Walnut Creek Watershed Management Plan—Overview

Assessment
Chapter 1  Process Overview
Chapter 2  Watershed Geography
Chapter 3  Climate and Streamflow
Chapter 4  Background Studies
Chapter 5  Character of Streams
Chapter 6  Key Pollutants and Sources

Action
Chapter 7  Strategic Framework
Chapter 8  Case Study: Subwatershed Strategic Plans
Chapter 9  Policy Recommendations
Chapter 10  Projects and Priorities

Implementation
Chapter 11  Education and Collaboration Plan
Chapter 12  Measures and Milestones
Chapter 13  Resource Requirements
Chapter 14  Evaluation and Amendments
Chapter 15  Best Management Practices Toolkit
Assessment
**Process Overview**

**Walnut Creek WMA**
- Board Meetings
- Executive Committee

**Public Interaction**
- Open House Events
- Stakeholder Meetings
- Individual Discussions

**Plan Development**
- Process throughout 2015
- Executive Committee Meetings
- Monthly Walnut Creek Watershed Management Authority (WMA) Meetings
- Open Houses
  - Windsor Heights (April)
  - Clive (October)
- Heartland Co-op Meetings

**Boots on the Ground**
- Windshield Survey
- Stream Assessment Walks
- Quadcopter Video Collection
- Water Quality Monitoring

**Desktop Assessments**
- GIS Analysis
- Computer Modeling & Simulation
Process Overview

Watershed Geography

**VISION:** Engaged stakeholders working across boundaries to create and sustain a healthy watershed

**MISSION:** Through collaboration, education, and research, implement science-based policies and practices to deliver flood mitigation, water quality improvements, natural resources protection, recreation, and to support economic vitality.

**What is a WMA?**
The WMA is formed by an agreement (Chapter 28E) between two or more eligible political subdivisions within a specific watershed. A board of directors governs the WMA. WMA’s may:
- Assess and reduce flood risk
- Monitor federal flood risk planning and activities
- Educate residents on the WMA’s role in water quality
- Allocate funds available to the WMA for water quality and flood mitigation

**Requirements of a WMA include:**
- All cities, counties, and SWCDs of the watershed must be invited to participate in the WMA
- A Chapter 28E agreement that includes a map of the watershed must be filed with the Secretary of State
- Must be governed by a Board of Directors
- WMA’s may not acquire land through eminent domain and do not have taxing authority

**Benefits of forming a WMA:**
- To conduct planning on a watershed scale, which has greater benefits for water quality improvement and flood risk reduction
- To foster partnerships and cooperation
- To leverage resources such as funding and technical expertise
- To facilitate stakeholder involvement in watershed management

**Information about forming a WMA:**
In 2010, Iowa lawmakers authorized forming Watershed Management Authorities. A Watershed Management Authority (WMA) is a mechanism for cities, counties, Soil and Water Conservation Districts (SWCDs), and stakeholders to cooperatively engage in watershed planning and management.
Watershed Geography

Plan Understanding

**Local Topography & Terrain**

82.8 square miles drains through Walnut Creek and its tributaries to the Raccoon River.

**Past & Current Land Uses**

During a recent 10-year period, 6.7 square miles were developed into urban land use.

Currently, the watershed is nearly evenly split between urban and agricultural land uses.

**Soil Conditions**

The slopes of soils, their ability to absorb water and their resistance to erosion are key features to consider in watershed planning.

- Topography and Terrain
- Soil Qualities
- Changes in Land Use
Watershed Geography

Topography and Terrain
- Landforms
- Slopes

Soil Qualities
- Hydric Soils (Wetlands)
- Infiltration / Percolation Rates
- Soil Erodibility

Changes in Land Use
- Pre-pioneer Settlement
- Agriculture
- Urban

Slope Map
Watershed Geography

Landscape Change

1970s
- Interstate highway system influences development
- Westward movement starts to accelerate
- Merle Hay Mall and Valley West Mall have been constructed

1990s
- Floods of 1993 force West Des Moines City Hall offices to relocate
- Development extends across most areas east and south of I-35/I-80, and begins to expand beyond that limit near I-235 interchange

2014
- Urban footprint nearly doubles since the 1990's
- Grimes and Johnston extend development into the Walnut Creek Watershed
## Watershed Geography

