherever possible for landscaping rather than turf grass to increase stormwater infiltration and evapotranspiration, reduce the need for watering, pesticides and fertilizers, filter pollutants from surface runoff, and provide habitat for native species. Plant native trees appropriate to the local area to increase interception, evapotranspiration, and uptake of precipitation.

iii. Reduce or eliminate the use of fertilizers and pesticides for turf management

iv. Replace areas not needed for recreational uses with native landscape systems

v. Disconnect storm sewers and manage all stormwater on site using stormwater BMPs

5.2.3 STREAM CORRIDOR RESTORATION & MANAGEMENT

Stabilization, restoration, and management of the stream channel, streambank, and riparian corridor are needed throughout the watershed to improve and protect water quality, maintain floodplain functions, and reduce property loss caused by erosion. Of particular importance are remediating the impairments and problems that were identified during the watershed inventory and assessment and preserving the beneficial characteristics of the stream channel such as healthy stream substrates. Streambank erosion is threatening property, damaging infrastructure, and degrading water quality and habitat. This problem includes significant erosion around and near stormwater outfall and discharge points and hydraulic structures. Aquatic and riparian habitat are also in need of restoration, including restoring instream habitat such as pools and riffles, removing excessive debris from the stream channel, establishing naturalized streambanks with native plants, and managing stream corridors by restoring native riparian buffers and reducing the density of trees.

Presently, private landowners, including golf courses, are responsible for maintaining the stream as if crosses their property or flows along a property line. This includes all aspects of management and maintenance, such as debris removal, invasive species control, streambank stabilization, and management of private stormwater outfall pipes. Since problems within the stream and riparian corridor can be the result of land use and other activities upstream of a particular property, it is in everyone's best interest to help ensure that this plan is implemented watershed-wide.

Exceptions to private landowner responsibility exist where the stream passes through public land. Municipalities have primary responsibility for land use and development decisions within their jurisdiction, including the allowable quantity and quality of stormwater discharge, which dramatically affects the quality of the stream corridor. Municipalities also are responsible, in part, for maintaining drainage system infrastructure, which includes most stormwater discharge points. General recommendations for stream corridor restoration and management are listed in Table 5.2.3.1.

Table 5.2.3.1 Stream Corridor Restoration and Management General Recommendations

STREAM CORRIDOR RESTORATION AND MANAGEMENT
9. Stabilize Eroding Streambanks: stabilize streambanks, bank toes, and side slopes using bioengineering practices with deep-rooted native plants to reduce erosion and sediment loads downstream and to reduce property loss. Bioengineering practices include A-Jacks, lunkers, fiber rolls, geotextile mats, live stakes, fascines, brush and branch layers, cribwalls, and vegetated geogrid lifts. a. Regrading to a 3:1 slope or less b. Stabilize bank toes with rock, biologs, or A-Jacks. c. Plant banks with deep rooted vegetation.
10. Stabilize, Repair, and Retrofit Stormwater Outfalls: stabilize outfall structures and the associated streambanks and channel to reduce erosion and protect stormwater infrastructure. Install flow attenuation and outlet protection measures to dissipate the energy of stormwater discharges, reduce erosion, and improve filtration of stormwater runoff entering the stream.
11. Restore Stream Channels, Streambeds, and Aquatic Habitat: this includes installing instream habitat features, such as natural channel substrates and pools & riffles, removing excessive debris, and stabilizing stream banks and the stream bed to improve water quality and aquatic biodiversity. Where feasible, daylight and remeander streams that have been contained in ditches or moved underground into culverts or pipes.
12. Manage and Restore Riparian Buffers: restore, expand, and limit development within an average 100' native riparian buffer of deep-rooted, native grasses, emergent wetland and wet prairie vegetation, and a few native trees along stream corridors to minimize streambank erosion, protect aquatic and riparian habitat, filter pollutants from runoff, and preserve natural aesthetics. a. Stop mowing turf grass within the buffer area.

Table 5.2.3.1 Stream Corridor Restoration and Management General Recommendations (continued)

b. Replace turf grass with deep-rooted native species.

c. Remove non-native invasive species through selective removal and controlled burning

d. Establish herbaceous ground cover

e. Remove non-native and invasive trees to restore native ravine ground cover vegetation. Thinning overgrown woodlands will allow sunlight to penetrate to the ground layer and establish ground cover vegetation, particularly on ravine slopes. Establish appropriate deep-rooted native plants as ground cover to help stabilize erodible soils on ravine slopes, edges, and buffers.

13. Conduct Stream Maintenance: develop and implement a regular stream inspection, maintenance, and restoration program among municipalities, institutions, and homeowners to remove accumulated woody debris and other debris and litter and to target restoration needs.

14. Manage the Rock River Shoreline: to help stabilize soils, reduce erosion, and restore riparian habitat. This may include thinning of a wooded canopy and removal of structures and infrastructure from within a minimum 100' Rock River buffer.

15. Residential Landowner Riparian Management:

a. Prohibit dumping of grass clippings, leaves, or other natural or man-made fill or debris that may damage underlying vegetation or prevent re-vegetation on ravine slopes. Properly dispose of yard and landscaping waste through composting or municipally provided collection programs. Avoid disposal or burning of yard waste in or near the stream or riparian buffer, which adds excess nutrients to the stream system and kills the plant buffer that stabilizes the ravine slopes and streambanks and filters runoff to the stream. Properly dispose of yard and pet wastes, household chemicals, and trash. Do not dispose of these in stormsewers, roadside swales, or the stream.

b. Install lot-level, small scale stormwater BMPs to prevent surface water discharge to ravines and streams.

i. Disconnect or redirect discharge pipes that carry water away from footing drains, rooftop drains, or sumps so that they do not discharge directly to the ravine or stream channel.

ii. Redirect runoff to rain gardens or other infiltration measures, if soils allow, or capture runoff with rain barrels for use in irrigation of the yard or garden.

iii. Where stormwater can not be infiltrated on site, do not direct downspout pipe and/or sump pump outlets on or within 25 feet of steep ravine slopes. Where site conditions do not allow for a 25 foot buffer between the discharge and the top of ravine slope, the discharge should be outlet at the bottom of the ravine. The ravine bottom discharge should be stabilized with rock for a distance of 25 feet or greater, depending on the size of the discharge.

c. Promote the use of environmentally friendly lawn care practices rather than the use of fertilizers (zero-phosphorous fertilizers are available) and pesticides, including private services that provide lawn care.

16. Industrial and Commercial Landowner Riparian Management:

a. Install stormwater BMPs to filter and infiltrate runoff from the broad expanses of impervious parking lots and roof tops. Investigate site soil and infiltration potential to help determine whether infiltration BMPs or other types of BMPs are appropriate.

b. Control water quality impairment through regular and frequent sweeping of parking lots

c. Control runoff / leaching from chemical storage areas, parking areas, or vehicle storage areas through containment structures and regular inspections and clean up.

d. Install stormwater BMPs appropriate to local soil conditions and characteristics to prevent surface water discharge to ravines and streams.

i. Disconnect or redirect discharge pipes that carry water away from footing drains, rooftop drains, or parking lots so that they do not discharge directly to the ravine or stream channel.

ii. Redirect runoff to rain gardens, bioretention swales or other infiltration measures.

iii. Where stormwater can not be infiltrated on site, allow parking lots to sheet drain to a minimum 25 foot native buffer measured from the top of ravine slope. For concentrated storm sewer discharges, even a 25 foot buffer will be insufficient in most cases and the storm sewer should be outlet at the bottom of the ravine. The ravine bottom discharge should be stabilized with rock for a distance of 25 feet or greater, depending on the size of the discharge.

17. Reduce Salt Application: Where the stream crosses and parallels streets, significant care should be taken to minimize the application of road salt for snow and ice control.

5.2.4 STORMWATER MANAGEMENT STANDARDS

The watershed contains a significan area of land that could be converted to urban uses in the future. Without stormwater management standards in place, new development could significantly worsen watershed impairments. The existing developed landscape has and continues to impact watershed resources primarily due to the conversion (and loss) of the natural landscape to urban uses, alteration of the natural drainage and water retention features of that landscape, and the rate, volume, and quality of stormwater runoff.

Watershed municipalities, as the primary land use and development decision-making entities, are responsible for adopting and enforcing many of the planning, zoning, subdivision, and development standards that will affect watershed resources. Current municipal planning and development standards do not adequately identify, prioritize, or preserve valuable landscape features nor require (and in some cases, they do not even allow) the use of conservation design, low impact development, or stormwater best management practices.

The parties that are responsible for implementing planning and development standards are primarily those responsible for land use decisions. Programmatic actions for stormwater management standards are listed in Table 5.2.4.1.

Table 5.2.4.1 Stormwater Management Standards Programmatic Actions

STORMWATER MANAGEMENT STANDARDS

18. Establish Stormwater Standards and Regulations: to prevent increases in flood damages and protect and improve the natural hydrologic, water quality, aquatic habitat, recreational, and aesthetic functions of streams, wetlands, and floodplains.
19. Require Stormwater Management BMPs to Minimize Discharge of Stormwater Pollutants: incorporate stormwater management BMPs such as bioswales, rain gardens, filter strips, infiltration basins, constructed wetlands, and naturalized wetland detention into stormwater management systems to treat stormwater runoff. Investigate site soil and infiltration potential to help determine whether infiltration BMPs or other types of BMPs are appropriate.
20. Apply Stormwater Standards to All Development Regardless of Size. However, as a practical matter the requirement to obtain a stormwater permit may be limited to development and redevelopment equaling or exceeding a specified size. (E.g., one residential dwelling unit or greater than 0.5 acres of new impervious surface.)
21. Restrict Runoff Release Rates for Channel Forming Flow: establish a maximum discharge release rate from development sites that prevents increases in instream flow rates during bankfull and smaller events (i.e. 2-year event) that are responsible for the majority of streambank erosion. Watershed analyses should be performed to determine the existing conditions 2-year discharge and this discharge (in cfs/acre) should be applied to all new development.
22. Establish Maximum Release Rate for Flood Causing Events: A 100-year discharge rate (in cfs/acre) should be established based an analysis of watershed flow rates.
23. Require the Use of Retention-based Site Stormwater BMPs: to minimize increases in runoff volumes from development sites. Also consider establishing a standard for runoff volume such as no greater than a 25% increase in runoff volume over the pre-development condition for the 2-year storm event.
24. Preserve Natural Drainage: identify natural overland drainage routes prior and incorporate into the site drainage system. Permanently preserve natural drainage in easements to prevent filling and blockage that could lead to flooding.
25. Preserve Natural Depressions: preserve on-site depressional storage to help maintain natural hydrologic patterns. Depressional storage should be preserved in addition to storage required to meet detention and runoff volume control standards.
26. Restrict Discharge to Ravines: prevent concentrated stormwater runoff into ravines for all storm events less than the 1-year frequency.

5.2.5 FLOODPLAIN, STREAM, & WETLAND (GREEN INFRASTRUCTURE) PROTECTION STANDARDS

Natural areas such as stream and riparian corridors, wetlands, and forested areas that remain in a natural state provide flood water retention and natural buffering for streams, but are also important to preserve the biological heritage of the watershed, conserve unique habitat, and serve as passive and active recreational spaces for watershed residents and visitors.

The green infrastructure network of the Duck Creek watershed is fairly well-established along Duck Creek but is neither extensive nor well connected along its tributaries. Some large open parcels have been protected as natural areas, such as Duck Creek Park and Middle Park, and others are protected for more active use, such as golf courses.

Wetland protection, management, and restoration are needed to protect the natural conveyance system, improve water quality, provide stormwater storage, and other natural resource benefits. Preservation of the green infrastructure system preserves environmental resources and makes good economic sense for the community. Green infrastructure helps protect the natural conveyance system, absorb flood waters reducing flood damage, can reduce the continued degradation of stream resources that requires expensive remediation, and can preserve high value resources making the community a healthy and desirable place to live.

A connected green infrastructure network throughout the watershed should be protected and enhanced or restored to improve its functional value. The watershed green infrastructure network primarily consists of the natural drainage system / stream corridor network. Municipalities, which are primarily responsible for preserving green infrastructure, should identify these areas as important within community plans, policies, and budgets, and avoid extending roads and utilities in a way that would impact green infrastructure areas. Standards and policies that protect the natural drainage system from land use activities such as clearing, compaction, draining, filling, dredging, and straightening, are needed, such as providing overlay zoning for green infrastructure. Development standards may include changes to zoning regulations and subdivision standards, to include conservation and low impact development techniques by right (rather than as an exception), natural buffers, and green infrastructure protection/management programs.

Green infrastructure protection standard general recommendations are listed in Table 5.2.5.1. The recommended green infrastructure network is shown in Figure 5.2.5.1. The areas identified as green infrastructure should not be precluded from future development, but development within these areas should incorporate the appropriate BMPs and conservation development principles to protect watershed resources within these sensitive areas.

