Water Quality Sponsored Projects: Feasibility Study Fort Dodge, Iowa

Prepared for:
McClure Engineering
and
City of Fort Dodge

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Project #: McClureFD-001

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Contents

Executive Summary

"The real wealth of the Nation lies in the resources of the earth – soil, water, forests, minerals, and wildlife."
-Rachel Carson, Scientist & Author

The City of Fort Dodge has funds for Water Quality Sponsored Projects. Practices being funded under Iowa's Sponsored Project program are primarily focused on restoring the natural hydrology of the watershed in which they're located. Included are bioswales and bioretention cells, permeable paving, rain gardens, wetland restoration, floodplain restoration, and other retention and infiltration practices for nonpoint source pollution management. While other benefits, such as flood control, stormwater management, or habitat restoration may also be achieved, the practices must result in improved water quality. In December 2018, Impact 7G staff met with Fort Dodge city staff and McClure Engineering to discuss options for water quality Best Management Practices (BMPs) improvement projects. It was decided that a city-wide approach would provide a comprehensive strategy for implementing targeted practices throughout the town and along noted waterways. This report is the culmination of on-site visits, spatial analysis using Geographic Information Systems (GIS) programs, and relevant data shared between the three project partners.

This report is organized into three parts:

1. Strategy Overview
2. Data Analysis & Results
3. Recommendations

The intention of this report is to provide an action-oriented plan that can be utilized when funding becomes available or grant opportunities are pursued. There is a list of potential grant opportunities provided in the appendix of the report for reference. This list is an initial starting point and should be updated annually to reflect changes in funding opportunities.

Strategy Overview

Addressing water quality within Fort Dodge city limits requires a comprehensive understanding of the soils, slope, city infrastructure (e.g. storm sewers, road network), current projects, flood zones, and impermeable surfaces (e.g. parking lots, sidewalks). Utilizing a Geographic Information

Systems (GIS) program, staff were able to identify ideal parcels throughout the city for installing various water quality Best Management Practices (BMPs).

Once Impact 7G staff had compiled and analyzed the data across four different categories of implementation, (Waterways, Regional, Small, and Hardscape), City staff and McClure Engineering staff further edited the list per the City's priorities based on these questions:

1. Of the categories, which category/categories should be the focus of the study?
2. Which parcels are a priority?
3. Which, if any, parcels should be removed from the study?

The edited list of potential parcels obtained from the City and McClure Engineering provided Impact 7G staff with a list of prioritized areas where BMPs would be more readily implemented. After further analysis, three areas were selected for prioritized action: Soldier Creek (south of 170th Street west of BHJ USA), Fort Dodge Community School District Stadium Parking Lot, and the Fort Dodge Senior High School Parking Lot. These areas were selected due to their ability to:

1. Improve and Enhance stream conditions in an urban and rural transition area.
    a. Address erosion and sediment deposition into the stream; improving downstream water quality
    b. Enhance current vegetation to include drought and flood resilient plant/tree species
    c. Re-meander waterway to slow water velocity and encourage sediment deposition and improve erosion of creek banks.
2. Protect and Enhance Water Quality within the City; ultimately improving this resource for human and wildlife interaction and aquatic habitat downstream.
    a. Address urban water quality within the city limits.
    b. Employ urban water quality practices to improve surface runoff within city limits.
    c. Seek additional opportunities to incorporate urban water quality practices for increased water quality improvements.
3. Implement Water Quality Practices that showcase good stewardship for residents and future developers within and around the City.
    a. Showcase urban water quality practices within the city limits.
    b. Educate residents on the function, benefits, and importance of urban water quality practices.
    c. Encourage incorporation of additional voluntary water quality practices from residents.
    d. Encourage incorporation of water quality practices

Stormwater Best Management Practices

State and federal regulations aimed at controlling water pollution have historically focused on point-source pollution sources, such as municipal or industrial facilities that discharge into state waters. This report focuses on the non-point source pollution remediation opportunities that Fort Dodge can implement to improve waterways that are impacted by roadway pollutants (e.g. heat, oil, hydrocarbons), agricultural runoff (e.g. pesticides, fertilizers), and urban development (increased impervious surfaces).

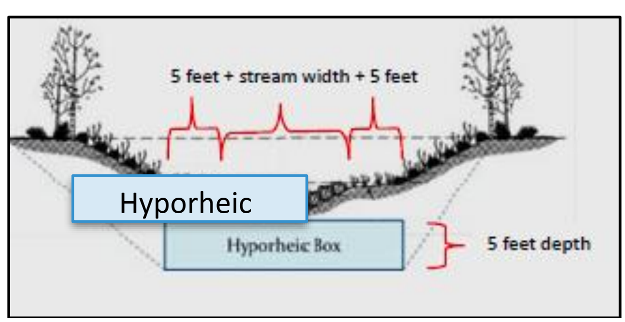
Urban-Rural Interface Practices

The following water quality practices are being proposed as part of this project based on analysis of existing conditions, objectives of the community, available space and cost effectiveness.
Note, Information about advantages and disadvantages of best management practices (BMP) has been compiled from a variety of resources including previously submitted SFR applications, the Iowa Stormwater Manual and the Minnesota Stormwater Manual. Additional floodplain restoration information was summarized from "Floodplain Restoration and Stormwater Management: Guidance and Case Study" by CRWP and Biohabitats, 2009.

Stream Restoration and Floodplain Reconnection

A floodplain is a flat or nearly flat lowland bordering a stream or river that experiences occasional or periodic flooding. The floodplain corridor acts as the "right-of-way" for a stream and functions as an integral part of the stream ecosystem. Floodplains perform important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and prevention of erosion. In addition, floodplains provide habitat for wildlife, recreational opportunities, and aesthetic benefits. Ideal floodplain conditions are rarely encountered in urban or disturbed watersheds; many floodplain functions have been lost to agricultural uses and more recently to urban and suburban development. Floodplain restoration is the process of fully or partially restoring a stream's access to its floodplain to return those valuable floodplain functions. There are multiple types of floodplain restoration:

- Hydrologic. Reconnecting the stream to the floodplain and restoring the stream's natural hydrology.
- Vegetative. Removing invasive species and replanting native



plant communities appropriate to the site and conditions.
- Habitat Restoration. Installing structures to improve wildlife habitat. Habitat is also gained through re-planting native plant communities.

Advantages of reconnecting the floodplain

- Improve Water Quality: Floodplains act as natural filters, absorbing harmful chemicals and other pollution, making rivers healthier for drinking and swimming, and for plants and animals. This includes Denitrification in the Hyporhiec zone.
- Storing and slowing floodwaters: When a river floods, water spreads across the floodplain and slows down. Without floodplains, rivers would rise and move faster, just as water from a hose moves faster when you hold your finger over part of the opening.
- Nurturing life: Floodplains are a productive environment for plants and wildlife and serve as nurseries for many species of fish. They provide vital habitat and are important for maintaining the web of life.
- Recharging groundwater: During floods, water can replenish groundwater supplies. Capturing flood water during wet years is one of the best ways to ensure adequate groundwater during droughts.
- Reduce erosion by stabilizing stream banks: Reduce bank erosion and soil loss.
- Reduce Phosphorus export: a restored wetland-channel complex and two-stage ditch, a popular form of floodplain reconnection in agricultural areas, reduces phosphorus export

Limitations:

Changes in watershed hydrology due to urbanization reduces effectiveness of “stream only” projects. Functional improvement is limited in developed areas without other prevention and restoration measures. Should be part of a treatment train with pre-treatment practices upstream.

Stormwater Wetlands

Constructed stormwater wetlands are used to remove a wide spectrum of pollutants from urban stormwater runoff while providing wildlife habitat and aesthetic features. These features can also be designed to reduce peak runoff rates. Stormwater wetlands are typically installed at the downstream end of the treatment train (they are considered an end-of-pipe BMP). Stormwater wetland size and outflow regulation requirements can be significantly reduced with the use of additional upstream BMPs. However, when a stormwater wetland is constructed, it is likely to be the only management practice employed at a site, and therefore must be designed to provide adequate water quality and water quantity treatment for all regulated storms (MPCA 2019)

Advantages:

- Improves water quality through removal of stormwater pollutants, emulate natural systems to minimize flooding, create wildlife habitat in urban areas. Constructed wetlands are estimated to remove as much as 73% of TSS, roughly 38% of phosphorus loading, 30% nitrogen loading, 70% of heavy metals, 80% of suspended hydrocarbons and 60% of harmful bacteria from stormwater runoff (MPCA 2019)

Disadvantages:

- May need large developable areas in order to be effective,
- can become a nuisance if not managed properly,
- can be difficult to establish native wetland plant species.
- They require more land than other practices;
- They require careful design and planning to ensure wetland hydrology is maintained
- Water quality behavior can change seasonally

Urban Small Practices

Smaller urban practices were divided into two categories: 1) hardscapes (pervious pavement); and 2) infiltration practices (bioretention cells, bioswales, other). The City reviewed and ruled out areas where there were existing plans for future improvements or other conflicts existed.

Permeable Pavers (Large Areas)

This practice allows water to slowly infiltrate through spaces between paver blocks instead of shedding stormwater from the surface to be collected by a traditional storm sewer system. Subsurface rock storage support permeable pavers while also providing pore spaces which infiltrate water and filter pollutants before reaching a subdrain at the bottom of the system. Along with improving water quality, permeable pavers also reduce peak flow and slowly discharge water into the storm sewer system.

Advantages:

High level of pollutant removal, reduction of stormwater runoff volume, appropriate for cold climates, pavers can be removed and replaced. Permeable pavement is estimated to remove on average 74% of TSS and 45% of phosphorus loading.

Disadvantages:

Higher install cost, increased maintenance, potential for groundwater contamination, and requires minimum soil infiltration rate or an underdrain system

Bioretention Cells (Biocells)

Biocells are landscaped depressions used to slow and treat on-site stormwater runoff. Stormwater is directed to the basin then percolates through the system over a period of 24 hours where it is treated by a number of filter layers. Native plants with deep root structures are integral to bioretention basins and aid nutrient and water uptake. The slowed, cleaned water is allowed to infiltrate native soils or directed to a subdrain at the bottom of the system.

Advantages:

Capable of being a landscape feature, very effective in removing urban pollutants, can reduce runoff volumes and rates, suitable for multiple locations, can be effective in highly impervious areas with correct engineering and adequate space, good retrofit technique. Bioretention is estimated to remove as much as 94% of TSS and between 60-85% of phosphorus loading.

Disadvantages:

Higher install cost, increased maintenance, potential for groundwater contamination, and requires minimum soil infiltration rate or an underdrain system.

Bioswales

This practice consists of constructing an engineered swale by excavating a trench that is backfilled with engineered soils and filter aggregate. Native vegetation is planted throughout the swale to assist in water and nutrient uptake while also stabilizing the swale and preventing soil erosion. Bioswales are designed to infiltrate smaller rainfall events and safely convey larger rainfall events to adjacent systems.

Advantages:

Improves water quality through removal of sediment and urban runoff pollutants, typically cheaper than traditional storm sewer piping, can recharge groundwater through infiltration, can be a landscape feature. Bioswales are estimated to remove as much as 68% of TSS and roughly 30% of phosphorus loading.

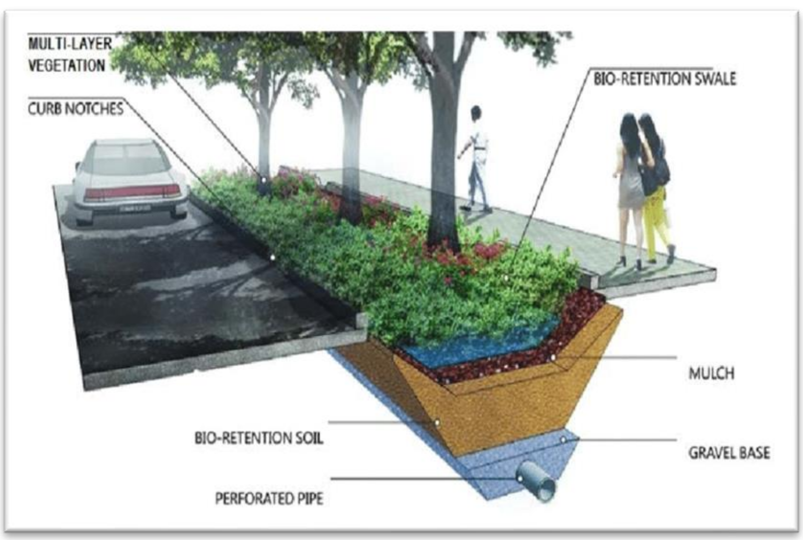


Figure 1. Bio-retention concept diagram. Source: https://www.researchgate.net/figure/Bioswale-concept-diagram-1-Dirty-and-polluted-water-from-rooftops-roads-and-parking_fig1_335219312

Disadvantages:

Cannot reach 80% total suspended solids removal, not feasible with slopes greater than 6%, sediment and pollution removal sensitive to design slope, requires routine maintenance.

Data Analysis & Results

There is not a one-size fits all methodology that can be applied to this type of water quality BMP assessment. The following section provides a detailed description of the methodology employed to analyze the data. In addition to the data-driven analysis, staff visited various areas of the city to verify feasibility of implementation.

In order to understand the movement of water through the soil topology and the built environment, parcel-level GIS data for ~500 publicly owned/exempt parcels were gathered, layered, and analyzed. The city boundary was used as the final extent of proposed practices; however, there were considerations for important adjacent parcels, such as the municipal airport, where opportunities could be found on a larger scale given the larger lot sizes. Watershed boundaries were also taken into consideration when looking at different stream practices, particularly where water sheds from agricultural farmland, industrial uses, or natural areas.

Staff organized land owned by the city or exempt land into five categories:

1. Des Moines River, Lizard Creek, and Soldier Creek Parcels: Parcels identified within 120' of adjacent waterways. These parcels are ideal areas for practices such as stream restoration, establishing riverine wetlands, …
2. Potential Regional Practices: Where larger parcels or adjacent parcels with hydric soils combine to treat a larger area with more intensive BMPs. These practices include stormwater wetlands, and bioretention cells.
3. Potential Small Practices: Individual parcels, such as vacant lots, smaller grassy areas, or larger easements along impermeable surfaces. These practices include raingardens, permeable paver driveways, and smaller bioretention cells along roadways.
4. Potential Hardscape Practices: Parking lots or alleyways that can support permeable pavers or similar stormwater infiltration practices.

Working with City staff and McClure Engineering, our team distilled these categories further into two categories:

1. Small Urban Practices: This category now includes both potential hardscape practices and potential small practices.
2. Potential Regional Practices: This category now includes larger parcels and parcels identified along Soldier Creek.

There were several factors that created these new categories. For instance, *the Des Moines River and Lizard Creek were taken out of the prioritized pool of parcels because they have water improvement projects already underway*. The reduction in waterway parcels to primarily focus on Soldier Creek was too narrow; and thus, the inclusion of regional practices provided a more feasible project scope. Many of the areas that were flagged for hardscaped practices were in the same areas as those identified for small practices, making it logical to combine them. For instance, a vacant lot (small project) was also adjacent to a parking lot or alleyway (hardscape project), creating an opportunity for a larger impact when combined. Figure 2 below provides an image of the ArcGIS attribute table that displays the Practice and Priority Level ranking criteria that was vetted by all project partners.

Figure 3: Attribute Table for selected projects.

Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete Copy

OBJECTID	Shape	PARCEL	OWNER_NAME	CLASS	Type	PRACTICE	PriorityLv	PRACTICE_GRP	Area_acres
168	Polygon	0729135001	CITY OF FORT DODGE IOWA	E	MASON MEM DR AR...	YES	High	REGNL_PRCTCS	0.36542
171	Polygon	0729103005	CITY OF FORT DODGE	E	MASON MEM DR AR...	YES	High	REGNL_PRCTCS	0.139586
190	Polygon	0728426008	FORT DODGE CITY OF	E	COMRCL CREEK	YES	High	REGNL_PRCTCS	1.18028
199	Polygon	0720356010	HARVEST BAPTIST CHURCH OF FORT...	E	PARKING LOT	MAYBE	High	HARDSCAPE_PR...	0.483522
208	Polygon	0720352008	CITY OF FORT DODGE	E	PARKING LOT	MAYBE	High	HARDSCAPE_PR...	0.137936
209	Polygon	0720352004	CITY OF FORT DODGE	E	PARKING LOT	MAYBE	High	HARDSCAPE_PR...	0.138494
220	Polygon	0720352005	CITY OF FORT DODGE	E	PARKING LOT	MAYBE	High	HARDSCAPE_PR...	0.19318

Maps

Staff aggregated and analyzed all data described above and produced a series of maps for the city and McClure Engineering to review. The following maps provide a visual representation of the methodology used in this report. Figure 4 is a map that shows the Potential Water Quality Practice Sites denoted in a bright green/blue color, which highlight all the potential practices as analyzed by Impact 7G staff. Figure 5 shows the Priority Level parcels colored in dark and light blue, which indicate the level of priority placed upon these parcels by the city and McClure Engineering. Figure 6 is a map that shows the potential sites still highlighted in bright green/blue as well as the final selections for project areas based on the priority-level input.

