MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

**Meeting:** Board of Managers
**Meeting date:** 8/27/2020
**Agenda Item #: 11.1**
**Request for Board Action**

| | |
|---|---|
| **Title:** | Approval of St. Bonifacius Local Water Management Plan |
| **Resolution number:** | 20-063 |
| **Prepared by:** | Name: Kate Moran<br>Phone: 952-641-4520<br>kmoran @minnehahacreek.org |
| **Reviewed by:** | Becky Christopher, Policy Planning Manager<br>Anna Brown, Planner/Project Manager |
| **Recommended action:** | Approval of City of St. Bonifacius Local Water Management Plan |
| **Schedule:** | Date: N/A |
| **Budget considerations:** | Fund name and code: N/A |
| **Past Board action:** | Res # 10-064 Title: City of St. Bonifacius Local Water Management Plan – Conditional Approval<br>Res # 10-065 Title: City of St. Bonifacius LWMP Memorandum of Understanding<br>Res #11-055 Title: Approval of Local Water Management Plans with Outstanding MOUs<br>Res # 18-004 Title: Approval and adoption of MCWD Watershed Management Plan for the implementation period 2018-2027 |

**Summary:**


Background

MN Statutes § 103B.235 and MN Rules § 8410.0160 grant watershed districts the authority to review and approve local water management plans (LWMPs). Under this framework, watershed districts can assign responsibilities to local government units (LGUs) for carrying out implementation actions defined in the watershed plan. The LWMP is a required element of the LGU comprehensive land use management plan which LGU's were required to adopt by the end of 2018.

The Minnehaha Creek Watershed District (MCWD or District) adopted its new Watershed Management Plan (Plan) in January 2018. The Plan is rooted in the District's Balanced Urban Ecology policy (BUE) as the principal strategy to accomplish its mission. The BUE policy recognizes the inter-dependence of the natural and built environment and that both benefit through a holistic planning approach. The BUE policy establishes the guiding principles of focus in areas of highest resource needs, flexibility to respond to emerging opportunities as a result of land use change in real time, and pursuing clean water goals in partnership with our communities.

The Plan establishes the District as a regional water planning agency. The Plan provides rationale for subwatershed-based planning and prioritization by which to focus implementation efforts for the 2018-2027 Plan cycle. The District has prioritized the subwatersheds of Minnehaha Creek, Six Mile Creek-Halsted Bay and Painter Creek-Jennings Bay based on a combination of resource needs and opportunities for management of some of the State's most prized recreational natural resources of Lake Minnetonka and Minnehaha Creek – including the Minneapolis Chain of Lakes.

In addition to these focused planning and implementation efforts, the District's approach watershed-wide is to remain responsive to opportunities created by local land use change or partner initiatives. The District's responsive approach relies on early and effective coordination by the District's communities to help identify opportunities to integrate plans and investments. As opportunities arise, the District will evaluate them against the resource needs and priorities defined for each subwatershed in the District's Plan and determine the appropriate response. The District has a wide range of services it can mobilize to address resource needs and support partner efforts, including data collection and diagnostics, technical and planning assistance, permitting assistance, outreach, grant support, and capital projects.

Integration of land use and water planning is the primary focus of the LWMP requirements set forth in the District's Plan. To effectively integrate the goals of MCWD and its LGUs in a way that maximizes community benefits and effectively leverages public funds, the District has invited a partnership framework with its communities. In addition to the legally required elements of LWMPs, as defined in State statute and rules, the MCWD Plan requires communities to propose a coordination plan which describes how the LGU and MCWD will share information and work together to integrate land use and water planning. Specifically, the purpose of a MCWD/LGU coordination plan is to:

1. Establish a framework to be informed as to current LGU land use and infrastructure planning and enable early coordination of land use and water resources management
2. Foster LGU development regulation that integrates water resource protection before plans are fixed
3. Identify and capitalize on project opportunities for improved water resources outcomes while maximizing other public and private goals

As established in the District's Plan, MCWD will prioritize implementation efforts and resource deployment based on its established priorities and LGU commitment to coordination. This commitment is demonstrated through the coordination plan and its implementation by the LGU.

St. Bonifacius LWMP Summary

The City of St. Bonifacius (City) has submitted its LWMP for MCWD review and approval. District staff reviewed the LWMP and provided detailed comments regarding the goals and requirements of the District's Plan for consideration and incorporation into the LWMP.

The City is entirely within the MCWD boundary and Hennepin County (see attached figure). The City occupies approximately 1.1 square miles within the MCWD's Six Mile Creek-Halsted Bay subwatershed, which was identified as a priority area in the District's Plan due to the its size, number of impaired waterbodies, abundance of natural resources, anticipated land use change, and existing partnerships in the area. No significant water resources are located within the City boundaries; however, the City drains to Mud Lake, Six Mile Marsh, and Six Mile Creek, which then flow into Halsted Bay. The lower portions of Six Mile Creek and Halsted Bay are impaired for excess nutrients and the City has been assigned a load reduction under the Upper Watershed Total Maximum Daily Load (TMDL) Study.

Beginning in 2016, as part of its District's Plan development process, MCWD convened a multi-jurisdictional partnership, of which St. Bonifacius is a participant, to work together to guide and prioritize planning and implementation efforts in this region. This Six Mile Creek-Halstead Bay Subwatershed Partnership worked through a collaborative process in which it reached a shared understanding of natural resource issues, drivers, and management strategies for the area. The partnership also worked to understand partner agencies' plans and priorities to help identify opportunities where local plans dovetail with identified natural resource needs to create a shared implementation framework.

The City worked with District staff to develop the attached Coordination Plan to further document a shared commitment by MCWD and the City to integrate land use and water planning through early coordination and continued collaboration as previously established in the Six Mile Creek Halsted Bay Subwatershed Partnership. The Coordination Plan covers the following areas: annual meeting, land use planning, partnership coordination, regulatory coordination, MS4 reporting, communications and education, and aligning plans and investments.

The City authorizes the District to continue to administer all of its water resource regulations. The City will retain Local Government Unit status for the Wetland Conservation Act.

Recommendation:

Staff has verified that the LWMP meets the requirements of Minnesota Statutes §103B.235, Minnesota Rules 8410.0160, and the MCWD Watershed Management Plan and recommends approval.

**Supporting documents:**

1. Overview Figure of St. Bonifacius
2. City of St. Bonifacius and MCWD Coordination Plan
3. City of St. Bonifacius LWMP

MINNEHAHA CREEK
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# RESOLUTION

**Resolution number:** 20-063

**Title:** Approval of St. Bonifacius Local Water Management Plan

WHEREAS, on January 11, 2018, the MCWD adopted its Watershed Management Plan (WMP) pursuant to Minnesota Statutes §103B.231 and Minnesota Rules 8410, which describes how the MCWD will fulfill its responsibilities under the Metropolitan Surface Water Management Act for implementation over the period 2018-2027, and which is guided by the organizational strategy and approach defined through the Balanced Urban Ecology policy; and

WHEREAS, the Balanced Urban Ecology policy prioritizes partnership with the land use community to integrate policy, planning, and implementation in order to leverage the value created when built and natural systems are in harmony; and

WHEREAS, the Balanced Urban Ecology policy rests on the guiding principles of focusing in areas of highest resource needs, being flexible to respond to opportunities that arise through land use changes, and working in partnership to achieve the MCWD's goals; and

WHEREAS, on watershed district adoption of its WMP, cities and towns (local government units or LGUs) within the watershed must prepare local water management plans (LWMPs) that meet content requirements of Minnesota Statutes §103B.235, Minnesota Rules 8410.0160 and the WMP; and

WHEREAS, the LWMP is a primary tool to provide a framework for increased early coordination of land use and water planning through the coordination plan that is a required component of the LWMP and the content of which is described in the WMP, Appendix A; and

WHEREAS, the MCWD will prioritize implementation efforts and resource deployment based on its established priorities and LGU commitment to coordination as demonstrated through the coordination plan and its implementation by the LGU; and

WHEREAS, the City of St. Bonifacius (City) has revised its LWMP and submitted it to the MCWD for review and approval; and

WHEREAS, MCWD staff reviewed the draft LWMP, provided detailed written comments on the LWMP, and thereafter worked with City staff to achieve the development of a proposed LWMP for consideration by the MCWD Board of Managers; and

WHEREAS, the Metropolitan Council has reviewed the LWMP and provided its written comments to the MCWD in a letter on October 9, 2018, and the MCWD has fully considered the comments; and

WHEREAS, the LWMP states that the City does not choose to exercise sole regulatory authority but, instead, wishes that the MCWD continue to require permits for the use and development of land, and otherwise exercise its regulatory authority, within the meaning of Minnesota Statutes §103B.211, subd. 1(a)(3); and

WHEREAS, the LWMP states that the City elects to continue to act as the Local Government Unit responsible to implement the Minnesota Wetland Conservation Act; and

WHEREAS, the LWMP contains a coordination plan that meets the standards set forth in the MCWD WMP, Appendix A; and

WHEREAS, the MCWD has determined that the final revised LWMP meets the requirements of Minnesota Statutes § 103B.235, Minnesota Rules 8410.0160, and is consistent with the MCWD WMP including Appendix A, "Local Water Plan Requirements";

NOW, THEREFORE, BE IT RESOLVED, that the Minnehaha Creek Watershed District Board of Managers hereby approves the City of St. Bonifacius Local Water Management Plan; and

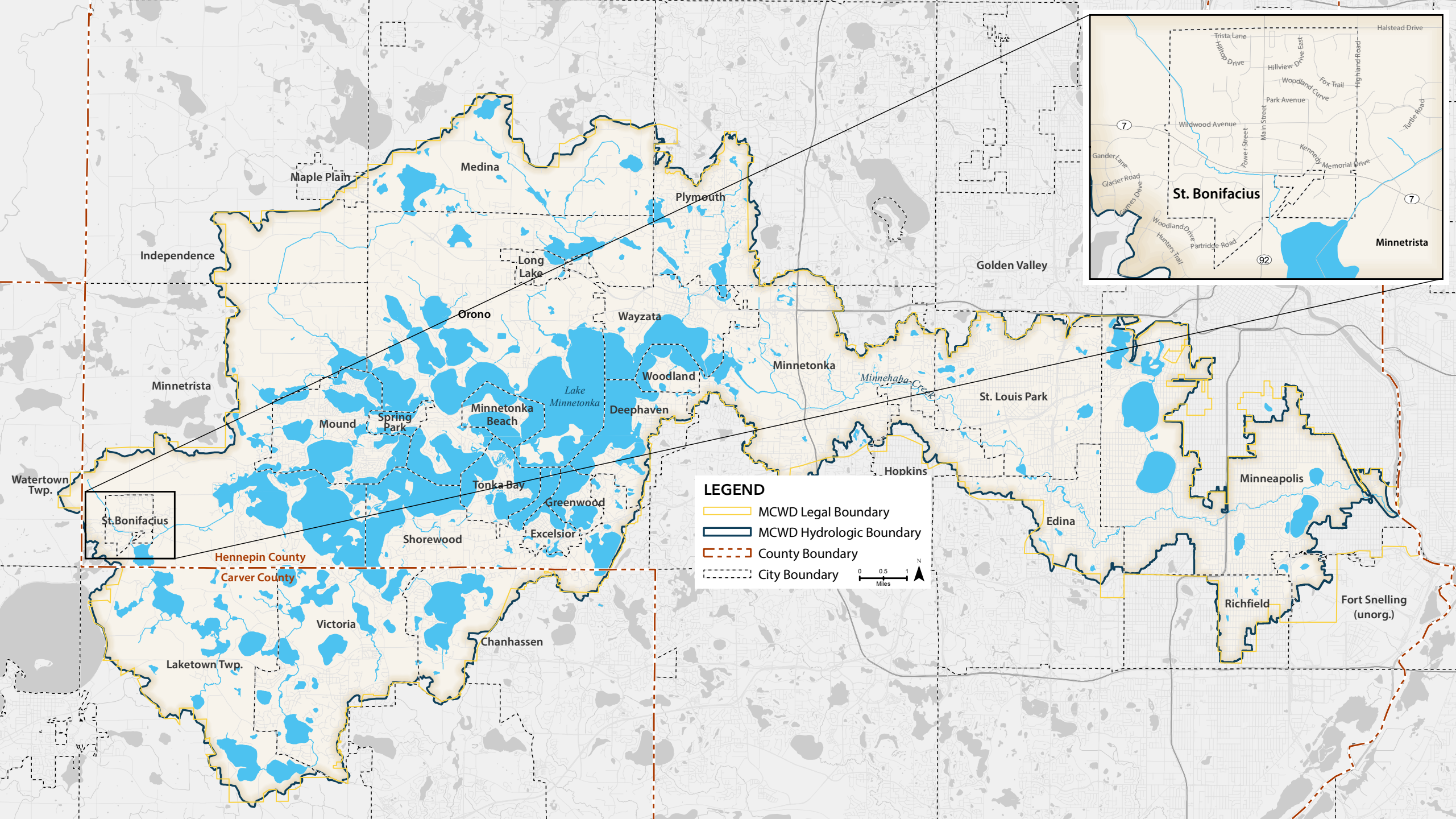
BE IT FURTHER RESOLVED, that the Board approves the associated coordination plan and adopts it on behalf of the MCWD; and

BE IT FINALY RESOLVED that the City is to adopt and implement its LWMP within 120 days, and to notify the MCWD within 30 days thereafter that it has done so.

Resolution Number 20- **063** was moved by Manager _____, seconded by Manager _____. Motion to adopt the resolution ___ ayes, ___ nays, ___abstentions. Date: 8/27/2020

_____ Date: _____

Secretary


Medina
Maple Plain
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Long Lake
Orono
Wayzata
Golden Valley
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Minnetrista
Lake Minnetonka
Woodland
Minnehaha Creek
St. Louis Park
Mound
Spring Park
Minnetonka Beach
Deephaven
Hopkins
Minneapolis
Watertown Twp.
Tonka Bay
Greenwood
St.Bonifacius
Excelsior
Edina
Shorewood
Hennepin County
Carver County
Victoria
Chanhassen
Richfield
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MCWD Legal Boundary
MCWD Hydrologic Boundary
County Boundary
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Minnetrista
Trista Lane
Halstead Drive
Hilltop Drive
Hillview Drive East
Highland Road
Woodland Curve
Fox Trail
Park Avenue
Wildwood Avenue
Main Street
Power Street
Turtle Road
Kennedy Memorial Drive
Gander Lane
Glacier Road
James Drive
Woodland Drive
Hunters Trail
Partridge Road
7
92

## 8.3 City - MCWD Coordination Plan

Early coordination and collaboration between entities is the key to maximizing shared water resource goals and community goals for private redevelopment and public capital improvements. It is the intent of the City to leverage this coordination to efficiently manage water quality, natural resource threats and opportunities that arise through land use change, our shared interest in conservation, and overall maximize the asset value of the City's natural resources in the future.

**Coordination Plan**

The following coordination plan will be adjusted and expanded as deemed appropriate by the City and MCWD during implementation. The City Administrator is the primary City contact and the Policy Planning Coordinator will be the District contact for the coordination plan.

1. Annual meeting. City and MCWD staff will meet during the first quarter of each year to review the following:
    a. National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) reports and activity from the previous year
    b. Draft Capital Improvement Plans (CIP) or budgeting for each organization for the upcoming year. The City will focus coordination of the Streets, Stormwater and Park budgets with MCWD.
    c. Opportunities for early or improved coordination and review of land use change applications
    d. Regulatory coordination to identify areas of collaboration
    e. Areas for improved coordination and process improvement.
    f. Public Education plans, resources and opportunities.

2. Land Use Planning and Regulatory Coordination. The City staff will continue to route requests for land use approvals to the District in an effort to maximize water resource benefits and streamline regulatory processes. Specific areas of regulatory coordination include the following:
    a. The City will continue to rely on MCWD to maintain authority for reviewing and approving applications for compliance with MCWD's rules and enforcing those rules as necessary. The City will rely on the water resource management standards set forth by MCWD in St. Bonifacius.
    b. The City will require documentation of required MCWD permits in advance of issuing applicable City permits. Approved MCWD permits will be stored with other project documentation for future reference.
    c. Pre-application meetings and permit reviews will be coordinated with MCWD early in the planning process as necessary.
    d. The City will continue to collaborate with MCWD on construction site inspections and compliance.
    e. MCWD will keep the City appraised of water resource violations and expectations for compliance.
    f. The City will continue to join with its partners in the Six Mile Creek-Halstead Bay Subwatershed Partnership in order to implement water resource priorities identified in the MCWD Watershed Management Plan; align local plans and capital investment to identify opportunities where local investments intersect with natural resource goals. Through on-going coordination of land use planning and changes the City and MCWD will adaptively evaluate project opportunities and assess them against the established goals of the partnership. Specific areas of opportunities to improve water quality of Mud Lake and downstream resources within the subwatershed are identified within the Mud Lake Subwatershed Assessment (October 2016).

g. Key Conservation areas- The City will assist MCWD in the preservation of those areas identified by MCWD by considering them in land use and zoning decisions.
h. The primary person responsible for regulatory coordination at the City of St. Bonifacius is the City Administrator and the Permitting Program Manager at MCWD
i. The City and MCWD will include each other in the notification protocols for Illicit Discharges.

3. Public Infrastructure Improvements. The City of St. Bonifacius staff will continue to route significant infrastructure improvements (streets, stormwater and parks in particular) to the MCWD as early in the planning process as possible in order to maximize resourcing opportunities, reduce any regulatory process delays and solicit any best practice expertise/ experience.
   a. Infrastructure and land improvements that require MCWD permits will be coordinated early in the planning and design process so that the regulatory process may be efficient and integrated water and natural resource improvements may be explored.
   b. The City will brief the MCWD on the Streets, Stormwater, and Parks budgets each year at the annual meeting. The City intends to coordinate applicable projects at the concept stage of project development, partner on competitive grant programs, and leverage MCWD technical resources and planning assistance.

4. Education coordination and partnership. The City will provide support and assistance to MCWD with the District's educational programs in the form of information sharing and help with promotion materials. The City will identify target audiences and educational needs and collaborate with MCWD to create educational opportunities to meet these needs.

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# SURFACE WATER MANAGEMENT PLAN

## CITY OF ST. BONIFACIUS, MN

**July 2020**

**Submitted by:**
Bolton & Menk, Inc.
2638 Shadow Lane, Suite 200
Chaska, MN 55318
P: 952-448-8838

# Surface Water Management Plan
## St. Bonifacius, Minnesota

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

By: Robert E Bean

Robert Bean, P.E.
Registration No. 40410

Date: July 28, 2020

# Table of Contents

**Appendices**

# 1.0 EXECUTIVE SUMMARY

## 1.1 Introduction

The City of St. Bonifacius has prepared this local Surface Water Management Plan (SWMP) to provide the City and its residents with direction concerning the administration and implementation of surface water management activities within the community. This SWMP inventories city land and water resources and presents water management policies and goals that address known surface water-related problems and concerns about future development/redevelopment activities. The SWMP also addresses the requirements of the various regulatory agencies involved in surface water management.