Table 5.2.5.1 Floodplain, Stream, & Wetland (Green Infrastructure) Programmatic Actions

FLOODPLAIN, STREAM, AND WETLAND (GREEN INFRASTRUCTURE) PROTECTION STANDARDS

27. Require Compensatory Storage: provide greater than 1:1 replacement ratio for all fill activities in the floodplain and depressional storage areas.
28. Discourage or Prohibit Detention in the Floodplain: adopt and continue to enforce floodplain protection standards within zoning, subdivision, and building codes or a 'stand-alone' floodplain protection ordinance that prohibits new building and roadway development, fill, or other encroachment within the floodplain, floodway, or flood fringe.
29. Avoid Onstream Detention (except as indicated in #10 above): to prevent the accumulation of runoff pollutants, degradation of stream and ravine resources, and dredging costs, avoid on-stream (including ravine) detention unless it provides regional flood control benefits, is in the public interest, and environmental mitigation is provided to reduce the negative impacts.
30. Prohibit Direct Discharge of Runoff to Streams and Wetlands: prohibit direct discharge of stormwater runoff to wetlands and streams to prevent degradation of aquatic resources, stream bank erosion, and other negative impacts. Instead, treat stormwater runoff with stormwater BMPs described in the Watershed BMP Toolbox prior to discharge to natural and mitigation wetlands. Where direct discharge is unavoidable, use energy dissipation measures at outfalls or eliminate outfalls altogether in favor of level spreaders or other practices that distribute rather than concentrate flow.
31. Minimize Disturbance to Wetlands. Where wetland impacts are unavoidable, mitigate the impacts by preserving and enhancing wetlands on site or within the same subwatershed.
32. Restore Farmed Wetlands: protect, and restore degraded, drained, and/or farmed wetlands to improve water quality, provide surface water storage, and improve habitat. Vegetative management, prescriptive burning, invasive species management, and hydrologic restoration can all be used to help improve wetland quality. The strategic removal and/or blockage of wetland drainage tiles, flood control structures, or other drainage structures can help restore wetland hydrology.
33. Avoid Stream and Ravine Modification: minimize modification of all natural streams and ravines except to perform stream and ravine restoration and maintenance activities consistent with watershed goals and objectives.
34. Require Stream, Lake, and Wetland Buffers: Development should be prohibited within 100 feet of water bodies.
35. Set back Development and Improvements from Buffers: require setbacks beyond the buffer described above along all streams, wetlands, and edges of ravines within which only minor improvements such as trails and educational signs, maintenance access for utilities, parks and recreational areas, and private and public lawns will be allowed. Alternately, consider effective mitigating measures based on development context and existing level of urban intensity. This standard is recommended to provide a transition zone between intensive development and the natural features of the buffer and to prevent erosion from threatening structures and their foundations.
36. Preserve Natural Drainage: Preserve and protect natural drainage and storage (green infrastructure) features of the landscape to filter and infiltrate runoff and to reduce the threat of flood damage, including stream corridors, native vegetation, natural riparian buffers, floodplains, flood prone areas, natural depressional and regional storage areas, and wetlands. Prevent fill, excavation, development, and other modifications or provide appropriate mitigation measures. Smaller depressional areas may potentially be incorporated into development as rain gardens, bioswales, and other measures that retain runoff rather than releasing it offsite. For lands not readily protected through land use planning and zoning, develop a preservation strategy to prioritize and purchase or otherwise protect the natural

Table 5.2.5.1 Floodplain, Stream, & Wetland (Green Infrastructure) Programmatic Actions

drainage system of stream corridors and wetland complexes. The strategy may include purchase funds, developer fees and donation funds, conservation easements, purchase of development rights programs, or other measures.

37. Manage the Rock River Floodplain: the Rock River floodplain, or highly sensitive portions thereof as defined through further study, including existing and former wetland areas, should be protected from fill and development and managed as natural lands to restore natural hydrology, recreate and enhance wetland and riparian habitat, and protect property and infrastructure from Rock River flooding to the extent possible or practical when considered in light of other appropriate community interests, needs, and policies.

38. Protect and Connect Valuable Natural Areas.

    a. Identify and prioritize important community landscape elements, gaps in the natural area network, remnant1 natural systems, and unprotected high quality natural areas for protection. Use the Green Infrastructure Plan, community goals, and regional greenways and trails plans and programs as guidance for prioritization.

    b. Develop a preservation strategy to preserve the highest priority areas as green space using available resources and techniques.

        i. Create a program to encourage voluntary property donations or dedications for green space by landowners.

        ii. Provide tax benefits to landowners willing to forego the right to develop some or all of their property.

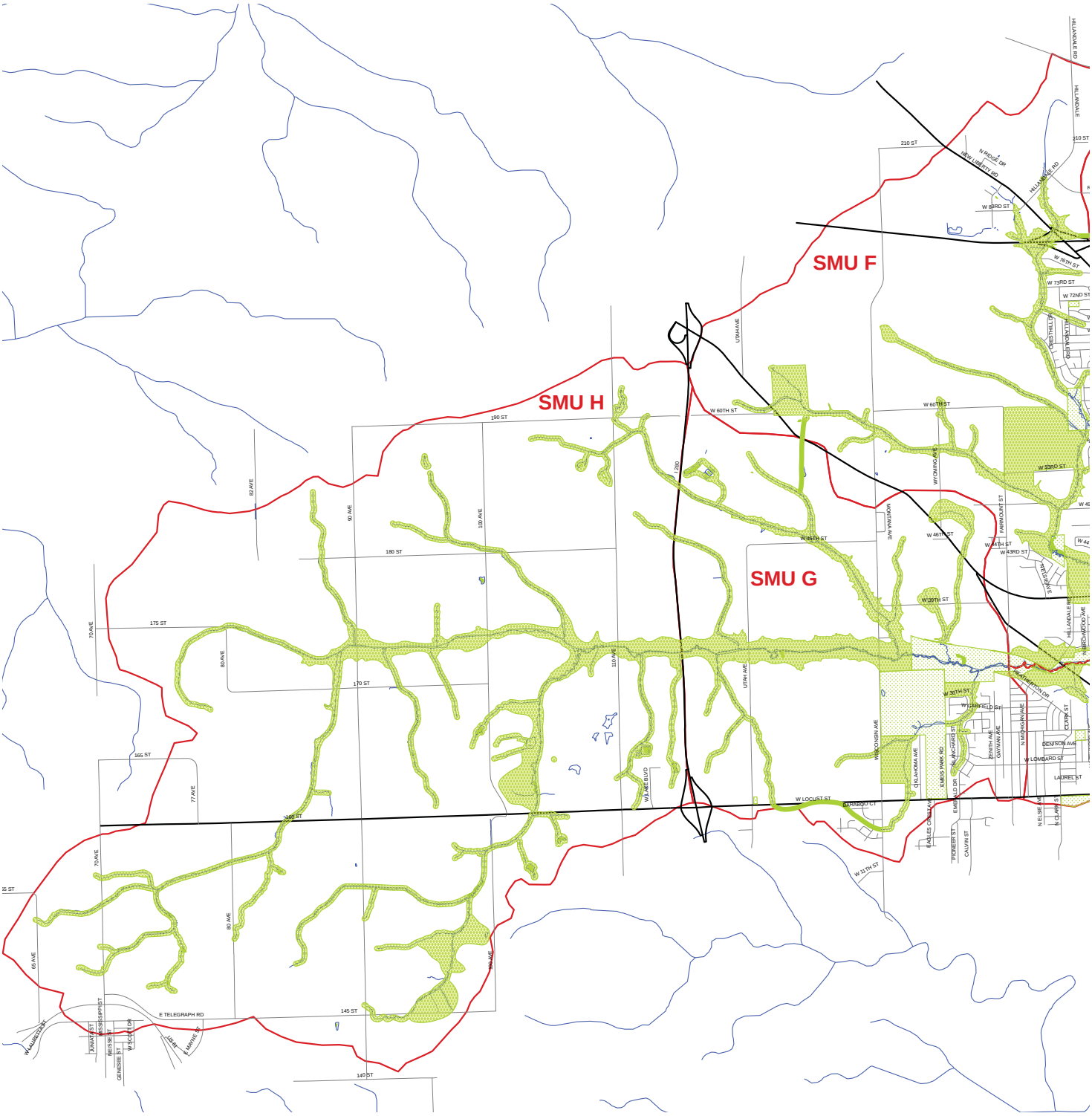
        iii. Purchase the right to develop some or all of a property from willing sellers (a purchase of development rights program).

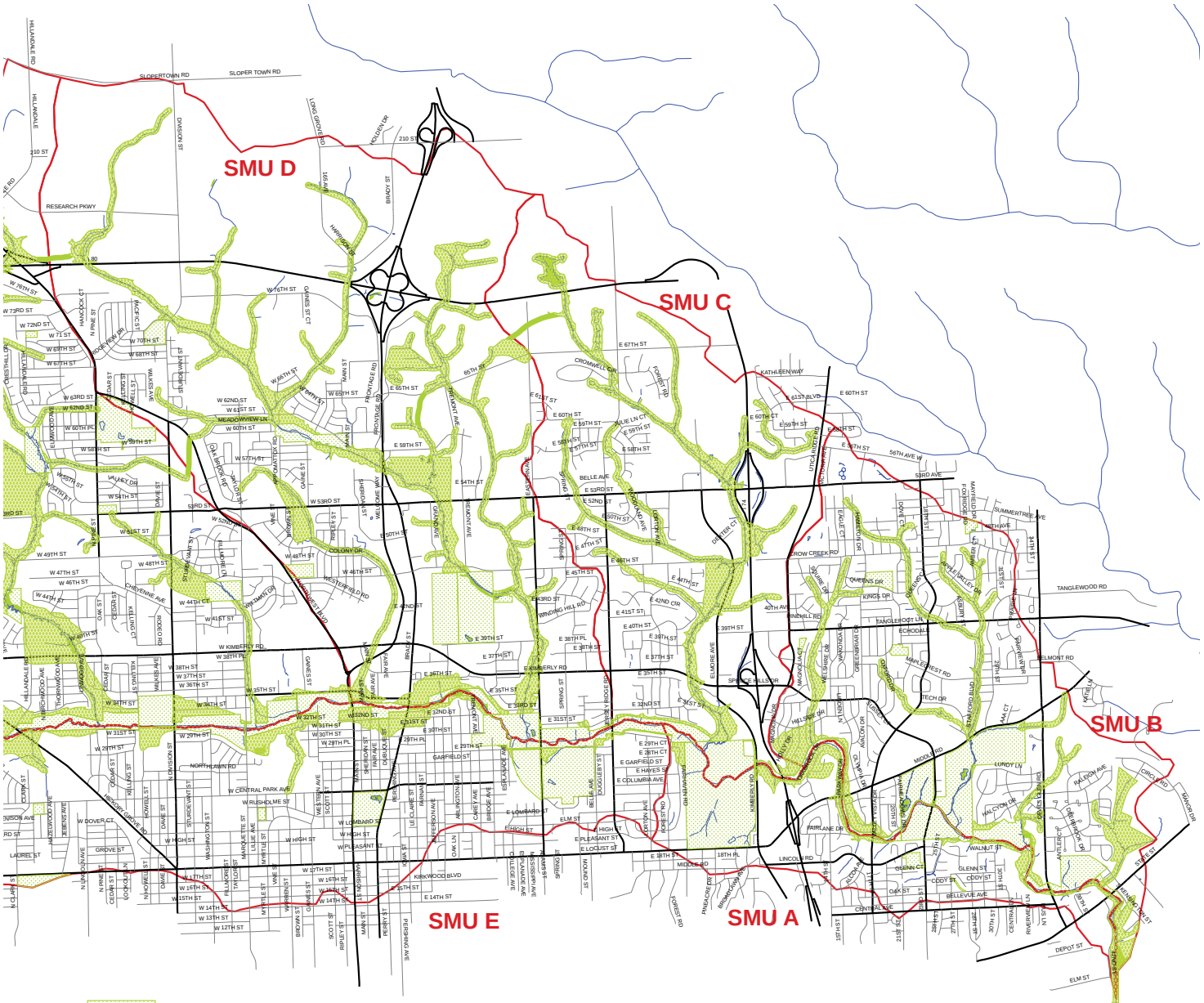
        iv. Purchase property from landowners to be preserved as green space.

        v. Establish conservation easements with landowners willing to restrict their land from being used for specific activities.

        vi. Trade publicly-owned land that is no longer needed for its original

Figure 5.2.5.1 Duck Creek Watershed Green Infrastructure Plan




SMU D
SMU C
SMU B
SMU A
SMU E
Public-owned Parcels
Proposed Green Infrastructure
Proposed Linkages

5.2.6 WATERSHED & STAKEHOLDER COORDINATION

The Duck Creek watershed stakeholders will have to coordinate efforts to implement many of the projects recommended in the action plan and to achieve meaningful results. Combining and coordinating resources, funding, effort, and leadership will be the most efficient and effective means of creating real improvement of watershed resources.

A committee or organization must be formed to step forward as a project leader to help organize and coordinate plan implementation. The Watershed Planning Committee is encouraged to function as the stakeholder forum for the watershed until a separate organization or committe can be created. The Planning Committee, or an established watershed organization, is encouraged to work to generate additional stakeholder interest and involvement with watershed plan implementation and stewardship activities.