Figure 4 Map of Initial Water Quality BMPs

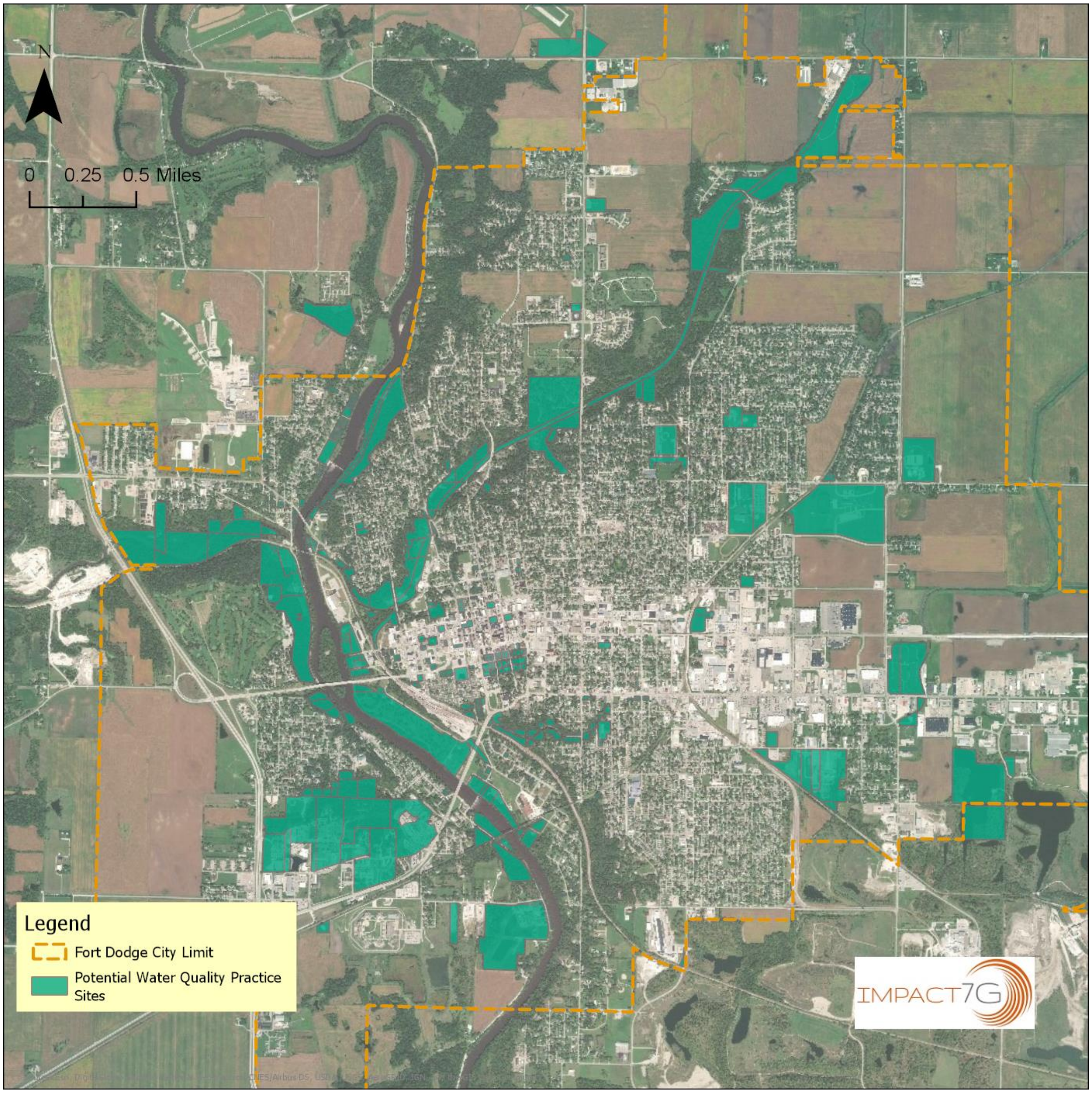


Figure 5 Map of Potential Water Quality Practices and Priorities

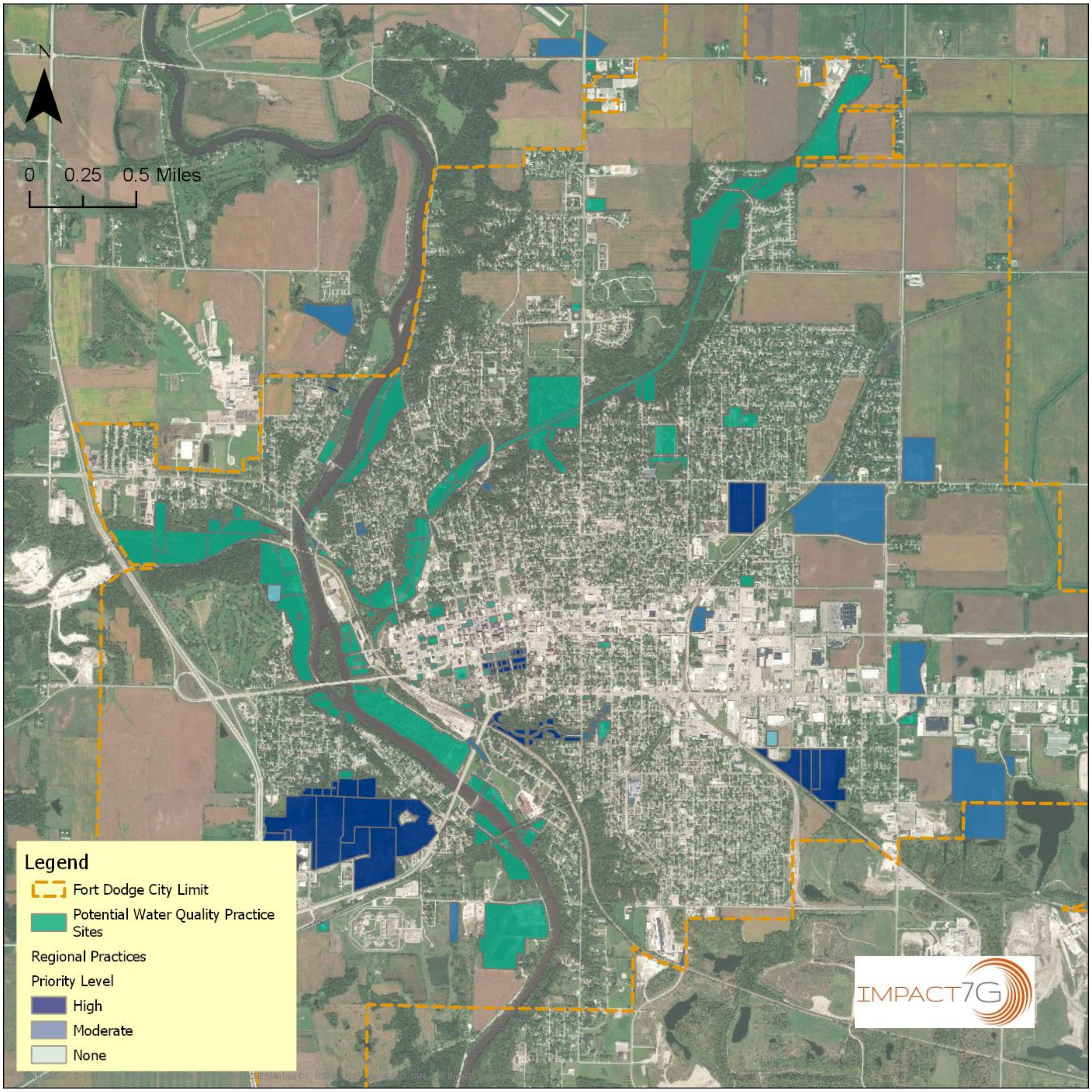
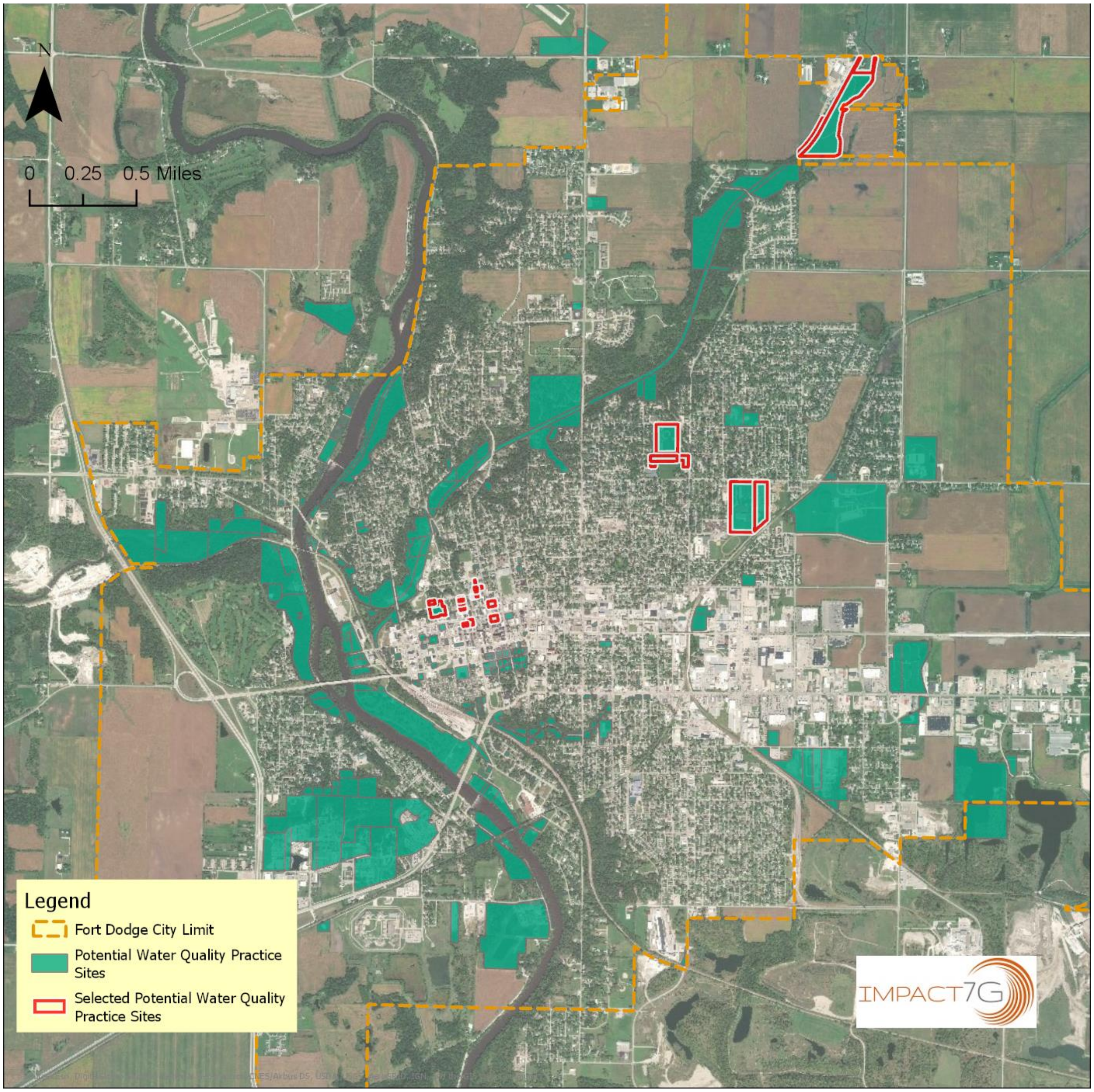


Figure 6 Map of Finalized Project Areas



Recommendations

Based on the results of our analysis, four areas have been identified as a high priority: one regional and three small urban practices. The regional project is located on the north end of Soldier Creek, and the two small urban practices are the Fort Dodge Senior High School Parking Lot the Fort Dodge Community School District Stadium Parking Lot, and the Downtown SSMID & Laramar Parking Lot (Figure 7). Staff have provided a detailed project scope for each area, including projected cost estimates.

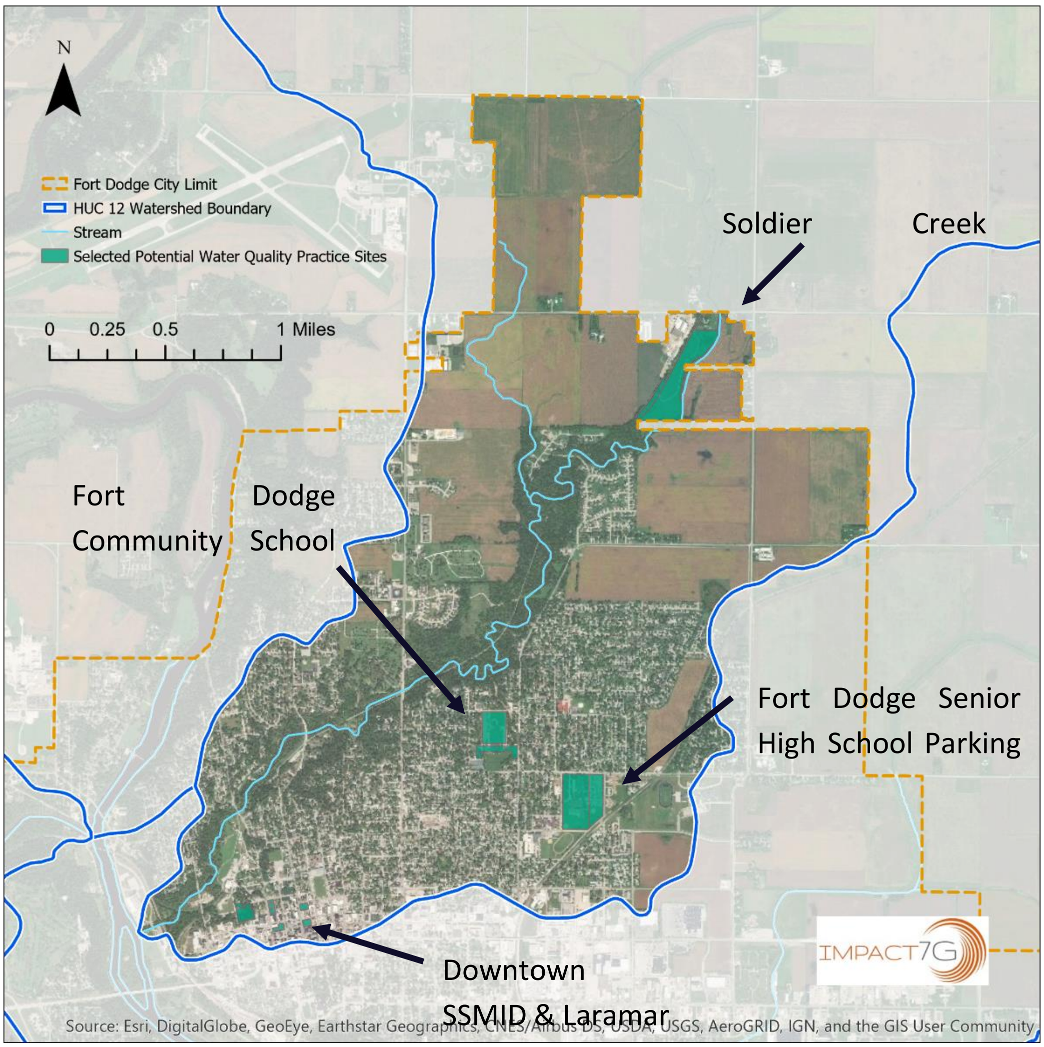


Figure 7 Selected BMP Practice Sites

Regional Practice

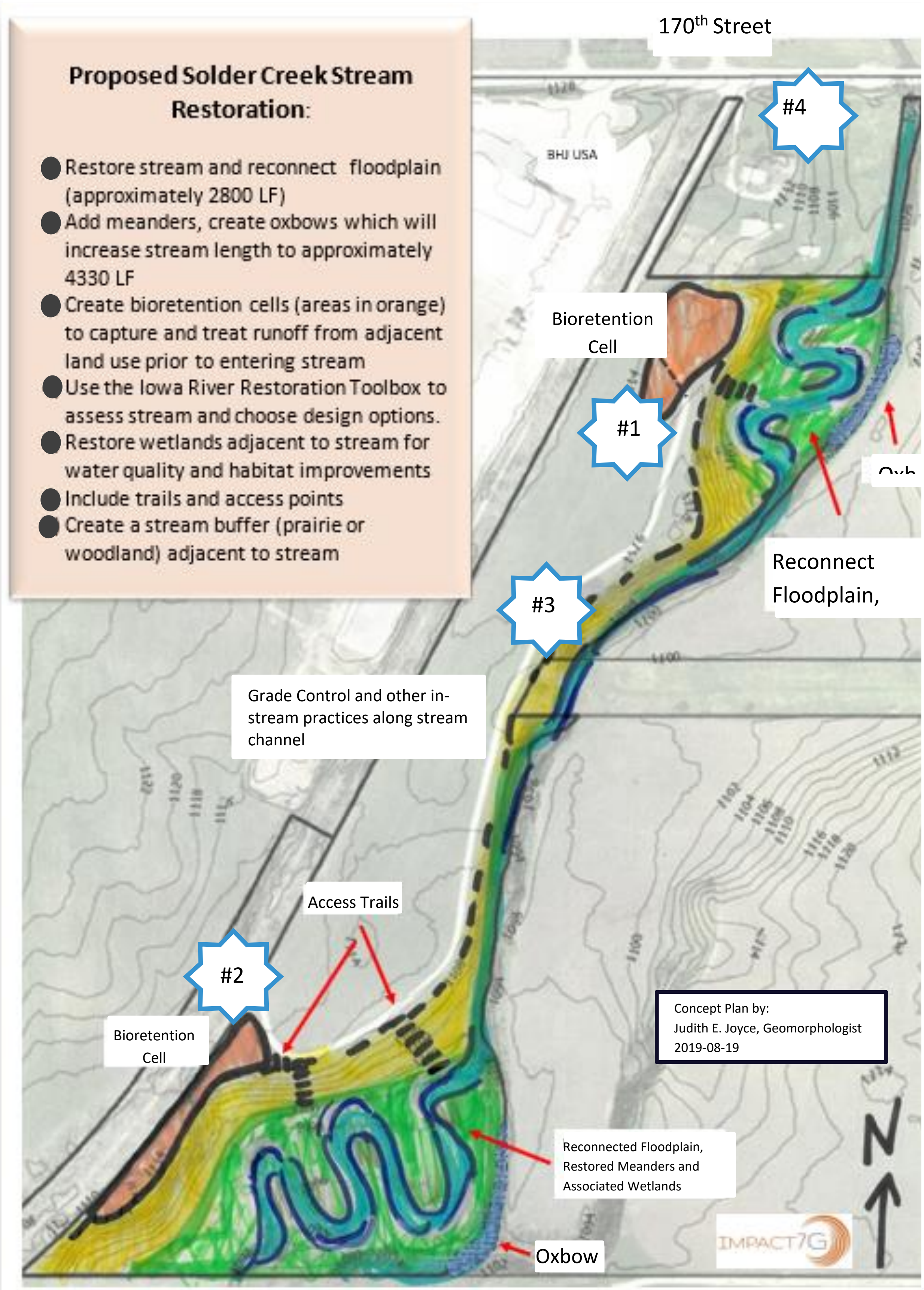
Soldier Creek Stream Restoration and Floodplain Reconnection.