## 1.2 Surface Water Management Plan Content

The City of St. Bonifacius' SWMP has been developed to meet the needs of the community and address the management planning requirements of the Metropolitan Surface Water Management Act. The SWMP has been prepared in general accordance with Minnesota Rules Chapter 8410 and follows the plan outline identified in the rules. The following paragraphs identify the major sections of the SWMP and where information can be located in the plan document.

### Section 1: Executive Summary

This section presents an introduction for the local water management plan, a summary of City objectives, regulatory requirements included in the plans preparation, and a general overview of the plan contents. This section also summarizes strategic recommendations for consideration by the City in implementing the SWMP.

### Section 2: Surface Water Management Plan Purpose

This section outlines the purpose of this plan.

### Section 3: Water Resources Management Responsibilities and Related Agreements

This section identifies any surface water-related agreements between the city and adjacent communities, organizations or government agencies.

### Section 4: Land and Water Inventory

This section categorizes a wide range of information under the subsections entitled Physical Environment, Human Environment, Surface Water System and Groundwater Resource Data. The subsections provide information and references regarding water resource and physical factors within the City of St. Bonifacius, including the following:

- Climate and Precipitation data.
- Topographic, geologic and groundwater information.
- Surface soils information
- Unique features and scenic areas.
- Land use and public utility services.
- Water-based recreational areas and land ownership.
- Surface water, wetlands, flood studies and water quality data.
- Groundwater resource data

## Section 5: Establishment of Goals and Policies

This section outlines goals and policies addressing water resource management needs of the City and their relationship with Regional, State, and Federal goals and programs. Goals and policies relating to the following issues are presented:

- Water quality
- Water quantity
- Erosion and sedimentation
- Wetlands
- Public ditch systems
- Groundwater
- Recreation and ecological integrity
- Education and Public Involvement
- Training, Inspection and Enforcement
- Low impact redevelopment, natural area preservation and water resource protection
- Municipal Housekeeping

## Section 6: Assessment of Issues and Corrective Actions

This section provides an assessment of existing or potential water resource related issues within the City. This section also describes potential structural, nonstructural and programmatic solutions to the identified problems. Assessments of the following issues are included:

- Excessive nutrient levels and MCWD phosphorus reduction
- Construction site erosion and sediment control
- Increase in runoff discharge rates from new and redevelopment
- General Storm System Maintenance
- Street and Utility Improvement Project Coordination
- Stormwater Runoff Management and Treatment Project Opportunities

## Section 7: Implementation Prioritization and Financial Considerations

This section ranks the goals and policies from Section 5 in an effort to associate a prioritization schedule with the items identified. The list is somewhat subjective and intended to be flexible with changing conditions and information. The section also includes a summary of funding sources available to the city.

## Section 8: Amendment Procedures

This section presents the expected longevity of the SWMP and the process for making amendments consistent with the MCWD Plan.

# 2.0 SURFACE WATER MANAGEMENT PLAN PURPOSE

This Surface Water Management Plan (SWMP) meets the requirements of Minnesota Statute 103B.235 and Minnesota Rule 8410. Minnesota Statute 103B.201 states that the purposes of the water management programs are to:

1. Protect, preserve, and use natural surface and groundwater storage and retention systems;
2. Minimize public capital expenditures needed to correct flooding and water quality problems;
3. Identify and plan for means to effectively protect and improve surface and groundwater quality;
4. Establish uniform local policies and official controls for surface and groundwater management;
5. Prevent erosion of soil into surface water systems;
6. Promote runoff abstraction and groundwater recharge;
7. Protect and enhance fish and wildlife habitat and water recreational facilities; and
8. Secure the other benefits associated with the proper management of surface and groundwater.

The City of St. Bonifacius is situated adjacent to Mud Lake and upstream of Six Mile Creek and is wholly contained within the Minnehaha Creek watershed. **Figure 1** shows the City and surrounding area.

# 3.0 WATER RESOURCE MANAGEMENT RESPONSIBILITIES AND RELATED AGREEMENTS

The City of St. Bonifacius is responsible for construction, maintenance, and other projects in or along the City's storm water management systems (i.e., ponds, pipes, channels, etc.). With regards to land disturbance, stormwater management, and antidegradation policy, the City of St. Bonifacius must comply with the Minnehaha Creek Watershed District (MCWD) Rules, NPDES General Stormwater Permit for Construction Activity, NPDES Permit for Municipal Separate Storm Sewer Systems (MS4), and the NPDES Multi-Sector General Permit for Industrial Activity.

Water Resource Agreements

- With MCWD regarding land use or related project improvements permitting to meet District rules within City boundaries shall be performed by the District.
- With MCWD, Laketown Township, Minnetrista, Victoria, Waconia, Carver County, Hennepin County, and the Three Rivers Park District regarding the Six Mile Creek – Halsted Bay Habitat Restoration Project. Over the next ten years, MCWD and the partners listed will engage in habitat restoration and water quality enhancement projects in this subwatershed, including the restoration of 2,488 acres of in-lake habitat across 14 connected deep and shallow lakes and the creation of corridors of restored wetland and uplands.

The regulations outlined in this plan do not supersede those put forth by MCWD or other Local, State, or Federal agencies. If a discrepancy exists between regulations contained in this plan and other agencies, the more restrictive requirement shall govern.

# 4.0 LAND AND WATER INVENTORY

## 4.1 Introduction

This section provides a generalized description and summary of factors affecting the water resources within the City of St. Bonifacius. The subsections include Physical Environment, Human Environment, Surface Waters, and Groundwater. The Physical Environment subsection presents local information on precipitation, geology, topography, soils and unique features and the Human Environment subsection identifies local land use, public utility services and water based recreational areas. The Surface Waters subsection presents information on the City's drainage patterns, hydrologic systems, public waters and wetlands, floodplain areas and flood studies, and water quality information, while the Groundwater subsection presents information pertaining to just that.

Much of the information contained within this section was compiled from available governmental sources. Whenever possible, the location of the information or additional resources have been identified or referenced.

## 4.2 Physical Environment

### 4.2.1 Location

The City of St. Bonifacius occupies approximately 1.0 square mile in western Hennepin County, as shown in **Figure 1**. St. Bonifacius is surrounded completely by the City of Minnetrista and is contained entirely within the jurisdiction of the Minnehaha Creek Watershed District.

### 4.2.2 Climate and Precipitation

St. Bonifacius has a Humid Continental Climate, typified by considerable seasonal temperature differences, hot and humid summers, and cold to extremely cold winters, and is located in USDA Plant Hardiness Zone 4b. Native vegetation has a seven month growing season (April to October) and crops have a five month growing season (May to September). Two-thirds of the precipitation occurs during the crop growing season, with a total of almost 31 inches annually. Refer to the links provided below for the 30-year average of temperature and precipitation data and the Point Precipitation Frequency Estimates provided by the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for estimated precipitation amounts for specific frequencies, durations, and locations.

https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=mn

### 4.2.3 Geology

The general geology of Hennepin County and the City of St. Bonifacius has been compiled by the Minnesota Geological Survey in a document titled Geologic Atlas of Hennepin County Minnesota (N.H. Balaban, Editor, 1989). This document and its figures are readily available on the Hennepin County website.

The general surficial geology in the City consists primarily of Glacial Till deposits and is dominated by loam with deposits of stratified sediment generally at a depth of 50 feet or more.

Bedrock is generally at a depth of 200 to 300 feet throughout the City, consisting of: St.

Lawrence and Franconia Formations; Ironton and Galesville Sandstones; and Eau Claire Formation. The Franconia consists of dolomitic fine-grained, glauconitic sandstone and shale; while the Ironton and Galesville are silty, fine- to coarse-grained quartzose sandstone underlain by sandstone with interbedded shale or dark-gray quartz grains. The Eau Claire Formation consists of siltstone and shale with small amounts of very-fine to fine sandstone and glauconite.

### 4.2.4 Topography

The topography of St. Bonifacius is undulating, with all of the storm water runoff from the City draining east and ultimately through Six Mile Creek to Halsted Bay of Lake Minnetonka. The runoff produced in the northwestern part of the city is conveyed southeast, where it combines with runoff from the southwest part of the city and drains into Mud Lake. Runoff from the northeastern portion of the city passes through a series of wetlands before ultimately discharging into Six Mile Marsh.

### 4.2.5 Soils

The Natural Resource Conservation Service (formerly the Soil Conservation Service) prepared the Soil Survey for Hennepin County in 1974. This reference shows the location of specific soil types throughout the City of St. Bonifacius and provides detailed data on the typical characteristics of each soil type (this information is readily viewable on the Hennepin County website).

The Lester Loam Association occupies the majority of the City, with smaller areas of Hayden and Kilkenny Loams mixed in. These soils are loams with a Type B moderate infiltration capacity. Lowland/wetland areas consist largely of peaty mucks and Cordova/Glencoe silty clay loams, which are Type D soils of poor infiltration capacity, also known as hydric soils. These soils, as well as the locations of soils of varying infiltration potential (known as hydraulic characteristic *Type*), are important for stormwater-related planning purposes (**Figure 4**).

### 4.2.6 Fish & Wildlife Habitat

The existence and health of habitat generally determines the abundance and diversity of fish and wildlife within the City. Three distinct habitats affecting wildlife are: prairie, forest and water areas. The MCWD Plan contains an overview of the various ground covers, forests, plant species, and water bodies within the watershed and city that provide habitat to the numerous types of terrestrial and aquatic animal species. Due to the rolling terrain, forest cover and wetlands within the City St. Bonifacius, there exist conditions well suited for diverse types of natural habitat and wildlife. The City's wildlife is appreciated and protected as much as feasible.

The MDNR has prepared a Fish Population Assessment and fisheries lake survey for Lake Minnetonka. The reports, management plans, and lake depth maps are available from the MDNR Fisheries Division. The MNDR has not prepared any fish or wildlife management plans nor have they designated any waterfowl lakes within the City.

### 4.2.7 Unique Features and Rare Species

There are no locations within the City of St. Bonifacius that have been identified by the MDNR Natural Heritage and Non-Game Research Program as having rare plant or animal species or other significant natural features relating to water resources (such as Outstanding Resource Value Waters).

#### 4.2.8 Key Conservation Areas

The MCWD Lake Minnetonka Subwatershed Plan identifies areas of high or exceptional wildlife or vegetative diversity as "Key Conservation Areas." The only Key Conservation area within the City of St. Bonifacius is in the extreme southeastern corner of the city limits, in and around Mud Lake. Additional Key Conservation Areas are further downstream around Six Mile Marsh.

### 4.3 Human Environment

#### 4.3.1 Land Use

The City of St. Bonifacius is completely surrounded by the City of Minnetrista, and little developable space remains. Land use is an important factor in estimating surface water runoff, as the impervious surface associated with each land use greatly affects the amount of runoff generated. **Figure 2** exhibits existing land uses in St. Bonifacius, and **Figure 3** exhibits the projected land uses for the year 2040. Land cover consists of mostly residential development, with a few pockets of wetlands and forest. In addition, all land within Hennepin County was mapped using the Minnesota Land Cover Classification System (MLCCS). Refer to **Figure 5** for the portion of area in and around St. Bonifacius. The MLCCS was developed by the Minnesota Department of Natural Resources (MnDNR), and categorizes all areas by type of land cover into two categories. Natural/Semi-natural areas consist of forests, grasslands, wetlands, etc., and Cultural areas consist of urban and agricultural areas. The two categories are further subdivided on the basis of plant types, soil hydrology, plant species, and amount of impervious surface. At this point the city has no goals or policies relating to these classifications. Additional information regarding land use and land cover can be found in MCWD's Watershed Management Plan.

#### 4.3.2 Public Utilities Services

The City of St. Bonifacius has municipal sanitary sewer available to all properties located throughout the city; all wastewater discharges to the Blue Lake Wastewater Treatment Plant in Shakopee, MN. In addition, all properties are served by municipal watermain from the city's water treatment facility.

The city has storm sewer and culverts throughout, generally following topographic relief patterns and roadway corridors. The city contains multiple stormwater treatment ponds, primarily constructed with more recent developments; however, much of the runoff from the older areas of town discharge into city wetlands and waterbodies without prior treatment. Additional information on storm sewer systems and drainage features are presented in the Surface Waters subsection of this SWMP.

#### 4.3.3 Public Park and Open Space

No lakes exist within the city limits for water based recreation. Mud Lake is immediately southeast of the city limits, but is a small Natural Environment lake (DNR classification) with no public access from St. Bonifacius. The City has a number of areas designated for park and open space within its corporate boundaries, owned and controlled by a variety of entities, including the City, Hennepin County, Three Rivers Park District, the State of Minnesota, and private owners. The typical uses at these facilities may include recreation, walking, swimming, and passive uses. In addition, dedication of fees to support park land acquisition are required for new development. Fees are outlined in the City's Fee Schedule available on the City's website. Refer to the City's Comprehensive Plan for more information on parks.

#### 4.3.4 Potential Pollutant Sources

Potential environmental hazards within the City include known and potential sources of soil and

groundwater contamination listed by the Minnesota Pollution Control Agency (MPCA) and wells.

**Known and Potential Sources of Soil and Groundwater Contamination:** The MPCA maintains a database of sites with known or potential soil and groundwater contamination, including Superfund candidate sites, contaminated soil treatment facilities, leak sites, petroleum brownfields, state assessment sites, and voluntary investigation and cleanup sites. The database contains sites that have already been investigated and cleaned up, sites currently enrolled in MPCA cleanup programs, and sites suspected of contamination but found to be clean after investigation. A complete listing of sources and interactive map is provided at the following link:

https://www.pca.state.mn.us/data/contaminated-sites-data

**Wells:** When properly installed, wells pose no threat for potential contamination of groundwater. However, if improperly installed or abandoned, wells can provide a conduit for pollutants to enter groundwater. The County maintains an Index of known wells, some of which have been properly abandoned and sealed. However, those still in operation or abandoned but not properly sealed may allow for contamination of aquifers.

## 4.4 Surface Waters

The following section provides a detailed description of the surface waters within St. Bonifacius.

### 4.4.1 Public Waters and Wetlands

The City of St. Bonifacius contains many wetlands within its surface water system. The following list includes the DNR Protected Waters & Wetlands within and around the city:

***Mud Lake:***

Mud Lake (DNR Protected Water #27-186P) is a 70-acre lake with a watershed of approximately 12,460 acres comprised of residential areas within the city limits, and rural development, agricultural and park land, and water bodies outside of the city. The lake is classified as a Natural Environment Lake with a series of lakes upstream and discharges north into Six Mile Creek and ultimately Halsted Bay of Lake Minnetonka. The DNR ordinary high water level (OHW) of the lake is 929.6, with the highest known elevation being 930.5.

***Six Mile Marsh:***

Six Mile Marsh (DNR Protected Wetland #27-960W) is a large wetland east of the city. The Marsh contains Six Mile Creek and receives discharge from Mud Lake, as well as additional runoff from the northeastern portion of the city. The DNR OHW of the marsh is 929.6 and the highest known elevation is 930.5.

***Unnamed Wetland DNR #10-145W:***

This is a large wetland in the northwestern portion of St. Bonifacius extending into Minnetrista. The large majority of the watershed is undeveloped land outside the city limits consisting primarily of agricultural areas with small, forested areas adjacent to the wetland. The wetland drains south, through a conveyance system and eventually to Mud Lake.

***Unnamed Wetland DNR #10-962W:***

This wetland is immediately east of the city limits, east of Highland Road. The wetland receives runoff from the northeastern portion of the developed city area prior to discharging into Six Mile Marsh.

Minnesota Chapter 103G provides specific criteria for protected status and the MDNR Protected Waters and Wetlands (PWI) maps identify the protected waters. In addition to the MDNR PWI Maps, National Wetlands Inventory (NWI) Maps have been prepared by the U.S. Fish and Wildlife Service, and Mosquito Wetland Inventory Maps have been prepared by The Metropolitan Mosquito Control District. These maps are available at the following links.

https://www.dnr.state.mn.us/waters/watermgmt_section/pwi/maps.html

https://www.fws.gov/wetlands/data/Mapper.html

https://www.mmcd.org/

The Minnehaha Creek Watershed District has completed a Functional Assessment of Wetlands (FAW), which includes those within the City of St. Bonifacius. The assessment identifies the locations of wetlands and provides a functional classification to all wetlands greater than ¼ acre in size. The categories are based on the function and value as determined in the field and include Preserve, Manage 1, Manage 2 and Manage 3. These categories are used to assist in managing water resources and applying buffer standards. The City will utilize the wetlands assessment as part of the site plan review process for individual projects, as well as for "global" planning activities. The City relies on the District for administration of its wetland protection rule. Refer to the following link for more information on MCWD's FAW.

http://www.minnehahacreek.org/41-integration-past-planning-efforts/412-functional-assessment-wetlands

### 4.4.2 Flood Insurance Studies

The current Flood Insurance Study (FIS) applicable for the City is dated November 4, 2016. The FEMA Community Number for the City of St. Bonifacius is 270183 and consists of one panel, which is viewable on FEMA's Map Service Center website. The FIRM identifies a small portion of the southeast corner of the city as being within Zone A, areas inundated during the 100-year flood event (1.0% chance of occurring any given year). The FIRM generally identifies flood levels but only the approximate extent of flooding since it is not based on accurate topography. The City currently uses the floodplain information to review development proposals based upon the extent of flood plains identified in the FIRM. For determination of specific flow rates and floodplain elevations, a detailed hydrologic/hydraulic analysis may be required utilizing survey-accurate topographic data. Refer to the following link for more information regarding the FEMA 100-year floodplain areas around the City.

https://msc.fema.gov/portal/advanceSearch#

### 4.4.3 Hydrologic/Hydraulic Analysis

The City of St. Bonifacius has a patchy storm sewer system for conveyance of rainfall runoff. The existing system generally operates adequately removing stormwater from City property and roadways, although there are areas in need of improvement, as mentioned in the later portions of this document. The storm sewer system and subwatershed areas within the City are shown on **Figures 8 and 9**. The identification numbers indicated were selected randomly and correspond to the modeling performed, as described below.

As part of the original SWMP preparation, a limited hydrologic and hydraulic analysis was

conducted for the subwatersheds of the city. This modeling utilized the HydroCAD modeling software to determine runoff from design events using the Soil Conservation Service (SCS) TR-20 methodology and precipitation depths based on Technical Paper 40 data. It provides a technical planning tool to address risk, along with a mechanism to consider various stormwater-related alternatives. However, the results should not to be used for design-level detail. The analysis included subwatershed delineation from USGS topography, available 2' aerial contours, and field reconnaissance. The analysis determined subwatershed areas, hydrologic conditions, and peak discharge rates for the 1-year, 10-year and 100-year, 24-hour storm events.