The watershed action plan contains recommendations, such as the repair or stabilization of a municipal stormwater discharge point, that can be added to municipal capital improvement and maintenance plans, budgets, and schedules. Other recommendations will require the involvement of multiple stakeholders for implementation, such as residents, a municipality, and a county, state, or federal agency to provide financial and technical support. Some actions require cross-jurisdictional coordination for issues, such as streambank stabilization, that span multiple jurisdictions or properties. And still other actions will require the cooperation of individual or groups of landowners, whether they are residents, homeowners associations, businesses, or institutions. Actions that recommend the adoption of new policies, plans, or standards that modify the form, intensity, or type of development or redevelopment in the watershed will require municipalities to understand how plans and policies can be modified and to discuss and adopt new, or modify existing, policies, plans and standards. General recommendations for watershed and stakeholder coordination are listed in Table 5.2.6.1.

Table 5.2.6.1 Watershed & Stakeholder Coordination Programmatic Actions

WATERSHED AND STAKEHOLDER COORDINATION

39. Form a Watershed Organization: to coordinate and lead watershed plan implementation activities.
40. Identify a Watershed Monitoring Committee: to oversee development and implementation of a monitoring strategy and plan.
41. Coordinate Watershed Restoration: coordinate projects and develop cost-share funding for best management practices.
42. Hold Regular Watershed Meetings: establish regular (e.g., quarterly) stakeholder coordination meetings to discuss projects, watershed plan implementation, and land use planning and development activities within and across jurisdictional boundaries.
43. Update Local Policies: Incorporate plan recommendations into regional, county, and municipal plans and budgets as appropriate, practical, and or feasible to the extent said recommendations are determined to be compatible and not inconsistent with other plans, policies, goals, and objectives.

5.3 SITE SPECIFIC ACTION PLAN

In addition to the general recommendations, which apply watershed wide, site specific action items and recommendations are tied to a particular location in the watershed: to neighborhoods, areas with concentrations of specific land uses, to natural areas, to stream reaches, or to a specific point on a stream. As with the general recommendations, these site specific recommendations were developed to address watershed problems, to improve watershed resources, and to achieve the watershed goals and objectives. These site specific recommendations are provided for the use, benefit, and consideration of the community-at-large and are not intended to create or imply any burden, expectation, or commitment on the part of any specific property owners, special interest groups, or governmental entities.

The process of identifying specific sites that are in need of, or suited to, watershed improvement projects has been ongoing during the planning process and will continue throughout plan implementation. Watershed improvement projects in the site specific plan range from small maintenance and repair tasks to large wetland restoration and green infrastructure preservation projects.

During development of the watershed-baed plan, several methods were used to identify project sites.

1. Members of the Watershed Planning Committee provided site and project recommendations to the planning team during meetings.
2. Sites were identified based on results of previous watershed studies.
3. New data was collected during the field assessment conducted by the planning team.
4. Map analysis using existing data including land use, wetlands, soils, and non-point source pollution loading.

This following action plan, Table 5.3.1.1, 5.3.2.1, 5.3.3.1, 5.3.4.1, 5.3.5.1, 5.3.6.1, and 5.3.7.1, is organized by the Subwatershed Management Unit (SMU) in which the recommendation falls. This structure should allow jurisdictional representatives to easily identify which recommendations are within their sphere of influence and control. However, it should be noted that they do not include all of the opportunities for best management practice projects in the watershed. The majority of the action recommendations have been located on the Subwatershed Management Unit Maps found in Figure 5.3.1 through Figure 5.3.4 and are identified by the two-digit Recommendation ID# that represents the SMU and the number of the recommendation within that SMU. For example, the identification number C4 refers to an action in Subwatershed Management Unit C and action number 4. These two digit identification numbers can also be used to locate additional detailed information such as cost, responsible party, and the action's impact on watershed resources for that particular action recommendation in the Implementation Plan in Chapter 6. Those recommendations that apply generally throughout the SMU, such as A1 for retrofitting residential neighborhoods with stormwater best management practices, were not shown in the SMU maps in order to preserve their readability and ease of use.

Implementation of this watershed plan and the improvement of watershed resources are ongoing, incremental, and long-term processes. Continuous research and investigation should be conducted to stay current with watershed conditions and resources. Likewise, this watershed plan should be updated regularly to accommodate changes in watershed conditions and resources and to reflect projects and plan implementation.

5.3.1 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT A

SMU A is within the Cities of Bettendorf and Davenport and is located on the south side of the Creek between Jersey Ridge Road and the Confluence with the Mississippi River. SMU A (1134 acres) is comprised primarily of low density residential land use and parks/open space, which make up 44% (500 acres) and 25% (288 acres) respectively. Industrial, commercial, and institutional uses make up 12% of the SMU. The remaining land within the SMU is primarily transportation and open space. Virtually no land use change is planned for this SMU as it is almost entirely built out.

Table 5.3.1.1 Duck Creek Subwatershed Management Unit A Recommendations

ID	RECOMMENDATION
A1	Retrofit Residential Neighborhoods with Stormwater BMPs: Implement rain gardens, vegetated swales, and naturalized detention (where feasible) and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
A2	Filter and Infiltrate Runoff from Commercial and Industrial Land Uses: Existing commercial and industrial areas with large roofs and parking lots are generally located downstream of State Street. The runoff from these impervious areas should be treated before being discharged to Duck Creek using BMPs such as bioretention and permeable paving that are readily integrated into existing developed areas with little area available for detention and other more land intensive BMPs. These BMPs are described in the BMP Toolbox. In areas of outdoor material storage and/or industrial processes, site specific runoff management plans should be prepared to prevent release of industrial materials.
A3	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
A3a	Restore as woodland the wooded bluff and riparian buffer that parallels Duck Creek from Devil's Glen Road upstream to I-74, particularly the more generous buffer area (averaging greater than 250' in width) that extends from Devil's Glen Road upstream to 18th Street.
A3b	Restore the large green infrastructure hub formed by Middle Road Park and the Palmer Hills Golf Course north of Duck Creek (between DW3 and DW4). Where feasible, restore wetlands in areas of hydric soils and install a minimum 100' restored riparian buffer along Duck Creek and tributary drainages such as that flowing through Palmer Hills Golf Course. Integrate natural landscape systems into the golf course rough and along water features to help reduce the impact of management practices and chemicals.
A3c	Within the Duck Creek Park and Golf Course, restore and expand wetlands along and near Duck Creek and a minimum 100' native riparian buffer. At a minimum, the remnant wetland near DW7, on the right bank of Duck Creek, should be preserved, restored, and expanded into surrounding areas of open space and hydric soils. Manage and restore remnant woodlands along Duck Creek Park Road, Fernwood Avenue, and Fairhaven Road.
A3d	Work with the Duck Creek Golf Course to implement management programs to limit nutrient and other chemical applications to only what is needed to maintain play areas, possibly including Integrated Pest Management practices.
A4	Address Residential Stormwater Discharges to Duck Creek: Investigate storm sewers that may be discharging from the residential areas above the bluff edge on the right bank (looking downstream) of Duck Creek. Retrofit neighborhoods as described in recommendation 1, above, and stabilize storm sewer outfalls that may be causing erosion of the steep terrain.
A5	Restore Poor Stream Habitat: Restore aquatic and riparian habitat near DW7 and DW8, where silt and muck substrates dominate the channel bottom within Duck Creek Golf Course and few instream habitat features were observed. Where appropriate, install artificial riffles and instream cover such as rocks and root wads to create habitat. Preserve meandering, pool / riffle structures, and cobble and gravel substrates along the highest quality reaches within the watershed from DW6 to DW2 by restoring upstream hydrology and stabilizing streambanks to reduce erosion and sedimentation. Restoration activities should follow Iowa DNR guidelines.
A6	Implement Riparian Commercial-Industrial Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
A6a	The Duck Creek main stem between State Street and the Mississippi River confluence.
A6b	Industrial and commercial properties adjacent to Duck Creek between Kimberly Road and I-74.

This SMU contains minor drainages and a long (approximately 5.5 mile) reach of the Duck Creek main stem, from the Mississippi River confluence (DW1) to Duck Creek Park (DW8). No wetlands remain, though two areas of hydric soils along the Duck Creek mainstem present opportunities for wetland restoration.

Because the SMU is largely built out, the recommendations are focused on retrofitting residential and commercial areas to improve the runoff from these developments that were largely constructed prior to stormwater detention requirements. In addition, the reach of Duck Creek upstream of State Street that flows through SMUs A, B, and C contains some of the most diverse habitat conditions found along the creek. Thus, there are also recommendations focused on protecting and restoring the creek corridor.

5.3.2 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT B

SMU B is located almost entirely within the City of Bettendorf and is located on the north side of the Creek between Utica Ridge Road and the confluence with the Mississippi River. This SMU contains the Stafford Creek drainage area and a portion of the Duck Creek mainstem.

SMU B (3092 acres) is almost entirely built out, with only a few acres of land, in the far north and eastern edges of the subwatershed, remaining for new development. However, no changes in land use are planned. Low density residential use makes up 49% (1524 acres) of this SMU, transportation and unclassified land comprise 15% (476 acres), and parks and open space make up 10% (308 acres). Commercial, industrial, and institutional land make up the remainder of this SMU. Wetland acreage is virtually non-existent.

Because the SMU is largely built out, the recommendations are focused on retrofitting residential and commercial areas to improve the runoff from these developments that were largely constructed prior to stormwater detention requirements. In addition, the reach of Duck Creek upstream of State Street that flows through SMUs A, B, and C contains some of the most diverse habitat conditions found along the creek. Thus, there are also recommendations focused on protecting and restoring the creek corridor.

The majority of the Stafford Creek corridor has been developed as residential use. Thus, residential riparian corridor management strategies such as establishing a natural buffer and preventing dumping of yard waste will be important along this corridor as well.

Table 5.3.2.1 Duck Creek Subwatershed Management Unit B Recommendations

ID	RECOMMENDATION
B1	Retrofit Residential Neighborhoods with Stormwater BMPs: Implement rain gardens, vegetated swales, and naturalized detention (where feasible) and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
B2	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
B2a	The concentration of green space comprised of the Palmer Hills Golf Course and Middle Road Park west of the golf course should be restored. Where feasible, restore wetlands in areas of hydric soils and install a minimum 100' restored riparian buffer along Duck Creek and tributary drainages such as that flowing through Palmer Hills Golf Course. Integrate natural landscape systems into the golf course rough and along water features to help reduce the impact of management practices and chemicals. Naturalize the golf course ponds with a native riparian buffer. Work with the Golf Course to implement nutrient and pesticide management programs to limit applications of these materials to only what is needed to maintain play areas.
B2b	The forested area within Hollowview Park (DW3), which exhibited the highest vegetative quality observed within the Duck Creek system. Thin the forest canopy, control invasive species, and nurture the recovery of this area with appropriate management, such as the use of controlled burning.
B2c	Restore a native riparian buffer and replace turf grass with deep-rooted native species between DW4 and I-74. A 100' buffer area is recommended, though in many areas along this reach 25' may be sufficient due to the park recreational uses and trail.
B2d	Manage and restore parts of Devil's Glen Park (DW2) as woodland and restore a native riparian buffer where mown turf grass now exists.
B2e	Preserve and restore the small, forested green infrastructure hub that buffers a small tributary in the far eastern edge of this SMU east of Devil's Glen Park. This area should be preserved and connected to Devil's Glen Park along the tributary stream corridor.
B2f	Establish a naturalized stream corridor on either side of Stafford Creek at Bettendorf High School.
B3	Install Bioengineering Practices to Stabilize Stream Banks:
B3a	Severe erosion and 6-10' cut banks near DW3,
B3b	Moderate erosion near DW6 and DW7, and
B3c	Mild to moderate erosion at DW3.1 and DW5.
B4	Restore Poor Stream Habitat: Restore aquatic and riparian habitat near DW5, where few instream habitat features were observed. Where appropriate, install artificial riffles and instream cover such as rocks and root wads following Iowa DNR guidelines.
B5	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
B5a	Along the majority of Stafford Creek upstream of Middle Road.
B5b	Along the majority of the smaller drainages within the SMU.
B5c	Along Duck Creek between DW4, DW5, and DW6, where the turf grass riparian corridor and runoff from surrounding residential areas and streets contributes urban non point source pollutants to the creek.
B6	Implement Riparian Commercial-Industrial Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas: along one of the west branches of Stafford Creek upstream of Middle Road.

5.3.3 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT C

SMU C includes the Pheasant Creek subwatershed north of Duck Creek and a short reach of Duck Creek from Interstate 74, upstream to Jersey Ridge Road. The SMU is almost entirely within the City of Bettendorf jurisdiction.

SMU C (3291 acres) is a mixture of low density residential, commercial/ industrial/ institutional, and agriculture/ open space. It has 1077 acres (33%) of low density residential, 401 acres (12%) of agriculture, 648 acres (20%) of commercial land use, and 648 acres (20%) of transportation and unclassified land. The high proportion of residential and commercial land uses are likely responsible for this SMU being identified as a potentially high contributor of non-point source pollution.

The Pheasant Creek tributary system, which also includes Hanlin Creek, is the primary drainage system within this SMU. Wetland acreage is low; however, a few opportunities for wetland enhancement and expansion do exist. In the future, approximately 400 acres are expected to change from agriculture / open land use to urban uses.

This SMU is mostly developed in urban uses but also includes significant areas of land available for development in the northern third. Thus, both retrofitting of BMPs and implementation of low impact development principles and strategies will be important.