The Soldier Creek Stream project would entail implementing a treatment train that includes bioretention cells, a prairie buffer, re-meandering reaches, reconnecting the floodplain, wetland restoration and the creation of oxbows (Figure 8).

The proposed location is at the rural - urban interface along 170th Street at the northern boundary of the City of Fort Dodge. This larger, regional practice will treat 30+ square miles and would address both rural and urban water quality concern. The project achieves the City's first water quality goal by providing treatment of rural and urban stormwater runoff. The project will provide a great opportunity for the City to showcase Soldier Creek, as part of their park system and as a recreational and natural resources. It will also feature urban water quality best management practices as part of the treatment train in a visible area along a well-used newly constructed trail system. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Thereby achieving the second water quality goal.

The parcel is owned by the City and therefore no permanent easements or land purchases would be required. Design options may include the requirement of a temporary construction easement for access and early conversations with the landowner are in progress. The construction of the individual components of the treatment train can be constructed in phases. The following includes a concept plan along with a discussion of each practice proposed.

Figure 8 Soldier Creek Stream Restoration Practice Locations



Location/Source: North Urban #1 – Non-Point run-off (adjacent industrial lot, BHJ USA): flows to culvert from the west and drains east to existing wetland and creek.

- Proposed practices
  - Forebay
  - Bioretention Cell
  - Overflow/spillway to proposed wetlands/restored creek
- Pollution Source
  - Vehicular traffic accounts for much of the build-up of contaminants on road surfaces and parking lots. Wear from tires, brake and clutch linings, engine oil and lubricant drippings, combustion products and corrosion, all account for build-up of sediment particles, metals, and oils and grease. Wear on road and parking surfaces also provides sediment and petroleum derivatives from asphalt. Spills from traffic accidents can occur on any street or highway.
- Pollutants of Concern
  - Heavy metals (lead, zinc, copper, cadmium, mercury)
  - hydrocarbons (oil and grease, gasoline, cleaning solvents)
  - Salt (sodium, chloride)
  - Sediment

Location/Source #2: South Urban – Non-Point run-off (adjacent industrial lot, BHJ USA, road, field): flows to culvert to ditch to culvert under trail to ravine to drainage ditch to creek.

- Proposed practices
  - Forebay
  - Ravine restoration
  - Bioretention Cell
  - Overflow/spillway to proposed wetlands/restored creek
- Pollution Source
  - Vehicular traffic accounts for much of the build-up of contaminants on road surfaces and parking lots. Wear from tires, brake and clutch linings, engine oil and lubricant drippings, combustion products and corrosion, all account for build-up of sediment particles, metals, and oils and grease. Wear on road and parking surfaces also provides sediment and petroleum derivatives from asphalt. Spills from traffic accidents can occur on any street or highway.
- Pollutants of Concern
  - Heavy metals (lead, zinc, copper, cadmium, mercury)
  - hydrocarbons (oil and grease, gasoline, cleaning solvents)
  - Salt (sodium, chloride)
  - Sediment

Location/Source #3: Agricultural run-off, west of trail; overland flow:

- Proposed practices
  - Native prairie buffer
  - Gully restoration within buffer
- Pollution Source
  - Lawn and garden maintenance of all types of land uses including residential, industrial, institutional, parks, and road and utility right-of-ways accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied.
- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand

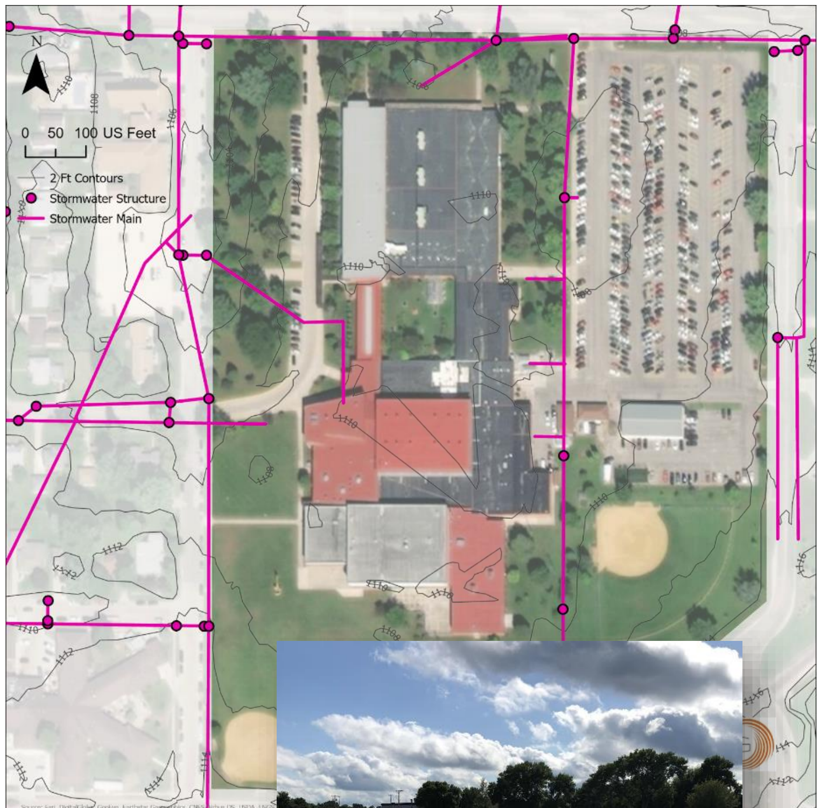
Location/Source #4: Agricultural run-off from upper reaches within the watershed. Drainage area is 30 sq. miles.

- Proposed practices
  - Soldier Creek Stream Restoration
  - Floodplain Connection
  - Restored/Stormwater Wetlands
  - Oxbows
- Pollution Source
  - Agricultural run-off from row cropped field, lawn and garden maintenance of all types of land uses including residential, parks, and road and utility right-of-ways accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.
- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Bacteria and viruses
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand

Small Urban Practices

Small urban practices were divided into two categories: 1) hardscapes (pervious pavement); and 2) infiltration practices (bioretention cells, bioswales, other). The City reviewed and ruled out areas where there were existing plans for future improvements or other conflicts existed.

Fort Dodge Senior High School Parking Lot



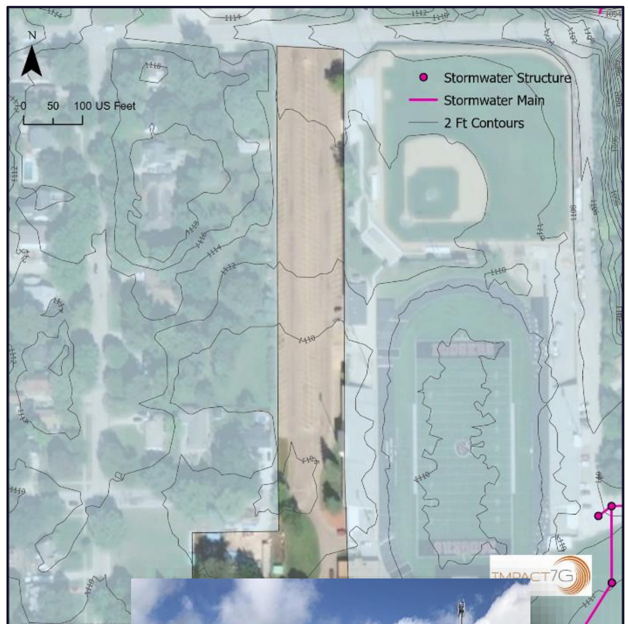
An additional water quality project identified through the watershed assessment would be to address the run-off from the high school parking lot which drains to one intake. Similar to the parcel discussed above, this would be a good area to improve aesthetics, reduce run-off and provide water quality improvement by treating run-off from the adjacent urban - residential lots. Again, numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere.

- Proposed practice options
    - Permeable Pavers
    - Bioretention Cells
    - Bioswale
    - Infiltration Trenches
- Pollution Source
    - Lawn and garden maintenance of all types of land uses including

residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.

- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Bacteria and viruses
  - Fertilizers and pesticides

Fort Dodge Community School District Stadium Parking Lot



The public-school district recently opened a smaller rocked parking lot to serve as additional parking for the main lot. Based on the watershed assessment, this would be a good area to improve aesthetics, reduce run-off and provide water quality improvement by treating run-off from the adjacent urban/residential lots.

The project achieves the City's first water quality goal by providing treatment of urban stormwater runoff and showcase a best management practices in a visible area along a well-used newly constructed trail system. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere.

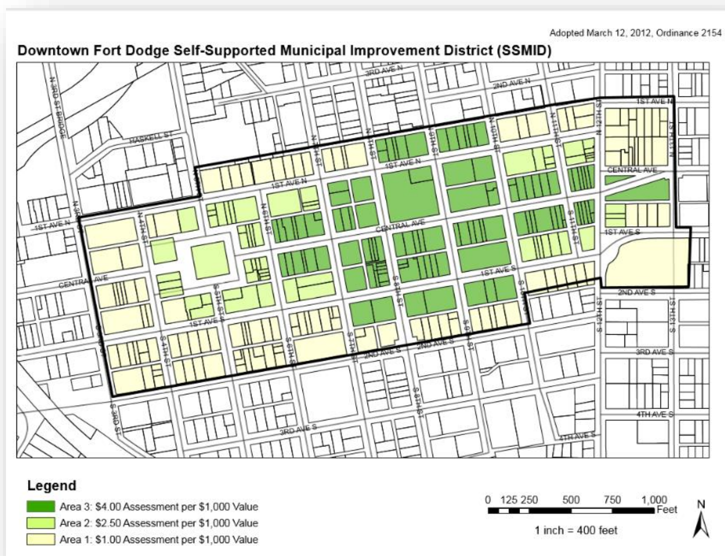
- Proposed practice options
  - Permeable Pavers
  - Bioretention Cells
  - Bioswale
  - Infiltration Trenches
- Pollution Source
  - Lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts

for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides, pet and wildlife feces and litter.

  - Runoff from residential driveways and parking areas can contain driveway sealants, oil, salt, and car care products.

- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Bacteria and viruses
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand·
  - Salts
  - PAHs
  - Hydrocarbons
  - Increased temperature

Main Street Fort Dodge Downtown Self-Supportive Municipal Improvement District (SSMID) & Laramar Parking Lot



As identified in the watershed assessment, the downtown corridor is highly impervious and heavily trafficked, which leads to large runoff volumes carrying vehicular pollutants. Several of the practices fall within the boundaries of the Downtown SSMID area (see figure on right). By focusing on this project area, the City achieves their water quality improvement goal by providing treatment of urban stormwater runoff. This project will also provide a great opportunity for the City to integrate several urban water quality best management practices in a highly visible area of town. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Thereby achieving the second water quality goal.

- Proposed practice options
  - Permeable Pavers
  - Bioswale, Bioretention Cells and/or Infiltration Trenches
- Pollution Source
  - Lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides can all contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.
  - Runoff from residential driveways and parking areas can contain driveway sealants, oil, salt, and car care products.
- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Bacteria and viruses
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand·
  - Salts & PAHs
  - Hydrocarbons
  - Increased temperature

Cost Estimates

The projects described above have varying degrees of costs associated to each of them and can be completed in different phases given available resources. Table 1 provides a snapshot breakdown of costs per each selected project area, including the proposed practices, estimated area, cost per square feet, annual maintenance costs, and total estimated costs.

The stream restoration is a multi-dimensional treatment train and each practice incurs a range of costs, and the overall estimated cost is near $1.5M. Impact 7G has submitted an SRF application in coordination with the City of Fort Dodge and McClure Engineering to fund this project and currently await the results.

The smaller urban areas are also highlighted here and primarily focus on the costs to install permeable pavers to replace impermeable asphalt in the parking areas and bioretention cells installed within the permeable paver area. Costs may vary, however, the resources used to determine the average cost of permeable pavers were gathered from the Wisconsin DOT Transportation Synthesis Report published in 2012, "Comparison of Permeable Pavement Types: Hydrology, Design, Installation, Maintenance and Cost", and the Center for Neighborhood Technology's (CNT), "Green Values, National Stormwater Management Calculator". The Minnesota Stormwater Manual was used to verify general specifications of the bioretention areas and the estimated annual maintenance costs. Bioretention cells required a more nuanced approach in order to capture excavation costs, topsoil, grading, hauling, and the costs of the pavers. The Minnesota Stormwater Manual also provides a Bioretention Cost Estimate Worksheet that was applied in this report to estimate costs for these smaller urban practices. Annual maintenance costs are also included here and reflect the need for permeable pavers to be vacuumed out four times a year and general weeding and maintenance of the bioretention areas.

Table 1: Summary Table of Estimated Costs per Project Area

Project Area	Practices	Estimated Area	Cost per ft^2	Annual Maintenance Cost	Total Estimated Cost
Soldier Creek	Stream Restoration	28 Acres	Range based on practices	Range based on practices	$1.5M
HS Parking Lot	Permeable Pavers	4.85 Acres	$12.23	$500	$2.58M
	Bioretention Cells	36,000 ft^2	Worksheet	$200	$3.5M
CSD Parking Lot	Permeable Pavers	2.82 Acres	$12.23	$500	$1.5M
	Bioretention Cells	10,980 ft^2	Worksheet	$200	$468,200
SSMID Laramar Lot (14 Parcels)	Permeable Pavers	2.91 Acres	$12.23	$500	$1.5M
	Bioretention Cells	208 ft^2	Worksheet	$200	$251,525

Estimated Costs for Total Small Urban Practices

Table 2 provides aggregated information for all small urban practices found in the city limits that adhere to parameters ideal for raingardens and permeable paver parking lots. Raingardens are smaller bioretention cells that residents can install to capture stormwater runoff from their rooftops or driveways. These BMPs tend to be smaller in size and this table is estimating an average size of 200ft^2 that can be one larger raingarden or two smaller raingardens depending on the aesthetic desires of the homeowner. 126 parcels have been identified as eligible for this practice and with an average cost of \$15 per ft^2 the estimated total cost would be around \$756,000. The average cost of \$15 per ft^2 is within the range referenced in the University of Connecticut Center for Land Use Education and Research's (CLEAR) NEMO Program. The average estimated costs for permeable pavers are aligned with the data sources mentioned above.

Cost-Share Programs

Several cities in Iowa provide a cost-share program for homeowners and commercial businesses to implement these types of BMPs. A cost share program is typically configured with the city incurring a certain percentage of the cost to implement a BMP up to a certain dollar amount. For instance, Iowa City has a Best Management Practices quality program that covers the costs of materials such as plantings, rock, and contractor labor for rain gardens, pervious pavement, soil quality restoration, and bioswale projects. The program is open to residents on a first-come, first-served basis and pays 50% up to \$3000 for infiltration practices. The city also requires that the designs must follow the standards set forth in the Iowa Stormwater Manual. The Estimated Cost to Owner column reflects the specific data found in this report for the residents of Fort Dodge.

Table 2: Estimated Costs for Total Small Urban Practices

Practices	Total # of Parcels	Average Size	Average Cost per ft^2	Estimated Total Cost	Estimated Cost to Owner
Total Small Practices (Raingardens)	126	200 ft^2	\$15	\$756,000	\$3,000
Total Hardscape Practices (Permeable Pavers)	55	0.55	\$12.23	\$16.1M	\$293,000

Sponsored Project Application

City of Fort Dodge, Iowa

September 3, 2019

Prepared by:

Table of Contents

Section 3: Information on the Identified Watershed and Water Quality Issues

(Summarize the information here and expand or add documentation, maps, monitoring data, and other data in the project conceptual plan attached to this application as shown in Section 7.)