Minnehaha Creek Watershed District Analyses

In 2003, MCWD completed a Hydrologic, Hydraulic, and Pollutant Study (HHPLS) to document the physical and biological characteristics of the entire watershed. Combining monitoring data with complex models, the amount and quality of water moving through the watershed was quantified. This HHPLS Report presents a compilation of three years of work by MCWD staff, technical consultants, elected officials, and the public. It identifies existing water management issues resulting from current and past *land use*s, defines the impact of future land use changes, and recommends how MCWD Managers can address these changes.

In 2016, MCWD completed the Mud Lake Subwatershed Assessment. Six Mile Creek is a Tributary to Lake Minnetonka and is a large portion of the upper extents of the Minnehaha Creek Watershed. The Six Mile Creek Watershed is primarily rural agricultural land with multiple lakes and wetland complexes. The 2013 Six Mile Creek Diagnostic Study identified the northwest drainage area to Mud Lake as a likely source of high nutrient loading to Mud Lake and ultimately Halsted's Bay (Lake Minnetonka). Additional water quality data collected following the Diagnostic Study corroborated this finding. The purpose of this subwatershed assessment was to identify solutions to address the significant nutrient loads contributed by these drainage areas.

### 4.4.4 Flood Problem Areas

The modeling done here, along with information from city staff, indicates that there are wetlands within the city that must be adequately maintained to ensure structural flooding potential is kept to a minimum. These areas may experience minor inconvenience flooding during extreme events and may not be within the FEMA 100 year floodplains. The city will continue to add pretreatment measures to improve quality of runoff discharged and maintain conveyance channels as necessary to limit flooding potential.

### 4.4.5 Surface Water Quality

#### *4.4.5.1 Available Water Quality Data*

MCWD monitors and collects water quality data in many of the lakes and streams in the District, and the data is publicly available through the Minnesota Pollution Control Agency's Lake and Stream Information Tool at the following link:

https://cf.pca.state.mn.us/water/watershedweb/wdip/index.cfm

#### *4.4.5.2 Impaired Waters*

The Federal Clean Water Act requires states to establish water quality standards, to test surface waters, and formally list those as "impaired" that do not meet the water quality standards. Subsequent sections present more detail on the impaired waters program and its relationship to St. Bonifacius' stormwater management program. A Total Maximum Daily Load (TMDL) study is the next step for an impaired water, although it can be

delayed years after identification of the impairment. The TMDL study can result in very specific water quality obligations for Cities. Once the TMDL Study is accepted by the MPCA, an Implementation Plan must be developed, and MS4 Cities must develop an approach to meet the obligations identified in the TMDL Study.

In and around St. Bonifacius, Halsteds Bay of Lake Minnetonka and Six Mile Creek are the surface waters listed as impaired, but only the TMDL Study and Implementation Plan has been completed for Halsteds Bay as of 2018. The Upper Minnehaha Creek Watershed Nutrient and Bacteria TMDL addresses impairment to the lake due to high levels of nutrients. Impaired waters around St. Bonifacius are summarized in **Table 4.1**. Mapping of impaired waters is also depicted on **Figure 7**. Additional information regarding TMDL requirements and tracking can be found in the City's SWPPP, which can be obtained at City Hall.

**Table 4-1: Impaired Waters**

| Waterbody/ Watercourse | AUID# | Listed Pollutant | Impaired Use | Year Listed | Year TMDL Approved | Existing Wasteload (TP) | Allowable Wasteload (TP) |
|---|---|---|---|---|---|---|---|
| Six Mile Creek | 07010206-551 | Nutrient/ Eutrophication | Aquatic Life | 2016 | 2025* | * | * |
| Lake Mtka Halsteds Bay | 27-0133-09 | Nutrient/ Eutrophication | Aquatic Recreation | 2008 | 2014 | 183 lbs/yr | 77 lbs/yr |

* Target date for completion.

### 4.4.6 Shoreland and Flood Plain Ordinances

The City of St. Bonifacius does not contain any shoreland and therefore has not adopted a shoreland ordinance.

To maintain St. Bonifacius' eligibility in the National Flood Insurance program and to minimize potential losses due to periodic flooding, the City has prepared and adopted a floodplain ordinance (Chapter 154) in accordance with MDNR requirements. The floodplain zoning district is an overlay zoning district to existing land use regulations of the city. The ordinance adopts by reference the Food Insurance Rate Map (FIRM) developed by the Federal Emergency Management Agency (FEMA) and identifies permitted uses, standards, and evaluation criteria for improvements proposed in floodplains. Refer to the following link for more information regarding the Floodplain Management ordinance.

http://library.amlegal.com/nxt/gateway.dll/Minnesota/stbonifacius_mn/stbonifaciusminnesotacodeofordinances?f=templates$fn=default.htm$3.0$vid=amlegal:stbonifacius_mn

## 4.5 Groundwater

### 4.5.1 Groundwater Resources

Water quality of surface waters can have great effect on groundwater due to the interaction via groundwater recharge and discharge. St. Bonifacius relies strictly on groundwater (aquifers) for drinking water, and therefore, groundwater quality is equally as important as surface water quality. Multiple aquifers exist within Hennepin County, but the majority of wells are finished in the Prairie du Chien-Jordan Aquifer.

**Wellhead Protection**

The Safe Drinking Water Act requires states to implement protection programs to prevent contamination of public drinking water sources. Therefore, the Minnesota Department of Health requires public water suppliers to delineate and manage Wellhead Protection Areas (WHPA) surrounding public water sources. Additional information regarding groundwater resources can be found in the City's Water Supply Plan.

# 5.0 ESTABLISHMENT OF GOALS AND POLICIES

The City of St. Bonifacius has developed the goals and policies contained in this section to conform to the water resource purposes specified in Minnesota Statute Section 103B.201. They have been developed to avoid conflict with existing State, Regional, and County goals and policies, and to be generally consistent with the MCWD Plan. The City regulates erosion control, wetlands, floodplain alteration, and stormwater management for all land development within the City limits in accordance with City Ordinance, the NPDES Permit, and the Wetland Conservation Act. The City relies on the Watershed to administer and enforce its Rules.

Additionally, the City's MS4 Storm Water Pollution Prevention Plan (SWPPP) contains information related to the required Best Management Practices (BMPs) and how the City intends to meet the overall goals of the SWPPP, which are directly related to the goals and policies listed here.

The goals and policies developed by the City address:

- Water quality,
- Water quantity,
- Erosion and sediment control,
- Wetlands,
- Public ditch systems,
- Groundwater,
- Recreation, fish and wildlife and
- Education and public participation.

Outlined below are the goals and policies developed for each of the above items. The annual costs associated with policy making and upkeep is included within the City's general budget.

## 5.1 Water Quality

Goal:
To maintain or improve water quality of surface waters throughout the city by reducing sediment and nutrient loads from the city subwatersheds.

Policies:
1. As an MS4 community, the City has developed a Storm Water Pollution Prevention Plan (SWPPP) outlining many of the municipal BMPs and associated actions being taken by the City. The SWPPP is referenced here and contains additional information on many of the following topics.

2. In the design and construction of new and redevelopment, treatment of stormwater runoff is required prior to discharge to a surface water or wetland. The City will continue to review and approve construction plans for conformance with the requirements of NPDES permitting.

3. The City will rely on MCWD to administer their rules regarding water quality and will require verification that District permit requirements are met.

4. The City will continually evaluate opportunities to reduce the phosphorus load to the area surface waters. All of the runoff from the city ultimately reaches Halsteds Bay of Lake Minnetonka, which is currently on the State's 303(d) list of impaired waters for excessive nutrient concentrations and has an approved TMDL. Therefore, the City will implement nutrient reduction BMPs as necessary to meet wasteload allowances approved. The Mud Lake Subwatershed Assessment completed by MCWD in 2016 identifies potential pollutant sources and BMPs to target phosphorus reduction. As streets and utilities are reconstructed in St. Bonifacius, the City intends to consult this assessment, in addition to any other available data, when evaluating opportunities for new stormwater management facilities. Additional information regarding TMDL requirements and tracking can be found in the City's SWPPP, which can be obtained at City Hall.

5. The City will make water resource protection a priority for city property, including: parks, open space, and other recreational areas. Areas are swept as needed and buffer establishment or other retrofit treatment techniques may be incorporated into future projects within these areas, when feasible.

6. The City annually inspects and maintains its public stormwater management facilities to ensure their continued effectiveness. When feasible, the City may require stormwater management measures to be contained within outlots; however, many facilities will remain private and maintenance agreements will be required for stormwater management facilities used to meet governmental requirements from the appropriate entity responsible for overall property maintenance.

7. The City will continue to sweep paved public streets within the community as outlined in the City's SWPPP and the Housekeeping section, section 5.11 below.

8. The City will continue to implement Best Management Practices (BMPs) on city-owned land as necessary to retain and prevent pollutants from leaving the site.

9. The City requires the preparation and implementation of water resources management and erosion and sediment control plans for construction and land development activities in accordance with NPDES requirements.

10. The City will disperse public education information to foster responsible water quality management practices by city residents and businesses. The public information will include proper lawn fertilizing and other lawn chemical use, disposal of lawn waste and solid, liquid, and household hazardous waste products, as well as many other surface water enhancement educational items.

## 5.2 Water Quantity

Goal:
To minimize downstream impacts by maintaining peak runoff discharge rates and providing runoff volume reduction.

Policies:
1. The City requires that proposed stormwater discharge rates as a result of development be consistent with the requirements of NPDES Permitting.

2. The City will rely on the MCWD to administer their rules regarding peak runoff rates and volume control and will require verification that District permit requirements are met.

3. The City will review downstream stormwater-related impacts (within the community) of development proposals and proactively address water resource-related concerns.

4. The City recognizes the potential environmental impacts associated with constructing new outlets to existing landlocked areas; therefore, the outletting of landlocked areas shall be done only as a last resort and shall be coordinated with the MCWD.

5. The design of new stormwater storage facilities will accommodate the 100-year storm event, providing the required freeboard and avoiding structure flooding. Storm sewers will be designed to pass the10-year rainfall event without the hydraulic grade line extending above the ground at any location, as long as downstream restrictions do not require a reduced-capacity design.

6. Stormwater facilities receiving discharges from adjacent communities will be designed to accommodate existing runoff rates and anticipated volumes.

7. Lowest floor elevations for new buildings shall be at or above the elevations as indicated in the City's floodplain ordinance, as well as meet the requirements of MCWD's Rules. Wetlands or water bodies without regulatory floodplain elevations or defined ordinary high water levels, but with outlets, shall have low opening elevations a minimum 2 feet above the 100-year high water level and a minimum 1 foot above the emergency overflow elevation. Structures around landlocked basins shall have low opening elevations 2 feet above the back-to-back 100-year events.

8. The City will encourage the use of natural drainageways for conveying stormwater where the drainageway can accommodate or be improved to accommodate proposed flows and volumes.

9. Enhanced infiltration practices will be encouraged, where feasible, in areas where the present or future land use does not have a significant potential to contaminate groundwater.

### 5.3 Erosion and Sedimentation

Goal:
To prevent erosion and sedimentation to the maximum extent practical through construction site permitting, inspection and good municipal housekeeping.

Policies:
1. The City requires the preparation and implementation of erosion and sediment control plans and best management practices for construction and land development activities in accordance with NPDES permit requirements with the ultimate goal of eliminating sediment discharge from the site.

2. The City will enforce the erosion and sediment control plan and best management practices on construction sites through the review and inspection process. Areas adjacent to water bodies and wetlands may require additional BMPs due to their environmental sensitivity.

3. The City will continue to sweep paved public streets as identified in the SWPPP. Areas with direct discharge into lakes, wetlands, and streams will be given first priority and areas requiring additional attention will be swept more on an as-needed basis.

### 5.4 Wetlands

Goal:
To protect wetland value and ensure conformance with the requirements of the Minnesota Wetlands Conservation Act (WCA), MCWD Rules, and other State and Federal regulations.

Policies:
1. The City administers the review and approval duties associated with the Wetland Conservation Act (WCA). The city defers administrative responsibility to MCWD for conformance with their wetland protection rules.

2. The City will notify parties proposing land disturbing activities (i.e.: altering, dredging, filling, and draining) to verify with MCWD for their wetland protection rules requirements, as well as possible permit requirements from the MDNR and US Army Corps of Engineers (COE).

3. The city contains a large amount of wetland areas that are critical to stormwater drainage throughout the city. The city manages the wetlands as necessary to minimize the potential for structure flooding and maximize public safety. As such, the city must occasionally remove sediment buildup from wetlands and, as in the past, will work with the appropriate agencies on a case-by-case basis.

4. The City will cooperate with interested private or governmental parties on wetland restoration projects and may participate in the State's wetland banking program.

### 5.5 Public Ditch Systems

Comment:
There are no known county or judicial public ditch systems within the City.

### 5.6 Groundwater

Goal:
To protect groundwater through prudent management of surface waters and areas of potential contamination.

Policies:
1. The City will cooperate as necessary with County and State agencies to inventory and seal abandoned wells and notify its residents of State standards on well abandonment.

2. The City will consider the significance of sensitive geologic areas when making land use decisions, when reviewing development proposals, or when proposing construction of stormwater facilities. Activities that may have significant contamination potential will be required to include groundwater protection measures.

3. The City will encourage the use of infiltration methods to promote groundwater recharge where groundwater will not be significantly impacted by the land use or stormwater runoff.

### 5.7 Recreation and Ecological Integrity

Goal:
To protect and enhance recreational facilities, fish and wildlife habitat, and overall ecological continuity.

Policies:
1. The City will support the efforts of Local, State, and Federal agencies promoting public enjoyment, and the protection of fish, wildlife, and recreational resource values in the City.

2. The City will protect wetlands in accordance with the goals and policies of this plan.

3. The City will encourage its residents to retain existing wetlands, vegetation buffers, and open spaces for the benefit of wildlife habitat.

### 5.8 Education and Public Involvement

Goal:
To educate and inform the decision makers and general public on water resources management issues; and to increase public participation in water management activities.

Policies:
1. The City will continue to promote best management practices for its residents. Public education will include topics such as: fertilizer use and the limited need for phosphorus in fertilizer; lawn care and lawn chemical use; solid, liquid and household hazardous waste disposal; illicit discharge detection; and natural water resource systems and protection methods.

2. The City will distribute educational information or notices regarding various water resources management and protection documents.

### 5.9 Training, Inspection and Enforcement

Staff training, inspection of City facilities, illicit discharges, and construction sites, and enforcement responses are done in accordance with the City's MS4 Permit requirements. Further information regarding training, inspection and enforcement can be found in the City's SWPPP located at City Hall.

### 5.10 Low Impact Development/Redevelopment, Natural Area Preservation & General Water Resource Protection

Goal:
To promote Low Impact Development (LID) techniques, preserve natural areas and protect surface water resources.

Policies:

1. The City is aware of the environmental benefits associated with LID and general natural area preservation and will work with redevelopment to implement these practices when feasible. These may include, but not be limited to:

    - Impervious area reduction
    - Impervious area disconnection
    - Decentralized stormwater management
    - Street width reduction
    - Rural street sections
    - Reduced setbacks
    - Ecological/pedestrian corridors
    - Natural space preservation and incorporation into site design
    - Site disturbance minimization
    - Pervious pavement
    - Green Roofs
    - Increased stormwater abstraction (infiltration, filtration, irrigation reuse, etc.)

2. The City currently does not plan to adjust its codes to address LID specifically; however, the codes will continue to be flexible and allow for variance to accommodate LID designs on a case-by-case basis.

3. The City is continually looking for ways to enhance protection of its surface water resources, including the integration of improvement techniques into municipal projects.

### 5.11 Municipal Housekeeping

Goal:
To conduct operations and maintenance of City facilities and infrastructure as necessary to keep systems operating adequately and limit potential for discharge of pollutants. Additional information regarding municipal housekeeping can be found in the City's MS4 Storm Water Pollution Prevention Plan (SWPPP).

Policies:

1. The City will continue to sweep all paved streets as outlined in the SWPPP.

2. The City will continue to inspect stormwater management facilities, stockpiles, and material handling areas as outlined in the SWPPP.

3. The City will continue to document inspections and maintenance activities as outlined in the SWPPP.

4. The City requires Operation and Maintenance Plans for all stormwater management facilities used to meet governmental requirements. The plans are required to outline operation, maintenance, and inspection schedules and reporting requirements

# 6.0 ASSESSMENT OF ISSUES AND CORRECTIVE ACTIONS

This section contains an assessment of existing and potential water resource related issues presently known within the city, as well as a description of structural, non-structural, or programmatic solutions that are proposed to address or correct the issues. These issues and concerns have been identified in the latest MCWD plan and/or by city staff as part of the land and water resource data collected in the preparation of this SWMP. Many of the general issues addressed here are addressed by policies set forth in Section 5 of this plan, while site-specific issues have specific proposed solutions. The timeframes shown are for planning purposes only and may change as needs and funding scenarios change in the future.

## 6.1 Excessive Nutrient Levels and Phosphorus Reduction

*Issue:*
The City of St. Bonifacius discharges stormwater runoff directly into Mud Lake and Six Mile Creek. Runoff carrying nutrients, primarily phosphorus, from developed and undeveloped land to these water bodies ultimately causes elevated nutrient concentration in the waters. High nutrient loads will lead to reduced clarity, excessive algal growth and overall decreased public value of the affected water bodies.

*Corrective Action:*
The City requires new and redevelopment to apply permanent stormwater treatment measures meeting the requirements of Watershed District and NPDES permitting. In addition, the City must reduce its discharge of phosphorus as outlined in the Upper Minnehaha Creek Watershed Nutrient and Bacteria TMDL (see Section 4 for allowable wasteload for identified impaired waters). In order to achieve the phosphorus wasteload reduction required, the City will employ a variety of BMPs, which may include the following:

- Require development abstraction of additional runoff volume (above that required)
- Evaluate municipal projects for incorporation of BMPs identified in the Mud Lake Subwatershed Assessment, completed by MCWD in 2016
- Evaluate municipal projects for incorporation of additional abstraction (above that required)
- Evaluate street sweeping effectiveness and adjust as needed
- Evaluate wetlands for sediment removal when localized flooding issues arise and coordinate potential removal with MCWD
- Natural area preservation
- Partnering with the MCWD for capital projects

Since management of allowable wasteloads defined by TMDLs is required per the MS4 permit, planning of potential BMPs and tracking of pollutant loading is administrated through the City's SWPPP, and the SWPPP should be referred to for the most current information regarding pollutant removal practices and management.