As discussed under SMU A, this reach of Duck Creek upstream of State Street that flows through SMUs A, B, and C contains some of the most diverse habitat conditions found along the creek. Thus, some of the recommendations are focused on protecting and restoring the Creek Corridor. Relatively large setbacks have been provided along Pheasant and Hanlin Creek for most of the stream corridor. These conditions provide an opportunity to establish wide natural riparian buffers along these reaches according to the green infrastructure recommendations.

Table 5.3.3.1 Duck Creek Subwatershed Management Unit C Recommendations

ID	RECOMMENDATION
C1	Utilize Stormwater BMPs and Low Impact Design Principles for New and Existing Development:
C1a	Retrofit residential neighborhoods with stormwater BMPs, such as rain gardens, vegetated swales, naturalized detention (where feasible), and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
C1b	Utilize low impact development principles and practices when urbanizing the undeveloped portions of the watershed.
C2	Install Stormwater BMPs in Commercial Areas: incorporate stormwater BMPs within the concentrated commercial and office land uses along I-74, Elmore Avenue, Utica Ridge Road, and East 53rd Street to capture, slow, filter, and infiltrate stormwater runoff before reaching Pheasant Creek. Also retrofit existing detention ponds to improve water quality.
C3	Filter Highway Runoff: capture, filter, and infiltrate road runoff from Interstate 74 before reaching Pheasant Creek through naturalization of the open drainageways along the highway corridor.
C4	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
C4a	Restore the riparian corridor along the entire, publicly-owned reach of Duck Creek, from Jersey Ridge Road to East Kimberly Road. Upstream of Duck Creek Golf Course, this restoration will likely consist primarily of a riparian buffer.
C4b	Within the Duck Creek Golf Course, restore and expand wetlands along and near Duck Creek and a minimum 100' native riparian buffer.
C4c	The partially- forested riparian buffer along the banks of Pheasant Creek and Hanlin's Creek, from West Kimberly Road upstream, past East 46th St., to approximately East 49th St. should be restored as a green infrastructure corridor.
C5	Install Bioengineering Practices to Stabilize Stream Banks: stabilize severe erosion at DW7 and DW8 and inspect Pheasant Creek and Hanlin Creek for areas of severe erosion.
C6	Restore Poor Stream Habitat: Restore the entire reach of Duck Creek following Iowa DNR guidelines, including installing artificial riffles and instream cover and habitat features such as root wads, rocks, and boulders. As far as possible, preserve the riffles and locations of gravel / cobble substrate observed near DW7.
C7	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
C7a	Hanlin Creek upstream of Lorton Avenue and East 49th Street.
C7b	Pheasant Creek from the Duck Creek Golf Course upstream to West Kimberly Road.
C7c	The entire length of the unnamed western tributary.
C7d	Reaches of Pheasant Creek adjacent to new residential development south of Jersey Ridge Road and East 67th Street.
C8	Implement Riparian Commercial-Industrial Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas: the main stem of Pheasant Creek upstream from Kimberly Road to approximately East 39th St., and from East 46th St. to East 49th St.

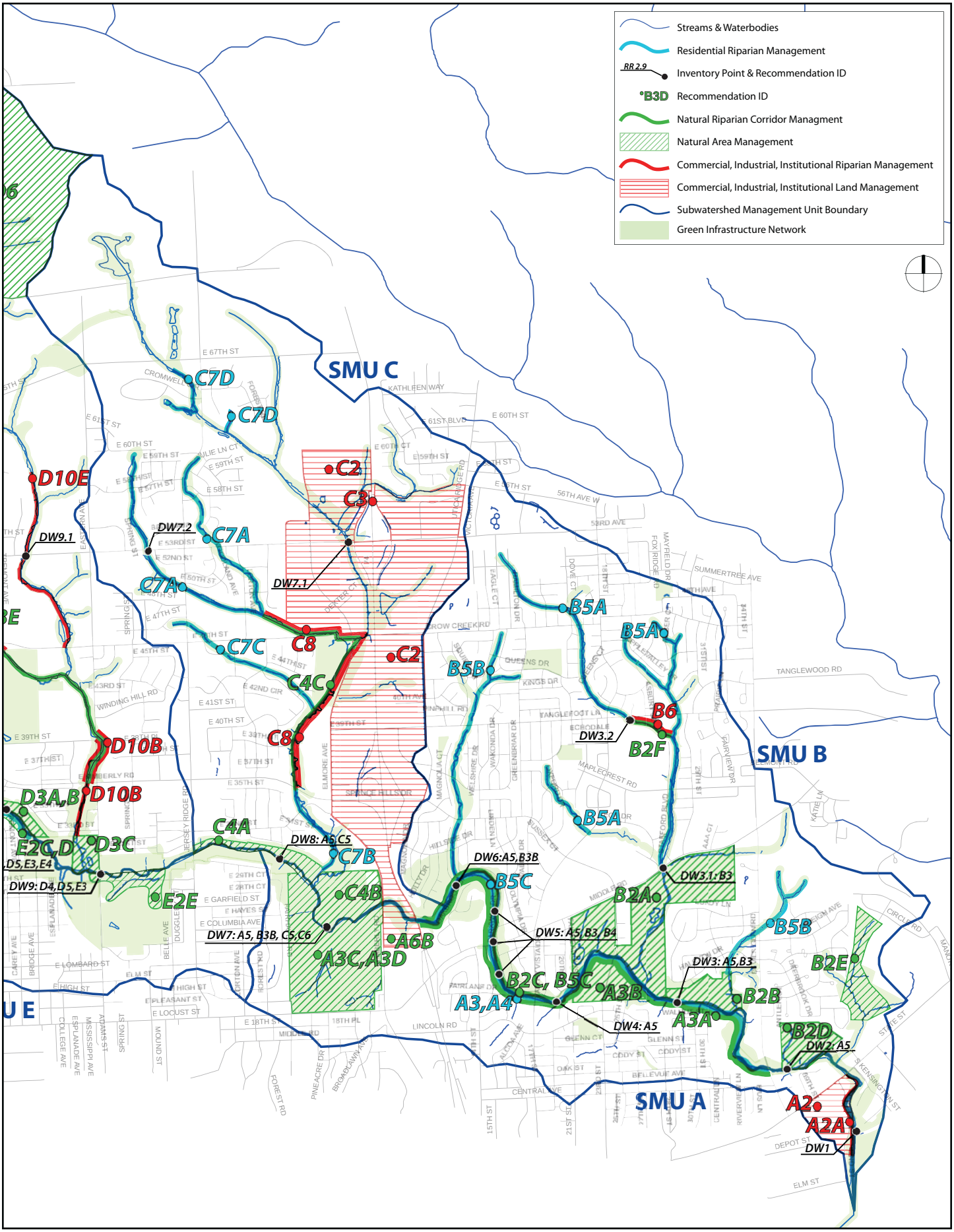


FIGURE 5.3.1 SUBWATERSHED MANAGEMENT UNITS A, B, AND C

5.3.4 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT D

SMU D includes a short reach of Duck Creek from Jersey Ridge Road upstream to Harrison Street and also includes the Goose Creek watershed. The SMU is almost entirely within the City of Davenport and includes a few areas of unincorporated Scott County.

SMU D (6960 acres) is comprised largely of agricultural land, making up 23% (1588 acres) of the SMU. Industrial land makes up 20% (1411 acres) and low density residentail makes up 15% (1013 acres). 981 acres (14%) are transportation or unclassified land uses. The high proportion of industrial, commercial, and institutional land uses is likely responsible for this SMU being identified as a potentially high contributor of non-point source pollution.

This SMU contains the Candlelight, Goose, and Deere Creek tributary areas and a portion of the Duck Creek mainstem. Wetland acreage is minimal; however, a few opportunities for wetland enhancement and expansion exist.

With the exception of the majority of Candlelight Creek, relatively large setbacks have been provided along the tributary stream corridors, and the Duck Creek corridor is almost entirely publicly owned. These conditions provide an opportunity to establish wide natural riparian buffers along these reaches according to the green infrastructure recommendations.

The reach of Candlelight Creek downstream of 46th Street is enclosed in a storm sewer; upstream of 46th Street much of the corridor is developed as residential. The City installed rain gardens and infiltration / detention ponds at North High School on West 53rd Street, which reduced runoff significantly.

The SMU is planned to experience significant land use change in the future, primarily from agricultural to low density residential, but also to a few industrial and commercial areas.

Table 5.3.4.1 Duck Creek Subwatershed Management Unit D Recommendations

ID	RECOMMENDATION
D1	Utilize Stormwater BMPs and Low Impact Design Principles for New and Existing Development:
D1a	Retrofit residential neighborhoods with stormwater BMPs, such as rain gardens, vegetated swales, naturalized detention (where feasible), and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
D1b	Utilize low impact development principles and practices when urbanizing the undeveloped portions of the watershed, a significant portion of which is planned for future residential and commercial development. It is critical to use conservation design / Low Impact Development techniques and BMPs in new development to prevent increases in flooding, stream bank erosion, and water quality degradation.
D1c	Implement agricultural land use recommendations for southern tributary just east of I-280
D2	Protect Goose Creek from High Runoff: reduce the rate and volume of stormwater discharged from Davenport Municipal Airport impervious surfaces to reduce the impact on the headwaters of Goose Creek's stream banks and channel.
D3	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
D3a	Restore the small wetland near DW10.
D3b	The forested riparian buffer along the banks near DW10 should be thinned to allow more sunlight to reach the forest floor.

Table 5.3.4.1 Duck Creek Subwatershed Management Unit D Recommendations (continued)

ID	RECOMMENDATION
D3c	Investigate the potential to recreate and restore wetlands in the area of the hydric soils near the confluence of Duck Creek and Goose Creek (DW9 in Eastern Avenue park).
D3d	Restore wetlands within the hydric soils in the upper reaches of Goose Creek, north and west of Appomattox Road and West 61st Street.
D3e	Restore the wetlands and woodlands along Goose Creek between East 39th Street and East 46th Street within the Pine Hill Cemetery, and the corridor extending upstream to East 53rd Street.
D3f	Preserve and restore a green infrastructure hub in the area bordered by Tremont Avenue on the east, East 53rd Street on the south, East 59th Street on the north, and North Brady Street on the west.
D4	Install Bioengineering Practices to Stabilize Stream Banks: stabilize bank erosion at DW9, DW11 and DW11.1, as well as the large stream bank blowout near the pedestrian bridge downstream of DW10.
D5	Restore Poor Stream Habitat: Restore the entire reach of Duck Creek following Iowa DNR guidelines, including installing artificial riffles and instream cover and habitat features such as root wads, rocks, and boulders. As far as possible, preserve the meandering, gravel bars, and the connection between the floodplain and the stream at DW9 and DW11.
D5a	Remove large woody debris obstructions from Candlelight Creek upstream of West 53rd Street (DW11.1).
D5b	Consider daylighting and restoring Candlelight Creek reaches that pass under the Northpark Mall and Lujack's Lexus properties near Kimberly Road and Northwest Boulevard. This is a long term recommendation that should only be considered if these properties are repurposed in the future.
D6	Restore the Landscape: restore the area northeast of the I-80 and Highway 61 intersection to prairie or other natural landscape.
D7	Stabilize Gully Erosion: use bioengineering to stabilize gully erosion along the right bank near DW10 and DW11 before additional erosion creates deeper and wider gullies that will be more difficult and costly to repair.
D8	Repair Stormwater Infrastructure: repair or replace the broken stormwater outfall pipe at DW9.2 and stabilize the streambank to prevent further erosion and infrastructure damage.
D9	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
D9a	The majority of Candlelight Creek upstream of West 46th Street.
D9b	Along Meadowview Lane and Appomattox on Goose Creek upstream and northwest of the Deere Creek confluence.
D10	Implement Riparian Commercial-Industrial Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
D10a	East 35th Street (DW11) on the Duck Creek main stem.
D10b	Goose Creek between East 33rd Street and East 39th Street.
D10c	Goose Creek between East 46th Street to East 53rd Street (DW9.2).
D10d	Goose Creek adjacent to the industrial land uses on West 76th Street.
D10e	The right bank of Deere Creek from East 46th Street upstream to East 59th Street.
D11	Establish Management and Maintenance Agreements for Stormwater BMPs: work with North High School to manage and maintain the rain gardens and stormwater infiltration / detention ponds on high school property within the Candlelight Creek drainage.

5.3.5 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT E

SMU E includes the reach of Duck Creek from east of Jersey Ridge Road upstream to North Fairmount Street. The SMU is entirely contained within the City of Davenport and includes some of the older residential areas of the city.

SMU E (3114 acres) is comprised primarily of low density residential land use (1480 acres), transportation and unclassified (758 acres), and institutional (338 acres) land uses, making up 48%, 24%, and 11% respectively.

SMU E contains a long reach of the Duck Creek main stem from Duck Creek Park (DC8) to Fairmount Street (DC16), a reach also shared by SMUs D and F. One minor surface tributary flows into Duck Creek upstream of DW12, but the majority of water drainage is below ground in storm sewers. As with the rest of the Duck Creek watershed, wetland acreage is minimal; however, a few opportunities for wetland enhancement and expansion exist, particularly along the main stem of Duck Creek where concentrations of hydric soils are present.

The majority of the Duck Creek corridor is publicly owned, providing an opportunity to establish a wide natural buffer along Duck Creek. One small area of the SMU, near the Hickory Grove Road Bridge (DW15) is planned to change land uses, but the SMU is largely built out.

