BOLTON & MENK, INC.

Consulting Engineers & Surveyors

Final Surface Water Management Plan

Paynesville, Minnesota

January 6, 2011

Bolton & Menk, Inc.
1960 Premier Drive
Mankato, MN 56001

Final Surface Water Management Plan

Paynesville, Minnesota

Project No. W13.040448

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: _____

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1.0 EXECUTIVE SUMMARY

This Comprehensive Surface Water Management Plan (SWMP) for the City of Paynesville has been prepared at the request of the Paynesville City Council. Cooperative funding for this study was also provided by the North Fork Crow River Watershed District, the Koronis Lake Association and the Rice Lake Association. This SWMP's purpose is to:

- Analyze the existing storm sewer network relative to its ability to protect City residents against flood damage for various storm intensities.
- Consider the effects of continued growth around the City on the existing municipal storm drainage system.
- Recommend general development policies that are designed to reduce the potential of flooding and storm water pollution associated with the urbanization of the undeveloped lands surrounding the City.
- Address the impaired status of the North Fork of the Crow River as well as the downstream Koronis and Rice Lakes.
- Recommend a set of best management practices (BMPs) that are designed to limit the City's contribution to the impaired status of the river and the nearby downstream lakes.
- Recommend City policies and/or ordinances that limit the potential for erosion and sedimentation from new developments and construction activities.

The major watersheds and their subwatersheds within and around the City have been mapped and modeled as a method of quantifying the effects of various rainfalls on the existing and proposed storm sewer systems. With this information, we have been able to size a combination of recommended storm water collection system pipe sizes, storm water retention basins, and infiltration/filtration basins.

Most Minnesota cities have existing pipe networks that were designed to relieve ponding within the original platted city limits. When these systems were designed, the concern for the downstream properties was not a consideration. The goal was the efficient and cost effective removal of storm water runoff from developed areas. In Paynesville's case, this meant the construction of direct pipelines to the North Fork of the Crow River.

As little as 20 years ago, the urban storm sewer pipe design recommended by the Minnesota Department of Transportation (MnDOT) on County State Aid Highways for cities the size of Paynesville was a 3-year design storm. That is, the pipe system was designed to handle less a typical 3.5-inch rainfall. Now, as rainfall intensities appear to be increasing and construction costs are increasing faster than material costs, the recommended design is for the pipes to handle a 10-year storm while ensuring that overflow spillway routes prevent property damage for larger storms.

Based on the existing system, the effects of unmitigated growth on the downstream systems can be devastating and can lead to legal action against the governing authority. One of the best methods of mitigating the effects of growth is through the construction of storm water retention basins. These basins are designed to store excess runoff at elevations where there is no adjacent property damage. The runoff is stored until the existing storm sewer system can take it away. Studies have shown that these basins not only provide flood protection, but can also help to remove storm water pollutants.

Typically, the most efficient and most economical retention basins serve larger areas. Hence, an effort has been made to locate regional retention ponds as opposed to scattering smaller, localized development

basins throughout the City. However, topography and available space must provide optimum locations for regional ponds. Regional ponds cannot be located in an existing wetland without the costly mitigation of the impacted wetland. They are also not recommended in floodplains. Recently, a Minnesota suburb was fined by the MPCA for illicit discharge of sediment into the Minnesota River associated with its floodplain storm water treatment pond having its containment bank eroded away by the flooded river. This Paynesville SWMP considers these factors when recommending the placement of regional ponds. It also considers information from long term residents of Paynesville and City staff regarding the observation of the natural ponding associated with heavy rainfalls when siting regional basins.

One drawback associated with regional pond planning is finding a funding mechanism to purchase the land needed and finding ways to have new development assist in their construction. Ideal planning of regional basins includes the purchase of the needed land while constructing the basin with funding generated from area charges on the new developments that generate the excess runoff. The trouble is that the land acquisition should be made before the development occurs, but the development fees are used to pay for the land and regional pond. Greater Minnesota cities are also reluctant to impose development charges, because their goal is to attract new businesses with low cost, and not to burden them with additional fees.

Other storm water management methods can be used instead of, or in conjunction with, regional pond planning. One such method is to install infiltration practices (rain gardens, bioretention basins, or infiltration basins) in strategic locations where storm water can be collected and allowed to infiltrate into the ground. Infiltration practices have the benefit of using the soil to assist in filtering the runoff. They also reduce runoff volumes from a developed area by taking a portion of the runoff and recharging the ground water. As such, they are often touted by surface water management agencies and review authorities. However, they must also be strategically placed to prevent the potential for contamination of City wells. Many cities have restricted the use of infiltration practices inside their wellhead protection area or well capture zone.

Currently, the City has been making an effort to protect its 1-year Wellhead Protection Area (WHPA) from contaminants that might be carried by storm water. The general practice is to route storm water to areas outside the 1-year WHPA. This report recommends that infiltration practices be located outside the 1-year WHPA where the soils are suitable.

Filtration practices, such as filtration basins, are similar to the more common infiltration practices, but are designed so that the storm water filters through plants and filter media before draining into a storm sewer and not infiltrating into the ground. Filtration basins are recommended to manage storm water runoff and improve water quality within the 1-year WHPA. Filtration basins are recommended wherever they will fit into the designs and encouraged wherever local private property owners might request retrofitting them into their landscaping. Any private filtration basins that are installed will help lessen the load on the existing storm sewer system and improve water quality. Because of the uncertain nature of the siting filtration basins, they have not been included in the modeling analysis of the watershed.

All <u>new</u> developments, creating more than one acre of impervious surfacing, are required to have some form of storm water treatment. In general, this need can be satisfied by properly designed filtration practices or wet retention basins.

There is currently no legal mandate requiring treatment through filtration practices or wet retention basins for <u>existing</u> fully developed areas in Paynesville. However, the 1987 Clean Water Act Amendment initiated a new focus on storm water. In 1991, cities with populations exceeding 100,000 had to prepare a

city-wide Storm Water Pollution Prevention Plan (SWPPP) as part of their mandatory Municipally Separate Storm Sewer System (MS4) permit. This MS4 permit required retrofitting of some water quality treatment methods in fully developed areas. In 2003, the MS4 permit requirement was extended to select cities with populations exceeding 10,000. In 2007, it was further extended to all cities larger than 10,000 and to cities with populations over 5,000 that discharge to officially listed impaired waters. It is likely that the City of Paynesville will be affected by some retrofitting requirements in the future.

This study includes the general recommendation and future pipe sizes to upgrade the current City storm sewer system from its current ability to handle a 3-year storm (approximately) to a future capacity that can handle a 10-year event. In addition to the recommended upgrade, or as an alternative, this report also attempts to consider the "best fit" scenario combining regional retention basin and/or filtration basin designs to handle the current flooding problems while monitoring the ultimate effects on the affected downstream properties and resources. The recommended design in this study is to construct a storm water basin in the undeveloped industrial area near the Industrial Loop.

In addition, improved water quality can be obtained by incorporating various Best Management Practices (BMPs) into the existing storm water system whenever possible. Typically recommended BMPs include infiltration/filtration basins, vegetated buffer strips, grit chambers and proprietary sediment trap manholes.

This report is a planning tool, which must make assumptions relative to types of developments, trends in growth, planning and zoning. It is recommended that each new development be incorporated into the computerized model created for this report as part of the plan review process to ensure that the plan does not become outdated after the first few developments in and around the City.

2.0 INTRODUCTION

A. Surface Water Management Plan Purposes

This Surface Water Management Plan (SWMP) is generally designed to meet the requirements of Minnesota Statutes 103B.235, Minnesota Rules 8410. However, the majority of these rules are explicitly applicable to the 7-County Metropolitan area surrounding Minneapolis and St. Paul. Nevertheless, these statutes make a good basis for storm water management planning, and following them may give the City of Paynesville a higher priority on potential future grants.