*Timeframe*

| | |
|---|---|
| Ongoing: | Site plan review for permit compliance |
| Ongoing: | Evaluation of treatment opportunities to decrease pollutant loads |
| Ongoing: | Reduction of phosphorus discharge to meet wasteload allowed by TMDLs |

### 6.2 Construction Site Erosion and Sediment Control

*Issue:*
Sediment leaving construction sites pollutes, fills and degrades surface waters, wetlands and conveyance systems.
*Corrective Action:*
The City will continue to monitor appropriate use of sediment and erosion control practices, as required by NPDES permitting, through the review and inspection process currently in place.

*Timeframe:*
Ongoing: Plan review and construction site inspection.

### 6.3 Runoff discharge from new and redevelopment

*Issue:*
The increased percentage of impervious area typically seen with new and redevelopment can cause a corresponding increase in flowrate and volume discharging from the area. These increases can lead to downstream erosion, flooding and/or decreased water quality if not properly mitigated.

*Corrective Action:*
The City requires new- and redevelopment to apply permanent stormwater rate and volume attenuation measures meeting the requirements of MCWD and NPDES permitting.

*Timeframe:*
Ongoing: Site plan review for permit compliance.

### 6.4 General Storm System Maintenance

*Issue:*
The existing storm drainage system is performing adequately to convey runoff, although, system maintenance will be required annually.

*Corrective Action:*
Storm drainage system maintenance required includes pond assessment and cleaning, street sweeping, sewer televising, and GIS/mapping.

*Timeframe:*
Ongoing: storm system maintenance.

### 6.5 Street and Utility Improvement Projects

*Issue:*
The existing storm drainage system is performing adequately to convey runoff, although, system maintenance will be required annually.

*Corrective Action:*
As street, sanitary sewer, and water main improvement projects are scheduled, project areas will also be reviewed for potential stormwater management and treatment improvements that were not previously identified. Potential improvements include, but are not limited to, conveyance

improvements, stormwater treatment devices, bioretention basins, wet retention ponds, slope stabilizations, and native vegetation restoration.

*Timeframe:*
Ongoing: storm system improvements.

### 6.6 Stormwater Runoff Management and Treatment Projects

*Issue:*
The existing storm drainage system is performing adequately to convey runoff, although, system maintenance will be required annually.

*Corrective Action:*
Correct flooding issues on City property as necessary to protect public safety and minimize potential for property damage. Also, collaborate as necessary with Watershed Districts and willing private landowners to install stormwater treatment measures (i.e. rain gardens, stormwater treatment devices, etc.) throughout the City to provide additional runoff storage capacity, reduce runoff rates and volumes, and/or reduce pollutant loads. Coordinate stormwater treatment improvements to treat stormwater from areas with inadequate or no treatment and improve the quality of runoff reaching area surface waters.

*Timeframe:*
Ongoing: storm system improvements.

# 7.0 IMPLEMENTATION PRIORITIZATION & FINANCIAL CONSIDERATIONS

## 7.1 Implementation Prioritization

Provided below is a generalized ranking of the *policies* and *corrective actions* identified in sections 5 and 6. The High, Medium, Low format has been selected over a numerical format to emphasize the need for flexibility and the inherent inexactness of trying to quantify something that is fairly subjective. Funding appropriations and projects may switch levels at any time given new information/circumstances.

All of the goals and associated policies identified in Section 5 are of high priority. Rather than restate each policy, the following policies are highlighted because they pertain to more recent developments.

**Table 7.1: Policy Prioritization**

| Policy Description | Ranking |
|---|---|
| Administer and maintain the City MS4 Storm Water Pollution Prevention Plan (SWPPP) | HIGH |
| Address Total Maximum Daily Load waste load allocations as they are developed (refer to SWPPP for TMDL management) | HIGH |
| Continued promotion of low impact development techniques, infiltration and general runoff volume reduction | HIGH |
| Maintain existing storm sewer system to provide adequate treatment and conveyance of runoff | HIGH |
| Evaluate street and utility improvement projects for potential stormwater management and treatment improvements | HIGH |
| Correct flooding issues on City property as necessary and collaborate with MCWD and Private Landowners to install stormwater treatment measures | MED |
| Expand public education program to make wider use of City website | LOW |

## 7.2 Funding Sources

The City currently has a number of funding sources available to pay for the regulatory controls, management programs and municipal housekeeping efforts for stormwater management. They include general tax revenue, special assessments and the City's stormwater utility fee. The City stormwater utility fee currently collects $6.50 per month per property. At 819 properties currently being charged, the fee generates $63,882 annually for general system maintenance and stormwater management and treatment related improvements. As projects are identified, the stormwater utility fee may be supplemented with the general fund, and if the project provides treatment beyond what is required, grant funding may also be pursued.

## 7.3 Capital Improvements Program

The City manages capital expenditures for surface water management as part of its Annual Budget. The Annual Budget provides yearly planning and management of infrastructure throughout the City. The City does not currently have any potential projects appropriate for a stormwater-oriented CIP. Instead, potential Stormwater Management projects will be evaluated as part of annual street and utility improvement projects, with funding provided from the stormwater utility fee for the stormwater management portions of the project. Following is a table summarizing anticipated water resource related implementation activities accounted for in annual budgeting:

Table 7.2: Implementation Plan

| Item | Schedule | Estimated Cost | Funding Source |
|---|---|---|---|
| Street Sweeping | Ongoing | $4,500 / yr | Stormwater Utility Fee |
| Inspection/Maintenance of Stormwater Runoff Management Facilities (including pond dredging) | Ongoing | $20,000 / yr | Stormwater Utility Fee |
| Site Plan Review/Inspection for NPDES Compliance | Ongoing | $10,000 / yr | Stormwater Utility Fee |
| Water Resource Related Improvements / Street Reconstruction BMPs | Ongoing | $25,000 / yr | Stormwater Utility Fee |
| Mud Lake Subwatershed BMPs Coordination | Ongoing | $500 / yr | Stormwater Utility Fee |

# 8.0 ADMINISTRATION

## 8.1 Review and Approval

It is the City's intention to have this SWMP reviewed and approved by the Minnehaha Creek Watershed District (MCWD) in accordance with Minnesota Statutes, Section 103B.235. The plan will be sent to Metropolitan Council for review and comment, with ultimate adoption as the water resources component of the City's Comprehensive Plan.

## 8.2 City Amendments

If the City proposes changes to this SWMP, the changes and their impacts will be determined by the City as either a "minor" change or a "major" change. The general descriptions of minor or major changes and the associated review and approval requirements are presented as follows:

Minor Changes would include small adjustments to subwatershed or subdistrict boundaries or other minor changes that would not significantly affect the rate or quality of stormwater runoff discharged across the municipal boundary or significantly affect high water levels within the City. Minor changes also include revisions made to the stormwater related Capital Improvements Program to best meet the City's water resource needs and financial considerations. For proposed minor changes, the City will prepare a document which defines the change and includes information on the scope and impacts of the change. The document will be forwarded to the MCWD for their records. The minor change will be implemented after the document is adopted by the City Council.

Major Changes are those that could have significant impacts on the rates, volumes, water qualities and water levels of stormwater runoff within the City or across its municipal boundaries. For proposed major changes, the City will prepare a document that defines the change and includes information on the scope and impacts of the change. The document will be forwarded to the MCWD for their review and approval. The MCWD shall have 60 days to comment on the proposed revisions. Failure to respond within 60 days will constitute approval. After MCWD approval, the City will adopt the amendment as part of the SWMP.

## 8.3 City - MCWD Coordination Plan

Early coordination and collaboration between entities is the key to maximizing shared water resource goals and community goals for private redevelopment and public capital improvements. It is the intent of the City to leverage this coordination to efficiently manage water quality, natural resource threats and opportunities that arise through land use change, our shared interest in conservation, and overall maximize the asset value of the City's natural resources in the future.

**Coordination Plan**
The following coordination plan will be adjusted and expanded as deemed appropriate by the City and MCWD during implementation. The City Administrator is the primary City contact and the Policy Planning Coordinator will be the District contact for the coordination plan.

1. Annual meeting. City and MCWD staff will meet during the first quarter of each year to review the following:
    a. National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) reports and activity from the previous year

b. Draft Capital Improvement Plans (CIP) or budgeting for each organization for the upcoming year. The City will focus coordination of the Streets, Stormwater and Park budgets with MCWD.
c. Opportunities for early or improved coordination and review of land use change applications
d. Regulatory coordination to identify areas of collaboration
e. Areas for improved coordination and process improvement.
f. Public Education plans, resources and opportunities.

2. Land Use Planning and Regulatory Coordination. The City staff will continue to route requests for land use approvals to the District in an effort to maximize water resource benefits and streamline regulatory processes. Specific areas of regulatory coordination include the following:
   a. The City will continue to rely on MCWD to maintain authority for reviewing and approving applications for compliance with MCWD's rules and enforcing those rules as necessary. The City will rely on the water resource management standards set forth by MCWD in St. Bonifacius.
   b. The City will require documentation of required MCWD permits in advance of issuing applicable City permits. Approved MCWD permits will be stored with other project documentation for future reference.
   c. Pre-application meetings and permit reviews will be coordinated with MCWD early in the planning process as necessary.
   d. The City will continue to collaborate with MCWD on construction site inspections and compliance.
   e. MCWD will keep the City appraised of water resource violations and expectations for compliance.
   f. The City will continue to join with its partners in the Six Mile Creek-Halstead Bay Subwatershed Partnership in order to implement water resource priorities identified in the MCWD Watershed Management Plan; align local plans and capital investment to identify opportunities where local investments intersect with natural resource goals. Through on-going coordination of land use planning and changes the City and MCWD will adaptively evaluate project opportunities and assess them against the established goals of the partnership. Specific areas of opportunities to improve water quality of Mud Lake and downstream resources within the subwatershed are identified within the Mud Lake Subwatershed Assessment (October 2016).
   g. Key Conservation areas- The City will assist MCWD in the preservation of those areas identified by MCWD by considering them in land use and zoning decisions.
   h. The primary person responsible for regulatory coordination at the City of St. Bonifacius is the City Administrator and the Permitting Program Manager at MCWD
   i. The City and MCWD will include each other in the notification protocols for Illicit Discharges.

3. Public Infrastructure Improvements. The City of St. Bonifacius staff will continue to route significant infrastructure improvements (streets, stormwater and parks in particular) to the MCWD as early in the planning process as possible in order to maximize resourcing opportunities, reduce any regulatory process delays and solicit any best practice expertise/ experience.
   a. Infrastructure and land improvements that require MCWD permits will be coordinated early in the planning and design process so that the regulatory process may be efficient and integrated water and natural resource improvements may be explored.
   b. The City will brief the MCWD on the Streets, Stormwater, and Parks budgets each year at the annual meeting. The City intends to coordinate applicable projects at the concept stage of project development, partner on competitive grant programs, and leverage MCWD technical resources and planning assistance.

4. Education coordination and partnership. The City will provide support and assistance to MCWD with the District's educational programs in the form of information sharing and help with promotion materials. The City will identify target audiences and educational needs and collaborate with MCWD to create educational opportunities to meet these needs.

# Appendix A

## Figures

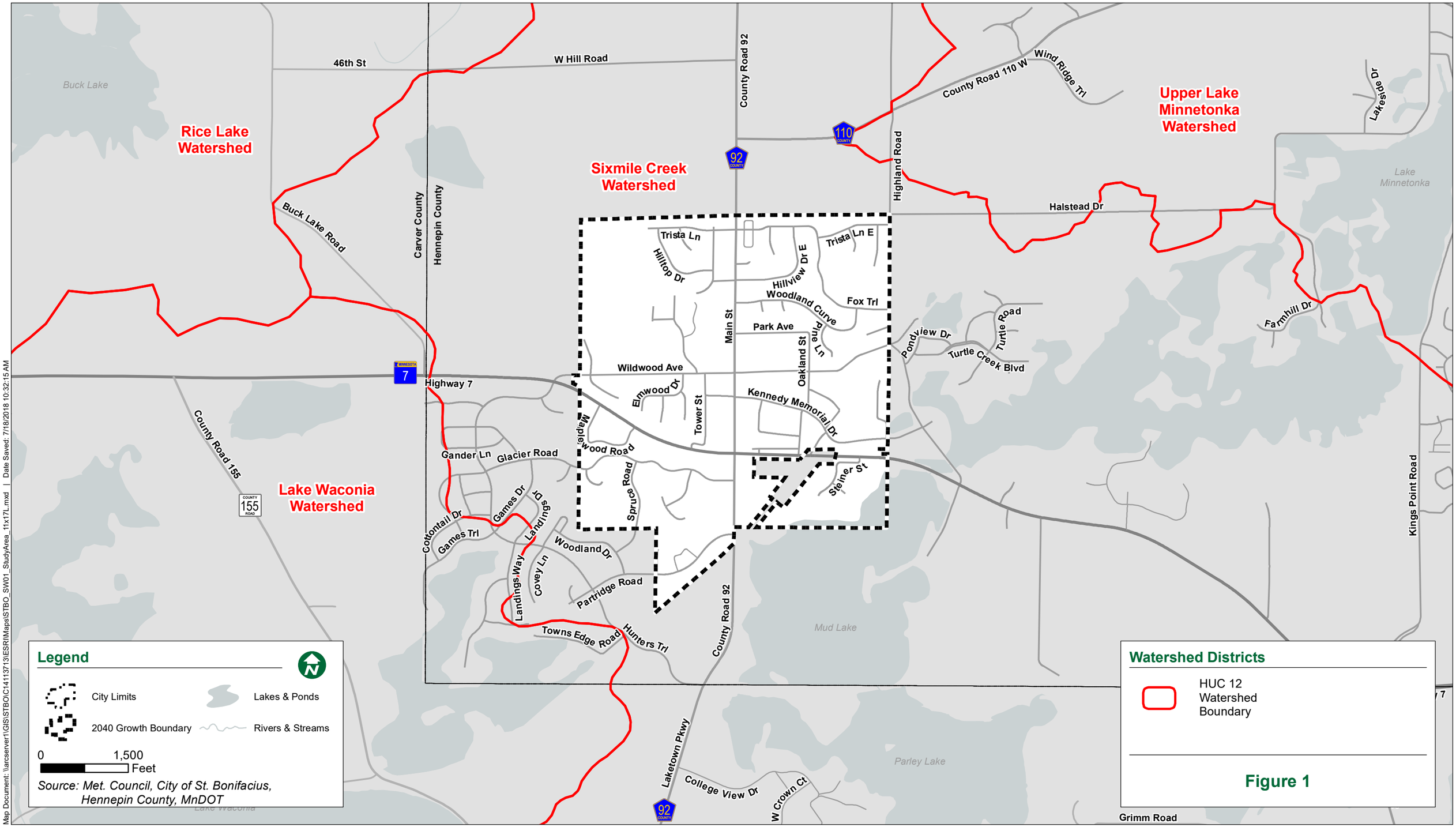
# 2040 Comprehensive Plan

St. Bonifacius, MN

## Study Area

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Watershed Districts

HUC 12 Watershed Boundary

**Figure 1**

# 2040 Comprehensive Plan

St. Bonifacius, MN

## Existing Land Use

July 2020

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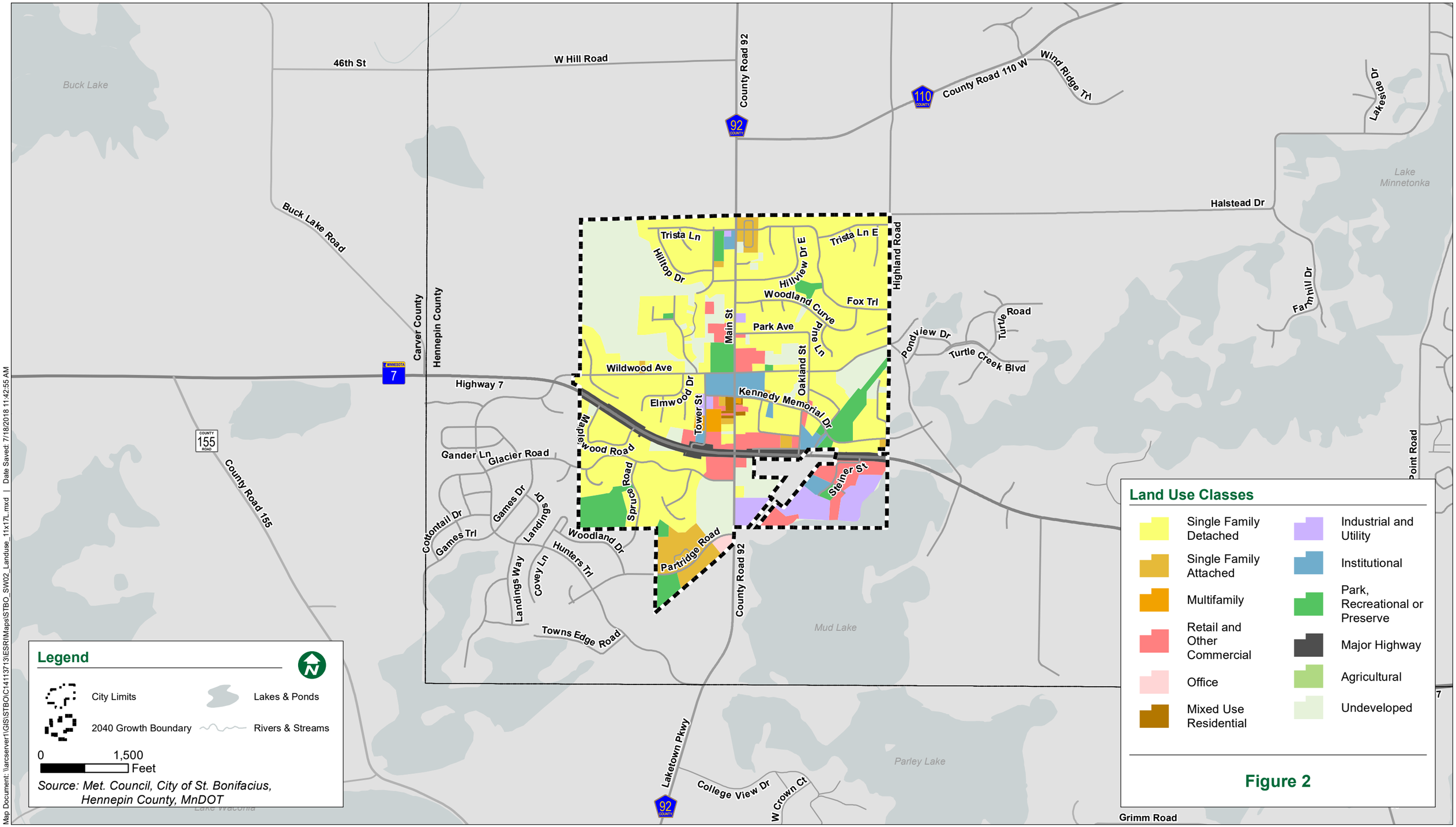
Real People. Real Solutions.