Name of Waterbody:	Soldier Creek and urban areas in watershed
HUC Number and Name (where both wastewater utility and waterbody are located)**:**	HUC-12 (071000040601); Soldier Creek – Des Moines River
Uses for the Waterbody (e.g. recreation, drinking water, other):	Agricultural drainage, industrial, urban and rural stormwater runoff. Designated as Class A1 Recreation: Primary Contact; Class B(WW-1) Aquatic Life: Warm Water Type 1
Water Quality Concerns (e.g. sediment, bacteria, nutrients):	Ag-dependent nutrient loading and sediment loading from various land use stormwater.
Sources of Water Quality Data (e.g. DNR water monitoring, IOWATER, US Geological Survey, utilities, other):	DNR water monitoring
Nonpoint Source Contributions to Water Quality Concerns (e.g. urban stormwater, soil erosion, livestock operations, other):	Agricultural drainage, rural and urban stormwater.
Primary Water Quality Goal of the Sponsored Project:	Reduce nutrient and sediment loading from rural agricultural drainage, stormwater, and urban stormwater tributaries

Section 4: Brief Summary of Proposed Water Resource Restoration Sponsored Project

Describe the scope of the proposed project (i.e., specific solution to the water quality problem). Summarize the process of analyzing and selecting the most appropriate nonpoint source practices relating to the unique issues and characteristics of the identified waterbody and planning area. Provide additional detail in the attachments to this application.
The City has focused on the Soldier Creek watershed to address water quality impacts related to agricultural, urban and industrial land-use stormwater. Through analyzing DNR water monitoring and the success of other regional best management practices, consultants have identified city-owned parcels which would be most feasible for water quality project implementation. Webster County has some of the most drainage districts for any county in the state and they use this tributary as an outlet for crop production so those, in conjunction with other land-uses leads to a unique and scalable scenario for multiple best management practices.

Section 5: Water Quality Organization(s) Involved in Project Planning

Organization	Contact Person	Email Address
Polk/Buena Vista Soil & Water Conservation District	Jennifer Welch Hannah Vorrie	jennifer.welch@ia.nacdnet.net hannah.vorrie@ia.nacdnet.net
City of Fort Dodge	Tony Trotter	ttrotter@fortdodgeiowa.org
Webster County Conservation	Matt Cosgrove	mcosgrove@webstercounty.ia.org
McClure Engineering	Luke Hugghins	lhugghins@mecresults.com
Impact 7G	Judy Joyce	jjoyce@impact7g.com

Section 6: Qualified Entity Information

Is the applicant proposing to enter into an agreement with a qualified third party entity to implement the sponsored project?

☒ No		
☐ Yes	Organization:	

Section 7: Sponsored Project Cost

Cost Category	Total Estimated Project Costs	Costs to be Covered from Other Funds	Costs to be Allocated from Up to 1% of SRF Loan Interest
Land and Easements			
Relocation Expenses			
Professional Planning Fees	$50,000		$50,000
Professional Design Fees	$240,000		$240,000
Professional Construction Fees	$60,000		$60,000
Construction	$1,000,000		$1,000,000
Equipment			
Miscellaneous			
Bond Counsel Fees			
Contingencies	$150,000		$150,000
		TOTAL	**$1,500,000**

1. Watershed Assessment

The City of Fort Dodge is located at the confluence of 6 HUC 12 watersheds. This project will focus on HUC-12 (071000040601); Soldier Creek – Des Moines River watershed. This watershed includes a segment of Soldier Creek (IA 04-UDM-0290_0) that was originally listed in 2006 as a Category 5b Impaired Waterbody, listed in Section 303(d) by the Iowa Department of Natural Resources. In 2016, it was moved from impairment Category 5b of Iowa's Integrated Report to Category 3a (designated use not assessed).

The upper reaches of the watershed consist of agricultural lands draining through intermittent and perennial streams flowing into the headwaters of Soldier Creek transitions from agricultural land to urban near the city limits. Soldier Creek originates in far northern Humboldt County as Drainage Ditch (DD) 7 then flows southerly into Webster County as DD 247, from there DD 247 becomes Soldier Creek and meanders through Fort Dodge and discharges into the Des Moines River. The creek/DD measures 19.1 miles in length and encompasses approximately 23,400 acres of watershed area with approximately 21,000 acres (90%) planted to agricultural crops (Appendix C1).

This project will focus on the Soldier Creek section located within Fort Dodge city limits.

1.1 Watershed Quality Concern

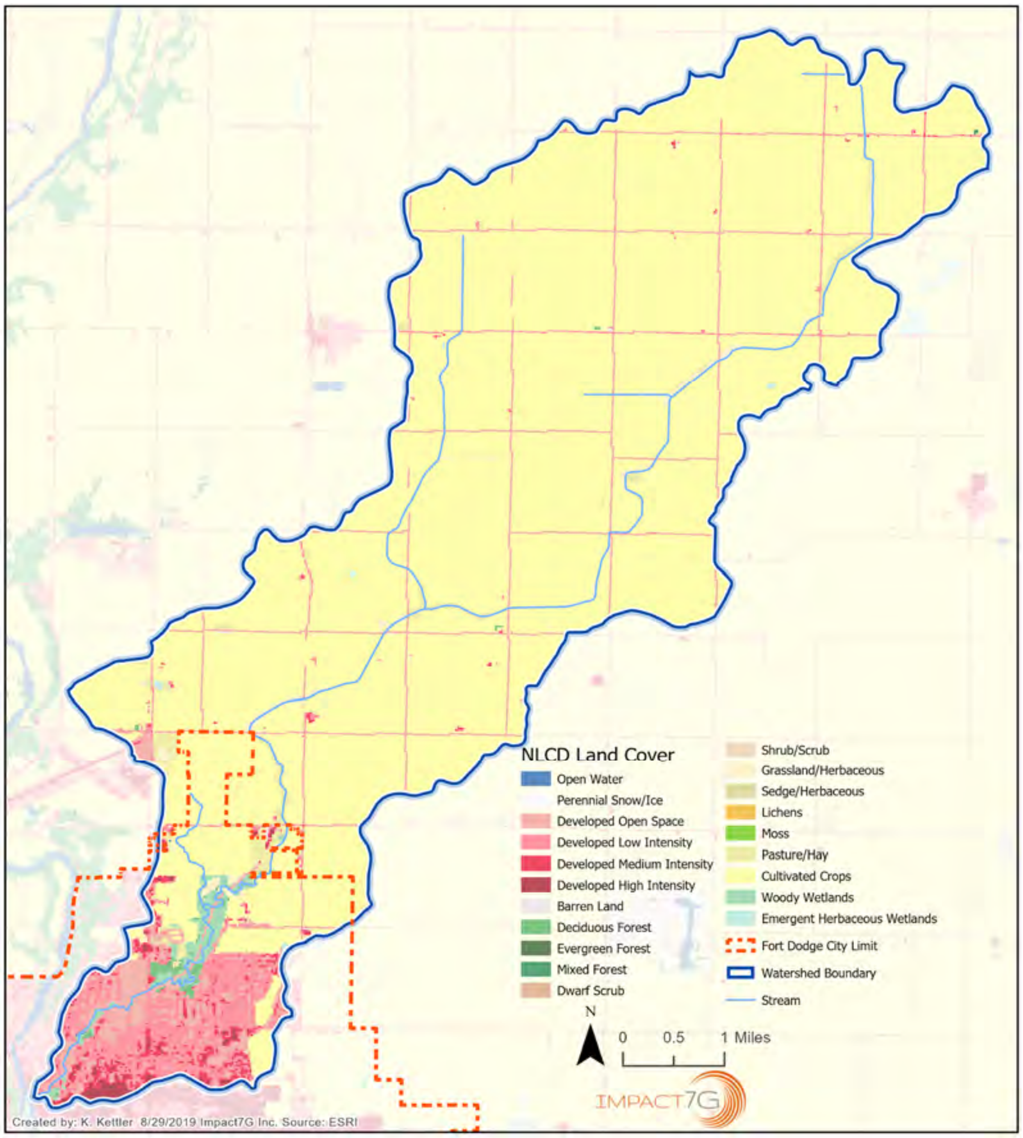
The primary concern is run-off from agricultural lands in the upper part of the watershed flowing into Soldier Creek which flows to the Des Moines River. In addition, urban run-off from a high concentration of impervious surfaces located in the lower reaches of the watershed is also a concern. Managing both rural and urban stormwater run-off is important to the city of Fort Dodge as any untreated sediment, nutrients, chemicals will be conveyed to the Des Moines River.

1.2 Water Quality Objectives

The main objective is to improve the water quality of Soldier Creek by restoring the reaches at the north end of the city along the rural-urban interface. Second objective is to reduce run-off in urban areas and treat the water quality volume throughout the community where people live, work, and recreate.

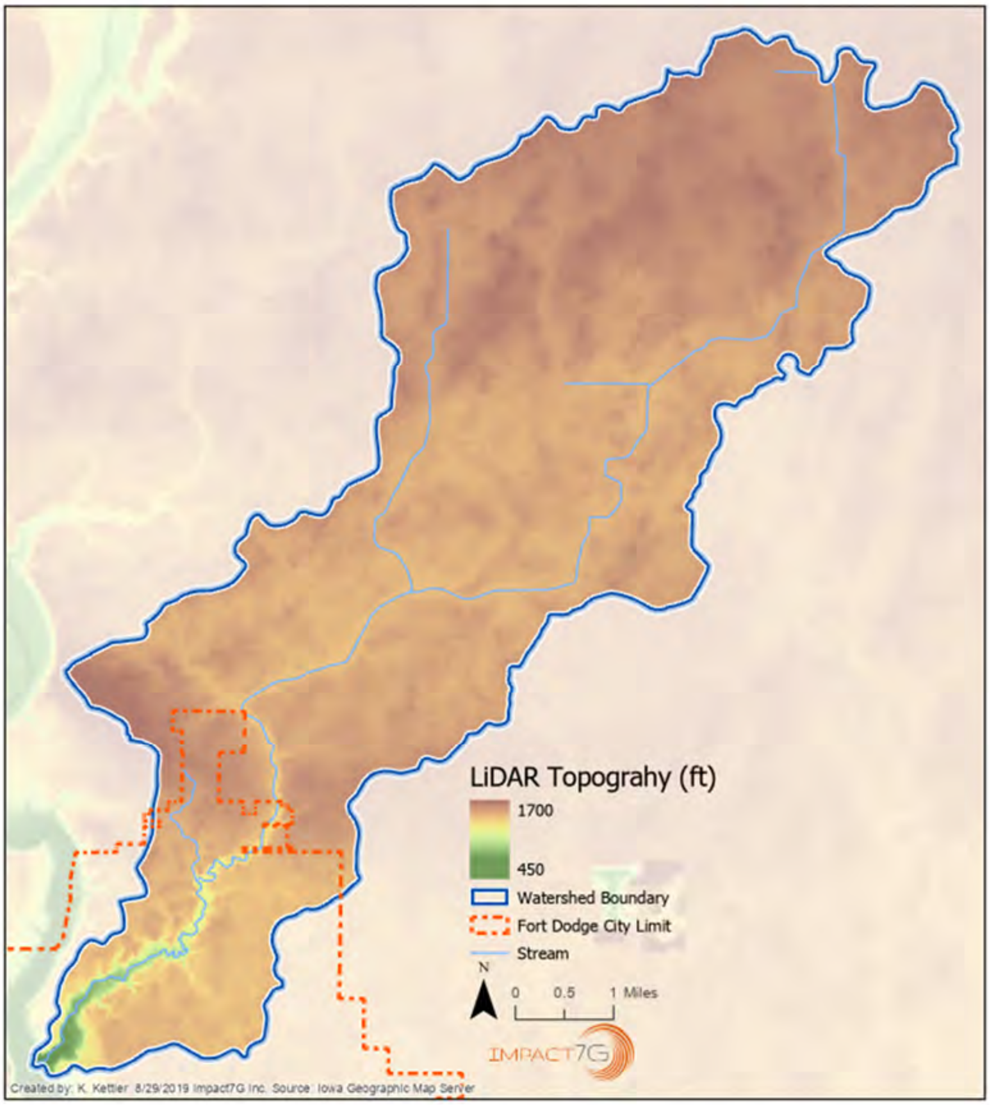
1.3 Watershed Inventory

The project area is located within the Soldier Creek- Des Moines River HUC-12 (071000040601) with a drainage area of approximately 35 square miles. Approximately thirty square miles of the watershed is upstream of the city limits. The majority of the run-off in the watershed, approximately 90%, is from agricultural lands (row-crop). The lower section of the watershed is medium to high density urban development within the city of Fort Dodge. Note, the west tributary of Soldier Creek is designated as Lateral Ditch Number 1.



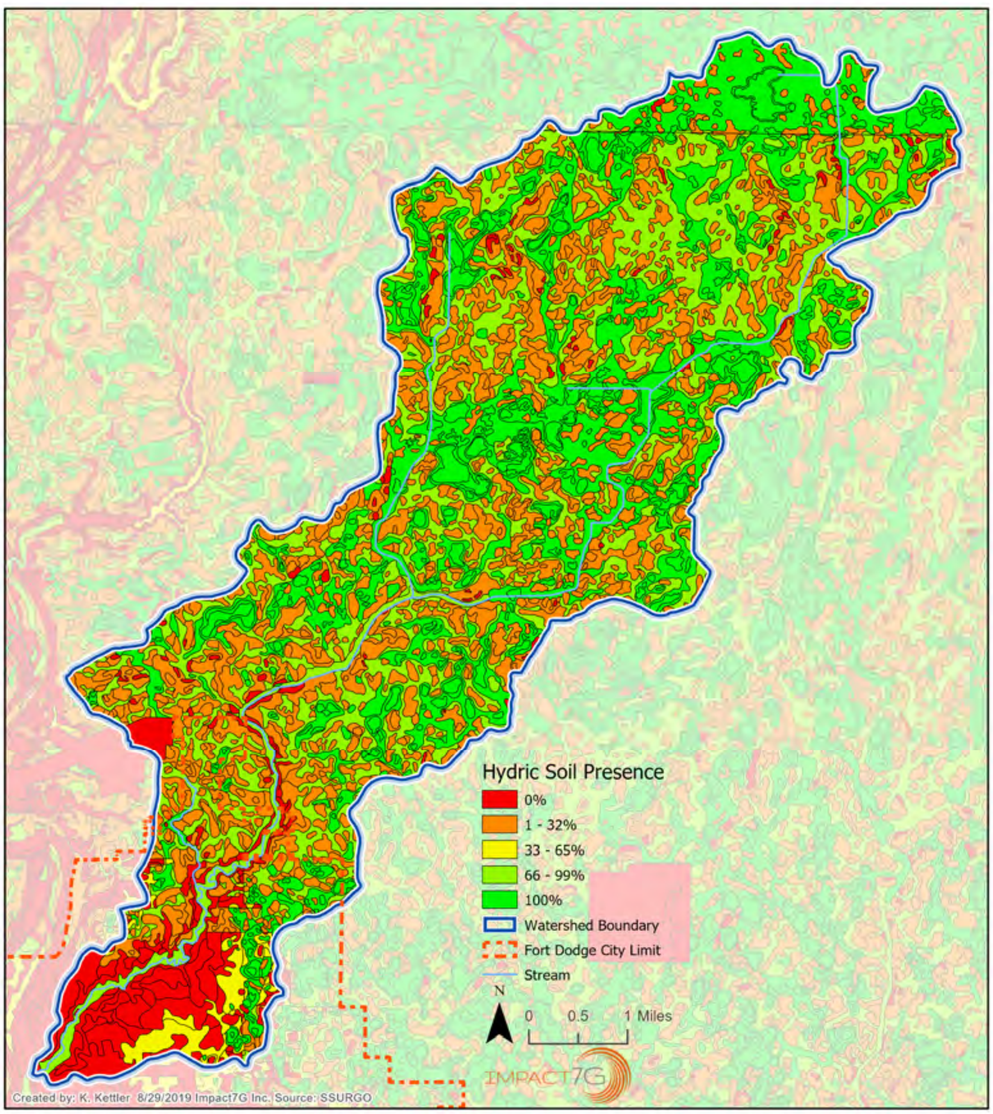
Topography

Like most of Webster county, this watershed is moderately sloping, but in small areas, particularly along Soldier Creek and other streams, slopes can be steep or very steep. The highest point within the watershed lies at an elevation >1155 feet, and the lowest point is <1107 feet.