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 more uniform local policies and official controls for surface and groundwater management;
5. Prevent erosion of soil into surface water systems;
6. Promote 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.

B. Water Resource Management Responsibilities and Related Agreements

As shown in Figure 8, the majority of the City of Paynesville drains to the North Fork of the Crow River.

All areas served by public ditches are subject to the rules governed by Minnesota Statute 103E and under the governance of Stearns County. Minnesota Statute 103E states that all connections to the ditch, or in this case, the County Tile, must be petitioned to the County Auditor.

Assistance in the cost of this report was provided by:

- The North Fork of the Crow River Watershed District
- The Koronis Lake Association
- The Rice Lake Association

There is no other record that the City has entered into any water resource management related agreements with its neighboring cities, the county, watershed district, lake associations or the state of Minnesota. The City of Paynesville has been responsible for construction, maintenance, and other projects in or along the City's storm water collection systems outside of the mainline County ditch and tile systems.

The Flood Insurance Study and the Flood Insurance Rate Map (FIRM) for the City of Paynesville prepared by FEMA and dated August 16, 1994 was used to generate the 100-yr floodplain shown on Figure 6. New Digital Flood Insurance Rate Mapping (DFIRM) has been prepared for the area, but it has not gone through the public review hearings that are required whenever the floodplain changes. When this occurs, it may be beneficial for an engineering review of the new maps and floodplain determination methodology. Although the funding provided significantly better topographic maps associated with LiDAR mapping of the entire county, limited funding for the DFIRM project may have also limited the extent of the hydrologic study necessary to change the mapping. For example, LiDAR has provided superior ground elevation data, but has not provided the river channel geometry below the water level or the bridge opening sizes at roadway crossings. These are key components in river modeling that must be considered in changing the floodplain location.

We have reviewed the current 303d list of impaired waters on the MPCA website and found the following:

Impaired Water	Year Listed	Pollutant or Stressor	Target TMDL Start	Target TMDL Completion	TMDL Approved
N. Fork Crow River – from Headwaters to Lake Koronis	2006	Mercury in fish tissue	Done	Done	2008
N. Fork Crow River – from Lake Koronis to M. Fork Crow River	2002	Mercury in fish tissue	Done	Done	2008
N. Fork Crow River – from Lake Koronis to M. Fork Crow River	2006	Aquatic macroinvertebrate bioassessments	2010	2015*	
Lake Koronis (Main Basin)	1998	Mercury in fish tissue	Done	Done	2008
Lake Koronis (Mud Lake)	1998	Mercury in fish tissue	Done	Done	2008
Rice Lake		Mercury in fish tissue	Done	Done	2008
Rice Lake		Nutrient/Eutrophication Biological Indicators	2009	2013	

* The 2010 Draft TMDL List adjusts the Target TMDL Completion from 2017 to 2015.

In addition to these local impairments, all downstream impairments may include the upstream watershed in the clean-up solution by limiting the pollutant that may be discharged. This limitation, called a waste load allocation, is typically part of the federally mandated Total Maximum Daily Load limit procedure that is designed to remove the cause of the impairment.

One example of a downstream impairment that will likely affect Paynesville is the current TMDL study of Lake Pepin on the Mississippi River near Lake City, Minnesota. The Lake Pepin TMDL may have a major impact on all NPDES permittees upstream. The City of Paynesville will likely have a phosphorus limitation on its Waste Water Treatment Facility associated with the need to limit pollutants going into Lake Pepin. Currently, the City uses spray irrigation for 100% of its discharge. In the event that this would change to a river discharge, the City will have to consider the phosphorus limitations. Likewise, the City may need to amend its local water management plan based on other downstream impairments and the associated waste load allocations needed to correct them.

In 1991, the Minnesota Legislature passed the Wetlands Conservation Act (WCA). The WCA is administered according to Minnesota Rules Chapter 8420 to implement the purpose of the Act, which is to:

- Achieve no net loss in the quantity, quality, and biological diversity of Minnesota's existing wetlands;
- Increase the quantity, quality and biological diversity of Minnesota wetlands by restoring or enhancing diminished or drained wetlands;
- Avoid direct and indirect impacts from activities that destroy or diminish the quantity, quality, or biological diversity of wetlands;
- Replace wetland values where avoidance of activities is not feasible and prudent. [1]

Pretreatment of all storm water from new developments is required prior to discharge into any wetlands. Wetlands may be, and are currently being used for storm water storage for larger rainfall events. They may continue to be used for this purpose – even after upstream development, provided that:

1. There is acceptable Best Management Practice pretreatment of the runoff in accordance with the MPCA NPDES/SDS Construction Permit, Section III.C., Permanent Stormwater Management System.
2. The bounce from the normal water level to the high water level does not exceed two feet.

The Minnesota Wetland Conservation Act (WCA) requires the designated Local Governmental Unit (LGU) in charge of administering the WCA to generate a Notice of Wetland Conservation Act Decision for any impact to wetlands within the City of Paynesville. For Paynesville, the LGU is Gregory Bechtold of Sterns County. National Wetland Inventory (NWI) wetlands are shown on Figure 2.

1 Excerpt taken from the University of Minnesota Duluth website: http://www.d.umn.edu/fm/safety_envir/wetlands/pdf_pages/4.0%20Wetland%20Regulations.pdf

In all but minor decisions, the LGU will call for a Technical Evaluation Panel (TEP) review of the application or impact prior to issuing a decision. The LGU must give notice of proposed actions affecting wetlands to all of the following:

1. The Minnesota Board of Water and Soil Resources
2. The Soil and Water Conservation District
3. The Minnesota Department of Natural Resources
4. Stearns County (LGU)
5. The U.S. Army Corps of Engineers
6. Interested citizens requesting notification of such actions

If a TEP meeting is required, all listed parties are invited to review the proposed action. However, it is not uncommon for a TEP meeting to consist of only a small contingent of this list, as some invitees may have no jurisdiction over the proposed action.

C. General Plan Description

This Paynesville SWMP is divided into ten sections as follows:

1. *Section I. Executive Summary* describes the general plan considerations relative to growth planning, the general approach toward flood mitigation, financing and assumptions.
2. *Section II. Introduction* provides background information and gives an overview of the plan contents.
3. *Section III. NPDES Phase II Considerations* details the NPDES requirements.
4. *Section IV. Modeling Methodology* details the assumptions made in modeling storm water runoff associated with the existing and proposed system.
5. *Section V. Hydrologic Parameters* presents information about the topography, soils, and land use.
6. *Section VI. Goals and Recommended Policies* outlines the City's goals and recommends policies pertaining to water management. It further recommends a regulatory framework of City ordinances and other governmental controls and programs that affect water resources.
7. *Section VII. Watershed Assessment and Recommended Solutions* outlines potential solutions to obtain the outlined goals (i.e., storm sewer system upgrades, retention basins, and bioretention basins).
8. *Section VIII. Costs and Funding* provides a general opinion of the probable costs associated with the various capital improvements recommended by this plan and discusses the various funding mechanisms to finance these improvements.
9. *Section IX. Conclusion* gives an overview of the Plan.
10. *Section X. Appendix* provides a general location to attach figures and relative documentation.

D. Background

The City of Paynesville (2000 census population 2,267) is located in Stearns County. State Highway 23 runs from the northeast to the southwest. State Highways 4 and 55 run southeast to northwest through Paynesville. Paynesville's nearest neighbor is Hawick, which lies approximately 6 miles to the southwest along State Highway 23. Willmar is approximately 29 miles to the southwest along State Highway 23. Another close neighbor is Roscoe, which lies approximately 6 miles to the northeast along State Highway 23. Further to the northeast, approximately 32 miles along State Highway 23, is St. Cloud, the county seat of Stearns County. Figure 9 shows the proposed Highway 23 alignment.

The vast majority of the drainage from the City enters the North Fork of the Crow River. Nearly all of the storm sewer pipes in town outlet to the river. The majority of the developed City has been divided into watersheds, as shown on Figure 8.