<table>
<thead>
<tr>
<th>Land Use</th>
<th>2001</th>
<th>2011</th>
<th>2001-11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>area (in acres)</td>
<td>% of watershed</td>
<td>area (in acres)</td>
</tr>
<tr>
<td>Open Water</td>
<td>146</td>
<td>0.3%</td>
<td>147</td>
</tr>
<tr>
<td>Urban</td>
<td>18663</td>
<td>35.3%</td>
<td>22936</td>
</tr>
<tr>
<td>Forest</td>
<td>1650</td>
<td>3.1%</td>
<td>1446</td>
</tr>
<tr>
<td>Grasslands /Wetlands</td>
<td>1209</td>
<td>2.3%</td>
<td>1135</td>
</tr>
<tr>
<td>Pastureland</td>
<td>3530</td>
<td>6.7%</td>
<td>2147</td>
</tr>
<tr>
<td>Cropland</td>
<td>27626</td>
<td>52.3%</td>
<td>25013</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52825</strong></td>
<td><strong>52825</strong></td>
<td></td>
</tr>
</tbody>
</table>
Climate and Streamflow

**Climate - Recent Trends**

- **Normal Annual Precipitation**
  - 1972: 30.51”
  - 2014: 35.2”

- **Normal Annual Temperature**
  - 1972: 49.3°F
  - 2014: 50.8°F

- **Highest Monthly Precipitation**
  - June: 4.87”
  - May: 4.67”
  - Aug: 4.27”
  - Jul: 4.12”
  - Apr: 4.09”

- **Highest Monthly Temperatures**
  - July: 85.90°F
  - Aug: 83.80°F
  - June: 81.70°F
  - Sept: 76.40°F
  - May: 72.87°F

- **90%** of all rainfall events in central Iowa are less than 1.25 inches in depth.

*1985-2014

**Streamflow - Recent Trends**

- **Annual Flow**
  - Average: 1.9
  - Highest: 5.6
  - 37% increase

- **5.6 billion cubic feet of water would fill 21,000 water towers**

- **The portion of rainfall converted to runoff has increased recently.**

- **2mil gal x 21,000**

- **Temperature**
- **Precipitation**
- **Streamflow**

- **Highest flows typically from May - June**
Downstream waterbodies are:
1. Des Moines River
2. Lake Red Rock
3. Mississippi River
4. Gulf of Mexico

Elevated levels of nutrients such as nitrogen and phosphorus have created a 5,840 square mile dead zone in the Gulf of Mexico (10% of the size of the entire State of Iowa).

**Walnut Creek**
- Currently considered an impaired waterbody due to high levels of bacteria.
- Flows into the Raccoon River which is impaired due to high levels of bacteria and nitrate.

Des Moines Water Works collects water from the Raccoon River for drinking water use. This water must be disinfected and nitrates removed through a special process when concentrations are above a certain level.

**Past Studies**
- Water Quality Improvement Plan for Raccoon River
- Raccoon River Watershed Water Quality Master Plan
- Iowa’s Nutrient Reduction Strategy

**Iowa’s Nutrient Reduction Strategy**
Created to reduce the amount of nutrient load sent from Iowa to the Gulf of Mexico.
Character of Streams

4-10x
how much wider streams are now than they were prior to pioneer settlement

57%
of all field assessed streams had moderate to severe erosion

239
miles of streams reviewed as part of the development of this plan

What is a buffer? Buffers slow and filter runoff before it enters the stream.

48%
of smaller streams (0 or 1st order) have no stream buffer or have a buffer that is less than 50 feet in total width

71%
of streams (1st order and above) are incised or deeply incised meaning they have downcut or become lower over time

Field Assessments
- 2014-2015
- 41 miles

GIS / Desktop Assessments
- Horizontal / Vertical Character
- Stream Buffer Type and Width
Character of Streams

Channel Stability

1%

*Less than 1% of the streams assessed within the urbanized areas of the watershed are stable.
Key Pollutants and Sources

**Water Quality Monitoring Samples**
- Collected by Iowa Soybean Association/Clean Water Alliance and IOWATER volunteers
- Collected at two sites along Walnut Creek, every other week, throughout spring and summer
- IOWATER completed sampling at over 30 locations within the watershed, but more infrequently