Hydric Soil Presence

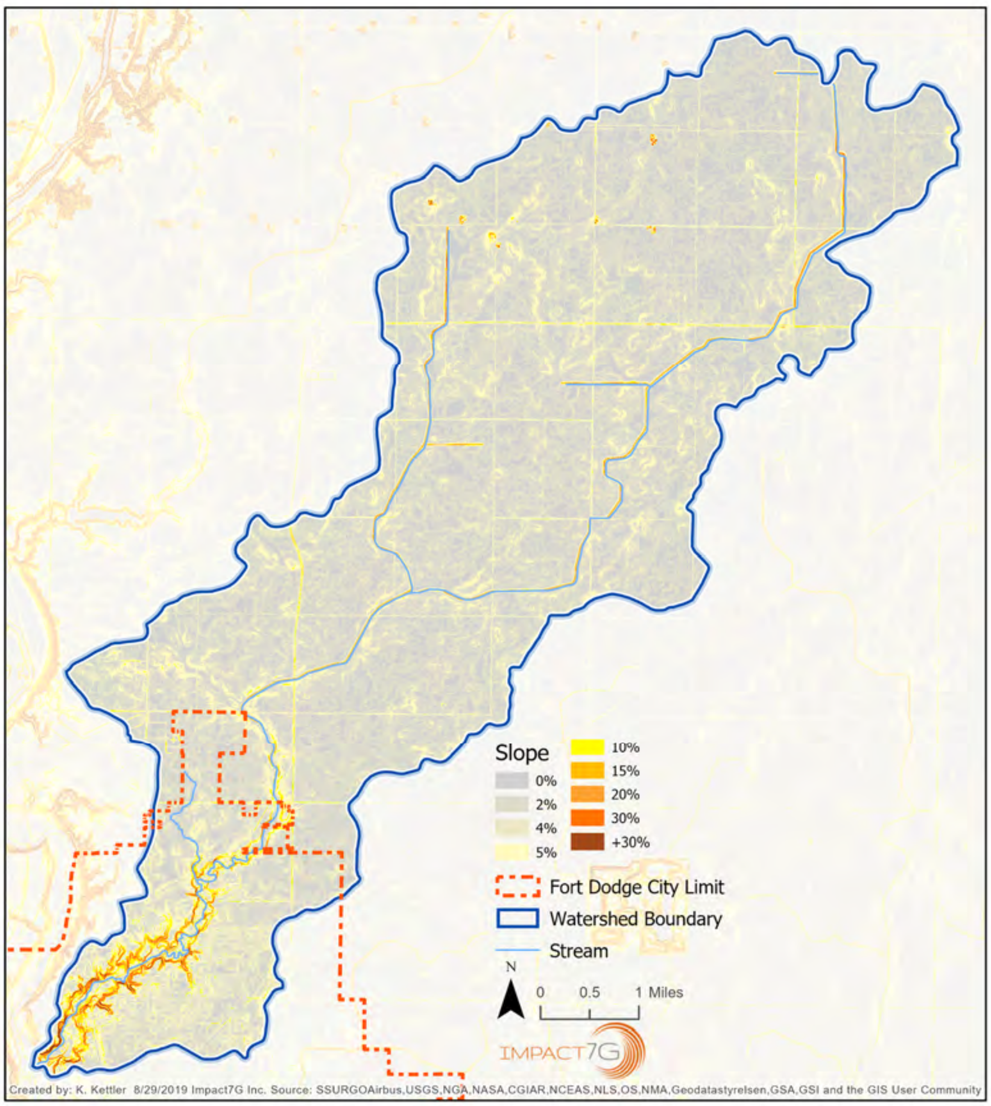
A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil. They indicate that the site is a wetland or historically a wetland (prior converted). One of the most important benefits that wetlands provide is their capacity to maintain and improve water quality. When healthy, wetlands have a rich natural diversity of plants and animals. These can act as filtering systems, removing sediment, nutrients and pollutants from water. The capacity of wetlands to maintain and improve water quality is under threat because human activity and extreme weather conditions have had a significant impact on water flows, nutrient balance and biodiversity. Hydric soils and/or soils that have hydric inclusions are found throughout the watershed with the exception of the well-drained (shown in



red) areas along the steeper, well drained slopes associated with Soldier creek and other streams.

Slope

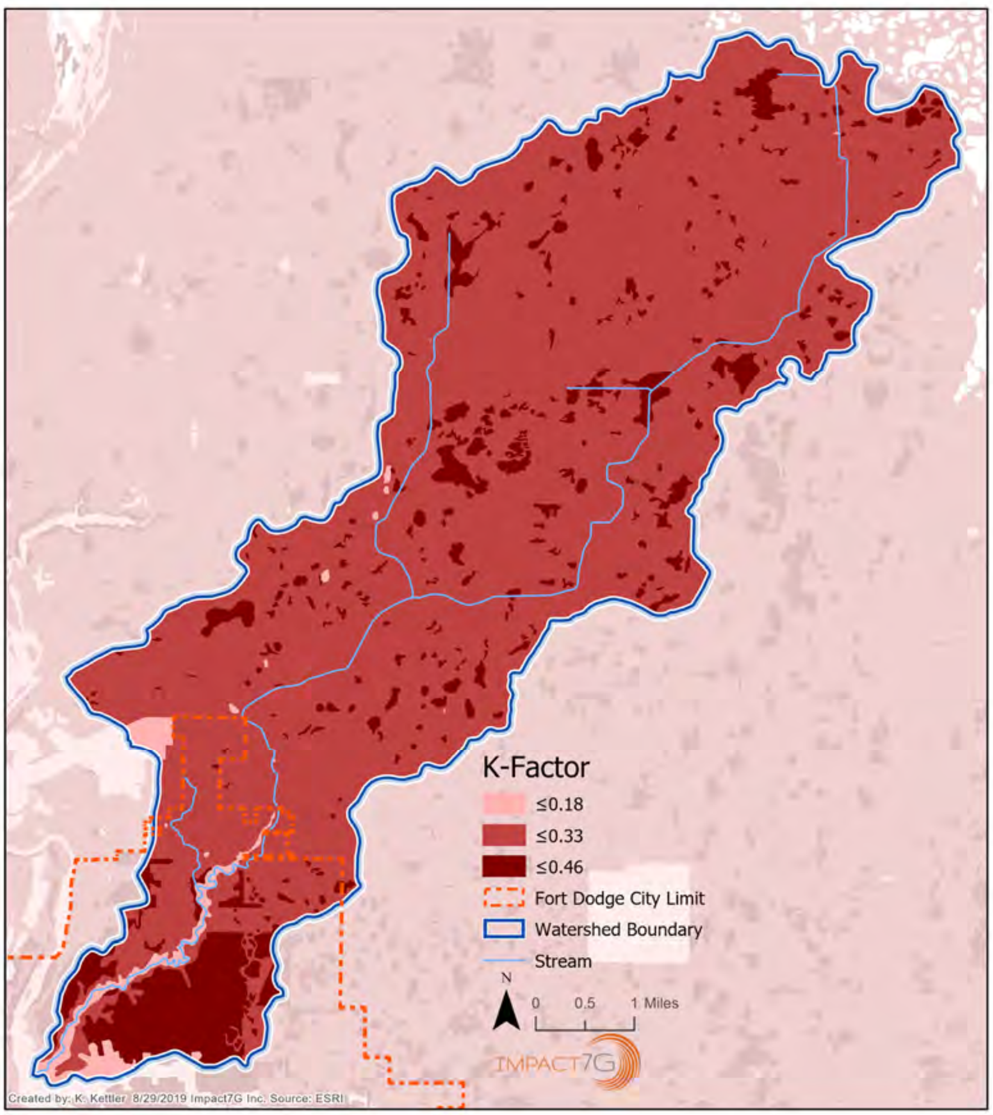
As previously mentioned, this watershed is moderately sloping, but in small areas, particularly along Soldier Creek and other streams, slopes can be steep or very steep. Slopes steepen as you go from the headwaters of Soldier Creek down to its confluence with the Des Moines River.



Run-off (K-Factor)

K-factor is soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition. Soils high in clay have low K values, about 0.05 to 0.15, because they are resistant to detachment. Coarse textured soils, such as sandy soils, have low K values, about 0.05 to 0.2, because of low runoff even though these soils are easily detached. Medium textured soils, such as the silt loam soils, have moderate K values, about 0.25 to 0.4, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having a high silt content are most erodible of all soils. They are easily detached; tend to crust and produce high rates of runoff. Values of K for these soils tend to be greater than 0.4.

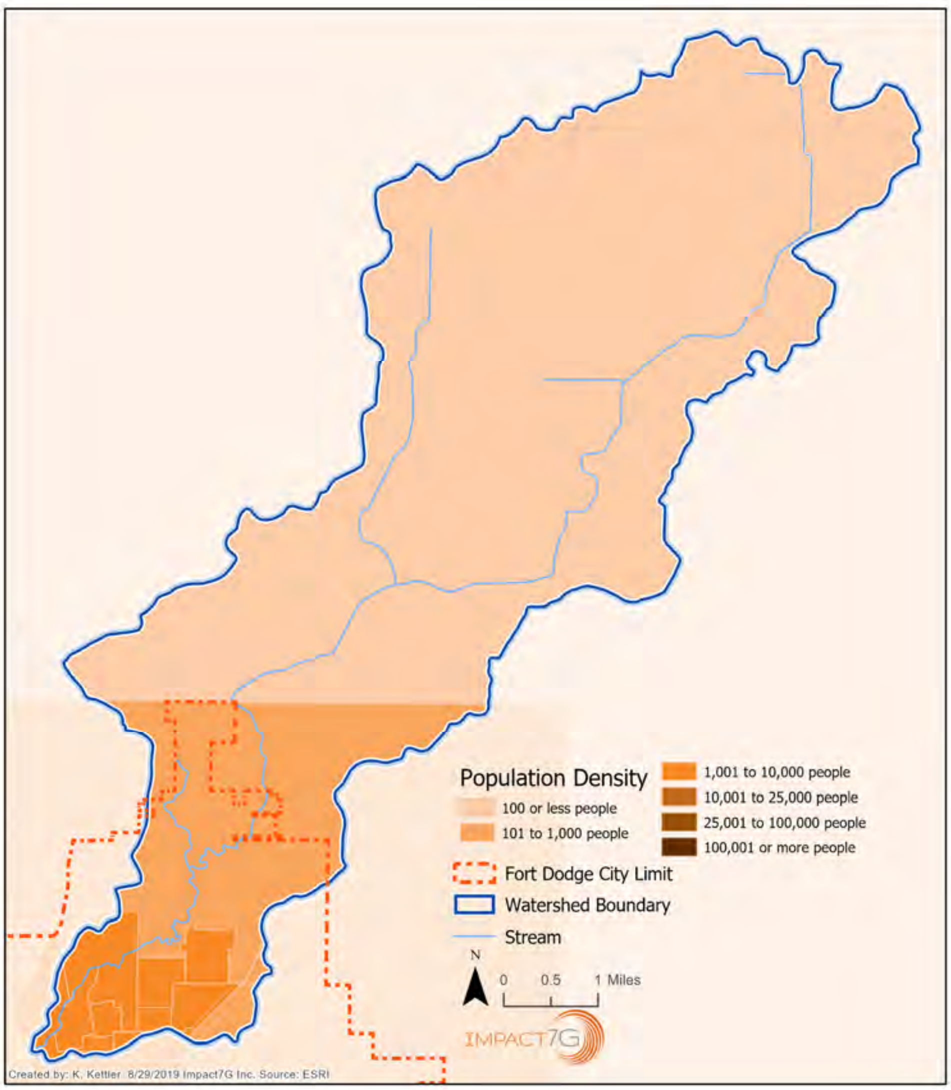
The K-factor for this watershed shows that much of the land produces moderate run-off with some areas producing high rates of runoff.



Population Density

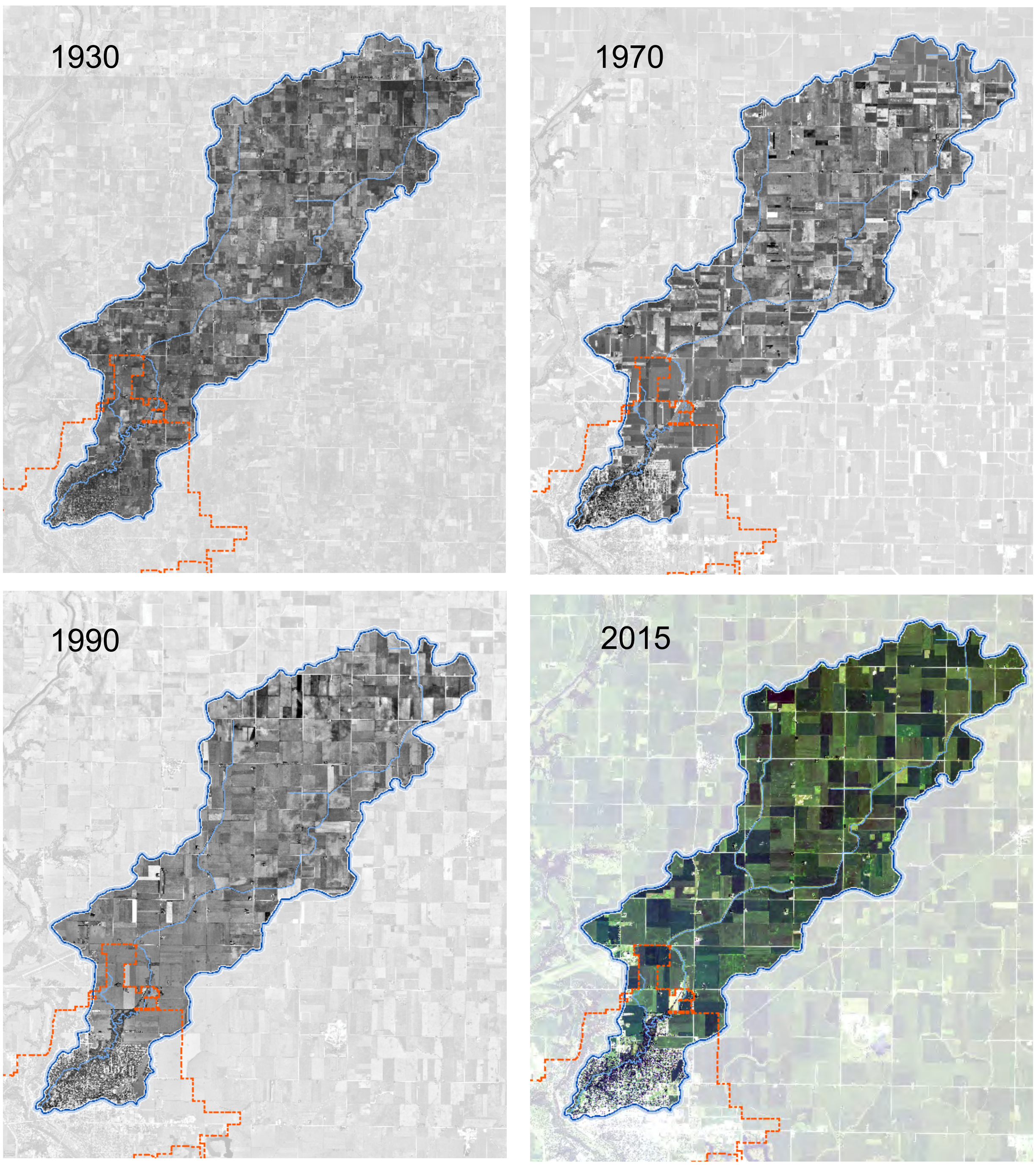
The population density within the majority of the watershed is between 0 and 100 people per square mile. The City of Fort Dodge has a population density of over 1,000 people per square mile within its residential districts. The watershed population is estimated at 11,425 based on 2010 U.S. Census data.

Fort Dodge is the largest municipality in Webster County in both land area (16.3 square miles) and population (24,098 2018 estimate). As of the census of 2010, there were 25,206 people, 10,275 households, and 5,850 families residing in the city. The population density was 1,570.5 inhabitants per square mile (606.4/km^2). There were 11,215 housing units at an average density of 698.8 per square mile (269.8/km^2).



Historic Aerial Images

The Soldier Creek- Des Moines River HUC-12 (071000040601) watershed has seen significant land use change since the 1960's as upland pasture and deciduous forest has been steadily replaced by residential housing, traditional lawn, and large-scale agricultural production. Historical aerial photographs of the watershed area from 1930 through 2015 are provided below.