Storm sewer design and available funding parameters have changed significantly as the City has grown. As little as 20 years ago, the urban storm sewer pipe design (and consequently the funding for improvements) recommended by the Minnesota Department of Transportation (MnDOT) on County State Aid Highways was a 3-year design storm. That is, County State Aid gas tax funding was limited to the 3-year storm, and consequently the pipe system was designed to handle peak rainfall rates of less than 3.5 inches in a 24-hour period. Now, as rainfall intensities appear to be increasing and construction costs are increasing faster than material costs, the recommended design is for the pipes to handle a 10-year storm (more than 4 inches in a 24-hour period) while ensuring that overflow spillways prevent property damage for larger storms.

There are six major outlets of the storm sewer system to the North Fork of the Crow River, all of which are outfalls at the river bank. Photographs of the outfalls are included in Appendix C and approximate locations are shown on Figure 14. In other Minnesota studies on erosion, it was found that a significant percentage of river turbidity (murky or cloudy water) is caused by bank erosion. For example, a recent study of the Blue Earth River found that 56% of sediment in the river originates from river bank erosion, and another study estimated the bank erosion contributions at 48-55% of the total sediment load in the Minnesota River at Mankato for the 1990-1992 water years.[2] It is likely that the North Fork of the Crow River has a similar percentage of sediment contributed by bank erosion. Figure 1 shows areas of high slopes. There are slopes greater than 18% along a large portion of the North Fork of the Crow River in Paynesville.

Perched outfalls are also much more likely to fail. Of the City's six outfalls, three (Outfalls 1, 4 and 5) are perched and are showing signs of bank erosion. To reduce bank erosion at these outfalls, it is recommended to construct drop outlets to near the normal river water level so that the energy is dissipated inside the pipe. Potential regional pond sites and the locations of proposed new drop structures to repair outlet erosion problems are shown on Figure 14.

2 Sediment Pollution in the Minnesota River, http://www.pca.state.mn.us/publications/presentations/lakepepin-gupta0406.pdf
Evaluation of Bank Erosion Inputs to the Blue Earth River with Airborne Laser Scanner, http://water.usgs.gov/wrri/AnnualReports/2000/MNfy2000_annual_report.pdf
Watershed Assessment Tool – Water Quality Concepts, Turbidity, http://www.dnr.state.mn.us/watershed_tool/wq_concepts.html

The area surrounding Paynesville is predominantly undeveloped and served by County ditches and the North Fork of the Crow River. The North Fork of the Crow River lies to the north of Paynesville. Lake Koronis lies to the south. The City can expand in most directions and is only limited by Lake Koronis, the wetlands, flood routing corridors and annexation.

The City of Paynesville is concerned that the growth around the City could cause flooding conditions in and around the City and degrade water quality in the nearby river and lakes. An ordered growth with consideration given to surface water management is the primary goal of this SWMP.

E. Watersheds

As stated earlier, the City of Paynesville drains to seven separate watersheds including (see Figure 8):

1. Major Watershed 1 (299.9 acres)
2. Major Watershed 2 (353 acres)
3. Major Watershed 3 (502.8 acres)
4. Major Watershed 4 (68.6 acres)
5. Major Watershed 5 (124.8 acres)
6. Major Watershed 6 (19.9 acres)
7. Major Watershed 7 (216.1 acres)

3.0 NPDES PHASE II CONSIDERATIONS

A. General City Permits

In 1987, the US Congress amended the Clean Water Act to include storm water pollution and directed the Environmental Protection Agency (EPA) to initiate rulemaking. The first round of EPA rules were implemented in 1991 when NPDES Phase I permits were required for all cities exceeding 100,000 in population. Phase II was implemented in 2003 and targeted all cities with populations exceeding 10,000. In 2008, the Phase II rulemaking expanded the list of targeted cities to include cities with populations exceeding 5,000 and that discharge into an impaired water. The Minnesota Pollution Control Agency (MPCA) assumed responsibility for implementing the rules and issuing all Phase II permits. The City of Paynesville is not currently targeted for a city-wide permit. However, the NPDES Phase II rules also apply to all construction disturbances of one acre or more. Furthermore, impaired waters like the Crow River mean that waste load allocations will be distributed to all potential contributors within the watershed in order to meet the Total Maximum Daily Load (TMDL) limitations that are required by federal law to facilitate correcting the impairment. It is highly probable that the City of Paynesville will be subject to a future TMDL requirement.

The primary targets of TMDL requirements are urban runoff and construction runoff. This is because urban runoff carries pollutants from cars, lawn fertilizers, pesticide spills and other contaminants into our lakes, wetlands and streams without entering wastewater treatment systems. Figure 7 shows the MPCA Delta Program Interest locations; these are potential contaminant sources. Construction runoff is often laden with sediment caused by large areas of open, exposed soil that is loosened by excavation and grading.

The federal mandates are intended to regulate these sources of continued environmental degradation. New developments have become increasingly targeted. All new developments, creating more than one acre of impervious surfacing, are required to have some form of storm water treatment. In general, this need can be satisfied by properly designed infiltration/filtration basins or wet retention basins.

The following is a listing of the available storm water quality and quantity systems currently being designed to handle the water quality/quantity issue:

1. Wet Retention Basins

   Numerous studies have been done on the water quality treatment afforded by wet retention basins, most notably one by William Walker Jr. for the Vadnais Lake Area Water Management Area (1987). The Walker study found that properly sized wet retention basins can effectively remove pollutants through sediment removal. When properly sized, these ponds can significantly reduce the contaminant levels, including phosphorus, commonly found in urban storm water runoff. According to the MPCA's Stormwater Manual, wet retention basins can remove 80% of suspended solids, 40% of total phosphorus, and 30% of total nitrogen. Wet retention basins also provide flood storage. Wet retention basins are also well known for their storm water quantity handling capabilities.

2. Bioretention Systems

   Another method of managing storm water runoff is to install bioretention practices in strategic locations where storm water will be collected and allowed to filtrate through the planting media or be taken up by vegetation before entering the storm sewer.

   a. Infiltration/Filtration Bioretention Basins

      According to the MPCA's Stormwater Manual,[3] bioretention facilities capture rainwater runoff to be filtered through a prepared soil medium. Pollutants are removed by a number of processes including adsorption, filtration, volatilization, ion exchange and decomposition (Prince George's County, MD, 1993). Filtered runoff from bioretention basins can either be allowed to infiltrate into the surrounding soil (functioning as an infiltration basin or rainwater garden), or collected by an under-drain system and discharged to the storm sewer system or directly to receiving waters ("filtration only" bioretention basin). Due to the groundwater vulnerability and the WHPA covering a large portion of the city limits, lined filtration basins are recommended for the areas of Paynesville within the 1-year WHPA. The 1-year WHPA is shown on Figure 13. Runoff from larger storms is generally allowed to bypass the filled bioretention basin and flow directly to the storm drain system. Infiltration/filtration basins are typically designed for treating the water quality and not for the water quantity of urban storm water runoff. That is, the MPCA requirement for water quality is to treat the first 0.5 to

3 Minnesota Stormwater Manual, Version 2, January 2008. http://www.pca.state.mn.us/publications/wq-strm9-01.pdf

1.0 inch of runoff from a site (water quality volume). This is in contrast to the larger amount of runoff that may be actually leaving the site for a 3 to 6 inch rainfall (water quantity). Because storm water quality has become a greater issue, bioretention basins have become a significant design tool for municipal storm water systems. Bioretention basins can remove 85% of suspended solids, 65% of total phosphorus, and 50% of total nitrogen.