**Legend**

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

**Land Use Classes**

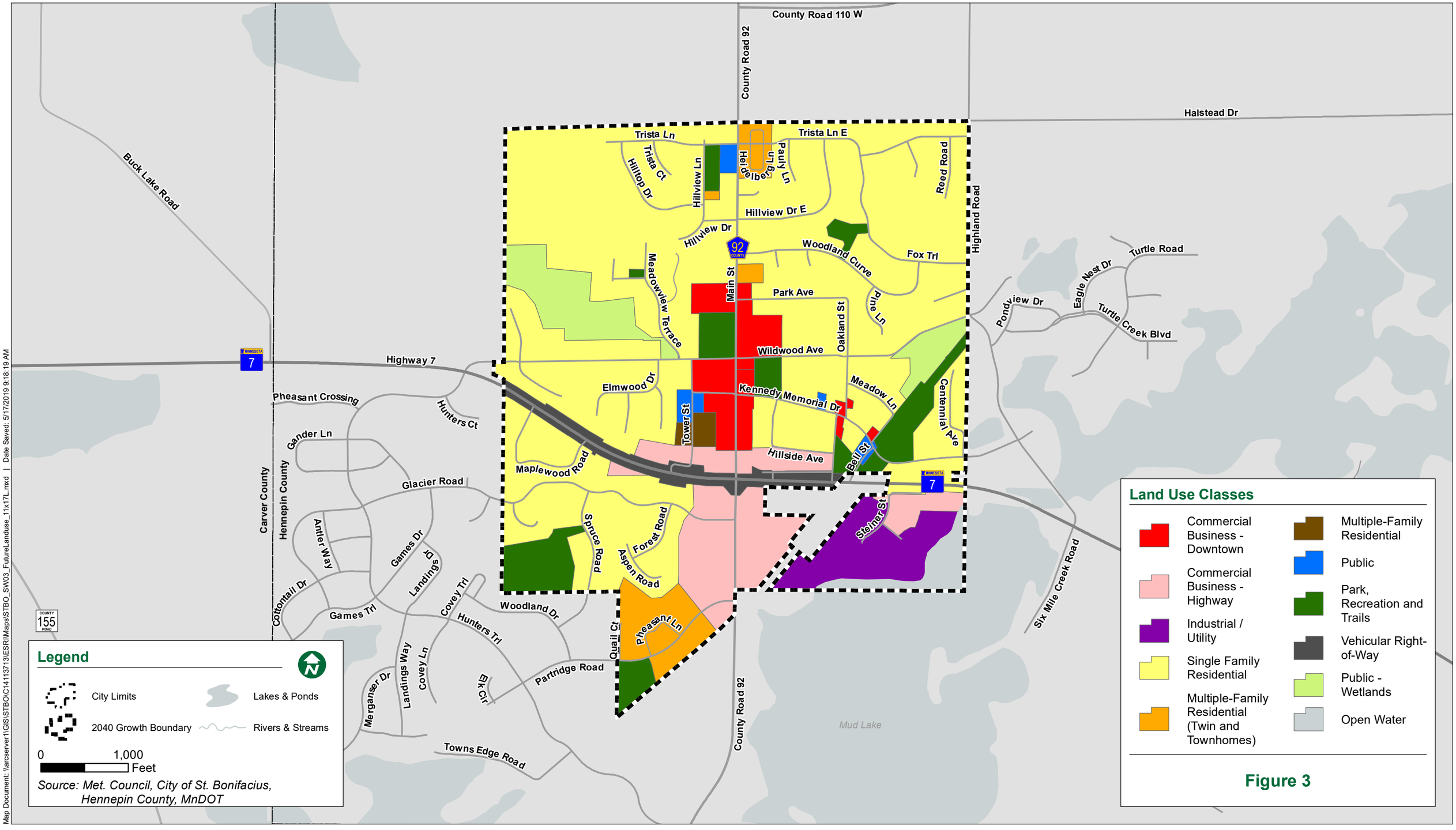
- Single Family Detached
- Single Family Attached
- Multifamily
- Retail and Other Commercial
- Office
- Mixed Use Residential
- Industrial and Utility
- Institutional
- Park, Recreational or Preserve
- Major Highway
- Agricultural
- Undeveloped

**Figure 2**

# Future Land Use

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,000 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Land Use Classes

- Commercial Business - Downtown
- Commercial Business - Highway
- Industrial / Utility
- Single Family Residential
- Multiple-Family Residential (Twin and Townhomes)
- Multiple-Family Residential
- Public
- Park, Recreation and Trails
- Vehicular Right-of-Way
- Public - Wetlands
- Open Water

**Figure 3**

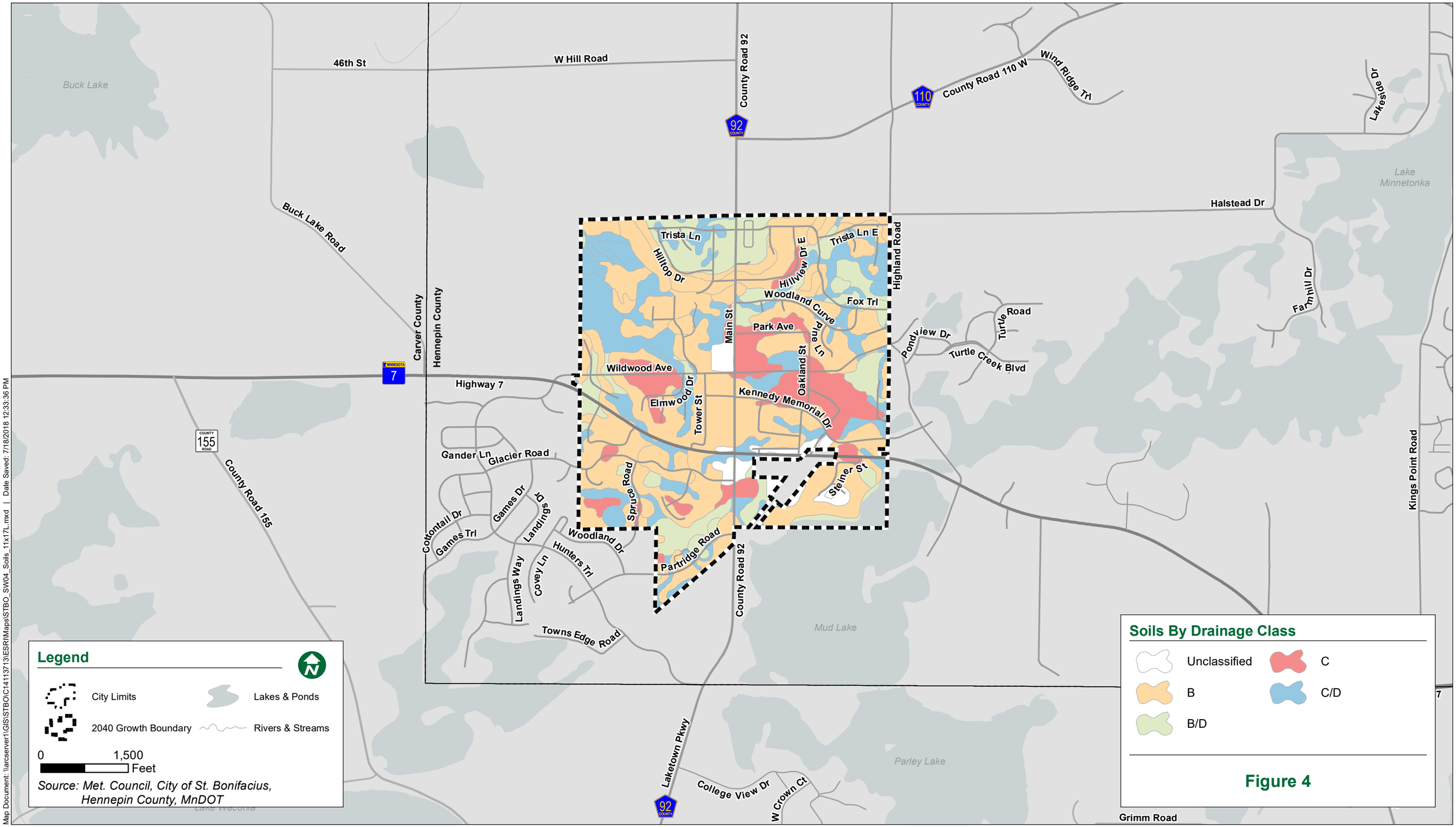
# 2040 Comprehensive Plan

St. Bonifacius, MN

## Soils

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Soils By Drainage Class

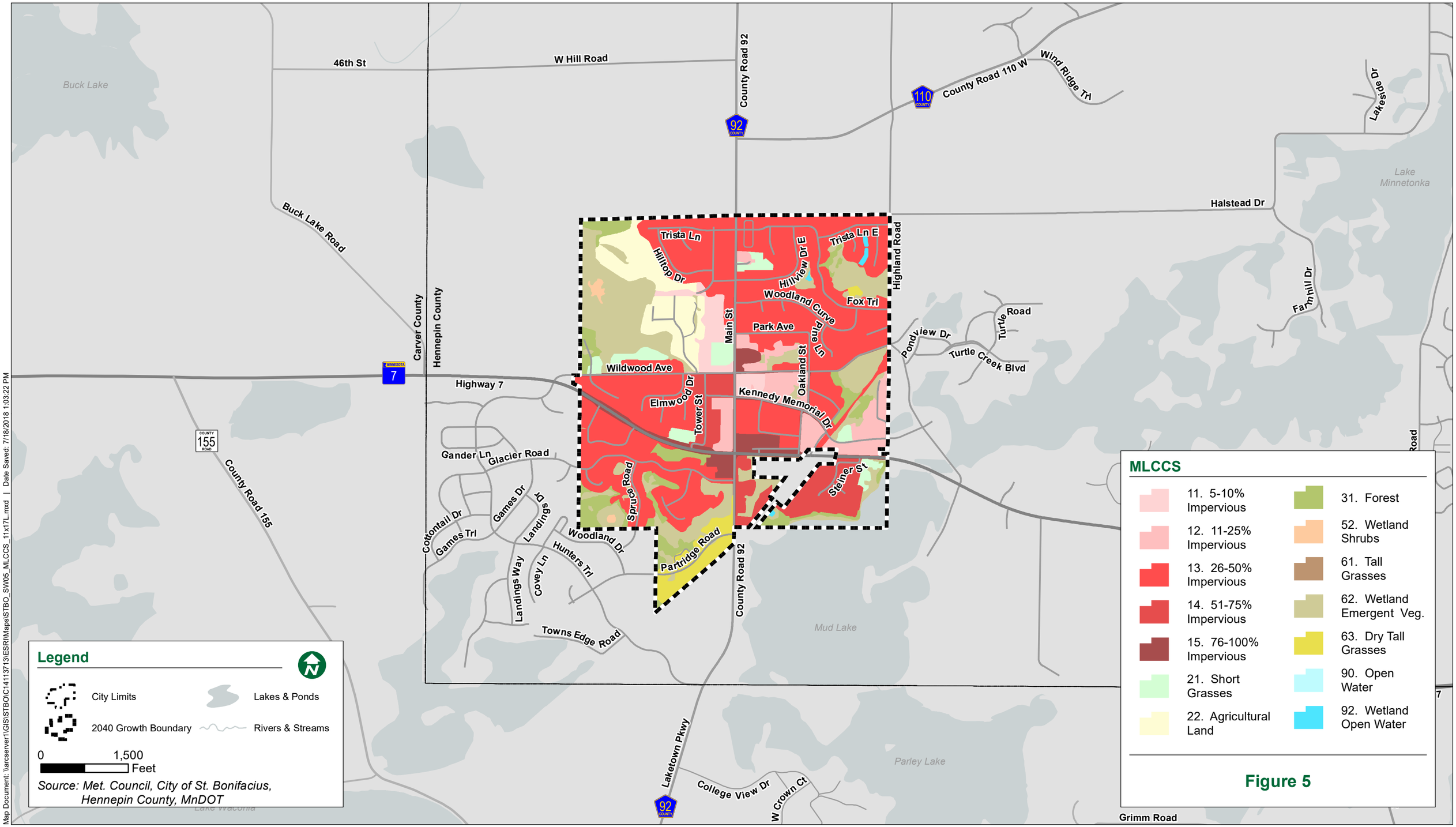
- Unclassified
- B
- B/D
- C
- C/D

**Figure 4**

# Minnesota Land Cover Classification

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## MLCCS

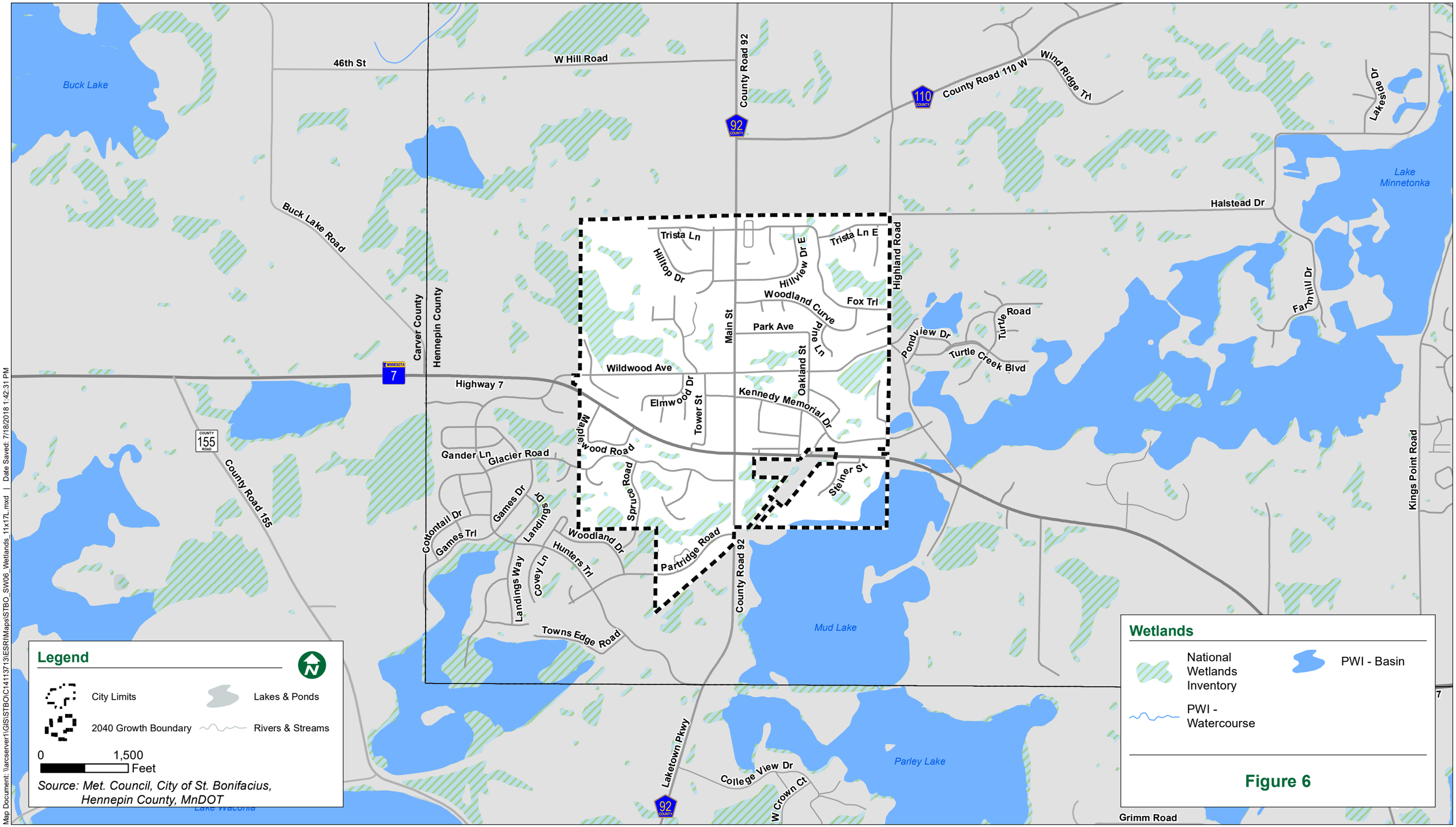
- 11. 5-10% Impervious
- 12. 11-25% Impervious
- 13. 26-50% Impervious
- 14. 51-75% Impervious
- 15. 76-100% Impervious
- 21. Short Grasses
- 22. Agricultural Land
- 31. Forest
- 52. Wetland Shrubs
- 61. Tall Grasses
- 62. Wetland Emergent Veg.
- 63. Dry Tall Grasses
- 90. Open Water
- 92. Wetland Open Water

**Figure 5**

# National Wetlands Inventory & DNR Public Waters

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Wetlands

- National Wetlands Inventory
- PWI - Basin
- PWI - Watercourse

**Figure 6**

Map Document: \\arcserver1\GIS\STBO\C14113713\ESRI\Maps\STBO_SW06_Wetlands_11x17L.mxd | Date Saved: 7/18/2018 1:42:31 PM