Table 5.3.5.1 Duck Creek Subwatershed Management Unit E Recommendations

ID	RECOMMENDATION
E1	Retrofit Residential Neighborhoods with Stormwater BMPs: Implement rain gardens, vegetated swales, and naturalized detention (where feasible) and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
E2	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
E2a	Restore wetlands within the complex of hydric soils, extending west along the Duck Creek main stem from Hickory Grove Road into SMU G (DW16 and DW15). The portion of this complex west of Fairmount Avenue is part of the US Army Corps of Engineers Duck Creek / Fairmount Park Wetland Restoration project to restore wetland, prairie, and stream restoration. This project should be prioritized for funding by the US Army Corps and the City of Davenport and implemented as soon as possible as a demonstration project. If designed and restored appropriately, this area may help to attenuate floodwater flows that are causing damage to the Duck Creek stream channel and riparian corridor.
E2b	Preserve and restore to prairie the undeveloped area south of Duck Creek and north of Heatherton Drive as a green infrastructure hub.
E2c	Restore the small wetland near DW10.
E2d	The forested riparian buffer along the banks near DW10 should be thinned to allow more sunlight to reach the forest floor.
E2e	Restore the stream channel, wetlands and woodlands in the area of hydric soils downstream of the Duck Creek confluence with Goose Creek (DW9 in Eastern Avenue Park) along the northern edge of Oakdale Memorial Gardens.
E2f	Restore the stream channel, restore and expand the wetland, and restore the degraded natural area along Duck Creek to a complex of wetland, woodland, and prairie. The area is bordered by Marquette Street on the west, Gaines Street on the east, and West Central Park Avenue to the south. This area could also serve an educational function for the nearby schools.
E3	Restore Poor Stream Habitat: Restore the entire reach of Duck Creek following Iowa DNR guidelines, including installing artificial riffles and instream cover and habitat features such as root wads, rocks, and boulders. As far as possible, preserve the following habitat features: minor meandering at DW9, DW12 and DW15; riffles and braiding at DW15 and DW16; and semi-natural floodplain connections at DW11 and DW16.
E4	Stabilize Gully Erosion: Use bioengineering practices to stabilize gully erosion along the banks near DW10, DW11, DW12 and DW14 as well as the severe streambank slumping at DW 12 and near the footbridge downstream of DW10 before additional erosion creates deeper and wider gullies that will be more difficult, and costly, to repair.
E5	Remove Stream Sediment: remove built up sediment to help restore stream habitat behind the low head dam upstream of the pedestrian bridge in Marquette Creek Park (DW13).
E6	Repair Stormwater Infrastructure: repair or replace the broken stormwater outfall pipe at DW13 and stabilize the streambank to prevent further erosion and infrastructure damage.
E7	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
E7a	East 32nd Street and Valley Vista Road (DW10).
E7b	West George Washington Boulevard and North George Washington Boulevard along the Duck Creek main stem.

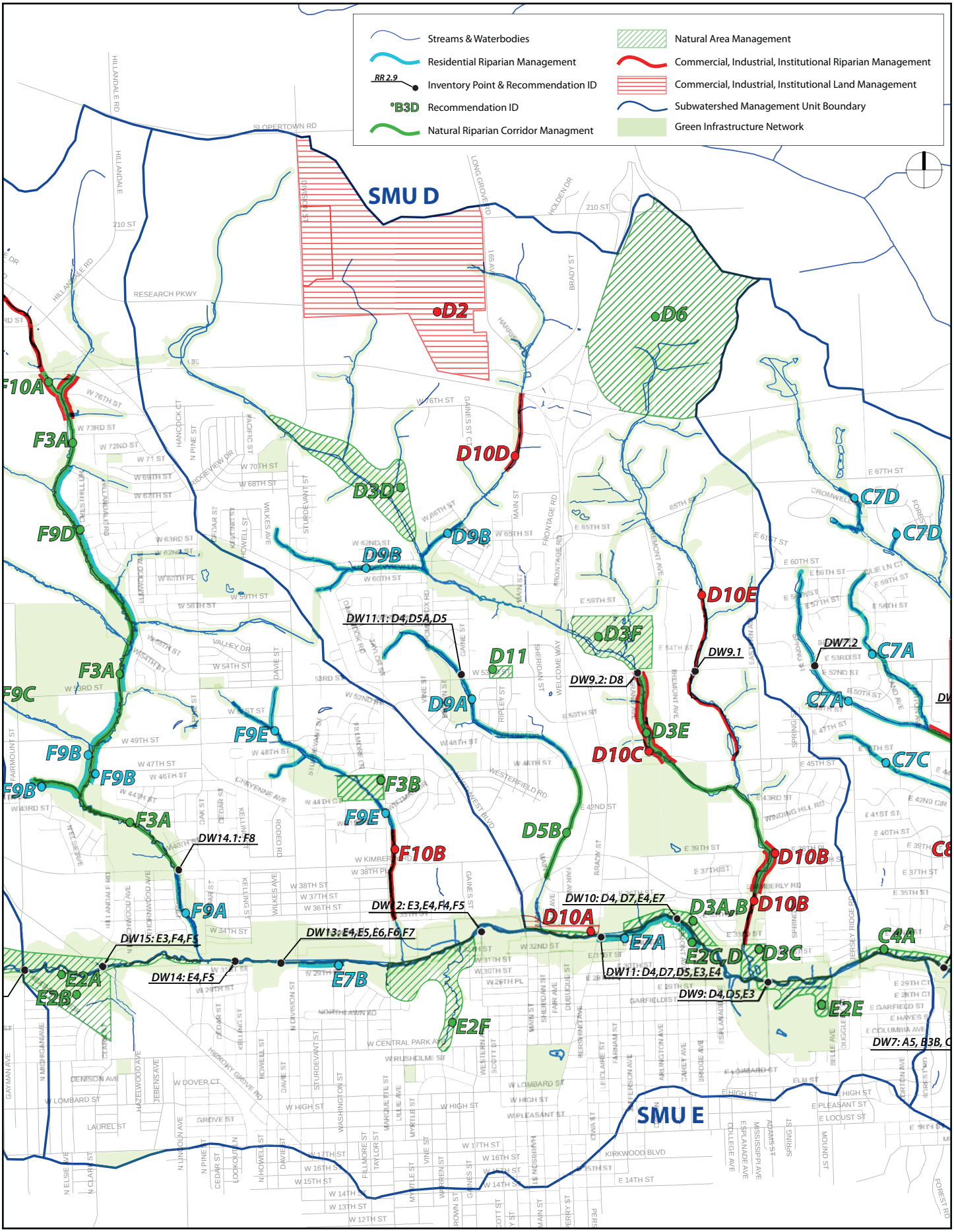


FIGURE 5.3.2 SUBWATERSHED MANAGEMENT UNITS D AND E

5.3.6 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT F

SMU F includes the reach of Duck Creek from Harrison Street upstream to North Fairmount Street and also includes the Silver Creek watershed. The SMU is almost entirely within the City of Davenport, with a small area of unincorporated Scott County in the northernmost end.

SMU F (7160 acres) is comprised primarily of low density residential land use in the eastern half and agriculture in the western half, making up 23% (1655 acres) and 42% (2973 acres) of the SMU respectively. General commercial and industrial land uses make up 7% (475 acres) and 5% (378 acres), while transporation and unclassified land uses are 12% (847 acres). This SMU contains the Silver Creek drainage and a portion of the Duck Creek mainstem. As with the rest of the Duck Creek watershed, wetland acreage is minimal; however, there are a few opportunities for wetland enhancement and expansion.

The SMU is planned to experience significant land use change in the future, primarily from agricultural to low density residential, but also conversion to industrial and commercial zones.

Table 5.3.6.1 Duck Creek Subwatershed Management Unit F Recommendations

ID	RECOMMENDATION
F1	Utilize Stormwater BMPs and Low Impact Design Principles for New and Existing Development:
F1a	Retrofit residential neighborhoods with stormwater BMPs, such as rain gardens, vegetated swales, naturalized detention (where feasible), and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
F1b	Utilize low impact development principles and practices when urbanizing the undeveloped portions of the watershed, a significant portion of which is planned for future residential and commercial development. It is critical to use conservation design / Low Impact Development techniques and BMPs in new development to prevent increases in flooding, stream bank erosion, and water quality degradation.
F1c	Implement agricultural land use recommendations for southern tributary just east of I-280
F2	Restore and Manage Wetlands: Restore wetlands within the complex of hydric soils, extending west along the Duck Creek main stem from Hickory Grove Road into SMU G (DW16 and DW15). The portion of this complex west of Fairmount Avenue is part of the US Army Corps of Engineers Duck Creek / Fairmount Park Wetland Restoration project to restore wetland, prairie, and stream restoration. This project should be prioritized for funding by the US Army Corps and the City of Davenport and implemented as soon as possible as a demonstration project. If designed and restored appropriately, this area may help to attenuate floodwater flows that are causing damage to the Duck Creek stream channel and riparian corridor.
F3	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
F3a	Along the Silver Creek system, which includes the large area north and west of Kimberly Road to approximately West 48th Street, which should be restored to wetland and prairie, and the corridor along the reach from West 49th Street north to I-80.
F3b	The publicly owned parcel bounded by North Marquette Street, West 43rd Street, and West 46th Street.
F4	Restore Poor Stream Habitat: Restore the entire reach of Duck Creek following Iowa DNR guidelines, including installing artificial riffles and instream cover and habitat features such as root wads, rocks, and boulders. As far as possible, preserve the following features: minor meandering at DW12 and DW15, riffles at DW16, braiding at DW15 and DW16, and a hydrologic floodplain connection at DW16.
F5	Stabilize Erosion: use bioengineering to stabilize the moderately severe gully erosion and severe streambank slumping near DW12 and minor gully erosion near DW14 before additional erosion creates deeper and wider gullies that will be more difficult and costly, to repair.
F6	Remove Stream Sediment: remove built up sediment to help restore stream habitat behind the low head dam upstream of the pedestrian bridge in Marquette Creek Park (DW13). Also repair erosion around the sheet pile at the low head dam that could lead to failure of the dam.
F7	Repair Stormwater Infrastructure: repair or replace the broken stormwater outfall found along the creek (DW13).
F8	Inspect Infrastructure: investigate the utility pipe that traverses the stream at West Kimberly Road (DW14.1) for damage; strengthen and/or reinforce the pipe and surrounding structures to prevent damage in the future.
F9	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
F9a	Near the area of North Elmwood, North Linwood, and West 36th Street.
F9b	Near the intersection of West 49th Street and Hillandale Road
F9c	Near the intersection of Leisure Boulevard and North Fairmount Street
F9d	Along Silvercreek Drive.
F9e	Along an unnamed tributary
F10	Implement Riparian Commercial-Industrial Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
F10a	Along I-80 west of the northwest blvd interchange (West 76th, West 73rd, W 83rd, and N Fairmount St).
F10b	Along an unnamed tributary from West 35th Street upstream to West 41st Street.

5.3.7 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT G

SMU G includes the reach of Duck Creek from North Fairmount Street upstream to Interstate 280 and also includes the Cardinal Creek watershed. The SMU contains portions of the City of Davenport but is mostly unincorporated Scott County.

SMU G (4353 acres) is comprised primarily of agricultural land use, making up 68% (2981 acres) of this SMU. Low density residential and park land uses are concentrated in the southeastern corner of the SMU, making up 13% (573 acres) and 9% (385 acres) respectively. Transportation and unclassified uses make up 10% (455 acres).

This SMU contains the Cardinal Creek tributary and a portion of the Duck Creek mainstem as well as two unnamed tributaries south of Duck Creek. Wetland acreage is minimal; however, a few opportunities for wetland enhancement and expansion exist, particularly along the main stem of Duck Creek where hydric soils and small wetlands remain.

The SMU is planned to experience significant land use change in the future, primarily from agricultural to low density residential, but also conversion to industrial zones along I-280.