B. NPDES Phase II Construction Permits

The NPDES Phase II construction storm water permit requirements have also taken effect. As of August 1, 2008 a new NPDES permit is in effect. A construction permit is required for any disturbance of more than 1 acre, as opposed to the 5-acre limit that was established in 1991. The permit process is best summarized in the following table:

CONSTRUCTION STORMWATER PERMIT REQUIREMENTS

Item	Requirement
Minimum Disturbance Triggering a permit	1 acre
New Homes	Permit required if part of the larger development
Permit Fee	$400
Storm Water Pollution Prevention Plan (SWPPP)	1. Must be on file 2. Must be submitted if over 50 acres and is within 1 mile and discharges into a Special Water
Responsibility for compliance	Contractor is responsible for erosion controls. Owner is responsible for implementation of the SWPPP
Responsibility after land sale	Transferred with the property until Notice of Termination

Inspection reports and certifications are required.

C. SWPPP for Construction Permits

The construction permit also requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP) for the disturbed site. The SWPPP requirements are as follows:

1. Must be designed prior to permit application and available on site.
2. Should typically use BMPs that are recognized as effective.
3. Unique innovative designs may be used, but have formal review and monitoring requirements.
4. Owner must identify a person with approved training in accordance with the Permit who will oversee the implementation of the SWPPP.
5. Owner must identify a person with approved training in accordance with the Permit that will be responsible for long-term operation and maintenance of the permanent BMPs.

6. Owner must develop a chain of responsibility to ensure that the SWPPP will be implemented and stay in effect until termination. The SWPPP must have the following:
   a. Location and type of all temporary and permanent erosion controls and sediment control BMPs.
   b. Standard plates and specifications for the BMPs.
   c. A site map with existing and final grades, subwatershed limits and direction of flow for both the pre and post development drainage areas. The site map must include impervious surfaces and soil types.
   d. Locations of areas not to be disturbed (construction limits).
   e. Locations of areas of phased construction to minimize duration of exposed soil.
   f. All surface waters and wetlands within 1 mile that can be identified on a quadrangle map and will receive runoff from the site.
   g. Methods used for final stabilization of exposed soils.

D. Permanent Sedimentation Pond Requirements

If more than one acre of new impervious surface is created by the construction, permanent water quality BMPs are required as part of the permanent SWPPP. If the filtration or infiltration alternatives listed above are not possible, a permanent wet retention basin is the most utilized method of meeting the requirements. The new construction storm water permitting requirements allow very little flexibility in using alternative BMPs to treat water. Alternative methods may be proposed, but the delays associated with review time become discouraging. The **permanent pond requirements** are summarized as follows:

1. A permanent volume (dead storage) of 1,800 cubic feet per acre draining to the basin.
2. A water quality volume (equal to ½ inch [for non-impaired waters] or 1 inch [for impaired waters] multiplied by the new impervious surface) that cannot be discharged at a rate exceeding 5.66 cfs per acre of pond surface area (when the pond has both the permanent volume and water quality volume in it).
3. A 3 foot minimum depth and a 10 foot maximum depth.
4. Outlets placed to minimize short circuiting and designed to skim floating debris.
5. An emergency overflow.
6. Adequate public access (typically 8 feet wide).

E. Regional Pond Considerations

An area regional pond may be used provided that:
1. The regional pond is not a wetland.
2. Must be designed to meet the treatment pond criteria for all impervious surfaces.
3. Regional pond owner's authorization must be secured as part of the permitting process.

F. Construction Storm Water Permit Approval Timelines

The construction storm water permit approval timelines are based on the proposed BMP treatment to be used and the potential impact on the existing area resources. The permit timeline is best described by the following table:

Project	Requirement
General Projects	Automatic, **7 days** after the postmarked date of the application submittal
Projects disturbing 50+ acres that are within 1 mile of, and flow into, protected waters	Automatic, **30 days** after the postmarked date of the application submittal
Projects proposing Alternative Methods	Automatic, **90 days** after the postmarked date of the application submittal

These timelines can grow if the MPCA replies with requested revisions. This possibility is greatly enhanced when proposing alternative storm water treatment methods.

4.0 MODELING METHODOLOGY

A. Hydrologic Modeling Methodology

The general procedure used in the runoff modeling aspects of this analysis has been performed using the AutoDESK SSA Modeling Software. The TR-20 process was used to formulate runoff hydrographs, route hydrographs through channels and reservoirs, provide discharges at selected locations, and determine peak discharges and their time of occurrence for individual storm events. This baseline modeling is extremely useful in evaluating the alternative flood mitigation designs as well as water quality treatment BMP measures.

Once the existing system flows were calculated, the undeveloped areas were modeled again under fully developed conditions and superimposed onto the existing network so that the effects of continued growth could be studied. Alternative flood mitigation/attenuation strategies, including detention basins were then designed and modeled to correct noted flooding issues, and where applicable, to mitigate the effects of the continued development.

Three Type II, 24-hour rainfall events were analyzed. For purposes of this report, we have chosen to analyze the effects of a 2.7-inch, a 4.1-inch rainfall, and a 5.8-inch rainfall. These three events are best described as having probabilities of occurring once every 2 years, 10 years, and 100 years, respectively.

The probabilities of occurrence do not imply that a 2.7-inch, a 4.1-inch or a 5.8-inch rainfall cannot occur multiple times within the same year; they simply say that a 2.7-inch rainfall will occur *on the average* once every 2 years, a 4.1-inch rainfall will occur *on the average* once every 10 years and that a 5.8-inch rainfall will occur *on the average* once every 100 years. It is often better to think of the 2 year rainfall as having a 50 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.

B. Precipitation

The state climatology office has records of all official rain gauges throughout Stearns County. The monthly precipitation totals and county-wide monthly averages for Stearns County are available online at:

http://climate.umn.edu/HIDENannual/

The number of rain gauges varied from year to year, with 8 gauges reporting in 2008. The 2008 rain gauges are located:

1. Soil and Water Conservation Service (SWCD) (123N 28W 12)
2. Soil and Water Conservation Service (SWCD) (123N 30W 15)
3. State Climatology Office Backyard Network (BYRG) (124N 28W 13)
4. Soil and Water Conservation Service (SWCD) (124N 28W 31)
5. National Weather Service (NWS) Collegeville (124N 30W 1)
6. Soil and Water Conservation Service (SWCD) (125N 28W 5)
7. National Weather Service (NWS) Melrose (126N 33W 34)
8. Department of Natural Resources (DNR) Melrose (126N 33W 34)

Information is readily available from 1972 to the present. There have been 394 rain gauges listed over the period from 1972 to 2008. Some of these may be in the same location, but are owned by a different agency. There are gauges in the following townships: 121N, 122N, 123N, 124N, 125N, 126N, 127N, and 175N. Over this time period, the aggregate annual precipitation ranged as follows:

Lowest annual precipitation..... 15.0 inches in 1976

Highest Annual Precipitation..... 41.6 inches in 1986

Average Annual Precipitation ..... 27.7 inches per year

The following is the average annual precipitation per decade:

1970s..... 26.3 inches per year

1980s..... 28.1 inches per year

1990s..... 28.0 inches per year

2000s..... 28.2 inches per year

On the average, June is the wettest month, followed by August and July.

5.0 HYDROLOGIC PARAMETERS

A. Topography

The general terrain is relatively flat on the central part of the city and hilly on the southern part. There are also some steep slopes near the river. Figure 1 shows areas of steep slopes in the vicinity of Paynesville. The elevations range from approximate elevation 1,150 feet

above mean sea level at the North Fork of the Crow River as it flows through Paynesville to near 1,208 feet in southeastern Paynesville. The straight-line distance between these points is approximately 4,585 feet, making the average slope less than 2 percent. In general, the land slope is in the 0 to 25 percent range.

Paynesville surrounds a portion of the North Fork of the Crow River and is within 2 miles of Lake Koronis and Rice Lake. Figure 2 shows the public waters in the vicinity of Paynesville. Both Lake Koronis and Rice Lake have an OHW established: 1,123.32 ft and 1,125.1 ft, respectively.