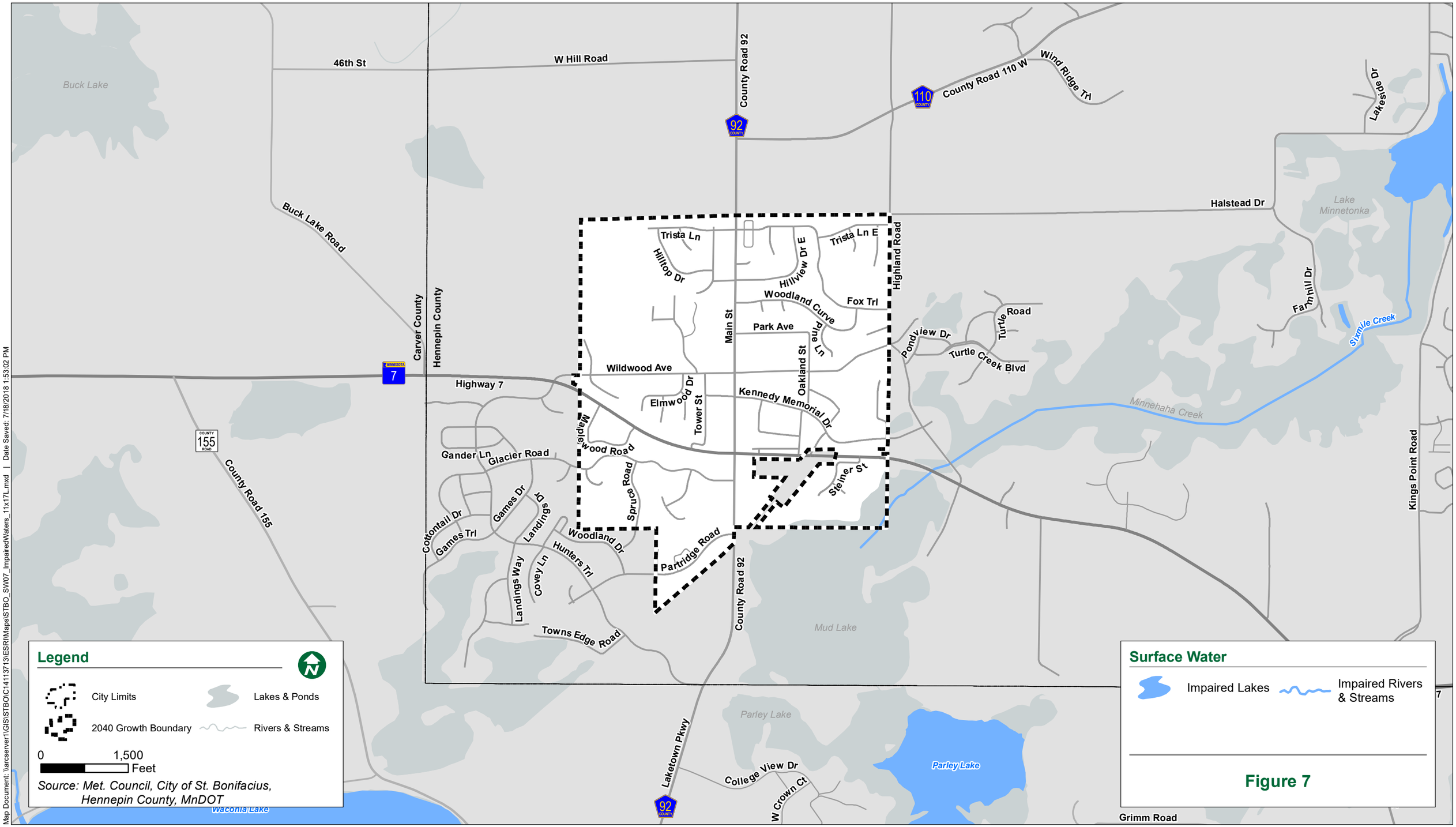
# 2040 Comprehensive Plan

St. Bonifacius, MN

## Impaired Waters

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Surface Water

- Impaired Lakes
- Impaired Rivers & Streams

**Figure 7**

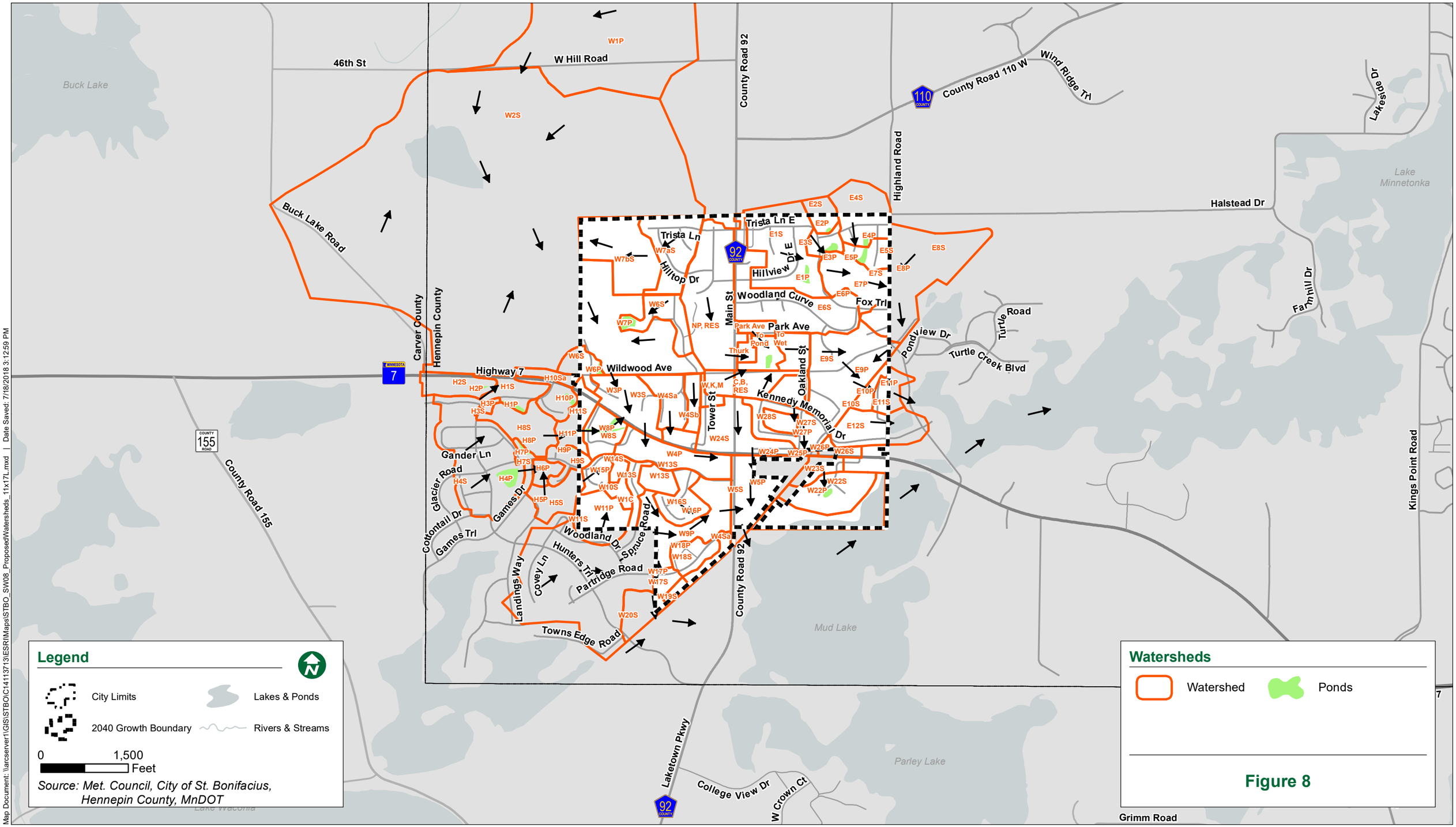
# 2040 Comprehensive Plan

St. Bonifacius, MN

## Proposed Watersheds

July 2020

BOLTON & MENK
Real People. Real Solutions.




## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Watersheds

- Watershed
- Ponds

**Figure 8**

Map Document: \\arcserver1\GIS\STBO\C14113713\ESRIMaps\STBO_SW08_ProposedWatersheds_11x17L.mxd | Date Saved: 7/18/2018 3:12:59 PM

# 2040 Comprehensive Plan

St. Bonifacius, MN

## Existing Storm Sewer System

July 2020

BOLTON & MENK
Real People. Real Solutions.

Buck Lake
46th St
W Hill Road
County Road 92
County Road 110 W
Wind Ridge Trl
Lakeside Dr
Lake Minnetonka
Halstead Dr
Buck Lake Road
Carver County
Hennepin County
Highland Road
Trista Ln
Trista Ln E
Hilltop Dr
Hillview Dr E
Woodland Curve
Fox Trl
Park Ave
Main St
Prairie Ln
Oakland St
Pondview Dr
Turtle Road
Turtle Creek Blvd
Farmhill Dr
Wildwood Ave
Highway 7
Elmwood Dr
Tower St
Kennedy Memorial Dr
Maplewood Road
Spruce Road
Steiner St
Gander Ln
Glacier Road
Games Dr
Landings Dr
Cottontail Dr
Games Trl
Woodland Dr
Partridge Road
Landings Way
Covey Ln
Hunters Trl
Towns Edge Road
County Road 92
Mud Lake
Kings Point Road
County Road 155
Laketown Pkwy
College View Dr
W Crown Ct
Parley Lake
Grimm Road
Lake Waconia

## Legend

- City Limits
- 2040 Growth Boundary
- Lakes & Ponds
- Rivers & Streams

0 1,500 Feet

*Source: Met. Council, City of St. Bonifacius, Hennepin County, MnDOT*

## Storm Sewer System

- Storm Pipe
- Storm Pond

**Figure 9**

# Appendix B

## Modeling Methodology

# MODELING METHODOLOGY AND MAPPING

1. The general procedure used in the runoff modeling aspects of this analysis has been performed using the HydroCad modeling software. The typical analysis is based on Soil Conservation Service, Technical Release No. 20 (SCS TR-20). The SCS procedure is based on a standard synthetic rainfall hydrograph, which is modified by local parameters (i.e., rainfall, soil type, time to peak flow, etc.) and is widely accepted among drainage engineers across the United States.

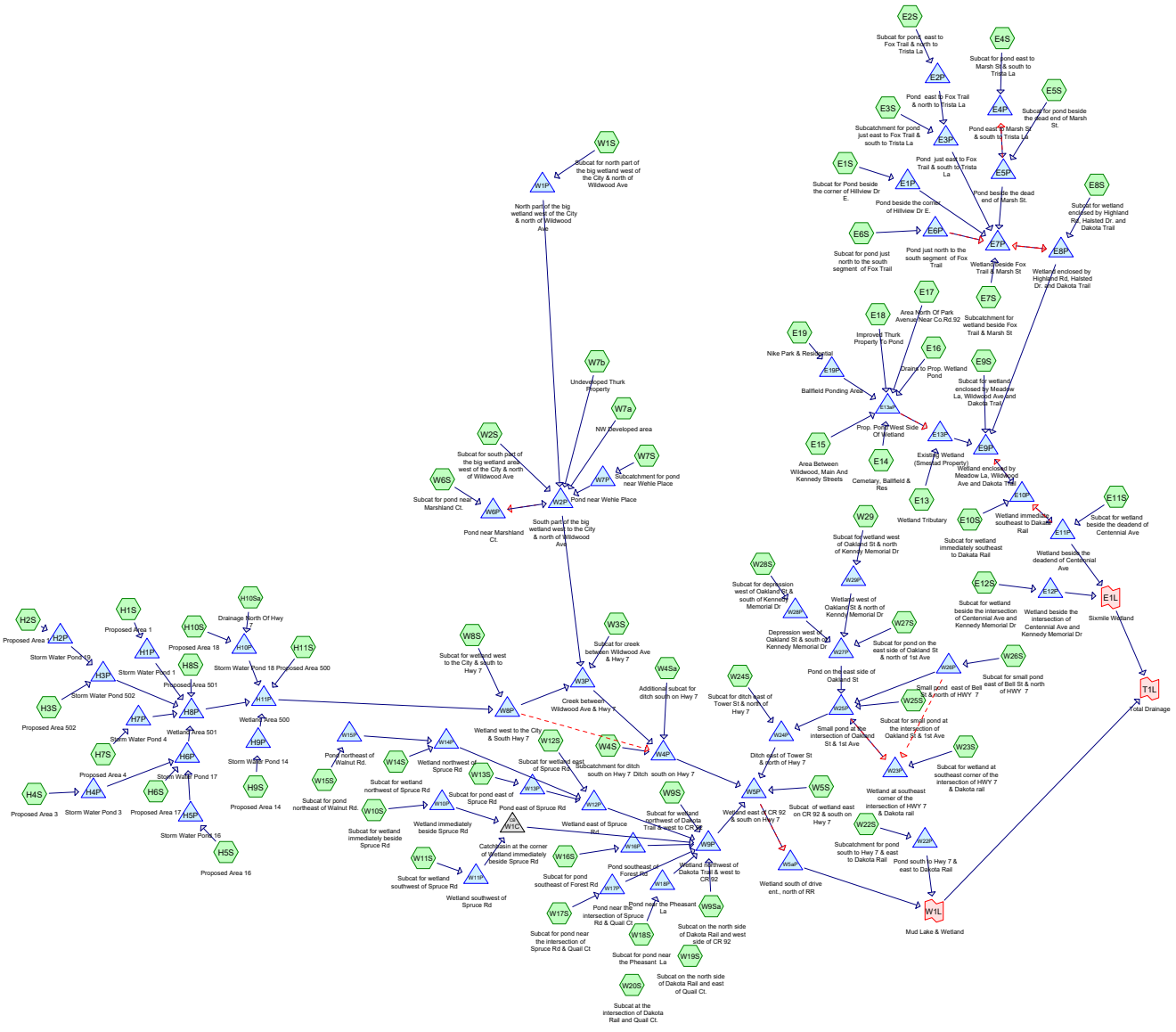
2. For purposes of this report and using precipitation depths from Atlas 14, typical 24-hour rainfall events of 2.47", 4.20" and 7.18" have been chosen to analyze runoff/development interaction. These events are best described as those having probabilities of occurring once every 1, 10 and 100 years, respectively.

3. The probabilities of occurrence do not imply that a 2.47", 4.20" or 7.18" rainfall cannot occur multiple times within the same year; they simply say that a 2.47" rainfall will occur *on the average* once every year, a 4.20" rainfall will occur *on the average* once every 10 years and a 7.18" rainfall will occur *on the average* once every 100 years. In other words, the 1-year rainfall has a 100 percent chance of occurring in any given year. Similarly, the 10-year rainfall has a 10 percent chance of occurring in any given year and the 100-year rainfall has a 1 percent chance of occurring in any given year.

4. The City's stormwater model is intended to provide only a general overview of the system to identify potential stormwater issues. Since the City has a policy of requiring developers/private owners to design and maintain on their own any stormwater management facilities necessary for their proposed improvements, the future improvements to stormwater management in the City will largely be driven by private development or re-development. With this approach, a majority of changes due to future stormwater improvement designs will be at the discretion of the private property owner, with only input from the City regarding desired outcomes. As private developments and public street and utility improvements are planned, the City will require review of stormwater runoff modeling for potential stormwater issues in the proposed project area, potential TMDL reduction opportunities, and volume reduction opportunities. Future review for both private and public improvements will require using the most current precipitation depth data available (Atlas 14), using survey quality information to adequately evaluate existing conditions, creating site specific models for proposed conditions to evaluate potential solutions and constructability, and updating the SWMP as necessary if stormwater treatment improvements are warranted at that time.