Table 5.3.7.1 Duck Creek Subwatershed Management Unit G Recommendations

ID	RECOMMENDATION
G1	Utilize Stormwater BMPs and Low Impact Design Principles for New and Existing Development:
G1a	Retrofit residential neighborhoods with stormwater BMPs, such as rain gardens, vegetated swales, naturalized detention (where feasible), and other BMPs to help filter and infiltrate runoff and reduce the flow of urban non-point source pollutants to Duck Creek.
G1b	Utilize low impact development principles and practices when urbanizing the undeveloped portions of the watershed, a significant portion (1500 acres) of which is planned for future residential and commercial development. It is critical to use conservation design / Low Impact Development techniques and BMPs in new development to prevent increases in flooding, stream bank erosion, and water quality degradation.
G1c	Implement agricultural land use recommendations for southern tributary just east of I-280
G2	Preserve, Restore, and Manage the Following Semi-natural Areas Adjacent to the Duck Creek Stream System as Part of the Green Infrastructure System:
G2a	Restore wetlands within the complex of hydric soils, extending west along the Duck Creek main stem from Hickory Grove Road into SMU G (DW16 and DW15). The portion of this complex west of Fairmount Avenue is part of the US Army Corps of Engineers Duck Creek / Fairmount Park Wetland Restoration project to restore wetland, prairie, and stream restoration. This project should be prioritized for funding by the US Army Corps and the City of Davenport and implemented as soon as possible as a demonstration project. If designed and restored appropriately, this area may help to attenuate floodwater flows that are causing damage to the Duck Creek stream channel and riparian corridor.
G2b	Restore wetlands within the hydric soil area near DW18 along the Duck Creek main stem.
G2c	Restore the stream channel and wetlands within the hydric soils adjacent to an unnamed southern tributary within the Emeis Municipal Golf Course.
G2d	Continue to acquire Duck Creek corridor as the Davenport municipal boundary extends west. The Duck Creek parkway is a significant amenity for the City, provides opportunity for a naturalized corridor, and prevents development pressure within the Duck Creek floodplain.
G3	Restore Poor Stream Habitat: Restore the entire reach of Duck Creek following Iowa DNR guidelines, including installing artificial riffles and instream cover and habitat features such as root wads, rocks, and boulders. As far as possible, preserve the intact riparian-floodplain connection, riffles, and some braiding at DW16.
G4	Stabilize Gully Erosion: Use bioengineering practices to stabilize gully erosion along the banks near DW17 and DW18 before additional erosion creates deeper and wider gullies that will be more difficult, and costly, to repair.
G5	Install Bioengineering Practices to Stabilize Stream Banks: stabilize bank erosion at DW 17 and DW18.
G6	Implement Riparian Residential Land Use Recommendations Contained in the General Recommendations for Duck Creek for the Following Areas:
G6a	Along the unnamed southern tributary as it flows along Emerald Drive and past West Central Park Ave.
G6b	Along the unnamed southern tributary as it flows along Friendship Drive.

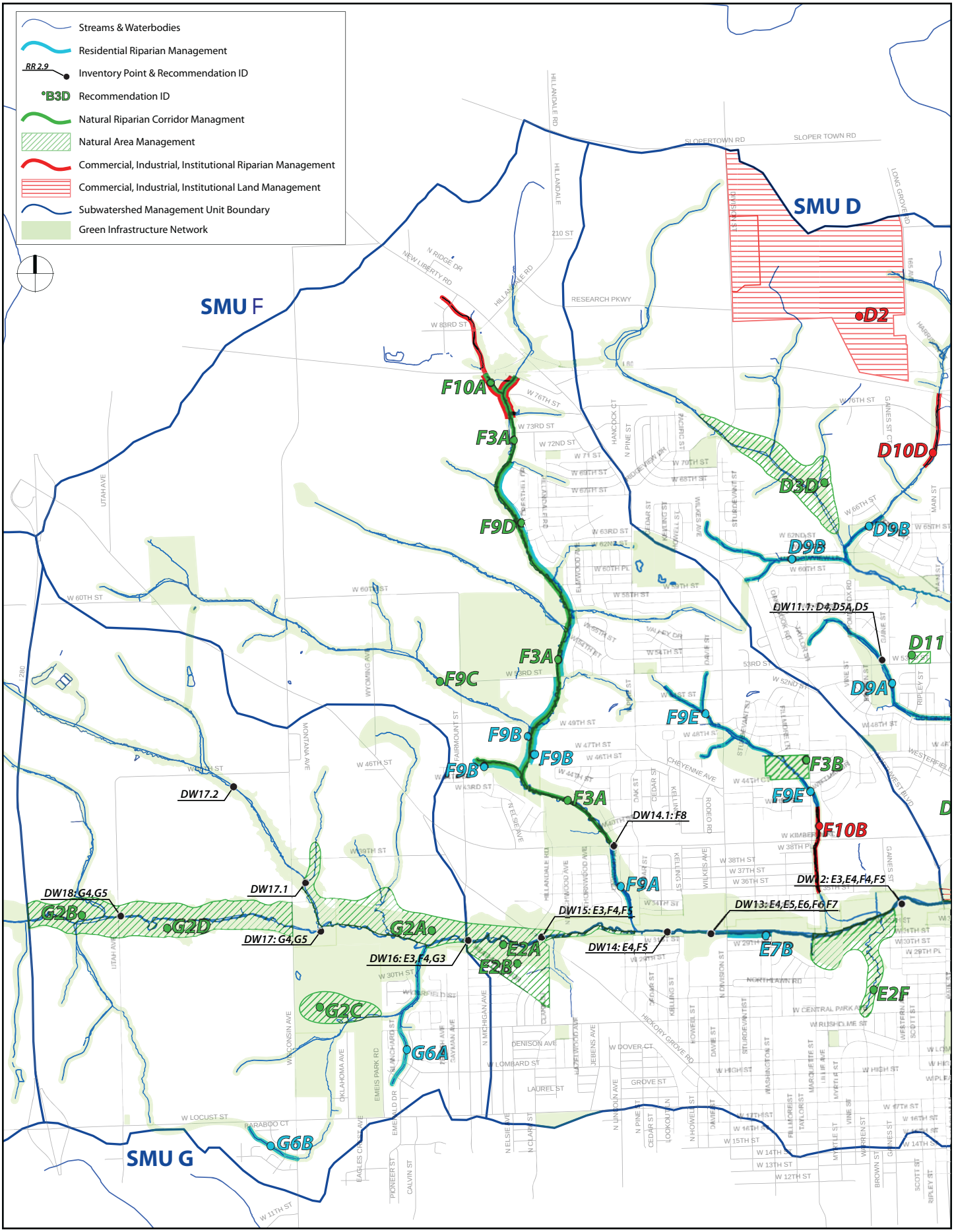


FIGURE 5.3.3 SUBWATERSHED MANAGEMENT UNITS F AND G

5.3.8 DUCK CREEK SUBWATERSHED MANAGEMENT UNIT H

SMU H includes the far western reaches of Duck Creek, west of I-280. The SMU is almost entirely unincorporated Scott County. SMU H is comprised primarily of agricultural land use. Site specific recommendations for SMU H are to be completed under a separate project and are not covered within this watershed plan.

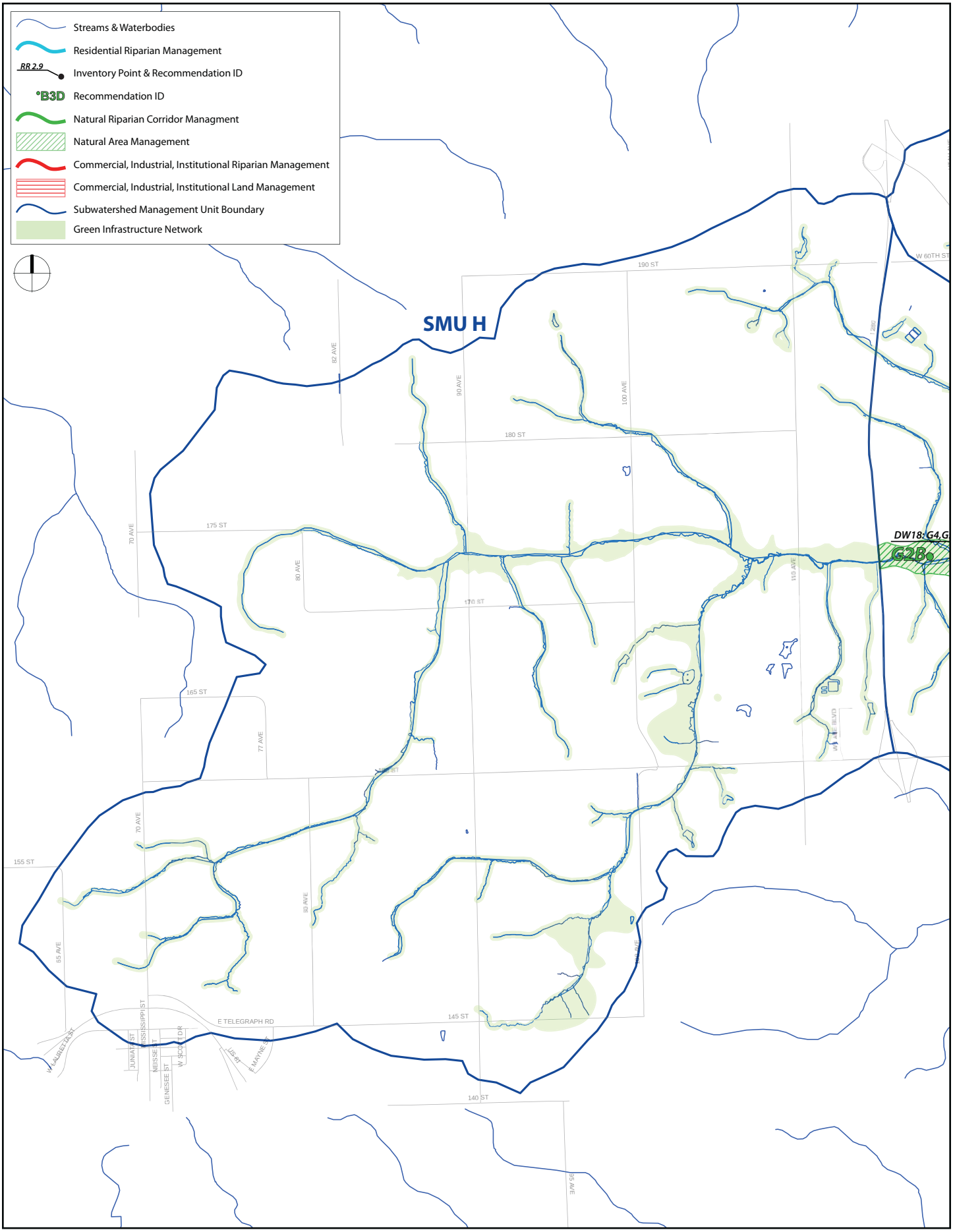


FIGURE 5.3.4 SUBWATERSHED MANAGEMENT UNIT H

5.4 AWARENESS AND EDUCATION STRATEGY

A watershed improvement plan must include a strategy for informing and educating the public and stakeholders about watershed issues that encourage them to take actions and change behaviors. This is especially true for nonpoint source pollution prevention because it is the product of activities of many people in the watershed. Furthermore, the general public is often unaware of the environmental impact of day-to-day activities on environmental resources. An understanding of watershed issues and how individual activities can play a role in protecting water quality helps provide the motivation and basis for changing behaviors. Informing and educating, providing opportunities for the public to get involved in watershed activities, and installing demonstration projects can help effect behavioral change.

This section of the plan provides a general overall strategy for information, education, and public involvement specifically for addressing the issues and concerns in the Duck Creek watershed. However, many of these strategies can be used universally to inform and educate on watersheds and watershed issues and concerns.

5.4.1 SPECIFIC EDUCATION GOALS

The Quad City Watershed Planning Committee (QCWPC) identified the Duck Creek Watershed as a priority watershed because of water quality impairment, E. coli bacteria. The goal and main focus of the Quad City Watershed Plan-Duck Creek Awareness and Education Campaign is to educate watershed stakeholders on; urban storm water management, floodplain planning and development, as it relates to the impairments of water quality and habitat degradation and alteration. It is a goal to change behaviors of landowners from practices that degrade watersheds to those that improve it.

5.4.2 TARGET AUDIENCES

To define the audience for educational outreach, contacts should be made with people, organizations, and decision-makers within the watershed community to determine their level of understanding of watershed issues and needs for further education. The intent is to include both existing partners, as well as stakeholders that previously have not been participants, and to be responsive to their needs for information.

The primary target audiences for this plan are residents and other landowners, land and resource managers, and governmental officials. More specifically, potential target audiences include:

- Landowners and property managers along the stream bank, tributaries, and lakes.
- Developers and property owners that will propose intensive land use changes.
- Municipalities, counties, and other local governments that manage land within the watershed
- Residents and landowners within the watershed
- Consultants (architects, engineers, planners, landscapers) working in the watershed
- Organizations, committees, agencies and groups interested in the future and management of watershed resources.

5.4.3 POSSIBLE PARTNERING ORGANIZATIONS

The education plan for the Quad City Watershed Plan/Duck Creek) will be headed by River Action. River Action and the Quad City Watershed Planning Committee/Duck Creek participants will continue to meet after the completion of the plan and implement the recommendations and education strategies.

- River Action (RA)
- Municipalities (Bettendorf, Davenport (M)
- Counties (Scott County) (C)
- Citizen Advocacy Groups (CAG)
- Academic Institutions (A)
- General Public (GP)
- Volunteers (V)
- Developers and Homebuilders (DH)
- Private Residential Landowners (PRL)
- Federal Emergency Management Agency (FEMA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Environmental Protection Agency (USEPA)

- U.S. Department of Agriculture (USDA)
- Iowa Department of Natural Resources (IDNR)
- Iowa Department of Transportation (IDOT)

5.4.4 EDUCATION AND AWARENESS IMPLEMENTATION STRATEGIES

Partnering organizations will be responsible for implementing the Education and Awareness Strategy through th following mechanisms:

Adoption of the Quad City Watershed Plan

- Present the Quad City Watershed Plan to city councils in involved communities with the intent of having it adopted.
- Include funding for planned watershed improvement projects in city and county budgets.

Information Dispersal

- Distribute Quad City Watershed Plan to QCWPC and libraries.
- Send updates to, or report to, city officials, public works directors, and parks directors.
- Prepare brochures and presentations that explain The Quad City Watershed plan in simple, descriptive terms.
- Send informational brochures to landowners in the watershed with their storm water utility bills.