The best, most reliable topographic elevation mapping for Paynesville is the Light Detection and Ranging (**LIDAR**) topographic data with a 2-foot contour interval. Bolton & Menk performed field reconnaissance to verify the watershed boundaries. Both the LIDAR information and the field information were used to help determine the watersheds. Figure 8 in Appendix A shows the major watersheds in the Paynesville area.

B. Watersheds

Since the majority of the existing City drains to the North Fork Crow River system, City has been divided into watersheds associated with the various mainline storm sewer systems connected into the River. The seven general watersheds are as follows:

Watershed 1 - Area 1 is approximately 299.9 acres in size. This is the central area of the City, including mostly single-family residential land uses, but also some multi-family residential areas and some commercial/industrial areas in the northeast.

Watershed 2 - This is the southwestern area of the City, including mostly single-family residential land uses, but also some multi-family residential areas and some commercial/industrial areas along Highway 23 as well as in the western part of the watershed. It also includes a portion of the golf course and some agricultural land use. Area 2 is approximately 353 acres in size.

Watershed 3 - This is the largest watershed in Paynesville. It is 502.8 acres in size. It is in the southeast of the City, and has a large proportion of agricultural, low-density single family residential, and wooded land uses. There are small areas of residential and industrial on the western part of the watershed.

Watershed 4 - This 68.6-acre watershed is on the west side of the city, near but not including the airport. This watershed has mostly industrial land use, with some agricultural land use and wooded areas near the river.

Watershed 5 - This 124.8-acre watershed includes most of the industrial development on the north side of the City.

Watershed 6 - This 19.9-acre watershed is on the north side of the North Fork of the Crow River, and has low-density single family residential.

Watershed 7 - This 216.1-acre watershed is on the north side of the North Fork of the Crow River, and is largely undeveloped agricultural land, with a few large agricultural buildings.

Figure 8 in Appendix A shows these seven general watersheds on the aerial photo of the area.

C. Soils

According to the Stearns County Soil Survey, in general, the city of Paynesville has sand, loam, and small areas of muck soils. See Figure 3 for soil type information and Table 5-1 for map symbols and soil names.

Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. The higher the infiltration rate for a given soil, the lower the runoff potential. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates.

For purposes of this report, we have chosen the Soil Conservation Service (SCS) method of classifying soils. The following is an excerpt from SCS Technical Release No. 55 (SCS TR-55) defining the four Hydrologic Soil Groups:

Type A Soils - Sand, Loamy sand, or Sandy loam. Type A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.3 in/hr).

Type B Soils - Silt loam or loam. Type B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15 to 0.30 in/hr).

Type C Soils - Sandy Clay Loam. Type C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05 to 0.15 in/hr).

Type D Soils - Clay loam, silty clay loam, sandy clay, silty clay, or clay. Type D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist of chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

According to the Stearns County Soil Survey, the underlying soils in and around the City of Paynesville are classified as SCS soils type A, A/D, B, and B/D; the large majority being B soils. Soil types A/D and B/D have the characteristics of the first letter group when drained. For example, an A/D soil that does not have drain tile installed acts as a D soil, but if drain tile is installed, will act as an A soil. See Figure 3 and Table 5-1 for soil hydraulic types.

Table 5-1. Soil Names and Hydrologic Groups

Component Name	Map Unit	Hydraulc Soil Group	Type
Biscay	392	B/D	fine-loam
Biscay	399	B/D	fine-loam
Blue Eart	35	B/D	fine-silt
Blue Eart	1805	B/D	fine-silt
Bluffton	75	B/D	fine-loam
Cathro	544	A/D	loamy
Cordova	109	B/D	fine-loam
Coriff	571	B/D	coarse-loam
Corunna	459	B/D	coarse-loam
Cylinder	129	B	fine-loam
Dakota	5A	B	fine-loam
Dakota	5B	B	fine-loam
Darfur	281	B/D	coarse-loam
Dickman	327A	B	sandy
Doland	591B	B	fine-loam
Dorset	406C	B	coarse-loam
Dorset	406B	B	coarse-loam
Duelm	260	A	sandy
Eckvoll	565	B	loamy
Esthervil	41A	B	sandy
Esthervil	875B	B	sandy
Esthervil	41B	B	sandy
Esthervil	999B	B	sandy
Esthervil	41C	B	sandy
Fairhaven	156B	B	fine-loam
Fairhaven	156A	B	fine-loam
Fedji	69B	B	sandy ove
Flom	36	B/D	fine-loam
Glencoe	114	B/D	fine-loam
Glencoe	1828	B/D	fine-loam
Hamel	414	B/D	fine-loam
Hawick	611C	A	sandy

Hawick	611D	A	sandy
Histosols	1055	A/D	not used
Hubbard	7B	A	sandy
Hubbard	7A	A	sandy
Hubbard	7C	A	sandy
Isan	261	A/D	sandy
Kalmarvil	465	B/D	coarse-loam
Koronis	461B	B	fine-loam
Koronis	804D	B	fine-loam
Koronis	461C	B	fine-loam
Koronis	807D	B	fine-loam
Lowlein	572	B	coarse-loam
Marcellon	511	B	fine-loam
Markey	543	A/D	sandy or
Mayer	318	B/D	fine-loam
Mayer	255	B/D	fine-loam
Muskego	525	A/D	not used
Normania	446B	B	fine-loam
Normania	446A	B	fine-loam
Nymore	207B	A	not used
Nymore	207C	A	not used
Nymore	207E	A	not used
Osakis	413	B	sandy
Pits	1029		
Psamments	1015	A	
Regal	566	B/D	fine-loam
Ridgeport	639A	B	coarse-loam
Roliss	582	B/D	fine-loam
Seelyevil	540	A/D	not used
Seelyevil	1825C	A/D	not used
Seelyevil	1879	A/D	not used
Shooker	72	B	fine-loam
Tara	597	B	fine-silt
Udifluven	1018	D	unclassified
Udorthent	1016	B	
Vallers	236	B	fine-loam
Ves	421C	B	fine-loam
Ves	999C	B	fine-loam
Ves	421B	B	fine-loam
Ves	954C	B	fine-loam

Ves	954D	B	fine-loam
Ves	999D	B	fine-loam
Water	W		
Water	M-W		

In the SCS methodology, runoff curve numbers are used to describe the infiltration and hence, the runoff characteristics of the soil and land use. The higher the SCS curve number, the higher the runoff generated from the site. For example, a paved parking lot would have a curve number of 98 while a sand plain meadow would have a curve number of 48.

The National Land Cover Dataset (NLCD) for Stearns County was used in conjunction with Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) soils information to calculate weighted curve numbers (CN) on a subwatershed basis. In ArcGIS, the land cover dataset was merged with the soils dataset and a lookup table was used to assign CN for each unique combination of land cover and soil type. The sum of the fraction of the total subwatershed area contained by each unique CN multiplied by the unique CN is the resultant overall weighted CN. Figure 4 shows the NLCD land cover information. Table 5-2 is the lookup table used in the analysis and Figure 5 is a map of the distribution of CN throughout the study area.

Table 5-2. Curve Numbers for Unique Combinations of Land Cover and Hydrologic Soil Group

	Hydrologic Soil Group			
	A	**B**	**C**	**D**
Open Water	98	98	98	98
Developed Open Space	49	69	79	84
Developed, Low Intensity	57	72	81	86
Developed, Medium Intensity	61	75	83	87
Developed, High Intensity	89	92	94	95
Barren Land	77	86	91	94
Deciduous Forest	30	55	70	77
Evergreen Forest	45	66	77	83
Mixed Forest	36	60	73	79
Shrub/Scrub	35	56	70	77
Grassland/Herbaceous	49	69	79	84
Pasture/Hay	68	79	86	89
Cultivated Crops	63	75	83	87
Woody Wetlands	36	60	73	79
Emergent Herbaceous Wetlands	49	69	79	84

Of course, as the City develops and increases the percentage of impermeable surfaces associated with houses and pavement, the soil classification becomes less important. As this occurs, the recommended retention basin and infiltration/filtration basin network will become a greater factor in the management of runoff.