**Pollutant Sources By Land Use**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>N</th>
<th>P</th>
<th>BOD</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>13.61%</td>
<td>26.14%</td>
<td>51.51%</td>
<td>6.89%</td>
</tr>
<tr>
<td>Cropland</td>
<td>80.59%</td>
<td>49.12%</td>
<td>33.76%</td>
<td>10.24%</td>
</tr>
<tr>
<td>Pastureland</td>
<td>1.91%</td>
<td>2.02%</td>
<td>5.09%</td>
<td>0.29%</td>
</tr>
<tr>
<td>Forest</td>
<td>0.14%</td>
<td>0.66%</td>
<td>0.25%</td>
<td>0.44%</td>
</tr>
<tr>
<td>Grasslands</td>
<td>0.04%</td>
<td>0.16%</td>
<td>0.06%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Gully</td>
<td>0.81%</td>
<td>4.79%</td>
<td>2.05%</td>
<td>18.97%</td>
</tr>
<tr>
<td>Streambank</td>
<td>1.63%</td>
<td>9.58%</td>
<td>4.10%</td>
<td>37.95%</td>
</tr>
<tr>
<td>Construction Site</td>
<td>1.27%</td>
<td>7.53%</td>
<td>3.20%</td>
<td>25.19%</td>
</tr>
</tbody>
</table>

**Key Pollutants of Concern**
- Nitrogen
- Phosphorus
- Sediment
- Pathogens (bacteria and viruses)
- Runoff rates and volumes

**Agricultural Areas**
Nitrogen and phosphorus compounds have been measured at higher levels.

**Urban Areas**
Levels of bacteria have been at higher concentrations.

8 loading reduction goals are outlined within this chapter.

**Nitrates**
Highest measured concentration

77,010 MPN/100mL

Higher than the Raccoon River Total Maximum Daily Load (TMDL) standard of 9.5 mg/L.

**Pollutants of Concern**

**Monitoring**
- Iowa Soybean Association
- IOWATER

**Modeling**
- Calibrated using monitoring data
- Watershed wide and case-studies

---

**77,010 MPN/100mL**

was observed to be the maximum level of E.coli (indicator bacteria), which is more than 330 times the state's allowable average concentration of 235 MPN/100mL.
Key Pollutants and Sources

Nitrates

E-Coli

Source: "Monitoring Data from Iowa Soybean Association, IDNR Snapshot and IowaWater"
## Key Pollutants and Sources

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Total Load (pounds)</th>
<th>Total Load (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>941,600</td>
<td>471</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>61,500</td>
<td>31</td>
</tr>
<tr>
<td>Sediment</td>
<td>59,360,000</td>
<td>29,700</td>
</tr>
</tbody>
</table>
Key Pollutants and Sources

Pollutant Loads By Source – Entire Watershed

<table>
<thead>
<tr>
<th>Source</th>
<th>N (%)</th>
<th>P (%)</th>
<th>Sediment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>13.6%</td>
<td>26.1%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Cropland</td>
<td>80.6%</td>
<td>49.1%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Pastureland</td>
<td>1.9%</td>
<td>2.0%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Forest</td>
<td>0.1%</td>
<td>0.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Grasslands</td>
<td>0.0%</td>
<td>0.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Gully</td>
<td>0.8%</td>
<td>4.8%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Streambank</td>
<td>1.6%</td>
<td>9.6%</td>
<td>38.0%</td>
</tr>
<tr>
<td>Construction Site</td>
<td>1.3%</td>
<td>7.5%</td>
<td>25.2%</td>
</tr>
</tbody>
</table>

TOTAL NITROGEN BY SOURCE

- Urban: 80.59%
- Cropland: 13.61%
- Pastureland: 1.91%
- Forest: 0.14%
- Grasslands: 0.03%
- Gully: 0.16%
- Streambank: 4.79%
- Construction Site: 9.58%

TOTAL SEDIMENT BY SOURCE

- Urban: 26.14%
- Cropland: 18.97%
- Pastureland: 10.24%
- Forest: 6.89%
- Grasslands: 4.4%
- Gully: 0.29%
- Streambank: 0.03%
- Construction Site: 0.02%

TOTAL PHOSPHORUS BY SOURCE

- Urban: 7.53%
- Cropland: 49.12%
- Pastureland: 4.79%
- Forest: 4.79%
- Grasslands: 0.66%
- Gully: 2.02%
- Streambank: 9.58%
- Construction Site: 49.12%
### Pollutant Sources By Land Use