Media and Marketing

- Create media list specifically for this plan including city, county, state and federal contacts.
- Make public service announcements about the Quad City Watershed Plan and local watershed issues on local television stations and in newspapers and other community publications.
- Create a media kit for the Quad City Watershed Plan implementation.
- Have a press conference in connection with an event or events.

Workshops

- Conduct workshops for the general public on issues and concerns of the Duck Creek Watershed with recommendations for improvement.
- Conduct workshops for a technical and professional audience (developers, professionals, public officials) concerning specific design principles, construction methods and costs of Best Management Practices.
- Conduct grant writing workshops for watershed improvement projects.
- Conduct Best Management Practice Tours for the general public to view local projects.

Website

- Continue to develop and update Quad City Watershed Plan on River Action's website.
- Expand watershed committee e-mail/mailing list to include all interested people and send monthly updates made to website on progress being made concerning the plan.
- Put funding guide for watershed improvement projects online at www.riveraction.org.
- Create a watershed projects and programs recognition page on website to honor outstanding watershed activities and add the watershed category to River Action's yearly Eddy Awards announced every April at the Fish and Fire Earth Day Celebration and Fundraiser.

Demonstration Projects

- Implement demonstration projects from the Quad City Watershed Plan.
- Implemented demonstration projects should be programmed with informational signage, brochures and workshops making clear to the resident and visitor the project's economic, aesthetic , cultural, historical, environmental and educational value.

Public Involvement

- Conduct lectures, river walks, bus and boat tours that incorporate Duck Creek watershed issues and concerns.
- Organize community events (clean ups, plantings) in the Duck Creek watershed.
- Create a self guided tour of the Duck Creek Watershed and make accessible via internet or RiverWay Audio Cell Phone Tour.
- Seek new volunteer base through existing organizations.

• Create an adopt-a-stream or stream segment program or clean up a stream day/event in which gloves, trash bags, trash pick up and recognition of volunteers are provided.
• Establish a hotline or notification system to report illegal dumping or stream concerns.
• Put on public works open houses where public works officials can talk to the general public about recommended Duck Creek watershed management techniques.
• Intensely stencil or sticker storm drains with "Don't Dump: This Drain Leads To River".

School Based Education
• Conduct workshops for teachers on watershed education.
• Develop and put online resources for teachers to access to conduct watershed organization and disseminate the availability of this information to teachers.
• Conduct workshops for kids on watersheds.

5.4.5 PUBLIC EDUCATION VS. TECHNICAL AND PROFESSIONAL EDUCATION

Two primary messages will be depicted when providing education on the Quad City Watershed Plan; public education and technical and professional education.

Public education will be directed at the general public, property owners and stakeholders in the watershed who are not familiar with watershed issues and concerns and how their daily activities effect the watershed. The focus with this group will be to:

• Foster care for the Duck Creek Watershed, focusing in on the benefits of the natural resource to adults, children and wildlife,
• Educate the public about issues and concerns within the Duck Creek Watershed
• Point out how daily activities can effect the watershed (Not So Best Management Practices)
• Inform and encourage practices and involvement that improve the watershed (Best Management Practices).

Technical and Professional education will be offered to developers, homebuilders, local professionals and city officials. This group plans and develops the Duck Creek Watershed and is already aware of watershed issues and concerns. The focus with this group will be to:

• Encourage technical and professional individuals to plan in the floodplain using technical assistance and resource manuals from the appropriate agencies to encourage compatible development in the watershed which minimizes nonpoint source pollution.
• Deliver technical information on planning, designing, sizing, constructing and funding Best Management Practices.
• Deliver best case scenario case studies of stream and urban storm water management, floodplain planning and development and wetland and undeveloped land preservation.

5.4.6 EDUCATION DELIVERY STRATEGIES

• One on one contact
• Presentations to targeted groups
• Presentations at regularly scheduled neighborhood, city, planning and other meetings
• Press Releases, news articles in local newspapers and other community publications
• Inserts in agency and organization newsletters
• Public service announcements or programs on television
• Watershed e-news letter
• Watershed website
• Watershed tours
• Watershed signage
• Workshops to targeted groups
• Special events and activities

5.4.7 EDUCATION TOPICS AND RESOURCES FOR GENERAL AND TECHNICAL- PROFESSIONAL EDUCATION

This section includes information and resources that can be used to educate the general public on the basic watershed

information as it pertains to the Quad City Watershed Plan/ Duck Creek.

Stormwater and Nonpoint Source Pollution

Main Target Audience: General Public

Educating individuals on the definition, issues, and concerns of nonpoint source pollution is the first step to behavioral changes in the watershed.

Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many different sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground, also called storm water runoff. As the runoff moves, it picks up and carries away natural and human made pollutants, finally depositing them into streams, lakes, rivers, wetlands, coastal waters and even our underground sources of drinking water.

According to EPA, pollutants include:

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- Oil, grease, and toxic chemicals from urban runoff and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks;
- Bacteria and nutrients from livestock, pet wastes, and faulty septic systems

Local Stormwater Fees and Reimbursements

Main Target Audience: General Public

Bettendorf

The City of Bettendorf is working on a program, but there is no time frame.

Davenport

A credits program is offered only to non-residential properties and public and private K-12 educational institutions. More information on these incentives can be found at (see Web Links 1 and 2 below).

Residential Property

The City of Davenport charges residents a flat monthly fee. No residential credit reimbursement is available.

Non-Residential Property

All non-residential properties pay a fee based on the amount of impervious area that is on the property. Credits are given to non-residential properties for Best Management Practices (BMP's) such as educating employees and customers on responsible stormwater management, cleaning and maintaining existing storm water systems and impervious surfaces, landscaping to reduce storm water runoff. Procedures must be followed in accordance with the manual (see Link 3). In cases requiring an hydrology analysis, a qualified professional engineer registered in the state of Iowa may be required. The application is sent in and approved by a city official before credits are received. Property owners must document BMP's every year for the credits to continue being issued.

Water quality education credits are also available for K-12 schools. Schools that seek to incorporate education pertaining to stormwater effects and responsible management techniques can fill out an application following the procedures within the manual (see Link 4).

Link 1. General Link for Stormwater Fees and Credit Program: www.cityofdavenportiowa.com/egov/apps/services/index.exe?path=details&action=i&id=79.

Link 2. Link for Related Documents: www.cityofdavenportiowa.com/egov/docs/1154741204897.htm.

Link 3. Link for Stormwater Management and Drainage Utility Credit Manual for Non-Residential Customers: www.cityofdavenportiowa.com/egov/docs/319271154740869.pdf.

Link 4. Link for Stormwater Management and Drainage Utility Education Credit Manual for Public and Private K-12 Educational Institutions: www.cityofdavenportiowa.com/egov/docs/345241154740916.pdf.

"Not So" Best Management Practices

Main Target Audience: General Public

Pet waste

Concern: Pet waste that is near a storm drain, ravine, stream, river or other waterway is a concern because the feces is washed away during rain events and snow melts and deposited into water ways. This puts excess bacteria into the stream which threatens water quality.

Alternatives: Do not allow pets to use these areas near waterways or pick up feces immediately.

Dumping leaves, grass clippings, yard debris and trash in ravines and yards

Concern: Dumping leaves, grass clippings, yard debris or trash in to ravines or streams is a concern because they choke out native vegetation that stabilizes soils. In turn, that soil is deposited into the waterway and travels into streams and rivers causing impairments for water quality and aquatic habitat, such as fish.

Alternatives: Purchase yard bags and stickers from local grocery stores provided by the cities and have yard waste picked up. Start a compost pile and turn yard waste and food remains into rich soil matter, great for gardening.

Local Yard Waste Disposal

Bettendorf

Yard waste for the residents of Bettendorf is on the regular trash collection schedule. It must be contained in kraft paper bags and special stickers must be attached to the bags. There is no charge for collecting bundled tree trimmings and branches. There is often a window of time during spring and fall when the sticker fee is waived. Waste can also be dropped of at the Davenport Compost Facility, 2707 Railroad Avenue, Davenport in 2-ply kraft paper bags. For more information: www.bettendorf.org

Davenport

Yard waste for the residents of Davenport is a separate weekly collection on the same day as garbage collection, but at a different time. It must be contained in 2-ply kraft paper bags and special 'Earth Cycle' stickers must be attached to the bags. There is often a window of time during spring and fall when the sticker fee is waived. Waste can also be dropped of at the Davenport Compost Facility, 2707 Railroad Avenue, Davenport in 2-ply kraft paper bags.

For more information: www.cityofdavenportiowa.com

Pouring into storm drains

Concern: Pouring hazardous materials, paints and other fluids into storm drains is a concern because it flows directly into waterways where children play and habitat live. Those waterways flow to the Mississippi River, the Quad Cities source of drinking water and millions of other communities from our region to the Gulf.

Alternatives: Residents of Scott County can take oils, paints, household cleaners and other hazardous materials to the Scott County Landfill or the Scott County Recycling Center by appointment. Disposal is free for homeowners, but there is a charge for businesses. Homeowners can call (563) 381.1300 or .9575 and speak with staff, and business owners can call (563) 381.1300.

Washing cars in the street

Concern: Washing cars, mowers and other machinery in the street puts soaps and car and other fluids into the storm sewers and then into waterways threatening water quality.

Alternatives: Use a commercial car wash facility that treats runoff, wash cars and other machinery in the yard allows the lawn to soak up some of the soaps and other fluids.

Tiling drainage problems

Concern: Often residential drainage problems like standing or pooling water are solved by installing drain tiles into ravines, streams, or neighbors' yards. This may solve individual drainage problems, but can add to larger drainage problems.

Alternatives: Consider soil restoration, aeration and compost application, to increase the infiltration and percolation of the entire lawn. Consider a rain garden or

other Best Management Practice to infiltrate and cleanse water rather then sending it down the line to a neighbor or other water system.

Mowing up to stream's or ravine's edges

Concern: Mowing up to a stream or ravine's edge causes erosion of these edges which can cause property loss and excess soil in local water ways.

Alternatives: Plant a strip of tall grasses or wildflowers along edges, decreasing mowing and stabilizing banks.

Applying fertilizers and other chemicals to lawns, landscapes and gardens

Concern: A large percentage of the chemicals applied to lawns, landscapes and gardens makes its way to local waterways.

Alternatives: Read labels on products carefully and apply sparingly. Avoid applying before a heavy rain or near a waterway. Try alternative methods like compost and organic lawn chemicals. Implement native lawns and landscapes that do not require chemicals.

Flushing prescription medication down the toilet

Concern: The United States Geological Survey found that 80% of the watersheds they sampled nationally contained at least one type of pharmaceutical chemical, with half of the streams containing seven or more.

Alternatives: Residents of Scott County may discard pharmaceuticals at the Scott County Landfill or the Scott County Recycling Center, by appointment. Residents can call (563) 381.1300 or .9575 and speak with staff; and business owners can call (563) 381.1300. Businesses are referred to Safety Clean (563) 322.7663.

Best Management Practices

Main Target Audience: General Public and Technical Audience

General Public

Best Management Toolbox, provided in Quad City Watershed Plan-Duck Creek

A toolbox of Best Management Practices within the plan specifically tailored for implementation in the Duck Creek Watershed to improve conditions. Includes definition, applicability, benefits and other design considerations.

Six Simple Things You Can Do To Save The Mississippi River, River Action Publication, www.riveraction.org

A 32 page handbook that outlines, simply, the most common retention projects to retain water. Provides detailed plans and specifications for building the retention projects, along with estimated costs for the improvements. Also provides a Resource List with suppliers, landscapers, contractors and architects, and sources of other products and services you need in order to install the retention projects.

River Action's Online Retain the Rain Calculator, River Action Publication, www.riveraction.org

Provides over 25 examples of Retain the Rain projects, including: rain gardens, rain barrels, runnels, bioswales, green roofs, porous paving, native plantings, and prairie restorations. The user will be able to see how projects work and create his or her own project. The user simply chooses the desired project from the eight options, inputs the dimensions of the intended project and the surrounding area, and the kiosk calculates how many gallons of rain water would be retained.

Technical and Professional Audience

Best Management Toolbox, provided in Quad City Watershed Plan/Duck Creek

See Above.

Iowa Stormwater Management Manual, www.ctre.iastate.edu/PUBS/stormwater/index.cfm

The purpose of this manual is to present planning and design guidelines for the management of stormwater quality and quantity in the urban environment.

Water Quality

Main Target Audience: General Public and Technical and Professional audience

General Public

United States Environmental Protection Agency: Water, www.epa.gov/ebtpages/water.html

A general information page with links to various water related issues.

Iowa Department of Natural Resources: Water Quality, www.iowadnr.com/water/index.html

A general information page with links, updates and reports on various water related issues specific to Iowa.

Technical and Professional Audience

United States Department of Agriculture: Natural Resources Conservation Service: Iowa Technical Resources www.ia.nrcs.usda.gov/technical/

A list of technical resources pertaining to Iowa water quality issues and concerns and conservation practices.

Habitat Restoration

Main Target Audience: General Public and Technical and Professional Audience

American Fisheries Society, http://www.fisheries.org/afs/publications.html

Provides education and guidelines on developing watershed implementations based on a fish and aquatic habitat.

Education for Teachers and Children

Resources for teachers and children to become involved in their watersheds and gain knowledge on issues and concerns.