D. Land Use

The City of Paynesville has developable space in most directions (see Figure 4). Land use and zoning data is an important factor in estimating surface water runoff. The hard or impervious surface areas associated with each land use greatly affect the amount of runoff generated from an area. Future land use projections indicate those areas that may be available for water resource enhancement and where improvements should be a priority. Significant changes in land use can increase runoff due to added impervious surfaces.

It is presumed that continued development will be predominantly residential with potential expansion of the current industrial zones and expansion of a commercial corridor along Highways 23/55/4.

This SWMP includes the suggested pipe sizes to handle a 10-year storm while the proposed pond system is designed to handle the 100-year storm. This works because the proposed ponds are located at low points where the streets can deliver the excess runoff to the ponds when the storm sewers are flowing full.

The proposed 10-year design pipe sizes should be considered whenever the City is planning a reconstruction project along an existing storm sewer pipe route. Figure 10 shows how the existing pipe system handles a design 10-yr storm (i.e., pipes flowing full and surcharged pipes). Figure 11 shows how the existing ponds handle a 100-yr design storm (i.e., ponds functioning properly, ponds that utilize the emergency overflow and ponds that may threaten structures). Figure 12 shows recommended pipe sizes. Where new pipe sizes were recommended, they were sized without consideration of the proposed new wet retention basins or infiltration/filtration basins into the system. Therefore, if the proposed new basins are built, the proposed new pipe sizes may be oversized. In any case, it is recommended that whenever a street is reconstructed that the recommended pipe size be considered in the reconstruction of the street.

E. Water Quality Information

Section 303d of the Clean Water Act requires that each state submit a list of Impaired Waters. The MPCA website lists the impaired waters as officially designated in 2008. There is a current (2008) MPCA 303d Impaired Water in Paynesville: the North Fork of the Crow River. There are also waters downstream of the City of Paynesville, such as Lake Koronis, Rice Lake, and Lake Pepin, which are impaired. The following table lists the nearest impairments:

303d Impaired Waters List Excerpt from MPCA

Impaired Water	Year Listed	Pollutant or Stressor	Target TMDL Start	Target TMDL Completion	TMDL Approved
N. Fork Crow River – from Headwaters to Lake Koronis	2006	Mercury in fish tissue	Done	Done	2008
N. Fork Crow River – from Lake Koronis to M. Fork Crow River	2002	Mercury in fish tissue	Done	Done	2008
N. Fork Crow River – from Lake Koronis to M. Fork Crow River	2006	Aquatic macroinvertebrate bioassessments	2010	2015*	
Lake Koronis (Main Basin)	1998	Mercury in fish tissue	Done	Done	2008
Lake Koronis (Mud Lake)	1998	Mercury in fish tissue	Done	Done	2008
Rice Lake		Mercury in fish tissue	Done	Done	2008
Rice Lake		Nutrient/Eutrophication Biological Indicators	2009	2013	

The process to remedy the impairment includes establishing a Total Maximum Daily Load (TMDL) allocation to each contributor to the problem. A TMDL is a calculation that determines the allowable pollutant load (a.k.a., Waste Load Allocation or WLA) that can be discharged into the impaired water so that the limited load will ensure that the water improves to levels where it is no longer impaired. The typical process is initiated by the MPCA and includes a series of stakeholder meetings to formulate viable solutions and mutually work out a reasonable allocation of acceptable pollutant loading.

The MPCA has performed a statewide study of mercury in fish tissue because it is associated with airborne pollutants and delivered by rainfall. The remaining TMDL studies are to be initiated and implemented in accordance with the schedule shown in the table. If MPCA has not invited the City of Paynesville to a TMDL meeting on the non-mercury related impairments, then the TMDL process has not been initiated for these impairments. It is strongly advised that your City Engineer be included in these meetings. Furthermore, the City should volunteer to participate in the stakeholder process.

Once a TMDL study is completed for the impaired water, the City will most likely need to limit its pollutant contribution to a study determined Waste Load Allocation level. This SWMP and the associated storm water modeling can be used to evaluate and implement proposed strategies to meet future waste load allocations. As MPCA completes its TMDL process for each impaired water, the implementation of the measures to meet the TMDL will immediately become a priority item for the City of Paynesville.

Another category of waters includes Special Waters. These are waters that are either Wild and Scenic areas or are pristine, unimpaired waters. Since the nearby waters have listed impairments, there are no area waters on MPCA's Special Waters list. There are Special Waters in other areas of Stearns County; one of them is the Mississippi River, which is considered Scenic/Recreational from St. Cloud to the northwest Anoka city limits.

It should be noted that once a waterbody is removed from the impaired waters list, it becomes an anti-degradation water that needs to be protected. We anticipate that after implemented TMDLs successfully remove waters from the impaired waters list, those waters will become Special Waters.

6.0 GOALS & RECOMMENDED POLICIES

A. Subdivision/Development Ordinance

A general recommendation for the undeveloped areas around Paynesville is to require the developers to submit a storm water pollution prevention plan as part of any future plats in the vicinity. Most growing cities implement a subdivision ordinance that includes requirements similar to the recommendations shown below. These are storm water related suggestions to be added to the City Subdivision Ordinance. Most subdivision ordinances address additional requirements relative to lot sizes, easements, minimum street widths, minimum street designs, etc. The following language (in italics) is for use with recommended development ordinance revisions:

Recommended Ordinance Language

1. *The post development runoff from all new developments shall be limited to the rates estimated to be generated by the existing condition for the 2-year, 10-year and 100-year, 24 hour rainfall events (2.7-inch, 4.1-inch or 5.8-inch rainfall depths, respectively). The analysis shall be computed using SCS TR-20 or SCS TR-55 methodology. The allowable SCS runoff curve number (CN) for the existing agricultural areas and the allowable CNs for developed conditions shall be limited to that shown in the following table:*

   Maximum existing farm field (row crops, good)..... CN =85

   Maximum existing residential development (1/4 acre lots) ..... CN=87

   Minimum new residential development (1/4 acre lots)..... CN=87

   Minimum paved area (parking lots, streets, etc) ..... CN=98

   Minimum grassed area (50- 75% cover) ..... CN=85

   Minimum industrial development ..... CN=93

2. *One option for controlling the post development runoff rates is to use wet retention basins that are designed with dead storage volumes in accordance with the following (Wm. Walker Jr., 1987)[4]:*

4 **Design Calculations for Wet Detention Ponds**, ***St. Paul Water Utility*, William W. Walker, Jr., 1987.**

Given the following definitions:

Aw	=	*Total watershed area in acres.*
Fi	=	*Ratio of impervious area total watershed area.*
CN	=	*Area weighted mean SCS curve number for the pervious portion of the watershed.*

Calculate the maximum soil retention as follows:

$$S = (1000/CN) - 10$$

Calculate the runoff for a 2-year storm as follows:

$$R = 2.5 * Fi + \frac{(2.5 - 0.2S)^2 * (1-Fi)}{(2.5 + 0.8S)}$$

Calculate Permanent Pool Volume, V in acre-feet as follows:

$$V = R*Aw/12$$

3. *The mean pond depth (pond volume/surface area) should be at least 4 feet and not more than 10 feet.*

4. *The pond should have a safety bench extending from the edge of the water into the pond a minimum distance of 10 feet with a maximum slope of 10:1 (i.e., the pond should be no greater than 1 foot in depth within 10 feet of the shoreline).*

5. *The maximum pond slopes beyond the safety bench should be no greater than 4:1 (horizontal to vertical).*

6. *The pond outlet structure shall not be closer than 50% of the pond length from the pond inlet to prevent short-circuiting.*

7. *The pond outlet structure shall be designed to skim and prevent floating debris from leaving the pond.*

8. *The pond outlet structure shall control the discharge to a rate less than 5.66 cfs per acre of surface area of the pond, in accordance with MPCA discharge rate requirements. Generally the pond volumes calculated as described above are slightly larger than volumes required by the MPCA, so pond volumes calculated as described above should be adequate to meet MPCA volume requirements.*

9. *The other option for controlling the post development runoff rates within the 1-year WHPA is to use "filtration only" bioretention basins designed following the guidance in the Minnesota Pollution Control Agency's Stormwater Manual (version 2, January 2008).Outside of the 1-year WHPA, infiltration bioretention basins designed following*

the guidance in the Minnesota Pollution Control Agency's Stormwater Manual should be used.