<table>
<thead>
<tr>
<th>Land Use</th>
<th>N</th>
<th>P</th>
<th>BOD</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>13.61%</td>
<td>26.14%</td>
<td>51.51%</td>
<td>6.89%</td>
</tr>
<tr>
<td>Cropland</td>
<td>80.59%</td>
<td>49.12%</td>
<td>33.76%</td>
<td>10.24%</td>
</tr>
<tr>
<td>Pastureland</td>
<td>1.91%</td>
<td>2.02%</td>
<td>5.09%</td>
<td>0.29%</td>
</tr>
<tr>
<td>Forest</td>
<td>0.14%</td>
<td>0.66%</td>
<td>0.25%</td>
<td>0.44%</td>
</tr>
<tr>
<td>Grasslands</td>
<td>0.04%</td>
<td>0.16%</td>
<td>0.06%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Gully</td>
<td>0.81%</td>
<td>4.79%</td>
<td>2.05%</td>
<td>18.97%</td>
</tr>
<tr>
<td>Streambank</td>
<td>1.63%</td>
<td>9.58%</td>
<td>4.10%</td>
<td>37.95%</td>
</tr>
<tr>
<td>Construction Site</td>
<td>1.27%</td>
<td>7.53%</td>
<td>3.20%</td>
<td>25.19%</td>
</tr>
</tbody>
</table>
Key Pollutants and Sources

Watershed – Sources of Nitrogen Loading (Annual Rate per Acre)

Source Loading
(pounds per acre per year)

Note: Does not include Construction Site Loading
Key Pollutants and Sources

Watershed – Sources of Phosphorus Loading (Annual Rate per Acre)

Source Loading
(pounds per acre per year)

Note: Does not include Construction Site Loading
Key Pollutants and Sources

Watershed - Sources of Sediment Loading (Annual Rate per Acre)

Note: Does not include Construction Site Loading
ONE
Reduce flooding through improved stormwater management and soil health.

TWO
Improve water quality, with an emphasis on sediment, nitrate, phosphorous and e-coli reductions.

THREE
Enhance recreation and public health through improved water quality, habitat restoration, stream accesses, improved connectivity to parks/trails and cultural opportunities.

FOUR
Deliver enriched conservation education and programming with emphasis on water quality/quantity management, wildlife/habitat, urban and agricultural needs within the watershed.

FIVE
Support community vitality and maintain economic health through implementing multi-purpose projects producing benefits in public, natural resources and economic health that can be documented.

SIX
Develop ongoing means for collaboration and implementation of effective policies and practices, taking a consistent watershed and/or regional scale approach as much as practical.

Vision
“Engaged residents working across political and property boundaries to create and sustain a healthy watershed.”

Mission
“Through collaboration, education and research, implement science-based policies and practices for flood mitigation, water quality improvements, natural resources protection and improved recreation while maintaining economic health.”

Goals
Case Study: Subwatershed Strategic Plans

- Gather more detailed info for modeling
- Target more improvements in a smaller area
- Test results (monitoring)
- Apply lessons learned to other watersheds
### Key Lessons Learned

#### Rural (411)
- Cropland is expected to be the largest source of nitrogen and phosphorus loads.
- Gully and streambank erosion is expected to be a large source of sediment load.

#### Urban (213)
From 2001-2011, construction sites made up 2-3% of this subwatershed. This small portion of this landscape is estimated to contribute:
- 61% Sediment load
- 17% Nitrogen
- 26% Phosphorus

#### Developing (602)
- Runoff volume increase in suburban residential areas compared to pre-settlement conditions during a one-year storm event (2.67” in 24 hrs): **7x**
- Rate of flow increase for same conditions: **43x**
- Reduction in peak outflow rates from developing areas for the one-year event, using new stormwater design methods outlined in the Iowa Stormwater Management Manual (compared to current methods): **97%**
- Restoring healthy topsoil layers to open space areas can reduce stormwater runoff by 1/2.

25% Construction sites likely contribute more than 25% of the total sediment load.