United States Environmental Protection Agency:

Various sources for teachers and kids that provide educational materials and activities concerning watersheds.

EPA for Students and Educators, www.epa.gov/epahome/students.htm.

Environmental Kids Club: Water, www.epa.gov/kids/water.htm.

Water for kids, www.epa.gov/water/kids/waterforkids.html.

5.4.8 EVALUATING THE QUAD CITY WATERSHED AWARENESS AND EDUCATION PLAN

Surveys distributed after workshops and other watershed stewardship special events will determine anticipated behavior changes. Follow up with survey participants will determine if behaviors or policies have changed as a result.

Using existing water quality data, the effectiveness of implemented watershed improvement projects will easily be determined by improved water quality results. Also, improved physical conditions of the watershed, a decrease in flooding levels and occurrences and an increase in habitat by observation of watershed stakeholders will determine achievements of watershed improvement projects.

5.4.9 IMPLEMENTATION PLAN

The Implementation Strategy, Table 5.4.9.1 on the next pages, outlines a general approach for providing education and outreach to watershed stakeholders. The table is organized by major Issues and Goals and by topic area within each of the Issue and Goal categories. Different strategies may be appropriate for different scales, e.g., a watershed wide storm drain stenciling campaign or a targeted one-on-one outreach campaign for streamside landowners and residents. The table includes the following information.

- Impairment, Cause, and Source are the major watershed problems and where they come from.
- Target Audiences: indicates the primary audiences who need to hear the message or receive the information.
- Message: suggests a number of messages to disseminate to address the impairment, cause and source.
- Delivery Mechanism: suggests the means by which the message should be distributed.
- Anticipated Behavioral Change: indicates the desired outcome that will result when a message is properly distributed.
- Evaluation Measures: suggests means to measure progress in implementing the Information and Education Strategy.
- Responsible Organization: recommends the primary parties that should be responsible for crafting and delivering the messages.
- Timeline: indicates the time frame for implementing the recommendation.

Table 5.4.9.1 Duck Creek Awareness and Education Plan

IMPAIRMENT	CAUSE	SOURCE	TARGET AUDIENCE	MESSAGES	
WATER QUALITY	T.S.S. Total Suspended Solids/ sedimentation and siltation	Urban Runoff	All	The effects of soil erosion on water quality and the importance of control measures, particularly on construction projects and agricultural land. Stormwater BMP practice and installation for urban runoff management. Highway and parking lot maintenance for improved water quality (e.g. regularly sweeping, salt application procedures and alternatives, etc) Volunteer stream monitoring	
		Streambank Modification and Destabilization	GP, DH, PRL, M, C	The importance of streambanks and buffers in controlling erosion and reducing T.S.S. loads; bank and buffer management and stabilization measures for landowners and land managers. Volunteer stream monitoring.	
	Bacterial Contamination	Unknown Sources	All	The completion of Iowa Department of Natural Resources' (IADNR) Total Maximum Daily Load (TMDL) will identify sources of bacterial contamination in the watershed, this document should be utilized in addressing sewer concerns.	
		Sanitary sewer problem/ failure, combined sewer overflows, on-site treatment systems (septic)	GP, DH, PRL, M, C	The impacts of inappropriate management and maintenance and the importance of appropriate sanitary sewer and septic system management and maintenance practices such as regular inspection and repair of tanks, fields, and infrastructure.	
		Animal operations	PRL (AGRICULTURAL)	Livestock operations and access to the stream increases the opportunity for bacterial contamination. Restricting access and conservation practices can limit this opportunity.	
	Nutrients	Urban Runoff, Golf Courses, Parks, Grassland, Forests	M, C	Stormwater BMP practices and installation for urban nutrient runoff management (e.g., raingardens, swales, naturalized detention, natural landscaping, etc.). Better turf and land management practices (appropriate fertilizer application and mowing/maintenance practices) for residents, parks, schools, golf courses and other expanses of turf area. Volunteer stream monitoring.	
		Agricultural Activities	PRL (AGRICUTURAL)	The effects of agricultural activities and land management (e.g., fertilizer application, filter strips) on nutrient loads and waters quality and the importance and effectiveness of controlling agricultural runoff with appropriate conservation practices.	
	Aquatic Life Toxicity (Chlorides/ Total Dissolved Oxygen)	Urban Runoff	All	Stormwater BMP practice and installation for urban runoff management, especially for areas contributing chlorides.	
		Agricultural Runoff	PRL (AGRICUTURAL)	Stormwater BMP practice and installation for urban runoff management, especially for areas contributing chlorides,	

	DELIVERY MECHANISM	ANTICIPATED BEHAVIORAL CHANGE	EVALUATION MEASURES	RESPONSIBLE ORGANIZATION	TIMELINE
	Presentations, workshops, meetings, media, and mailings, one on one direct contact	Voluntary installation of stormwater BMP's; improved highway and parking lot maintenance practices (e.g., additional street sweeping, salt application altered and reduced in locations in the watershed); greater volunteer base for stream monitoring	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, implementation of BMP's, changes in highway and parking lot maintenance, improved water quality (T.S.S.)	M, C, State and Federal Agencies	0-2 years
	Presentations, workshops and meetings; media and mailings; watershed events and stewardship, one on one direct contact	Improved bank and buffer management; wider natural/vegetated riparian buffer; greater volunteer base for stream monitoring	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, implementation of stream bank stabilization and buffers, changes in highway and parking lot maintenance, improved water quality (T.S.S.)	M, C, State and Federal Agencies	0-2 years
	Presentations, workshops, meetings, media, and mailings, public service announcements, one on one direct contact	Use of the TMDL for identification of sewer and septic concerns, updates, improvements and education	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, identification, updates, and improvements of sewer and septic systems	M, C, State and Federal Agencies	0-2 years
	Presentations, workshops, meetings, media, and mailings, public service announcements, one on one direct contact,	Identification, updates, and improvements of sewer and septic systems, increased maintenance and investigation; increased inspection and regulation	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, identification, updates, and improvements of sewer and septic systems	M, C, State and Federal Agencies	0-2 years
	Presentations, workshops, meetings, and mailings, one on one direct contact	Voluntary implementation of conservation practices, elimination or limitation of livestock access to stream.	Interest direct contact and mailings in implementing conservation practices, attendance at presentations, workshops and meetings,	C, State and Federal Agencies	0-2 years
	Presentations, workshops, and meetings; media and mailings, one on one direct contact	Voluntary installation of stormwater BMP's; improved turf and land management practices (e.g.; less frequent mowing, less fertilizer application); greater volunteer base for stream monitoring.	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, implementation of BMP's, changes in turf and land management, improvement in water quality (nutrients)	State and Federal Agencies	0-2 years
	Presentations, workshops, meetings, and mailings, one on one direct contact	Voluntary implementation of conservation practices	Interest direct contact and mailings in implementing conservation practices, attendance at presentations, workshops and meetings,	C, State and Federal Agencies	0-2 years
	Presentations, workshops, meetings, and mailings, one on one direct contact	Voluntary installation of stormwater BMP's; improved highway and parking lot maintenance practices (e.g., additional street sweeping, salt application altered and reduced in locations in the watershed); greater volunteer base for ravine and river monitoring	Feedback and inquires from direct contact, media outputs and mailings, attendance at presentations, workshops and meetings, implementation of BMP's, changes in highway and parking lot maintenance, improved water quality (Chloride)	M, C, State and Federal Agencies, AI	0-2 years
	Presentations, workshops, meetings, and mailings, one on one direct contact	Voluntary implementation of conservation practices	Interest from direct contact and mailings in implementing conservation practices, attendance at presentations, workshops and meetings,	C, State and Federal Agencies	0-2 years

Table 5.4.9.1 Duck Creek Awareness and Education Plan (continued)

IMPAIRMENT	CAUSE	SOURCE	TARGET AUDIENCE	MESSAGES	
HABITAT DEGRADATION AND ALTERATION	Lack of habitat characteristics (pools, riffles, substrate, meandering, cover streambanks)	Instream and surrounding land use alterations	All	Alterations in and around streams, ravines and rivers has lead to a lack of productive habitat for wildlife. Restoring surrounding land use to area that support habitat, improving and stabilizing banks lessening soil deposition into the stream, removing hydrostructures that regulate and modify flow, and implementing aquatic habitat structures improves habitat in and around streams.	
	Hydrologic disturbance/flow (increase and decrease of streamflow)	Urban Runoff	All	Increased amounts of urban runoff cause unstable flows. Decreasing the amount of urban runoff by installing stormwater BMP's can lead to a more stable stream flow, decreasing soil and other hazards from entering the stream, improving conditions for habitat.	
		Floodplain development and management	GP, DH, PRL, M, C, State and Federal Agencies	Floodplain clearing, developing and land use conversion leading to the loss of depression drainage areas and wetland storage alters hydrologic cycles that has negative effects on habitat and wildlife.	
	Draining, filling, degradation of wetlands	Draining, filling, loss of wetlands	GP, DH, PRL, M, C, State and Federal Agencies	Modification of wetlands, including, draining, filling, and loss to development has detrimental effects to water quality and wildlife. Existing wetland preservation and reestablishment and rehabilitation of past existing wetlands	
	Exotic and invasive species (natural areas and riparian zone)	Habitat modification/ Spread from existing infestations	All	Habitat modification has caused and environment that is more suitable for invasive, exotic plants to thrive and spread. Removal of exotic and invasive plants and replacement with native species that improve water quality, stabilize banks and provide food sources and homes for wildlife.	
	Loss/reduction/degradation of natural buffer; streamside alterations	Streambank modification and destabilization/ Habitat modification, loss of riparian habitat and vegetation	GP, DH, PRL, M, C, State and Federal Agencies	Modification and destabilization of ravines, streams and rivers has lead to the loss, reduction and degradation of natural buffers. Installing, connecting and enriching riparian corridors and buffers providing native vegetation for wildlife improves habitat in and around stream.	
		Inappropriate land management, site clearing, development and land use conversion	GP, DH, PRL, M, C, State and Federal Agencies	The impacts of different land uses on habitat and improved land management measures for improving habitat	
		Urban (Golf Course) and Agricultural Runoff	PRL, M, C	The effects of agricultural and urban activities (golf courses) and land management (e.g., fertilizer application, filter strips) on the alteration of stream sides and loss reduction and degradation of natural buffers and the importance and effectiveness of controlling runoff and creating habitat with appropriate stream side applications (riparian areas, grassed filter strips, etc)	

	DELIVERY MECHANISM	ANTICIPATED BEHAVIORAL CHANGE	EVALUATION MEASURES	RESPONSIBLE ORGANIZATION	TIMELINE
	Mailings; media and presentations, workshops and meetings, one on one direct contact	Implementation of in stream, bank and surrounding land use structures and areas that support habitat	Feedback and inquires from direct contact, media outputs and mailings; attendance at presentations, workshops and meetings; implementation of habitat supporting areas and structures in and around stream; increase in habitat	M,C, State and Federal Agencies	0-5 years
	Mailings; media and presentations, workshops and meetings, One on one direct contact	Voluntary installation of stormwater BMP's; filter strips and riparian areas to reduce amount of stormwater entering the stream which leads to "flashy" hydrology	Feedback and inquires from direct contact, media outputs and mailings; attendance at presentations, workshops and meetings; implementation of storwmater BMP's, filter strips and riparian areas, increased habitat	M, C, State and Federal Agencies	0-5 years
	Mailings; media and presentations, workshops and meetings, One on one direct contact	Conversion of areas in the floodplain to depression drainage areas and wetland storage improving hydrologic cycles and providing habitat for wildlife future planning of the floodplain to include these practices	Feedback and inquires from direct contact, media outputs and mailings; attendance at presentations, workshops and meetings; future planning of the floodplain to include wetland restoration, implementation of wetland storage and depression drainage areas, increased habitat	M, C, State and Federal Agencies	0-5 years
	Mailings; media and presentations, workshops and meetings and special events, one on one direct contact	future planning of the floodplain to include wetland preservation, reestablishment, and rehabilitation, implementation of wetlands, increased habitat	Feedback and inquires from direct contact, media outputs and mailings; attendance at presentations, workshops, meetings and special events;	M, C, State and Federal Agencies	0-5 years
	mailings; media and presentations, workshops and meetings and special events, one on one direct contact	Removal of exotic, invasive species and implementation of native	Feedback and inquired from direct contact, media outputs and mailings; attendance at presentation, workshops, meeting and special events	All	0-5 years
	Mailings, media and presentations, workshops and meetings and special events, one on one direct contact	Implementation of riparian areas and buffers with native plants	Feedback and inquires from direct contact, media outputs and mailings; attendance at presentations, workshops, meetings and special events; increase in habitat	M, C, State and Federal Agencies, AI	0-5 years
	Mailings; media and presentations, workshops and meetings and special events, one on one direct contact	Changes in land management (sod application, mowing, and fertilizing to and near waters edge)	Feedback and inquires from direct contact, media outputs and mailings; attendance at presetation, workshops, meetings and speicial events, increase in habitat	M, C, State and Federal Agencies, AI	0-5 years
	Presentations, workshops, meetings, and mailings, one on one direct contact	Voluntary implementation of conservation practices	Interest from direct contact and mailings in implementing conservation practices, attendance at presentations, workshops and meetings,	State and Federal Agencies, AI	0-5 years