This recommended ordinance language follows a fairly standard retention basin design procedure with ponds being required to ensure that the immediate development in the area will not adversely affect the downstream peak flow conditions. On the city-wide scale, this individual site approach can result in uncoordinated and piecemeal pond development. Uncoordinated storm water management can have significant impacts. For example: a multitude of scattered ponds associated with each individual site development may be designed to reduce the peak outflow for its smaller area, by storing the excess runoff and releasing it at a lesser rate for a longer duration. This longer pond outflow duration has a greater chance of coinciding with the reduced peak flows from other individual site ponds and creating a larger combined peak flow than the original undeveloped condition.

It is hoped that this SWMP and its comprehensive model can be used and updated throughout the growth of the city so that minor changes to the various new development plans can be made so that the cumulative plan produces the desired results.
To this end, we also recommend that any subdivision/development ordinance reserve the right of the City to require more restrictive outflow conditions, perhaps up to 30 percent additional flow reduction over the predevelopment flows, to prevent/remedy potential downstream flooding and legal issues. Care should be taken to fully document this plan and the increased probability for downstream flooding problems if additional restrictions are taken, so that legal action cannot be taken against the City. The reason for requiring additional restrictions must be to ensure that the downstream properties are not adversely affected; it cannot be randomly invoked.

A regional ponding approach to new developments is also an excellent way to prevent adverse downstream effects from multiple uncoordinated ponds. Done properly, they can benefit the whole area by creating a more cost effective flood mitigation measure for an entire developable drainage area.

B. Erosion Control Ordinance

To protect the water quality in the City, erosion control measures are needed to limit and control the amount of sediment being allowed to enter the storm water conveyance system. Construction sites in particular can be a source of nuisance amounts of sediment and construction related debris which can reduce the general flow capacities of the storm sewer system, limit the treatment characteristics of retention basins and limit the overall flood control provided. When sites are disturbed by construction, erosion rates can be 10 to 100 times the rates anticipated from undisturbed sites. In addition, sediment can carry phosphorus and other unwanted pollutants into the ultimate receiving waters.

The following is a list of BMPs that are applicable to erosion control:

1. Temporary Sediment Basins
2. Interim Seeding
3. Storm Sewer Inlet Protection
4. Silt Fencing

5. Rock Weirs
6. Limit Area of Disturbance
7. Phasing of Earth Work
8. Rock Vehicle Entrance/Exit

The Rock Vehicle Entrance/Exit should be a standard requirement together with a street sweeping deposit to limit construction-related mud from tracking onto the area streets. The street sweeping deposit would allow the City the opportunity to order the streets to be swept while ensuring the contractor pays for the inconvenience.

It is recommended that the City Subdivision Ordinance require developers to submit an erosion control plan as part of their platting and/or grading permit requirements, along with a storm water pollution prevention plan. The above listing of BMPs should be consulted in the preparation and/or review of the erosion control plan.

C. General Citywide Conservation

In addition to the recommended ordinances controlling new developments in accordance with MPCA mandates, there are also several recommended alternatives to increasing the pipe sizes throughout town. They include the following:

1. Implementation of regional storm water retention basin approach. Regional storm water facilities can reduce discharge rates and act as surge basins for larger storm events and accommodate large drainage areas when properly designed and located in a watershed. Regional basins are recommended according to Figure 14.

2. Implementing “filtration only” bioretention basins within the 1-year WHPA, and infiltration bioretention basins outside the 1-year WHPA. These storm water treatment practices can also help beautify a neighborhood.

3. Preservation of existing wetlands in accordance with State and Federal wetlands laws where encountered. Existing wetlands provide natural water quality ponding for storm water runoff. Any wetland impacts must be mitigated to provide replacement of water quality functions. Mitigation of lost wetland is usually required within the watershed.

D. Summary of Goals

The City's goals and recommended policies pertaining to water management are as follows:

1. **Water Quality.** Maintain or enhance the water quality of the Paynesville area rivers, wetlands, and watercourses.

2. **Runoff Management and Flood Control.** Preserve, maintain and expand (where possible) the storm water storage and detention systems to control excessive runoff volumes and rates, prevent flooding, protect public health and safety, and minimize public capital expenditures. Establish minimum building floor elevations relative to the

modeled 100-year flood levels (i.e., the lowest floor of a building must be 3 feet above the 100-year High Water Level (HWL).

3. **Wetlands.** Consider Federal and State wetland laws in attempting to limit the loss of wetlands and requiring mitigation of wetlands, where affected by growth.

4. **Erosion and Sediment Control.** Enforce the most recent extension of the 1987 Amendment to the Federal Water Quality Act which includes the NPDES Phase II requirements for erosion and sediment control from construction sites disturbing greater than 1 acre. This effort is anticipated to protect the existing capacity of the City's storm water management system by:

   a. Preventing sediment build-up
   b. Preventing flooding
   c. Maintaining the water quality of the runoff
   d. Correcting existing erosion and sedimentation problems

5. **Groundwater.** Protect the quality and quantity of groundwater resources.

6. **Education and Public Involvement.** Increase public awareness, understanding and involvement in water and natural resource management issues.

7. **Financing**. Minimize and fairly distribute public expenditures for plan implementation. Options include:

   a) Initiating a storm water utility fee
   b) Increasing the general levy (within levy limits)
   c) Creating a storm sewer assessment district
   d) Accessing funds from other City projects and funds
   e) Initiating a storm water development charge (storm water trunk fees)

   Of these, only a) and b) are realistic methods of fairly distributing the burden. Assessment districts and special assessments are often the subject of legal disputes. Most Greater Minnesota cities are not willing to create a storm water development charge, which charges new developments for their impact on the downstream system, because these cities are concerned that it would deter business opportunities and growth.

7.0 WATERSHED ASSESSMENT AND RECOMMENDED SOLUTIONS

A. General Procedures

The general procedure and scope of this SWMP includes the development of a design document to size and locate future storm sewers, retention basins, bioretention basins and

other drainage facilities within the City as affected by the future growth areas around the City. Procedures for preparation of this SWMP follow traditional storm sewer design procedures. By necessity, therefore, this SWMP becomes a very technical document. The following summarizes the major activities associated with plan development:

1. The existing City utility and storm sewer mapping was researched to determine existing drainage patterns, catch basin locations, and other pertinent drainage features.

2. LIDAR data and USGS topographic mapping was obtained and correlated with the existing storm sewer utility data to determine and model the existing drainage patterns. The elevation contours on the LIDAR topographic maps are shown at 2-foot intervals, and this is the best available data.

3. A physical field inspection of key areas of concern was made using topographic mapping and storm sewer data. Existing storm sewer structures were surveyed. Field inspection was made to identify recent topography changes and delineate subtle watershed breaks not discernible from, or at variance with, the available topographic contour data.

4. Each minor drainage area, flowing to a collection point, such as a manhole at a low intersection, an existing catch basin, or a natural agricultural low area, was identified and mapped on a master drainage area and topography drawing.

5. All subwatersheds and existing storm sewer data were transferred to a GIS compatible computer mapping system. Drainage areas were computed for each subwatershed.