2. Project Goals & Objectives

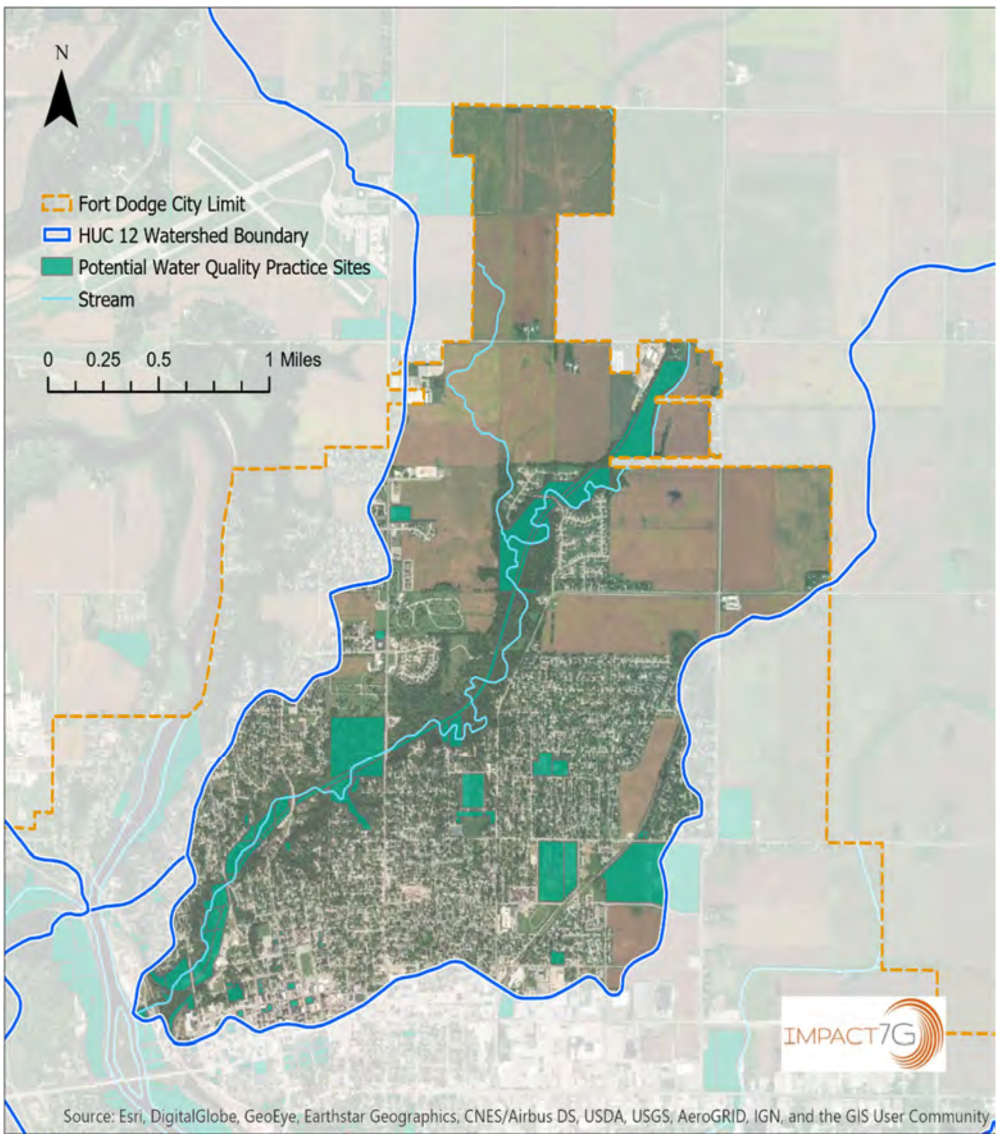
Fort Dodge is committed to improving in-stream water quality by implementing projects that achieve the following goals and objectives:

1. Improve and Enhance streambank conditions in an urban and rural transition area.
    a. Address erosion and sediment deposition into the stream; improving downstream water quality
    b. Enhance current vegetation to include drought and flood resilient plant/tree species
    c. Re-meander waterway to slow water velocity and encourage sediment deposition and improve erosion of creek banks.
2. Protect and Enhance Water Quality within the City; ultimately improving this resource for human and wildlife interaction and aquatic habitat downstream.
    a. Address urban water quality within the city limits.
    b. Employ urban water quality practices to improve surface runoff within city limits.
    c. Seek additional opportunities to incorporate urban water quality practices for increased water quality improvements.
3. Implement Water Quality Practices to showcase good stewardship for residents and future developers within and around the City.
    a. Showcase urban water quality practices within the city limits.
    b. Educate residents on the function, benefits, and importance of urban water quality practices.
    c. Encourage incorporation of additional voluntary water quality practices from residents.
    d. Encourage incorporation of water quality practices

3. Evaluation of Potential Water Quality Practices

In order to assess where potential water quality improvement practices could be implemented, the project team conducted a city-wide evaluation of city-owned/public parcels. Utilizing ArcGIS, staff were able to perform a spatial analysis of several data layers: 2-foot Contours, Flood Zones, Roadways, City Limits, and Soil Survey data. The river and creek boundaries were created using a 120' buffer analysis from the stream centerline in order to capture water-prone parcels along these waterbodies. Our team evaluated over 450 parcels of land owned by the city and then identified where adjacent overflow run-off could be intercepted and/or storm sewer lines could be intercepted for water quality treatment.

Once the spatial analysis was complete, maps were created to help staff identify potential project locations and subsequent practices within these targeted areas.



Two categories of parcels were identified for this project:

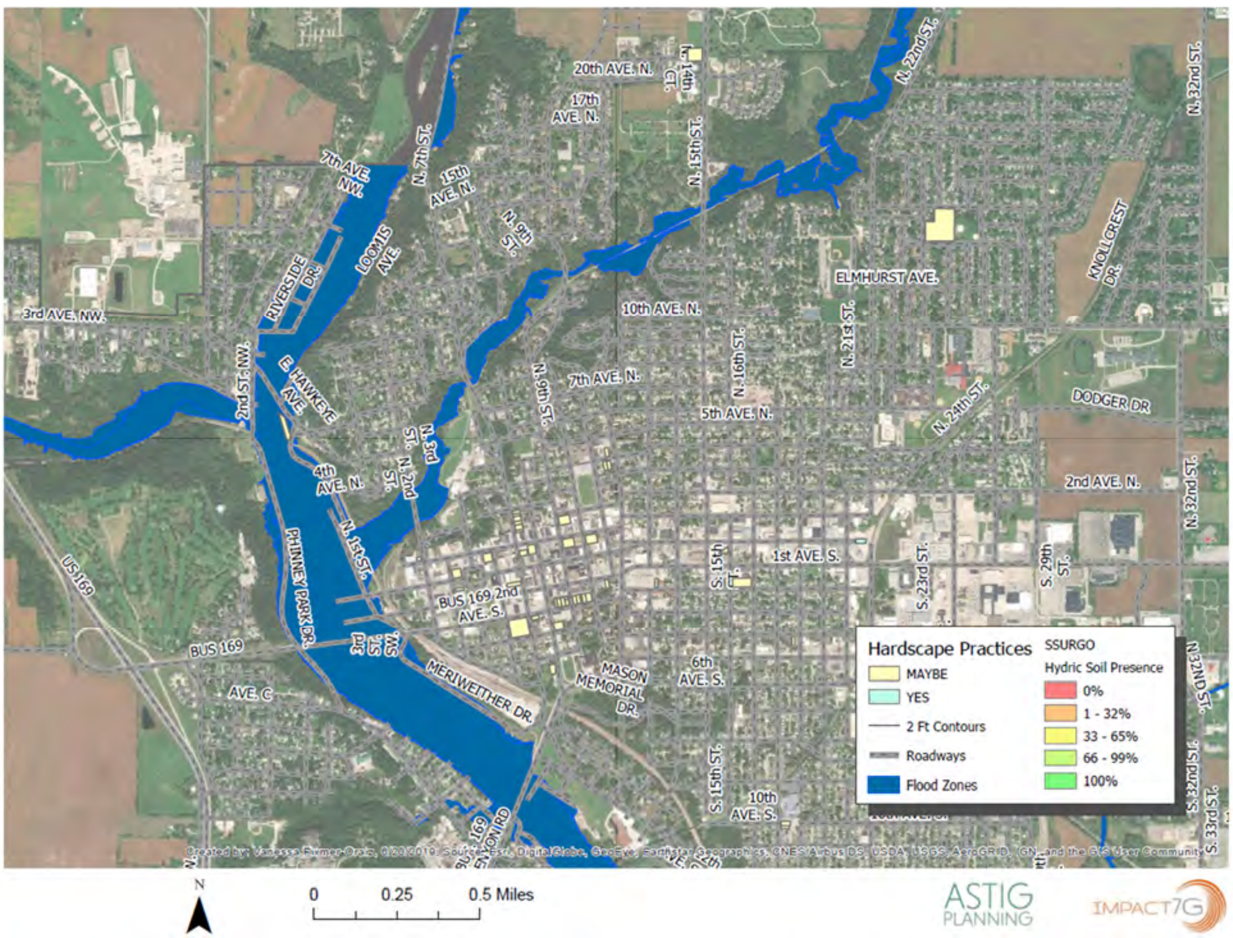
1) Potential Urban-Rural Interface Parcels –Indicates that a large parcel or group of parcels contained hydric soils, adjacent to waterbody, and/or contained storm sewer infrastructure.
    a. Potential Practices – Streambank restoration, stormwater wetlands
2) Potential Urban Small Parcels – includes parcels that are vacant, smaller grassy area, or large/narrow easements along impervious surfaces.
    a. Practices – Permeable Pavers, Bioretention Cells, Bioswales

Parcels adjacent to Soldier Creek that were identified for stream restoration/floodplain reconnection.

City Review Process

This analysis was reviewed by City staff and priority areas were determined for this project. City staff were able to indicate where newly paved parking lots prohibited the implementation of small urban practices, such as permeable pavers. Areas where there were existing projects or future development is anticipated were ruled out. The urban-rural interface projects align with the extensive trail network the City has invested in and continues to expand, which are bolstered by access to natural streambank restoration aspects.

Potential Small Urban Practices Near Downtown SSMID – Prioritization of practices by City Staff and Engineers.



3.1 Urban-Rural Interface Practices

The following water quality practices are being proposed as part of this project based on analysis of existing conditions, objectives of the community, available space and cost effectiveness.

Note, Information about advantages and disadvantages of best management practices has been compiled from a variety of resources including previously submitted SFR applications, the Iowa Stormwater Manual and the Minnesota Stormwater Manual. Additional floodplain restoration information was summarized from “Floodplain Restoration and Stormwater Management: Guidance and Case Study” by CRWP and Biohabitats, 2009.

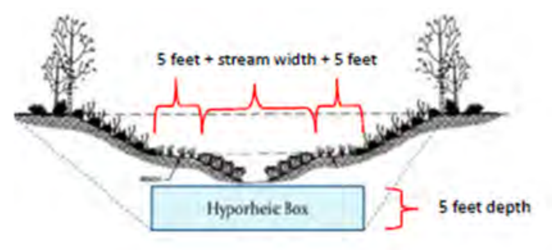
1) <u>Stream Restoration and Floodplain Reconnection</u>
A floodplain is a flat or nearly flat lowland bordering a stream or river that experiences occasional or periodic flooding. The floodplain corridor acts as the “right-of-way” for a stream and functions as an integral part of the stream ecosystem. Floodplains perform important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and prevention of erosion. In addition, floodplains provide habitat for wildlife, recreational opportunities, and aesthetic benefits. Ideal floodplain conditions are rarely encountered in urban or disturbed watersheds; many floodplain functions have been lost to agricultural uses and more recently to urban and suburban development. Floodplain restoration is the process of fully or partially restoring a stream’s access to its floodplain to return those valuable floodplain functions. There are multiple types of floodplain restoration:

- Hydrologic. Reconnecting the stream to the floodplain and restoring the stream’s natural hydrology.

- Vegetative. Removing invasive species and replanting native plant communities appropriate to the site and conditions.

- Habitat Restoration. Installing structures to improve wildlife habitat. Habitat is also gained through re-planting native plant communities.

Advantages of reconnecting the floodplain



- **Improve Water Quality**: Floodplains act as natural filters, absorbing harmful chemicals and other pollution, making rivers healthier for drinking and swimming, and for plants and animals. This includes Denitrification in the Hyporhiec zone.
- **Storing and slowing floodwaters:** When a river floods, water spreads across the floodplain and slows down. Without floodplains, rivers would

rise and move faster, just as water from a hose moves faster when you hold your finger over part of the opening.

- **Nurturing life:** Floodplains are a productive environment for plants and wildlife and serve as nurseries for many species of fish. They provide vital habitat and are important for maintaining the web of life.
- **Recharging groundwate**r: During floods, water can replenish groundwater supplies. Capturing flood water during wet years is one of the best ways to ensure adequate groundwater during droughts.
- **Reduce erosion by stabilizing stream banks:** Reduce bank erosion and soil loss.
- **Reduce Phosphorus export:** a restored wetland-channel complex and two-stage ditch, a popular form of floodplain reconnection in agricultural areas, reduces phosphorus export

Limitations:
Changes in watershed hydrology due to urbanization reduces effectiveness of “stream only” projects • Functional improvement is limited in developed areas without other prevention and restoration measures. Should be part of a treatment train with pre-treatment practices up stream.

2) <u>Stormwater Wetlands</u>
Constructed stormwater wetlands are used to remove a wide spectrum of pollutants from urban stormwater runoff while providing wildlife habitat and aesthetic features. These features can also be designed to reduce peak runoff rates. Stormwater wetlands are typically installed at the downstream end of the treatment train (they are considered an end-of-pipe BMP). Stormwater wetland size and outflow regulation requirements can be significantly reduced with the use of additional upstream BMPs. However, when a stormwater wetland is constructed, it is likely to be the only management practice employed at a site, and therefore must be designed to provide adequate water quality and water quantity treatment for all regulated storms (MPCA 2019)

Advantages:

- Improves water quality through removal of stormwater pollutants, emulate natural systems to minimize flooding, create wildlife habitat in urban areas. Constructed wetlands are estimated to remove as much as 73% of TSS, roughly 38% of phosphorus loading, 30% nitrogen loading, 70% of heavy metals, 80% of suspended hydrocarbons and 60% of harmful bacteria from stormwater runoff (MPCA 2019)

Disadvantages:

- May need large developable areas in order to be effective,
- can become a nuisance if not managed properly,
- can be difficult to establish native wetland plant species.
- They require more land than other practices;
- They require careful design and planning to ensure wetland hydrology is maintained

- Water quality behavior can change seasonally

3.2 Urban Small Practices

Smaller urban practices were divided into two categories: 1) hardscapes (pervious pavement); and 2) infiltration practices (bioretention cells, bioswales, other). The City reviewed and ruled out areas where there were existing plans for future improvements or other conflicts existed.

3) Permeable Pavers (Large Areas)
   This practice allows water to slowly infiltrate through spaces between paver blocks instead of shedding stormwater from the surface to be collected by a traditional storm sewer system. Subsurface rock storage support permeable pavers while also providing pore spaces which infiltrate water and filter pollutants before reaching a subdrain at the bottom of the system. Along with improving water quality, permeable pavers also reduce peak flow and slowly discharge water into the storm sewer system.

   Advantages:
   High level of pollutant removal, reduction of stormwater runoff volume, appropriate for cold climates, pavers can be removed and replaced. Permeable pavement is estimated to remove on average 74% of TSS and 45% of phosphorus loading.

   Disadvantages:
   Higher install cost, increased maintenance, potential for groundwater contamination, and requires minimum soil infiltration rate or an underdrain system

4) Bioretention Cells (Biocells)
   Biocells are landscaped depressions used to slow and treat on-site stormwater runoff. Stormwater is directed to the basin then percolates through the system over a period of 24 hours where it is treated by a number of filter layers. Native plants with deep root structures are integral to bioretention basins and aid nutrient and water uptake. The slowed, cleaned water is allowed to infiltrate native soils or directed to a subdrain at the bottom of the system.

   Advantages:
   Capable of being a landscape feature, very effective in removing urban pollutants, can reduce runoff volumes and rates, suitable for multiple locations, can be effective in highly impervious areas with correct engineering and adequate space, good retrofit technique. Bioretention is estimated to remove as much as 94% of TSS and between 60-85% of phosphorus loading.

   Disadvantages:
   Higher install cost, increased maintenance, potential for groundwater contamination, and requires minimum soil infiltration rate or an underdrain system.

5) Bioswales

This practice consists of constructing an engineered swale by excavating a trench that is backfilled with engineered soils and filter aggregate. Native vegetation is planted throughout the swale to assist in water and nutrient uptake while also stabilizing the swale and preventing soil erosion. Bioswales are designed to infiltrate smaller rainfall events and safely convey larger rainfall events to adjacent systems.

Advantages:

Improves water quality through removal of sediment and urban runoff pollutants, typically cheaper than traditional storm sewer piping, can recharge groundwater through infiltration, can be a landscape feature. Bioswales are estimated to remove as much as 68% of TSS and roughly 30% of phosphorus loading.

Disadvantages:

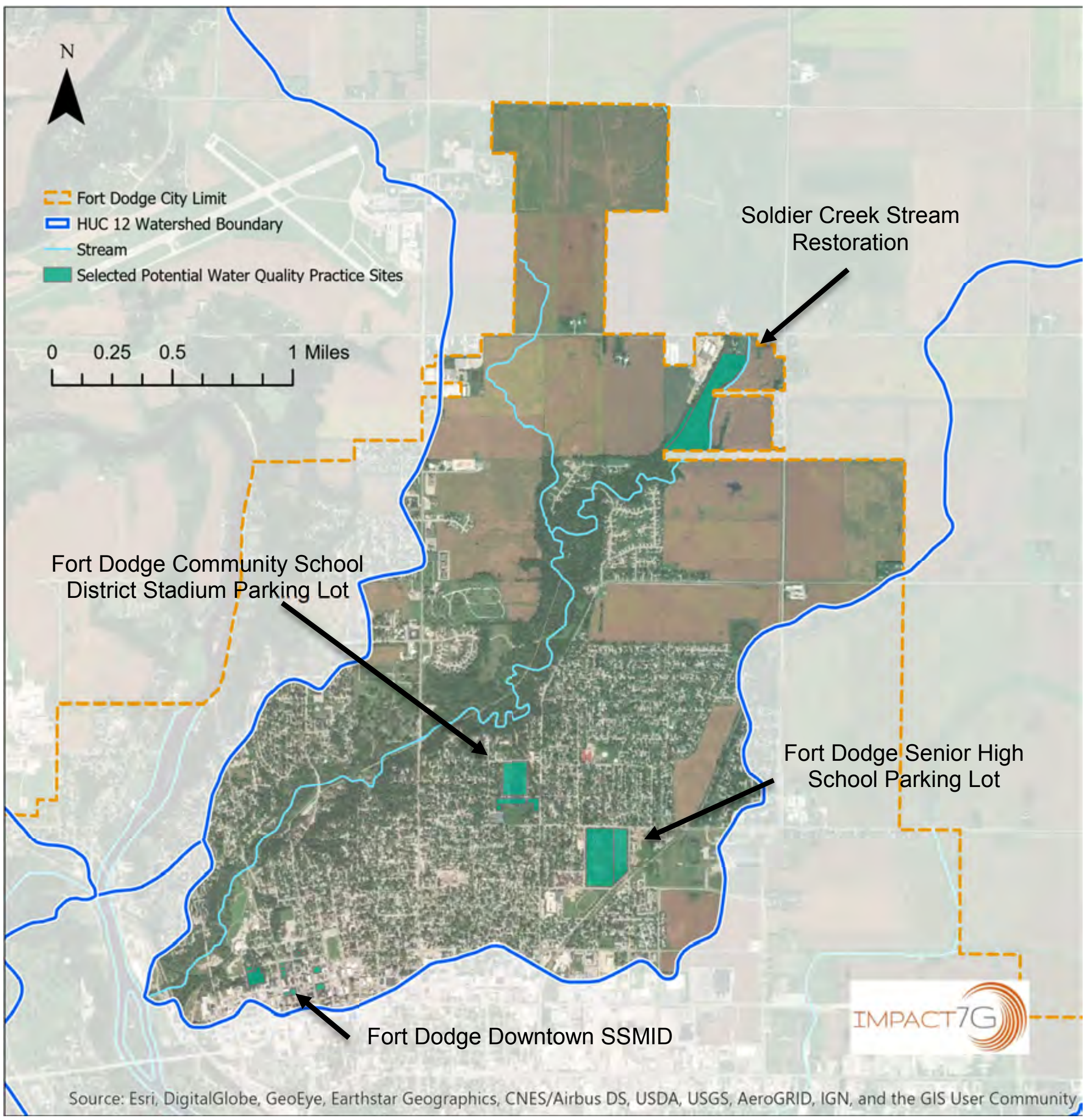
Cannot reach 80% total suspended solids removal, not feasible with slopes greater than 6%, sediment and pollution removal sensitive to design slope, requires routine Maintenance.