# Appendix C

## Modeling Results




**Routing Diagram for STBO**

Prepared by Bolton & Menk Inc, Printed 7/28/2020

HydroCAD® 10.00-20 s/n 00822 © 2017 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 9.847 | 70 | 1/2 acre lots, 25% imp, HSG B (W10S, W6S) |
| 279.356 | 72 | 1/3 acre lots, 30% imp, HSG B (E11S, E12S, E1S, E2S, E3S, E4S, E5S, E6S, E9S, W12S, W14S, W15S, W16S, W23S, W24S, W28S, W29, W4Sa, W7a, W8S) |
| 15.720 | 50 | 1/3 acre lots, 30% imp, HSG B (W27S) |
| 133.959 | 72 | 1/4 acre lots, 30% imp, HSG B (E13, E14, E16, E18, E19, H10S, H11S, H1S, H2S, H4S, H5S, H6S, H7S, H8S, H9S) |
| 32.862 | 75 | 1/4 acre lots, 38% imp, HSG B (E17, W13S, W17S, W18S, W7S) |
| 14.067 | 75 | 1/4 acre lots, 38% imp, HSG B & industrial buildings (W5S) |
| 32.533 | 69 | 50-75% Grass cover, Fair, HSG B (W3S, W4S) |
| 49.488 | 61 | >75% Grass cover, Good, HSG B (E13, E14, E15, E16, E19, E7S, H10S, H11S, H1S, H2S, H3S, H4S, H5S, H8S) |
| 439.590 | 70 | Crop/Pasture (W2S) |
| 3.646 | 82 | Dirt roads, HSG B (W26S) |
| 0.566 | 65 | Graassland (W25S) |
| 2.730 | 100 | Open Water (H10S, H1S, H2S, H3S, H4S, H7S) |
| 36.164 | 98 | Open water surface (E8S, E9S, H9S, W12S, W23S, W4S, W6S, W7S, W8S, W9S) |
| 1.397 | 98 | Open water surface (ditch) (W24S) |
| 12.057 | 98 | Open water surface Water (W5S) |
| 3.196 | 98 | Oprn water surface (W3S) |
| 33.120 | 61 | Pasture/grassland/range, Good, HSG B (E12S, W7b) |
| 4.100 | 79 | Pasture/grassland/range, Poor, HSG B (E10S) |
| 1.650 | 89 | Paved roads w/open ditches, HSG B (H10S, H11S) |
| 0.260 | 98 | Pond Surface (E18) |
| 5.251 | 98 | Pond surface (E1S, E2S, E3S, E5S, E6S, W13S, W15S, W16S, W17S, W18S, W22S) |
| 0.800 | 85 | Pond/Wetland Area (E16) |
| 0.174 | 98 | Road surface and open water surface (W25S) |
| 221.453 | 70 | Row crops, C&T + CR, Good, HSG B (W11S, W1S, W9S) |
| 16.471 | 73 | Row crops, C&T + CR, Poor, HSG B (W19S, W20S, W9Sa) |
| 4.103 | 75 | Row crops, SR + CR, Good, HSG B (H10Sa) |
| 18.417 | 81 | Urban industrial, 72% imp, HSG A (W22S) |
| 6.640 | 88 | Urban industrial, 72% imp, HSG B (E15, E18, E19) |
| 88.000 | 80 | Wetland (E7S, W2S) |
| 16.400 | 85 | Wetland (H11S, H5S, H6S, H8S) |
| 1.800 | 85 | Wetland Area (E13) |
| 6.536 | 98 | Wetland Surface (W10S, W11S, W14S) |
| 72.000 | 60 | Woods, Fair, HSG B (W2S) |
| 34.678 | 65 | Woods/grass comb., Fair, HSG B (E8S) |
| 41.510 | 98 | open water surface (W1S) |
| 0.763 | 98 | pond surface (E4S) |
| **1,641.304** | **72** | **TOTAL AREA** |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | E14 | 0.00 | 0.00 | 300.0 | 0.0030 | 0.013 | 18.0 | 0.0 | 0.0 |
| 2 | E15 | 0.00 | 0.00 | 750.0 | 0.0030 | 0.013 | 18.0 | 0.0 | 0.0 |
| 3 | E17 | 0.00 | 0.00 | 360.0 | 0.0280 | 0.013 | 15.0 | 0.0 | 0.0 |
| 4 | E17 | 0.00 | 0.00 | 330.0 | 0.0100 | 0.013 | 15.0 | 0.0 | 0.0 |
| 5 | E10P | 932.84 | 933.00 | 42.0 | -0.0038 | 0.030 | 18.0 | 0.0 | 0.0 |
| 6 | E10P | 932.99 | 932.66 | 42.0 | 0.0079 | 0.030 | 18.0 | 0.0 | 0.0 |
| 7 | E10P | 932.74 | 932.78 | 49.4 | -0.0008 | 0.013 | 30.0 | 0.0 | 0.0 |
| 8 | E11P | 933.25 | 932.00 | 52.0 | 0.0240 | 0.013 | 15.0 | 0.0 | 0.0 |
| 9 | E11P | 932.66 | 932.99 | 42.0 | -0.0079 | 0.030 | 18.0 | 0.0 | 0.0 |
| 10 | E12P | 931.92 | 931.65 | 117.0 | 0.0023 | 0.013 | 15.0 | 0.0 | 0.0 |
| 11 | E13aP | 951.20 | 951.00 | 30.0 | 0.0067 | 0.013 | 24.0 | 0.0 | 0.0 |
| 12 | E13aP | 947.50 | 948.00 | 20.0 | -0.0250 | 0.013 | 24.0 | 0.0 | 0.0 |
| 13 | E13P | 950.97 | 951.19 | 67.0 | -0.0033 | 0.013 | 18.0 | 0.0 | 0.0 |
| 14 | E19P | 958.80 | 956.58 | 750.0 | 0.0030 | 0.013 | 18.0 | 0.0 | 0.0 |
| 15 | E19P | 959.10 | 958.80 | 10.0 | 0.0300 | 0.013 | 18.0 | 0.0 | 0.0 |
| 16 | E1P | 946.00 | 942.00 | 270.0 | 0.0148 | 0.012 | 15.0 | 0.0 | 0.0 |
| 17 | E2P | 957.50 | 944.00 | 212.0 | 0.0637 | 0.013 | 15.0 | 0.0 | 0.0 |
| 18 | E3P | 944.00 | 943.00 | 55.0 | 0.0182 | 0.013 | 15.0 | 0.0 | 0.0 |
| 19 | E4P | 940.00 | 940.00 | 39.0 | 0.0000 | 0.013 | 18.0 | 0.0 | 0.0 |
| 20 | E5P | 940.00 | 939.75 | 24.0 | 0.0104 | 0.013 | 21.0 | 0.0 | 0.0 |
| 21 | E5P | 940.00 | 940.00 | 39.0 | 0.0000 | 0.013 | 18.0 | 0.0 | 0.0 |
| 22 | E6P | 938.00 | 937.80 | 24.0 | 0.0083 | 0.013 | 24.0 | 0.0 | 0.0 |
| 23 | E6P | 938.00 | 937.80 | 24.0 | 0.0083 | 0.013 | 24.0 | 0.0 | 0.0 |
| 24 | E7P | 935.67 | 935.63 | 40.0 | 0.0010 | 0.024 | 36.0 | 22.0 | 0.0 |
| 25 | E8P | 935.39 | 935.33 | 155.0 | 0.0004 | 0.024 | 18.0 | 0.0 | 0.0 |
| 26 | E9P | 932.78 | 932.74 | 49.4 | 0.0008 | 0.013 | 30.0 | 0.0 | 0.0 |
| 27 | H10P | 962.26 | 961.49 | 156.0 | 0.0049 | 0.013 | 12.0 | 0.0 | 0.0 |
| 28 | H11P | 953.70 | 953.57 | 19.0 | 0.0068 | 0.013 | 18.0 | 0.0 | 0.0 |
| 29 | H1P | 963.11 | 962.11 | 17.0 | 0.0588 | 0.013 | 24.0 | 0.0 | 0.0 |
| 30 | H2P | 980.02 | 978.58 | 33.0 | 0.0436 | 0.013 | 12.0 | 0.0 | 0.0 |
| 31 | H3P | 966.04 | 965.87 | 24.0 | 0.0071 | 0.013 | 12.0 | 0.0 | 0.0 |
| 32 | H4P | 968.48 | 967.59 | 211.0 | 0.0042 | 0.013 | 24.0 | 0.0 | 0.0 |
| 33 | H6P | 967.15 | 965.77 | 54.0 | 0.0256 | 0.013 | 21.0 | 0.0 | 0.0 |
| 34 | H7P | 963.06 | 962.75 | 16.0 | 0.0194 | 0.013 | 12.0 | 0.0 | 0.0 |
| 35 | H8P | 960.16 | 957.08 | 89.0 | 0.0346 | 0.013 | 12.0 | 0.0 | 0.0 |
| 36 | H9P | 963.28 | 962.75 | 24.0 | 0.0221 | 0.013 | 12.0 | 0.0 | 0.0 |
| 37 | W10P | 959.01 | 957.97 | 42.0 | 0.0248 | 0.013 | 18.0 | 0.0 | 0.0 |
| 38 | W11P | 969.90 | 959.97 | 377.0 | 0.0263 | 0.013 | 18.0 | 0.0 | 0.0 |
| 39 | W12P | 952.87 | 952.56 | 40.0 | 0.0078 | 0.013 | 24.0 | 0.0 | 0.0 |
| 40 | W13P | 954.08 | 953.48 | 18.0 | 0.0333 | 0.013 | 18.0 | 0.0 | 0.0 |
| 41 | W14P | 961.09 | 958.08 | 320.0 | 0.0094 | 0.013 | 18.0 | 0.0 | 0.0 |

## Pipe Listing (all nodes) (continued)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 42 | W15P | 962.00 | 961.80 | 20.0 | 0.0100 | 0.013 | 15.0 | 0.0 | 0.0 |
| 43 | W16P | 935.88 | 932.78 | 35.0 | 0.0886 | 0.013 | 24.0 | 0.0 | 0.0 |
| 44 | W17P | 942.06 | 941.61 | 30.0 | 0.0150 | 0.013 | 15.0 | 0.0 | 0.0 |
| 45 | W18P | 936.26 | 934.22 | 35.0 | 0.0583 | 0.013 | 24.0 | 0.0 | 0.0 |
| 46 | W1C | 957.97 | 953.53 | 140.0 | 0.0317 | 0.013 | 18.0 | 0.0 | 0.0 |
| 47 | W1P | 954.50 | 953.83 | 56.0 | 0.0120 | 0.030 | 30.0 | 0.0 | 0.0 |
| 48 | W22P | 937.25 | 934.27 | 279.4 | 0.0107 | 0.013 | 15.0 | 0.0 | 0.0 |
| 49 | W23P | 933.00 | 933.40 | 150.0 | -0.0027 | 0.013 | 18.0 | 0.0 | 0.0 |
| 50 | W24P | 932.90 | 932.04 | 40.0 | 0.0215 | 0.013 | 36.0 | 0.0 | 0.0 |
| 51 | W25P | 933.17 | 933.00 | 30.0 | 0.0057 | 0.013 | 24.0 | 0.0 | 0.0 |
| 52 | W25P | 933.40 | 933.00 | 150.0 | 0.0027 | 0.013 | 18.0 | 0.0 | 0.0 |
| 53 | W26P | 935.00 | 934.40 | 200.0 | 0.0030 | 0.013 | 24.0 | 0.0 | 0.0 |
| 54 | W26P | 935.00 | 933.00 | 40.0 | 0.0500 | 0.013 | 24.0 | 0.0 | 0.0 |
| 55 | W27P | 934.00 | 933.70 | 27.0 | 0.0111 | 0.013 | 18.0 | 0.0 | 0.0 |
| 56 | W28P | 934.45 | 934.29 | 32.0 | 0.0050 | 0.013 | 12.0 | 0.0 | 0.0 |
| 57 | W29P | 950.50 | 950.32 | 10.0 | 0.0180 | 0.013 | 12.0 | 0.0 | 0.0 |
| 58 | W2P | 946.47 | 947.47 | 50.0 | -0.0200 | 0.013 | 48.0 | 36.0 | 0.0 |
| 59 | W2P | 947.97 | 948.00 | 8.0 | -0.0037 | 0.025 | 12.0 | 0.0 | 0.0 |
| 60 | W3P | 943.06 | 942.38 | 130.7 | 0.0052 | 0.013 | 42.0 | 0.0 | 0.0 |
| 61 | W4P | 932.48 | 932.04 | 115.8 | 0.0038 | 0.013 | 42.0 | 0.0 | 0.0 |
| 62 | W5aP | 929.51 | 928.38 | 69.5 | 0.0163 | 0.013 | 36.0 | 0.0 | 0.0 |
| 63 | W5aP | 927.81 | 927.21 | 69.5 | 0.0086 | 0.013 | 36.0 | 0.0 | 0.0 |
| 64 | W5P | 930.50 | 930.20 | 30.0 | 0.0100 | 0.024 | 30.0 | 0.0 | 0.0 |
| 65 | W5P | 930.50 | 930.20 | 30.0 | 0.0100 | 0.024 | 30.0 | 0.0 | 0.0 |
| 66 | W6P | 948.00 | 947.97 | 8.0 | 0.0037 | 0.025 | 12.0 | 0.0 | 0.0 |
| 67 | W7P | 954.00 | 953.76 | 60.0 | 0.0040 | 0.025 | 12.0 | 0.0 | 0.0 |
| 68 | W8P | 945.60 | 943.58 | 146.7 | 0.0138 | 0.013 | 30.0 | 0.0 | 0.0 |
| 69 | W8P | 956.27 | 954.05 | 70.0 | 0.0317 | 0.013 | 15.0 | 0.0 | 0.0 |
| 70 | W9P | 930.30 | 930.13 | 50.0 | 0.0034 | 0.030 | 24.0 | 0.0 | 0.0 |

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**SubcatchmentE10S: Subcat for wetland** Runoff Area=4.100 ac 0.00% Impervious Runoff Depth=4.75"
Tc=12.0 min CN=79 Runoff=27.50 cfs 1.623 af

**SubcatchmentE11S: Subcat for wetland** Runoff Area=7.970 ac 30.00% Impervious Runoff Depth=3.98"
Tc=30.0 min CN=72 Runoff=27.57 cfs 2.645 af

**SubcatchmentE12S: Subcat for wetland** Runoff Area=20.350 ac 26.14% Impervious Runoff Depth=3.88"
Tc=30.0 min CN=71 Runoff=68.41 cfs 6.572 af

**SubcatchmentE13: Wetland Tributary** Runoff Area=7.500 ac 20.40% Impervious Runoff Depth=4.20"
Flow Length=150' Slope=0.0300 '/' Tc=12.3 min CN=74 Runoff=44.59 cfs 2.625 af

**SubcatchmentE14: Cemetary, Ballfield &** Runoff Area=8.900 ac 16.52% Impervious Runoff Depth=3.45"
Flow Length=690' Tc=18.2 min CN=67 Runoff=35.96 cfs 2.560 af

**SubcatchmentE15: Area Between** Runoff Area=2.900 ac 52.14% Impervious Runoff Depth=4.97"
Flow Length=1,100' Tc=19.8 min CN=81 Runoff=15.97 cfs 1.202 af

**SubcatchmentE16: Drains to Prop.** Runoff Area=6.990 ac 23.56% Impervious Runoff Depth=3.98"
Flow Length=440' Tc=12.5 min CN=72 Runoff=39.24 cfs 2.320 af

**SubcatchmentE17: Area North Of Park** Runoff Area=3.800 ac 38.00% Impervious Runoff Depth=4.31"
Flow Length=1,290' Tc=14.6 min CN=75 Runoff=21.41 cfs 1.364 af

**SubcatchmentE18: Improved Thurk** Runoff Area=3.410 ac 66.62% Impervious Runoff Depth=5.54"
Tc=7.0 min CN=86 Runoff=30.45 cfs 1.574 af

**SubcatchmentE19: Nike Park &** Runoff Area=44.573 ac 26.70% Impervious Runoff Depth=3.88"
Flow Length=850' Tc=19.5 min CN=71 Runoff=194.92 cfs 14.395 af

**SubcatchmentE1S: Subcat for Pond** Runoff Area=36.480 ac 33.09% Impervious Runoff Depth=4.09"
Tc=20.0 min CN=73 Runoff=166.02 cfs 12.436 af

**SubcatchmentE2S: Subcat for pond east** Runoff Area=6.349 ac 31.37% Impervious Runoff Depth=4.09"
Tc=20.0 min CN=73 Runoff=28.89 cfs 2.164 af

**SubcatchmentE3S: Subcatchment for** Runoff Area=5.826 ac 35.17% Impervious Runoff Depth=4.20"
Tc=15.0 min CN=74 Runoff=31.63 cfs 2.039 af

**SubcatchmentE4S: Subcat for pond east** Runoff Area=20.274 ac 32.63% Impervious Runoff Depth=4.09"
Tc=30.0 min CN=73 Runoff=72.09 cfs 6.912 af

**SubcatchmentE5S: Subcat for pond** Runoff Area=7.021 ac 38.02% Impervious Runoff Depth=4.31"
Tc=15.0 min CN=75 Runoff=39.06 cfs 2.521 af

**SubcatchmentE6S: Subcat for pond just** Runoff Area=30.434 ac 30.56% Impervious Runoff Depth=3.98"
Tc=35.0 min CN=72 Runoff=94.74 cfs 10.101 af

**SubcatchmentE7S: Subcatchmentfor** Runoff Area=17.924 ac 0.00% Impervious Runoff Depth=3.66"
Tc=20.0 min CN=69 Runoff=72.91 cfs 5.470 af

**SubcatchmentE8S: Subcat for wetland** Runoff Area=44.678 ac 22.38% Impervious Runoff Depth=3.98"
Tc=60.0 min CN=72 Runoff=95.07 cfs 14.829 af

**SubcatchmentE9S: Subcat for wetland** Runoff Area=39.189 ac 40.72% Impervious Runoff Depth=4.42"
Tc=40.0 min CN=76 Runoff=123.75 cfs 14.428 af

**SubcatchmentH10S: Proposed Area 18** Runoff Area=8.409 ac 27.91% Impervious Runoff Depth=4.20"
Tc=17.0 min CN=74 Runoff=42.89 cfs 2.943 af

**SubcatchmentH10Sa: Drainage North Of** Runoff Area=4.103 ac 0.00% Impervious Runoff Depth=4.31"
Tc=14.0 min CN=75 Runoff=23.60 cfs 1.473 af

**SubcatchmentH11S: Proposed Area 500** Runoff Area=10.874 ac 3.17% Impervious Runoff Depth=3.98"
Tc=21.0 min CN=72 Runoff=46.85 cfs 3.609 af

**SubcatchmentH1S: Proposed Area 1** Runoff Area=9.875 ac 18.19% Impervious Runoff Depth=3.56"
Tc=20.0 min CN=68 Runoff=38.96 cfs 2.927 af

**SubcatchmentH2S: Proposed Area 19** Runoff Area=10.536 ac 18.37% Impervious Runoff Depth=3.56"
Tc=23.0 min CN=68 Runoff=38.22 cfs 3.122 af

**SubcatchmentH3S: Proposed Area 502** Runoff Area=1.049 ac 24.79% Impervious Runoff Depth=3.88"
Tc=8.0 min CN=71 Runoff=6.72 cfs 0.339 af

**SubcatchmentH4S: Proposed Area 3** Runoff Area=46.793 ac 29.40% Impervious Runoff Depth=3.98"
Tc=25.0 min CN=72 Runoff=181.80 cfs 15.531 af

**SubcatchmentH5S: Proposed Area 16** Runoff Area=11.375 ac 19.45% Impervious Runoff Depth=4.09"
Tc=16.0 min CN=73 Runoff=58.34 cfs 3.878 af

**SubcatchmentH6S: Proposed Area 17** Runoff Area=3.937 ac 20.86% Impervious Runoff Depth=4.42"
Tc=18.0 min CN=76 Runoff=20.50 cfs 1.449 af

**SubcatchmentH7S: Proposed Area 4** Runoff Area=4.621 ac 33.79% Impervious Runoff Depth=4.20"
Tc=15.0 min CN=74 Runoff=25.09 cfs 1.617 af

**SubcatchmentH8S: Proposed Area 501** Runoff Area=15.929 ac 4.71% Impervious Runoff Depth=4.53"
Tc=14.0 min CN=77 Runoff=95.90 cfs 6.010 af

**SubcatchmentH9S: Proposed Area 14** Runoff Area=6.409 ac 33.03% Impervious Runoff Depth=4.09"
Tc=12.0 min CN=73 Runoff=37.55 cfs 2.185 af

**SubcatchmentW10S: Subcat for wetland** Runoff Area=3.533 ac 39.56% Impervious Runoff Depth=4.31"
Flow Length=200' Slope=0.0500 '/' Tc=7.8 min CN=75 Runoff=25.13 cfs 1.268 af

**SubcatchmentW11S: Subcat for wetland** Runoff Area=16.305 ac 30.68% Impervious Runoff Depth=4.75"
Flow Length=100' Slope=0.0120 '/' Tc=12.8 min CN=79 Runoff=106.46 cfs 6.453 af

**SubcatchmentW12S: Subcat for wetland** Runoff Area=5.953 ac 41.82% Impervious Runoff Depth=4.42"
Tc=25.0 min CN=76 Runoff=25.63 cfs 2.192 af

**SubcatchmentW13S: Subcat for pond east** Runoff Area=5.779 ac 40.75% Impervious Runoff Depth=4.42"
Tc=15.0 min CN=76 Runoff=32.91 cfs 2.128 af

**SubcatchmentW14S: Subcat for wetland** Runoff Area=2.357 ac 55.18% Impervious Runoff Depth=4.97"
Tc=9.0 min CN=81 Runoff=18.16 cfs 0.977 af

**SubcatchmentW15S: Subcat for pond** Runoff Area=6.576 ac 33.50% Impervious Runoff Depth=4.09"
Tc=10.0 min CN=73 Runoff=41.26 cfs 2.242 af

**SubcatchmentW16S: Subcat for pond** Runoff Area=11.844 ac 33.39% Impervious Runoff Depth=4.09"
Tc=20.0 min CN=73 Runoff=53.90 cfs 4.038 af

**SubcatchmentW17S: Subcat for pond near** Runoff Area=3.854 ac 41.78% Impervious Runoff Depth=4.42"
Tc=15.0 min CN=76 Runoff=21.95 cfs 1.419 af

**SubcatchmentW18S: Subcat for pond near** Runoff Area=8.228 ac 40.28% Impervious Runoff Depth=4.42"
Tc=40.0 min CN=76 Runoff=25.98 cfs 3.029 af

**SubcatchmentW19S: Subcat on the north** Runoff Area=2.150 ac 0.00% Impervious Runoff Depth=4.09"
Tc=15.0 min CN=73 Runoff=11.38 cfs 0.733 af

**SubcatchmentW1S: Subcat for north** Runoff Area=154.134 ac 26.93% Impervious Runoff Depth=4.64"
Tc=55.0 min CN=78 Runoff=408.95 cfs 59.578 af