- Pollutant Sources
- Construction Site Pollution Prevention
- Increases in flow in developing areas
- New methods better manage small storms
- Importance of healthy topsoil

Modifying key pond outlet structures to manage small storms could reduce:
- One-year outflow rates for the area served by more than 40%
- Phosphorus and sediment loads downstream by 10%
### Policy Recommendations

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Policies</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Elevated pollutant concentrations</td>
<td>• Use new stormwater management guidelines in developing areas</td>
<td>• Where implemented runoff is captured, filtered and reduced for more than 90% of all storm events</td>
</tr>
<tr>
<td>• Long-term cost to repair eroded stream corridors ($2-3 million/mile)</td>
<td>• Reserve open spaces for flood plains and stream buffers</td>
<td>• Reduction in rapid bounce in water levels in small tributaries</td>
</tr>
<tr>
<td>• 25% of sediment load to Walnut Creek may be attributed to construction site runoff</td>
<td>• Make improvements on points of emphasis for sediment and erosion control practices</td>
<td>• Establish a more natural pattern of flow in developing areas</td>
</tr>
<tr>
<td>• Flood damage to buildings and structures</td>
<td>• Protect or restore healthy topsoil layers on open spaces in developing areas</td>
<td>• Lower the potential for costly stream bank and channel erosion</td>
</tr>
<tr>
<td>• Lack of access for maintenance or repairs</td>
<td>• Rural management strategies</td>
<td>• Sediment loading related to construction sites and streambank erosion minimized</td>
</tr>
<tr>
<td>• Damage to habitat and loss of resources</td>
<td></td>
<td>• Reserved spaces for access and improvements</td>
</tr>
</tbody>
</table>

**Urban**
- Policies
- Points of Emphasis

**Rural**
- In Development
Policy Recommendations

Urban
- Stormwater Management
- Flood Plain Protection
- Stream Buffer Protection
- Construction Site Pollution Prevention
- Soil Quality Restoration

Draft Recommendations—Policy

Stormwater Management
- New policies such as the Buffalo River Code with the local Stormwater Management Manual which will be managed by the departments of both and will be implemented.
- Water Quality Series: Cotations of all areas also include vegetation control and water control to improve water quality.
- Stormwater Management: All areas will be included in the Stormwater Management Manual.
- Sheet Metal: Inverted Catchments: Cotations of the catchment areas, installation of trees up to 12 and 40 years.
- Stormwater mitigation measures can also be included within the catchment areas.

Flood Plain Protection
- Stormwater mitigation measures should be adopted to protect flood plains for the following reasons:
  - Reduce the risk of flooding by intercepting and preventing floodwaters from entering the flood plain.
  - Minimize erosion and sedimentation by intercepting and diverting water from floodplains to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from floodplains to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from floodplains to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from floodplains to other areas.

Stream Buffer Protection
- Stormwater mitigation measures should be adopted to protect stream buffers in the following areas:
  - Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
  - Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.

Construction Site Pollution Prevention
- New policies such as the Buffalo River Code with the local Stormwater Management Manual which will be managed by the departments of both and will be implemented.
- Construction Site Pollution Prevention: All areas will be included in the Stormwater Management Manual.
- Sheet Metal: Inverted Catchments: Cotations of the catchment areas, installation of trees up to 12 and 40 years.
- Stormwater mitigation measures can also be included within the catchment areas.

Draft Recommendations—Best Practices

Preserve topsoil
- Modify existing detention basins to manage 90% of all events
- Manage the water quality volume using green infrastructure
- Slope areas to prevent erosion and sedimentation
- Trees and shrubs for stormwater mitigation
- Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
- Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
- Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.
- Minimize erosion and sedimentation by intercepting and diverting water from stream buffers to other areas.

Developing Recommendations
- Recent Meetings with Farmers / Landowners
Projects and Priorities

Ten-Year Implementation Plan

- Case Study Areas
- CIP Programs
- Other Watershed Wide Project Recommendations
Implementation
- How does the message about the plan get to those who can help implement it?
- How do groups work together?
Measures and Milestones

Timeline

- 10-year initial plan
- Full watershed plan will take decades
- First order of business:
  - Establish monitoring program
  - Begin education and outreach
  - Review and amend local policies
- Next steps:
  - Implement projects as funding is acquired or allocated
  - Evaluate progress annually
  - Report results
  - Plan updates
Implementation

- Resource Requirements
  - Financial
  - Technical
  - Staffing
- Evaluation and Amendments
- Best Management Practices Toolkit