4. Description of Practices to be Implemented

4.1 Project Locations

All proposed Water Quality Practices are to be located within the Soldier Creek HUC 12 watershed and within the City of Fort Dodge City Limits as shown in the Figure below.

Several techniques and project locations are being considered for implementation to improve the water quality. These generally include practices to reduce sediment loss, infiltration, and biological uptake practices. This section includes an assessment of



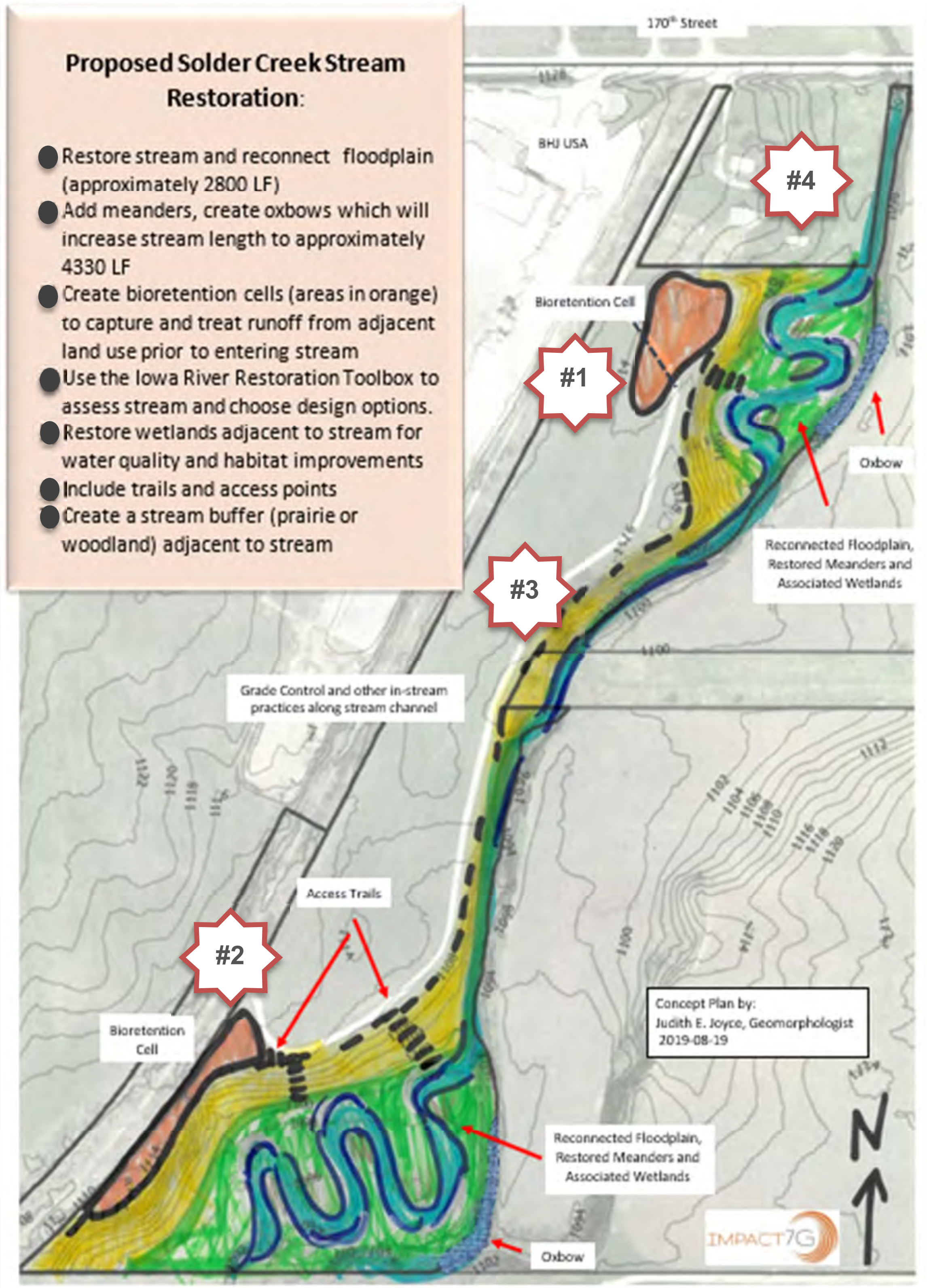
the urban best management practices that may be considered as part of this project. Practices are listed in the order of the City's priority for implementation.

4.2 Soldier Creek Stream restoration and floodplain reconnection

If awarded funding, the City's first priority is to implement a treatment train that includes bioretention cells, a prairie buffer and the stream restoration of Soldier Creek. This project includes re-meandering reaches, reconnecting the floodplain, wetland restoration, and the creation of oxbows. Below focuses on the northeast edge of city limits along Soldier Creek, however the City has recently been planning riverfront improvements along the Des Moines River and would be interested in pursuing similar work beginning at the connection of Soldier Creek and the Des Moines River and working upstream along the Soldier Creek corridor if deemed feasible by project partners.

Soldier Creek Stream Project; 2' Contours.

Soldier Creek Streambank Restoration Practice Locations



As identified in the watershed assessment, the headwaters of Soldier Creek consist mainly of row cropped agriculture lands. The proposed location is at the rural - urban interface. This larger, regional practice will treat 30+ sq miles and would address both rural and urban water quality concern. The project achieves the City's first water quality goal by providing treatment of rural and urban stormwater runoff. The project will provide a great opportunity for the City to showcase Soldier Creek, as part of their park system and as a recreational and natural resources. It will also feature urban water quality best management practices as part of the treatment train in a visible area along a well-used newly constructed trail system. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Thereby achieving the second water quality goal.

This parcel is owned by the city and therefore no permanent easements or land purchases would be required. Design options may include the requirement of a temporary construction easement for access and early conversations with the landowner are in progress.
The construction of the individual components of the treatment train can be constructed in phases. The following includes a concept plan along with a discussion of each practice proposed.

#1 **Location/Source: North Urban – Non-Point run-off** (adjacent industrial lot, BHJ USA): flows to culvert from the west and drains east to existing wetland and creek.

- Proposed practices
    - Forebay
    - Bioretention Cell
    - Overflow/spillway to proposed wetlands/restored creek

- Pollution Source
    - Vehicular traffic accounts for much of the build-up of contaminants on road surfaces and parking lots. Wear from tires, brake and clutch linings, engine oil and lubricant drippings, combustion products and corrosion, all account for build-up of sediment particles, metals, and oils and grease. Wear on road and parking surfaces also provides sediment and petroleum derivatives from asphalt. Spills from traffic accidents can occur on any street or highway.
- Pollutants of Concern
    - Heavy metals (lead, zinc, copper, cadmium, mercury)
    - hydrocarbons (oil and grease, gasoline, cleaning solvents)
    - Salt (sodium, chloride)

- Sediment

#2

Location/Source: South Urban – Non-Point run-off (adjacent industrial lot, BHJ USA, road, field): flows to culvert to ditch to culvert under trail to ravine to drainage ditch to creek.

- Proposed practices
  - Forebay
  - Ravine restoration
  - Bioretention Cell
  - Overflow/spillway to proposed wetlands/restored creek
- Pollution Source
  - Vehicular traffic accounts for much of the build-up of contaminants on road surfaces and parking lots. Wear from tires, brake and clutch linings, engine oil and lubricant drippings, combustion products and corrosion, all account for build-up of sediment particles, metals, and oils and grease. Wear on road and parking surfaces also provides sediment and petroleum derivatives from asphalt. Spills from traffic accidents can occur on any street or highway.
- Pollutants of Concern
  - Heavy metals (lead, zinc, copper, cadmium, mercury)
  - hydrocarbons (oil and grease, gasoline, cleaning solvents)
  - Salt (sodium, chloride)
  - Sediment

#3

Location/Source #3: Agricultural run-off, west of trail; overland flow

- Proposed practices
  - Native prairie buffer
  - Gully restoration within buffer
- Pollution Source
  - Lawn and garden maintenance of all types of land uses including residential, industrial, institutional, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied.
- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand

#4

<u>Location/Source #4: Agricultural run-off from upper reaches within watershed</u>. Drainage area is 30 sq. miles.

- Proposed practices
    - Soldier Creek Stream Restoration
    - Floodplain Connection
    - Restored/Stormwater Wetlands
    - Oxbows
- Pollution Source
    - Agricultural run-off from row cropped field, lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.
- Pollutants of Concern
    - Phosphorus
    - Nitrogen
    - Bacteria and viruses
    - Fertilizers and pesticides
    - Organic debris
    - Oxygen demand

Tile outlet from eastern farm field (Upper Left); From the west looking east at eroded banks of Soldier Creek (Upper Right); Eroded banks along Soldier Creek from bluff (Lower Left); Eroded gully with vegetation (Lower Right)

4.3 Fort Dodge Community School District Stadium Parking Lot

The public-school district recently opened a smaller rocked parking lot to serve as additional parking for the main lot. Based on the watershed assessment, this would be a good area to improve aesthetics, reduce run-off and provide water quality improvement by treating run-off from the adjacent urban/residential lots.

The project achieves the City's first water quality goal by providing treatment of urban stormwater runoff and showcase a best management practices in a visible area along a well-used newly constructed trail system. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Additional coordination will be needed with the School District if those respective sites are considered for final project development to determine the best timing for minimal disturbance of school district activities and final buy-in from the school Board and staff at that time.

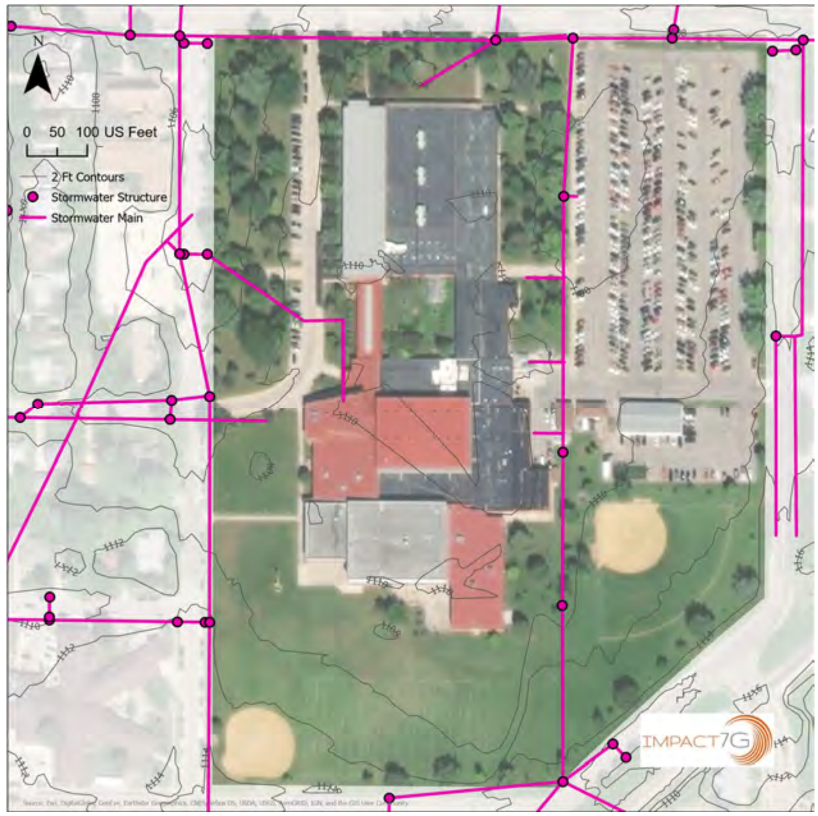
- Proposed practice options
    - Permeable Pavers
    - Bioretention Cells
    - Bioswale
    - Infiltration Trenches

- Pollution Source
    - Lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides, pet and wildlife feces and litter.

- Runoff from residential driveways and parking areas can contain driveway sealants, oil, salt, and car care products.

- Pollutants of Concern
  - Phosphorus
  - Nitrogen
  - Bacteria and viruses
  - Fertilizers and pesticides
  - Organic debris
  - Oxygen demand·
  - Salts
  - PAHs
  - Hydrocarbons
  - Increased temperature

4.4 Fort Dodge Senior High School Parking Lot



An additional water quality project identified through the watershed assessment would be to address the run-off from the high school parking lot which drains to one intake.

Similar to the parcel discussed above, this would be a good area to improve aesthetics, reduce run-off and provide water quality improvement by treating run-off from the adjacent urban - residential lots. Again, numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Additional coordination will be needed with the School District if those respective sites are considered for final project development to determine the best timing for minimal disturbance of school district activities and final buy-in from the school Board and staff at that time.

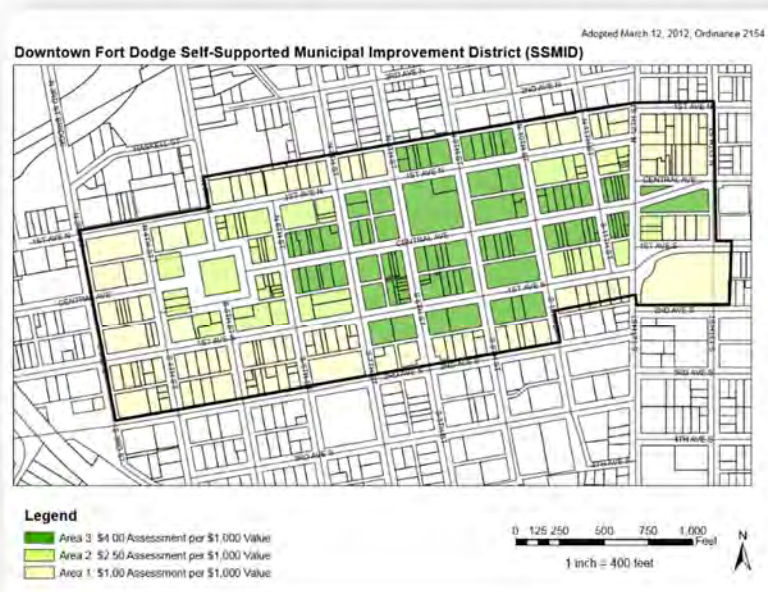
- Proposed practice options
    - Permeable Pavers
    - Bioretention Cells
    - Bioswale

- Infiltration Trenches

- Pollution Source
    - Lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides all can contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.

- Pollutants of Concern
    - Phosphorus
    - Nitrogen
    - Bacteria and viruses
    - Fertilizers and pesticides

4.5 Main Street Fort Dodge Downtown Self-Supportive Municipal Improvement District (SSMID) & Laramar Parking Lot



As identified in the watershed assessment, the downtown corridor is highly impervious and heavily trafficked, which leads to large runoff volumes carrying vehicular pollutants. Several of the practices fall within the boundaries of the Downtown SSMID area (see figure on right). By focusing on this project area, the City achieves their water quality improvement goal by providing treatment of urban stormwater runoff. This project will also provide a great opportunity for the City to integrate several urban water quality best management practices in a highly visible area of town. Numerous opportunities would exist to incorporate educational signage to help educate residents on the importance of water quality and encourage the incorporation of other water quality best management practices elsewhere. Thereby achieving the second water quality goal. There are multiple city-owned lots in the downtown district which were reviewed but not considered for project sites for various reasons called out below.