**SubcatchmentW20S: Subcat at the** Runoff Area=9.882 ac 0.00% Impervious Runoff Depth=4.09"
Tc=20.0 min CN=73 Runoff=44.97 cfs 3.369 af

**SubcatchmentW22S: Subcatchmentfor** Runoff Area=18.760 ac 72.51% Impervious Runoff Depth=4.97"
Tc=40.0 min CN=81 Runoff=66.40 cfs 7.774 af

**SubcatchmentW23S: Subcat for wetland** Runoff Area=6.269 ac 49.25% Impervious Runoff Depth=4.75"
Tc=25.0 min CN=79 Runoff=28.90 cfs 2.481 af

**SubcatchmentW24S: Subcat for ditch** Runoff Area=23.387 ac 34.18% Impervious Runoff Depth=4.20"
Tc=40.0 min CN=74 Runoff=70.15 cfs 8.184 af

**SubcatchmentW25S: Subcat for small** Runoff Area=0.740 ac 23.51% Impervious Runoff Depth=4.09"
Tc=8.0 min CN=73 Runoff=4.99 cfs 0.252 af

**SubcatchmentW26S: Subcat for small pond** Runoff Area=3.646 ac 0.00% Impervious Runoff Depth=5.09"
Tc=12.0 min CN=82 Runoff=25.90 cfs 1.545 af

**SubcatchmentW27S: Subcat for pond on** Runoff Area=15.720 ac 30.00% Impervious Runoff Depth=1.77"
Tc=30.0 min CN=50 Runoff=20.65 cfs 2.316 af

**SubcatchmentW28S: Subcat for** Runoff Area=4.394 ac 30.00% Impervious Runoff Depth=3.98"
Tc=16.0 min CN=72 Runoff=21.95 cfs 1.458 af

**SubcatchmentW29: Subcat for wetland** Runoff Area=6.464 ac 30.00% Impervious Runoff Depth=3.98"
Tc=30.0 min CN=72 Runoff=22.36 cfs 2.145 af

**SubcatchmentW2S: Subcat for south part** Runoff Area=591.590 ac 0.00% Impervious Runoff Depth=3.77"
Tc=80.0 min CN=70 Runoff=956.61 cfs 185.784 af

**SubcatchmentW3S: Subcat for creek** Runoff Area=19.138 ac 16.70% Impervious Runoff Depth=4.20"
Tc=10.0 min CN=74 Runoff=123.03 cfs 6.697 af

**SubcatchmentW4S: Subcatchment for** Runoff Area=19.185 ac 13.52% Impervious Runoff Depth=4.09"
Tc=20.0 min CN=73 Runoff=87.31 cfs 6.540 af

**SubcatchmentW4Sa: Additional subcat** Runoff Area=25.206 ac 30.00% Impervious Runoff Depth=3.98"
Tc=30.0 min CN=72 Runoff=87.19 cfs 8.366 af

**SubcatchmentW5S: Subcat of wetland** Runoff Area=26.124 ac 66.61% Impervious Runoff Depth=5.54"
Tc=35.0 min CN=86 Runoff=111.21 cfs 12.058 af

**SubcatchmentW6S: Subcat for pond near** Runoff Area=7.373 ac 28.79% Impervious Runoff Depth=3.88"
Tc=12.0 min CN=71 Runoff=41.02 cfs 2.381 af

**SubcatchmentW7a: NW Developed area** Runoff Area=21.400 ac 30.00% Impervious Runoff Depth=3.98"
Tc=25.0 min CN=72 Runoff=83.15 cfs 7.103 af

**SubcatchmentW7b: Undeveloped Thurk** Runoff Area=30.500 ac 0.00% Impervious Runoff Depth=2.83"
Tc=35.0 min CN=61 Runoff=65.36 cfs 7.199 af

**SubcatchmentW7S: Subcatchment for** Runoff Area=13.018 ac 42.87% Impervious Runoff Depth=4.53"
Tc=10.0 min CN=77 Runoff=89.61 cfs 4.912 af

**SubcatchmentW8S: Subcat for wetland** Runoff Area=10.460 ac 32.52% Impervious Runoff Depth=4.09"
Tc=30.0 min CN=73 Runoff=37.19 cfs 3.566 af

**SubcatchmentW9S: Subcat for wetland** Runoff Area=110.318 ac 11.60% Impervious Runoff Depth=4.09"
Tc=50.0 min CN=73 Runoff=276.14 cfs 37.608 af

**SubcatchmentW9Sa: Subcat on the north** Runoff Area=4.439 ac 0.00% Impervious Runoff Depth=4.09"
Tc=15.0 min CN=73 Runoff=23.50 cfs 1.513 af

**Pond E10P: Wetland immediate** Peak Elev=937.44' Storage=14.437 af Inflow=34.33 cfs 42.142 af
Primary=10.47 cfs 28.044 af Secondary=0.00 cfs 0.000 af Outflow=10.47 cfs 28.044 af

**Pond E11P: Wetland beside the deadend** Peak Elev=936.73' Storage=5.769 af Inflow=28.55 cfs 30.681 af
Primary=9.99 cfs 24.972 af Secondary=0.69 cfs 0.017 af Outflow=9.99 cfs 24.989 af

**Pond E12P: Wetland beside the** Peak Elev=933.99' Storage=3.897 af Inflow=68.41 cfs 6.572 af
15.0" Round Culvert n=0.013 L=117.0' S=0.0023 '/' Outflow=5.00 cfs 6.017 af

**Pond E13aP: Prop. Pond West Side Of** Peak Elev=956.17' Storage=3.482 af Inflow=136.80 cfs 23.345 af
Primary=32.44 cfs 12.646 af Secondary=70.07 cfs 10.565 af Outflow=101.78 cfs 23.211 af

**Pond E13P: Existing Wetland (Smestad** Peak Elev=955.22' Storage=7.971 af Inflow=130.39 cfs 25.835 af
18.0" Round Culvert n=0.013 L=67.0' S=-0.0033 '/' Outflow=12.16 cfs 25.627 af

**Pond E19P: Ballfield Ponding Area** Peak Elev=965.76' Storage=8.184 af Inflow=194.92 cfs 14.395 af
Outflow=10.08 cfs 14.325 af

**Pond E1P: Pond beside the corner of** Peak Elev=954.22' Storage=6.546 af Inflow=166.02 cfs 12.436 af
Outflow=12.45 cfs 12.134 af

**Pond E2P: Pond east to Fox Trail & north** Peak Elev=964.33' Storage=0.370 af Inflow=28.89 cfs 2.164 af
15.0" Round Culvert n=0.013 L=212.0' S=0.0637 '/' Outflow=14.71 cfs 2.164 af

**Pond E3P: Pond just east to Fox Trail &** Peak Elev=948.57' Storage=2.281 af Inflow=43.61 cfs 4.203 af
15.0" Round Culvert n=0.013 L=55.0' S=0.0182 '/' Outflow=11.73 cfs 4.197 af

**Pond E4P: Pond east to Marsh St & south** Peak Elev=944.07' Storage=3.333 af Inflow=72.09 cfs 6.912 af
Outflow=45.93 cfs 6.873 af

**Pond E5P: Pond beside the dead end of** Peak Elev=943.51' Storage=4.539 af Inflow=53.50 cfs 9.394 af
Primary=30.56 cfs 9.345 af Secondary=0.00 cfs 0.000 af Outflow=30.56 cfs 9.345 af

**Pond E6P: Pond just north to the south** Peak Elev=941.59' Storage=1.198 af Inflow=94.74 cfs 10.101 af
Primary=48.67 cfs 8.387 af Secondary=45.30 cfs 1.446 af Outflow=93.97 cfs 9.833 af

**Pond E7P: Wetland beside Fox Trail &** Peak Elev=939.87' Storage=34.943 af Inflow=693.88 cfs 600.889 af
Primary=8.70 cfs 9.842 af Secondary=714.29 cfs 571.149 af Outflow=720.95 cfs 580.991 af

**Pond E8P: Wetland enclosed by** Peak Elev=939.86' Storage=21.654 af Inflow=723.08 cfs 595.820 af
Primary=7.32 cfs 20.309 af Secondary=686.96 cfs 560.098 af Outflow=694.12 cfs 580.407 af

**Pond E9P: Wetland enclosed by** Peak Elev=937.64' Storage=21.065 af Inflow=136.70 cfs 60.359 af
30.0" Round Culvert n=0.013 L=49.4' S=0.0008 '/' Outflow=25.64 cfs 40.509 af

**Pond H10P: Storm Water Pond 18** Peak Elev=966.48' Storage=3.323 af Inflow=65.84 cfs 4.416 af
Outflow=4.98 cfs 4.382 af

**Pond H11P: Wetland Area 500** Peak Elev=957.62' Storage=3.152 af Inflow=81.25 cfs 26.259 af
18.0" Round Culvert n=0.013 L=19.0' S=0.0068 '/' Outflow=13.37 cfs 25.588 af

**Pond H1P: Storm Water Pond 1** Peak Elev=964.85' Storage=1.991 af Inflow=38.96 cfs 2.927 af
24.0" Round Culvert n=0.013 L=17.0' S=0.0588 '/' Outflow=11.47 cfs 2.840 af

**Pond H2P: Storm Water Pond 19** Peak Elev=984.42' Storage=1.327 af Inflow=38.22 cfs 3.122 af
12.0" Round Culvert n=0.013 L=33.0' S=0.0436 '/' Outflow=6.59 cfs 3.116 af

**Pond H3P: Storm Water Pond 502** Peak Elev=967.09' Storage=0.829 af Inflow=9.83 cfs 3.455 af
Outflow=7.03 cfs 3.437 af

**Pond H4P: Storm Water Pond 3** Peak Elev=973.59' Storage=15.291 af Inflow=181.80 cfs 15.531 af
24.0" Round Culvert n=0.013 L=211.0' S=0.0042 '/' Outflow=24.23 cfs 15.352 af

**Pond H5P: Storm Water Pond 16** Peak Elev=974.71' Storage=2.155 af Inflow=58.34 cfs 3.878 af
Outflow=9.31 cfs 3.840 af

**Pond H6P: Storm Water Pond 17** Peak Elev=970.65' Storage=5.333 af Inflow=40.72 cfs 20.642 af
21.0" Round Culvert n=0.013 L=54.0' S=0.0256 '/' Outflow=18.76 cfs 20.509 af

**Pond H7P: Storm Water Pond 4** Peak Elev=964.28' Storage=0.798 af Inflow=25.09 cfs 1.617 af
Outflow=20.14 cfs 1.569 af

**Pond H8P: Wetland Area 501** Peak Elev=963.92' Storage=26.200 af Inflow=120.57 cfs 34.365 af
12.0" Round Culvert n=0.013 L=89.0' S=0.0346 '/' Outflow=6.02 cfs 16.095 af

**Pond H9P: Storm Water Pond 14** Peak Elev=965.18' Storage=1.000 af Inflow=37.55 cfs 2.185 af
Outflow=29.18 cfs 2.177 af

**Pond W10P: Wetland immediately beside** Peak Elev=960.19' Storage=0.563 af Inflow=25.13 cfs 1.268 af
18.0" Round Culvert n=0.013 L=42.0' S=0.0248 '/' Outflow=4.97 cfs 1.254 af

**Pond W11P: Wetland southwest of** Peak Elev=970.94' Storage=4.104 af Inflow=106.46 cfs 6.453 af
18.0" Round Culvert n=0.013 L=377.0' S=0.0263 '/' Outflow=4.52 cfs 5.486 af

**Pond W12P: Wetland east of Spruce Rd** Peak Elev=954.79' Storage=2.714 af Inflow=41.32 cfs 6.904 af
24.0" Round Culvert n=0.013 L=40.0' S=0.0078 '/' Outflow=12.59 cfs 6.819 af

**Pond W13P: Pond east of Spruce Rd** Peak Elev=957.06' Storage=1.032 af Inflow=32.91 cfs 2.128 af
18.0" Round Culvert n=0.013 L=18.0' S=0.0333 '/' Outflow=12.70 cfs 2.125 af

**Pond W14P: Wetland northwest of Spruce** Peak Elev=962.26' Storage=0.751 af Inflow=19.02 cfs 2.627 af
18.0" Round Culvert n=0.013 L=320.0' S=0.0094 '/' Outflow=5.46 cfs 2.588 af

**Pond W15P: Pond northeast of Walnut Rd.** Peak Elev=963.84' Storage=1.108 af Inflow=41.26 cfs 2.242 af
15.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=6.24 cfs 1.651 af

**Pond W16P: Pond southeast of Forest Rd** Peak Elev=938.56' Storage=3.115 af Inflow=53.90 cfs 4.038 af
24.0" Round Culvert n=0.013 L=35.0' S=0.0886 '/' Outflow=19.61 cfs 3.975 af

**Pond W17P: Pond near the intersection of** Peak Elev=944.47' Storage=0.752 af Inflow=21.95 cfs 1.419 af
15.0" Round Culvert n=0.013 L=30.0' S=0.0150 '/' Outflow=7.90 cfs 1.416 af

**Pond W18P: Pond near the Pheasant La** Peak Elev=938.66' Storage=1.269 af Inflow=25.98 cfs 3.029 af
24.0" Round Culvert n=0.013 L=35.0' S=0.0583 '/' Outflow=17.92 cfs 3.019 af

**Pond W1C: Catchbasin at the corner of Wetland immediately** Peak Elev=959.62' Inflow=8.06 cfs 6.740 af
18.0" Round Culvert n=0.013 L=140.0' S=0.0317 '/' Outflow=8.06 cfs 6.740 af

**Pond W1P: North part of the big** Peak Elev=955.64' Storage=254.977 af Inflow=408.95 cfs 59.578 af
30.0" Round Culvert n=0.030 L=56.0' S=0.0120 '/' Outflow=4.94 cfs 12.196 af

**Pond W22P: Pond south to Hwy 7 & east to** Peak Elev=947.57' Storage=3.541 af Inflow=66.40 cfs 7.774 af
15.0" Round Culvert n=0.013 L=279.4' S=0.0107 '/' Outflow=12.08 cfs 7.761 af

**Pond W23P: Wetland at southeast corner** Peak Elev=936.18' Storage=8.850 af Inflow=44.32 cfs 4.864 af
18.0" Round Culvert n=0.013 L=150.0' S=-0.0027 '/' Outflow=1.67 cfs 2.009 af

**Pond W24P: Ditch east of Tower St &** Peak Elev=936.16' Storage=2.782 af Inflow=73.72 cfs 15.000 af
36.0" Round Culvert n=0.013 L=40.0' S=0.0215 '/' Outflow=42.48 cfs 13.527 af

**Pond W25P: Small pond at the intersection** Peak Elev=936.18' Storage=0.356 af Inflow=18.01 cfs 8.348 af
Primary=8.24 cfs 6.818 af Secondary=8.22 cfs 1.448 af Outflow=14.58 cfs 8.266 af

**Pond W26P: Small pond east of Bell St &** Peak Elev=936.55' Storage=0.305 af Inflow=25.90 cfs 1.545 af
Primary=7.81 cfs 0.596 af Secondary=11.04 cfs 0.935 af Outflow=18.85 cfs 1.531 af

**Pond W27P: Pond on the east side of** Peak Elev=936.64' Storage=0.933 af Inflow=26.52 cfs 5.674 af
Outflow=16.43 cfs 5.493 af

**Pond W28P: Depression west of Oakland** Peak Elev=938.03' Storage=0.389 af Inflow=21.95 cfs 1.458 af
12.0" Round Culvert n=0.013 L=32.0' S=0.0050 '/' Outflow=6.00 cfs 1.457 af

**Pond W29P: Wetland west of Oakland St &** Peak Elev=951.27' Storage=1.283 af Inflow=22.36 cfs 2.145 af
12.0" Round Culvert n=0.013 L=10.0' S=0.0180 '/' Outflow=1.71 cfs 1.901 af

**Pond W2P: South part of the big** Peak Elev=950.44' Storage=146.674 af Inflow=1,002.54 cfs 219.152 af
Primary=64.07 cfs 158.697 af Secondary=0.52 cfs 0.015 af Outflow=64.07 cfs 158.712 af

**Pond W3P: Creek between Wildwood** Peak Elev=948.24' Storage=9.764 af Inflow=159.99 cfs 194.412 af
42.0" Round Culvert n=0.013 L=130.7' S=0.0052 '/' Outflow=78.63 cfs 189.764 af

**Pond W4P: Ditch south on Hwy 7** Peak Elev=939.19' Storage=8.347 af Inflow=209.03 cfs 204.635 af
42.0" Round Culvert n=0.013 L=115.8' S=0.0038 '/' Outflow=90.17 cfs 201.648 af

**Pond W5aP: Wetland south of drive ent.,** Peak Elev=932.40' Storage=2.157 af Inflow=99.91 cfs 241.879 af
Outflow=99.71 cfs 240.735 af

**Pond W5P: Wetland east of CR 92 &** Peak Elev=936.14' Storage=31.160 af Inflow=226.19 cfs 263.048 af
Primary=74.69 cfs 211.504 af Secondary=27.68 cfs 30.429 af Outflow=99.91 cfs 241.933 af

**Pond W6P: Pond near Marshland Ct.** Peak Elev=951.69' Storage=1.509 af Inflow=41.02 cfs 2.396 af
12.0" Round Culvert n=0.025 L=8.0' S=0.0037 '/' Outflow=6.27 cfs 2.081 af

**Pond W7P: Pond near Wehle Place** Peak Elev=957.83' Storage=5.629 af Inflow=89.61 cfs 4.912 af
12.0" Round Culvert n=0.025 L=60.0' S=0.0040 '/' Outflow=3.79 cfs 4.792 af

**Pond W8P: Wetland west to the City &** Peak Elev=949.97' Storage=0.439 af Inflow=48.61 cfs 29.149 af
Primary=41.77 cfs 29.052 af Secondary=0.00 cfs 0.000 af Outflow=41.77 cfs 29.052 af

**Pond W9P: Wetland northwest of** Peak Elev=937.56' Storage=43.228 af Inflow=342.37 cfs 61.090 af
24.0" Round Culvert n=0.030 L=50.0' S=0.0034 '/' Outflow=14.39 cfs 35.862 af

**Link E1L: Sixmile Wetland** Inflow=11.87 cfs 30.980 af
Primary=11.87 cfs 30.980 af

**Link T1L: Total Drainage** Inflow=112.79 cfs 279.359 af
Primary=112.79 cfs 279.359 af

**Link W1L: Mud Lake & Wetland** Inflow=101.13 cfs 248.442 af
Primary=101.13 cfs 248.442 af

**Total Runoff Area = 1,641.304 ac Runoff Volume = 550.174 af Average Runoff Depth = 4.02"**
**83.12% Pervious = 1,364.220 ac 16.88% Impervious = 277.084 ac**