- Proposed practice options
    - Permeable Pavers
    - Bioswale, Bioretention Cells and/or Infiltration Trenches

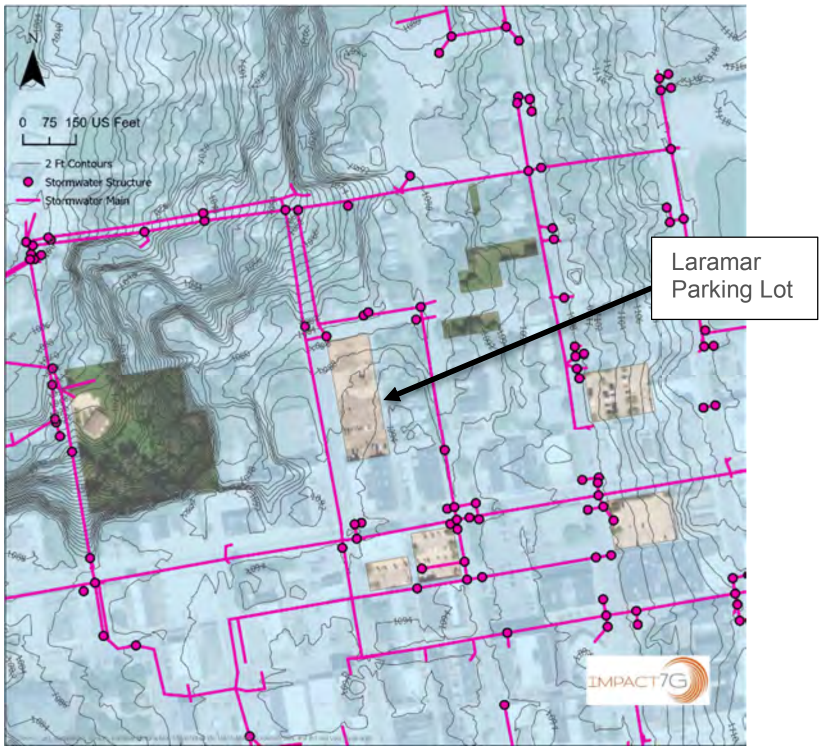
- Pollution Source
    - Lawn and garden maintenance of all types of land uses including residential, parks, and road and utility rights-of-way accounts for additions of organic material from grass clippings, garden litter and fallen leaves. Fertilizers, herbicides and pesticides can all contribute to pollutant loads in runoff if not properly applied. Pet and wildlife feces and litter introduce organic contamination, nutrients and bacteria.

    - Runoff from residential driveways and parking areas can contain driveway sealants, oil, salt, and car care products.

- Pollutants of Concern
    - Phosphorus
    - Nitrogen
    - Bacteria and viruses
    - Fertilizers and pesticides
    - Organic debris
    - Oxygen demand·
    - Salts & PAHs
    - Hydrocarbons
    - Increased temperature

1) <u>Laramar Parking Lot</u>

A large parking lot, locally referred to as the Laramar Parking Lot was identified along with several other open lots suitable for practices. These improvements will not only improve water quality by increasing infiltration and reducing run-off but will be helpful in creating a downtown environment conducive to future development. Another auxiliary benefit is the general beautification of the parking lot and downtown streetscape.

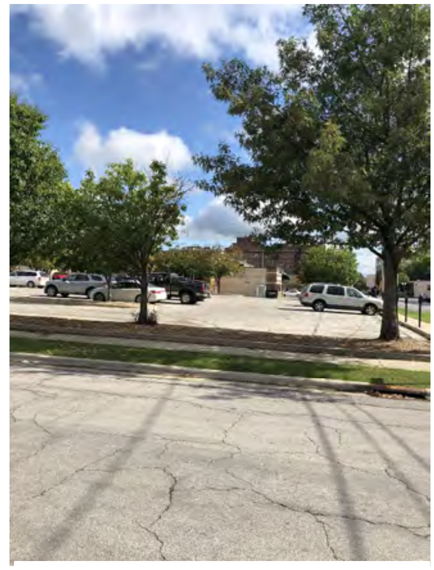


Laramar Parking Lot 1st Ave. between 7th and 8th St.

Laramar Parking Lot 1st Ave. between 7th and 8th St

2) Projects within the SSMID Area
The following proposed areas are smaller projects located in the Downtown SSMID.

Small strip parcel along 4th Avenue north. Proposed Practice: Bioswale or Infiltration Trench



Parking Lot at 2nd Avenue N. and 9th Street facing south. Proposed Practices: Pervious

Open Lot along 3rd Avenue North between 8th N. street and N. 9th street. Proposed Practice: Bioretention Cell or Infiltration Trench

North 9th Street Facing North East, Parking lot. Proposed Practice: Pervious pavers

5. Expected Water Quality Outcomes

Funding awarded to this project will yield multiple water quality benefits within the community; with the largest impact being to the proposed reach improvements to Soldier Creek along with the properties adjacent to and downstream of the proposed improvements. By utilizing the Iowa DNR River Restoration Toolbox, we can restore streams using natural/geomorphic channel designs and thereby recover the streams water quality benefits and restore a local underused natural resource for recreational use and enjoyment. It is reasonable to see how successful implementation of these projects can intensify adoption of these practices in other areas of the community and with future developments.

Certain factors such as pollutant-loading and impervious areas will determine the feasibility of proposed practices. As such, certain site measures must be performed to ensure each system functions as designed. Each practice will be designed and sized according to the Iowa Stormwater Management Manual.

At a minimum, all systems will be sized to capture the Water Quality Volume (WQv) which is the first 1.25” of rainfall in a 24-hour period. This rainfall event transports the majority of pollutants to the nearest storm sewer where they then outlet to a body of water downstream. Pollutants transported in urban stormwater include sediments (sand and soil), nutrients (phosphorus and nitrogen), petroleum hydrocarbons, and heavy metals (zinc and lead).

Along with capturing the majority of pollutants, peak flow will be reduced in receiving gullies, streams and rivers, which lead to severe bank erosion. Bank erosion has been cited as a major contributor to pollutant loading in Iowa’s waterbodies. Partnering the filtering and infiltrating capabilities of these best management practices with the reductions of peak flows in the Fort Dodge city limits will provide significant water quality benefits to this more highly erodible reach of Soldier Creek.

6. Project Partners & Organizations

The City of Fort Dodge is proposing to partner with Polk and Buena Vista County Soil and Water Conservation Districts, Webster County Conservation, McClure Engineering Company, and Impact7G to successfully implement these projects. Each of these organizations will exercise their strengths to compliment the gaps in responsibility from others. The Greater Fort Dodge Growth Alliance will also provide general community support for the projects.

1. The City of Fort Dodge will function as the project lead and main promoter of the project. City Council will approve all projects and respective project documentation. City engineering staff will oversee the project planning, design and construction. City Parks, Recreation and Forestry staff will oversee all ongoing maintenance after providing input on respective maintenance plans during project planning. The City Clerk will work with engineering staff and the Consultant to most efficiently time the SRF loan amendment. The Mayor and City Manager will generally promote the project.
2. Polk and Buena Vista County Soil and Water Conservation Districts will provide the technical support of their urban conservationists, per SRF sponsored project requirements, to review urban practice designs, review construction and provide final approval for practice implementation in accordance with the Iowa Stormwater Management Manual.
3. Iowa Department of Agriculture and Land Stewardship (IDALS). The City will work closely with IDALS Urban Conservationists throughout the duration of the project. Urban conservationists will provide assistance with practice site selections, design review, construction oversight, and final inspection of selected projects.
4. Webster County Conservation will provide general technical assistance and conservation planning for the region. They may include the project in applicable education material for the public.
5. McClure Engineering Company will serve as the local lead consultant. They have administrative staff, engineers, surveyors and on-site representatives based out of Fort Dodge to service the project during design, bidding and construction locally. They will serve as the project manager of the projects.
6. Impact7G will serve as a partner consultant working directly with McClure as the environmental specialist.
7. The Greater Fort Dodge Growth Alliance will provide general support in the community including facilitating any planned ribbon cuttings for the project sites.

7. Project Schedules & Milestones

As multiple wastewater projects are included in the parent loan, the sponsored projects schedule will be underway alongside these projects.

- SRF Sponsored Project Application Submitted - **September 3, 2019**
- Receive Notification of Project Acceptance - **December 2019**
- 1st Meeting with project partners to finalize targeted areas and practices - **January 2020**
- Begin design on Best Management Practices - **January 2020**
- Finalize design on BMPs - **May 2020**
- Hold Pre-Bid Meeting, Public Hearing and Bid Letting - **June 2020**
- Hold Pre-Construction Conference and begin construction - **July 2020**
- Complete construction and hold final project walkthrough - **November 2020**

The City Engineer, City Clerk and the Consultant will also coordinate during the planning process with Lee Wagner and Tracy Scebold on the appropriate time to file for the SRF loan amendment. The City is willing to adjust the project schedule listed above if it is the opinion of SRF and IDALS technical staff to do so to achieve respective project success.

8. Project Evaluation Procedures & Measures

The City understands the importance of implementing well-designed practices which are accessible for future water quality evaluation. To accomplish this, the City will partner with urban conservationists, Webster County Conservation, and technical consultants to verify BMPs meet the design requirements of the Iowa Stormwater Management Manual for best management practices while also utilizing the Iowa Rivers Restoration BMP toolbox. The City, through internal on-site representation and coordinated site visits with project partners, will ensure the practices are built according to the final designs. These final designs will account for the possibility of installing water quality monitoring equipment for future on-going assessment. During construction, an on-site representative will be provided by the City and/or the Consultant to monitor progress, take daily notes, prepare change orders and pay estimates which project partners will have access to for review purposes.

The City Parks and Recreation and Forestry Department is familiar with regular maintenance of other BMPs in the region through specific maintenance plans derived during the planning process. Final maintenance plans will be reviewed by

P&R staff during the planning phase to solicit input and agreement for ongoing support in conjunction with the final maintenance plan respective to each BMP.

9. Explanation of Proposed Budget

The City of Fort Dodge, being originally strategically located in the Soldier Creek watershed along the Des Moines River has a lot of potential for different project sites. Furthermore, the amount of wastewater work in the community being facilitated through the SRF Loan Program makes the City eligible for more than the $1 million cap on sponsored projects currently in place. The City and Consultants are experienced in identifying a diverse group of projects to most effectively match the awarded dollar amounts with the best project sites available for meeting project goals and further assessing options for other forms of funding for the remaining project sites. The City understands that in the event the Iowa Finance Authority identifies a surplus of funds in the sponsored project program, IFA may review the potential for awarding additional funds for shovel-ready projects, at their discretion but this is not guaranteed and should not be expected.

The City will be tracking the Water Quality Initiative program to apply for applicable funds for the project site(s) which cannot be covered by sponsored project funds alone. The City also makes an annual trip in March-April to Washington D.C. to identify funding programs for a variety of initiatives including water quality from many of the federal agencies which could potentially partner with sponsored project state funds.

Currently the City has $15.5 Million worth of wastewater work allocated to five separate community sewer projects as submitted in the IUP, still noted as in the planning phase. Therefore, the City is requesting 10 percent of the loan amount in sponsored project funds, equal to $1.5 Million. The City understands that if one of the five projects receives the construction permit then they would not be eligible for sponsored project money if all projects are kept in the same loan. If during the loan review and sponsored project application review process, one wastewater project worth approximately $1 Million is separated to a separate loan, the City subsequently requests 10% of the remaining SRF loan of approximately $14.4 Million or approximately $1.4 Million in sponsored project funds. At this time, the remaining four wastewater projects specifically would be the Oak Forest Lift Station, Williams Drive Sewer Improvements, G10 – M05 Phase 4 Improvements and CSI Collection System Rehabilitation Phase 2 Improvements all part of the

Community Sewer Initiative (CSI) projects to be funded with SRF funds. The one project receiving a construction permit prior to sponsored project application deadlines is G10 – M05 Phase 3 Improvements. As mentioned above, the City understands there is currently a $1 Million maximum on the award amounts.

Based on previous stream restoration projects, we estimate that the construction of the Soldier Creek stream restoration and floodplain improvements will be approximately $1M. In addition to construction, the budget includes engineering services, construction monitoring, environmental clearance (wetland, archaeology, T&E, other) as well as a detailed stream assessment using the Iowa DNR River Restoration Toolbox.

10. Preliminary Communication Plan

The City understands the importance of a thoughtful, well-executed communication plan applicable to all project stakeholders. There are a variety of frequent communication methods which the City is experienced using to inform project partners, contractors and the public about community initiatives.

1. Specific Public Outreach
   a. The City holds council meetings on the 2nd and 4th Mondays of the month at 6:00PM. Any contracts relating to the planning phases of SRF Sponsored Projects will be up for discussion at these meetings which are all advertised and open to the public.
   b. The City and Consultant(s) will hold an open forum for potential project sites open to the public which will be advertised in the local newspaper and individual invites will be extended to adjacent property owners. The open forum will include a review of the sponsored project goals, potential concepts and BMPs.
   c. The City and Consultant(s) will hold a preliminary design review meeting with the same anticipated audience as listed above to review the project in approximately 60% complete format.
   d. The City and Consultant(s) will hold a final design review meeting with the same anticipated audience as above to review construction drawings displaying the anticipated final product.
2. General Outreach for All Parties During Project Planning and Construction Phases
   a. The City has a proactive relationship with the local newspaper, "The Messenger", which serves multiple surrounding counties daily. As can be seen in the Editorial Section at the link below from the August 8, 2016 edition of "The Messenger" the paper itself commended the city for utilizing State Revolving Funds for Sponsored Projects. The City will provide the newspaper with applicable information throughout the project cycle. https://www.messengernews.net/opinion/editorial/2016/08/snell-crawford-park-is-looking-good/
   b. Another increasingly unique communication tool is the local talk radio show – "Devine Intervention – 1400 KVFD" where the Mayor, a Councilman and the City Manager contribute as weekly guests to answer calls from citizens and discuss community projects. The show itself airs daily and is livestreamed and recorded on YouTube at "1400 KVFD" to gather other audiences. The SRF Sponsored Projects' history and progress will be discussed on this show open for public calls and input. https://www.youtube.com/channel/UC-OsI0TClc3KXpCWqK3CkkQ
   c. Upon final site selection, a message Board identifying project design intentions, project partners, funding sources and links to other communication methods will be placed on site.

d. The City utilizes Facebook to inform the public of important notices or progress steps.
e. The City includes important community updates in monthly water bills. As community water users pay additional fee to help water and wastewater infrastructure from SRF loans, the City will include a summary of sponsored projects to help educate the public on the additional benefits of the SRF Sponsored Projects program for regional water quality.
f. The City will partner with the Greater Fort Dodge Growth Alliance to host a public ribbon cutting at the project site(s) to recognize the completion of this important community addition.

3. Project Delivery Team Communications
    a. The City and Consultant(s) will hold 30%, 60% and 90% design review meetings with the project planning partners.
    b. The City and Consultant(s) will hold pre-bid and pre-construction conferences with contractors which will include agreed upon regular construction progress meeting dates and content for all project construction partners.
    c. The Consultant(s) will provide weekly update to City staff and leadership to stay current on construction progress.
    d. The City and Consultant(s) will coordinate with all project partners for site-visits throughout the project

GREATER
FORT DODGE
GROWTH ALLIANCE

August 28, 2019

RE: City of Fort Dodge - SRF Sponsored Project Application

Dear Selection Committee,

Our Mission is to unify and coordinate accountable economic and community development, to enhance the quality of life in Fort Dodge, Iowa and the region. The State Revolving Fund has been a critical component in helping the region partner in this Mission through a variety of infrastructure improvements. It is our understanding the City of Fort Dodge is further pursuing Sponsored Projects from the State Revolving Fund to address water quality in the Soldier Creek watershed. Like previously awarded SRF Sponsored Projects in the City, these projects will inevitably be highly visible and promote a higher quality of life for its residents.

As fellow promoters of effective collaboration between private entities, school districts, city and county government, we especially value these opportunities to exercise and display successful partnerships. We would like to express our support to the City of Fort Dodge in pursuing SRF Sponsored Projects and will continue to seek ways to partner with the City on building a culture of awareness for the importance of regional water quality efforts.

We look forward to helping the City promote these initiatives.

Sincerely,

Dennis A Plautz

Dennis Plautz
Chief Executive Officer
Greater Fort Dodge Growth Alliance

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DORSEY™
always ahead

August 20, 2019

VIA ELECTRONIC MAIL

State Revolving Fund
Iowa Department of Natural Resources
c/o Lee Wagner
401 SW 7th Street, Suite M
Des Moines, IA 50309

Re: Water Resource Restoration Project/City of Fort Dodge, Iowa
Our File No. 419414-131

To the Iowa Department of Natural Resources:

Dorsey & Whitney LLP serves as bond counsel to the City of Fort Dodge, Iowa (the "City") and we have been asked to submit this correspondence to you as an accompaniment to the City's Water Resource Restoration Sponsored Project Application. As bond counsel, we have reviewed the application and the provisions of Chapter 384 of the Code of Iowa (the "Code") related to the financing of water resource restoration projects.

For purposes of our review, we have assumed that the project (the "Project") described by the City in the application meets the statutory definition of "water resource restoration project" as set forth in Section 384.80(15) of the Code. Based upon our review, we concur that the City will have legal authority to approve financing for the Project either through the issuance or modification of general obligation debt or sewer utility revenue debt. As is typical, in order to become vested with the legal authority to borrow money, the City will need to follow the procedures set forth in Chapter 384 of the Code.

We hope that you will contact us if you have any questions regarding our correspondence. We are looking forward to working with you on the City's behalf to complete the proposed financing transaction.

Best regards,

John P. Danos