6. A draft watershed map was plotted for the City. The map was used to review existing drainage patterns and determine reasonable alternatives for future storm sewer improvements. Many factors were considered in this planning/design process including, but not limited to the following:

    a. Incorporating recent storm sewer improvements into the future plan to assure that maximum usage and benefit was achieved from prior City investments.

    b. Considering alternative designs such as incorporating retention facilities for flood protection and cost effective pipe sizing wherever open public space or future development permits such facilities. Such retention basins can be incorporated into the storm water quality aspects of the plan for water quality enhancement and conformance with NPDES Phase II storm water permitting requirements.

    c. Combining or rerouting of parts of major watersheds to assure cost effective future storm sewer improvements and to reduce existing flooding problems.

    d. Diverting of subwatershed areas into retention basins to assist in storm water quality management.

    e. Incorporating of bioretention basins, since they provide storm water treatment as well as aesthetic benefits.

Surface runoff and storm sewer design is dependent upon the permeability of existing surfaces. Representative runoff coefficients (C factors) for the rational method of storm water modeling and Curve Numbers (CNs) for the SCS method were computed for each major watershed to reasonably reflect the degree of existing industrial, commercial and residential development. Undeveloped areas were designed using runoff coefficients and curve numbers representative of the proposed land use. Based on the subwatershed and route analysis, a proposed future storm sewer piping system was developed.

For each prospective retention basin or dry infiltration basin site, SCS TR-20 method was used to size basins for flood mitigation potential. SSA, a hydrologic modeling program component of AutoDESK, was used as a watershed modeling tool to assist in retention basin sizing and location. Preliminary basin sizing was based on the guidelines recommended by:

1. The recommended design criteria from William Walker Jr. for the Vadnais Lake Area Water Management Area (described in Section 6.C of this report).
2. The Minnesota Pollution Control Agency (MPCA) *"Protecting Water Quality in Urban Areas."*
3. The design criterion described in the MPCA General Permit for Authorization to Discharge Stormwater Associated With Construction Activity under NPDES Phase II.
4. The Minnesota Board of Water and Soil Resources (BWSR) recommendations for wet retention basins and water quality enhancement.
5. The infiltration basin and bioretention basin sizing methodology in MPCA's Stormwater Manual (Version 2, January 2008).

Storm sewer sizing, upstream and downstream of retention basins, has been integrated with the retention basin design. Such integration is intended to reduce overall pipe sizes and reduce the likelihood of surface and street flooding from large storm events. As each subwatershed design was completed, the proposed storm sewer sizes, storm sewer grades and manholes were added to the compiled topographic map.

B. Recommended Improvements

Several factors were considered in developing the proposed future storm water plan for the City of Paynesville. Recommended modifications to the existing City storm water management system were kept to a minimum because of the associated costs to upgrade. Because of the intricacies of the recommended improvements, this summary report will not discuss every detail of the possible improvements. However, we wish to highlight several key design issues and recommendations:

7. The proposed storm sewer has been sized to carry the flow from a 10-year storm, without considering wet retention basins, bioretention basins or dry infiltration basins in the system. Figure 10 shows the 10-yr storm sewer capacity. The City should refer to the storm sewer pipe size recommendations in an ongoing manner as the existing sewer and/or street needs maintenance and replacement, and upsize pipes whenever possible. See Figure 12 for the recommended storm sewer pipe sizes.

8. Some outlets from the storm sewer to the river need to be replaced. These outlets are perched and are causing erosion due to their elevation. The outlets that need to be replaced are Outlets 1, 4 and 5. At Outlet 5, it is recommended that a stilling basin be

built in addition to lowering the outlet. It is recommended that the outlets be lowered and that energy by dissipated inside the pipe network.

9. Proposed Regional Basin 1 is highlighted on the proposed retention basin map (Figure 14). The basin has been located in a strategic low area in the industrial development area to allow for future development. Proposed Regional Basin 2 is located on the northeast side of the industrial park in a strategic low area. They are intended to protect the low areas from upstream runoff and provide water quality enhancement.

10. The basins have been sized to accommodate ultimate watershed development and have been preliminarily sited to fit natural low areas. The location and shape of the basins can be modified to fit future development provided that the controlling design conditions are maintained (storage volume, maximum elevation, recommended ordinance, MPCA requirements, and BWSR requirements).

11. Preliminary locations of the basins are based on available open space and hydraulic requirements. Cursory consideration has been given to land use, development potential, boundary lines, etc.

12. If ultimate development characteristics of the watershed change significantly, retention basin design and interconnected storm sewers will need to be modified accordingly.

13. The hydrologic modeling for this SWMP was intended for planning purposes. When future improvements occur, the model should be revisited. It is recommended that more detailed hydrologic modeling be done for design of future improvements.

14. The National Wetlands Inventory (NWI) maps were also reviewed in an effort to site the proposed basins in areas where wetlands are not anticipated. The NWI wetlands are shown on Figure 2. However, field delineation review is recommended prior to detailed design of any proposed basin to ensure there are no conflicts.

Unfortunately, in the older, more densely developed portions of the community (such as the originally platted areas in Watershed 1), open space for retention basin or infiltration/filtration basin development is extremely limited. Throughout most of these previously developed drainage areas, retention storage basin construction would require site clearing of previously developed properties. Consequently, in these highly developed areas, drainage needs will need to be satisfied through the construction of major storm sewer interceptors to manage flow. Another option is to use localized infiltration/filtration basins to minimize the storm water, in conjunction with storm sewers. Infiltration/filtration basins and grassed swales are recommended as retrofits where ever feasible.

C. Basin Design Criteria

The recommended wet retention basins design includes a dead storage volume, below the outlet elevation, in accordance with that recommended by William Walker Jr.[5] and described in the recommended ordinance of Section 5.

5 **Design Calculations for Wet Detention Ponds**, ***St. Paul Water Utility*, William W. Walker, Jr., 1987.**

For the most part, Paynesville and the surrounding area consist of loam/sand soils, agricultural drainage, Lake Koronis, the North Fork of the Crow River and wetlands. A large percentage of the soils found within the study area were classified as hydrologic type B (moderate infiltration capability).

"Filtration only" and infiltration bioretention basins should be designed using the guidance from the MPCA's Stormwater Manual (2008). The only major consideration relative to the design of bioretention basins is wellhead protection. Rain gardens, infiltration bioretention basins, or dry infiltration basins are not an alternative in areas where water supply is provided from shallow unconfined aquifers (1-year WHPA). In Paynesville's case, water supply is considered highly vulnerable, so this is a concern. Absolutely no infiltration should be located within the 1-year WHPA as listed in the City of Paynesville's Wellhead Protection Plan. Infiltration possibilities will need to be addressed with each new bioretention basin as more detailed soils information becomes available. "Filtration only" bioretention basins are the best choice inside the 1-year WHPA, and infiltration bioretention basins are the best choice (where the soils can accommodate them) outside of the 1-year WHPA.

Infiltration/filtration basins may be designed to reduce the size of trunk storm sewer pipe that would be required for inflowing and outflowing storm water transport. When considering the proposed basins, please keep in mind that the actual design of a regional pond or basin does not need to be a symmetrical depression designed only to hold water, but could easily be designed as a non-uniform meandering waterway creating a more natural appearance while maintaining the design intent, and reducing the quantity of pipe needed either upstream or downstream from the basin.

Further consideration should be given to future development in order to maintain viable and safe flood routing. With this in mind, the proposed ultimate network makes every attempt to utilize the natural drainage routes.

D. Proposed Basin Network and System Improvements

The following is brief description of the various major watershed and subwatershed areas studied. At present, the descriptions are limited to the existing system and potential growth areas within the current city limits. The watershed areas and pond numbers correspond to the numbers shown in Figure 8. The drainage study area includes seven separate watersheds (Watersheds 1 through 7).

1. Watersheds

The 7 watersheds are shown on Figure 8.

a. Watershed 1

Area 1 is approximately 299.9 acres in size. This is the central area of the City, including mostly single-family residential land uses, but also some multi-family residential areas and some commercial/industrial areas in the northeast. The general drainage pattern is toward the North Fork of the Crow River. The soil characteristics of this area are best described as Type B in general.

With every reconstruction in this watershed, it is important to manage storm water runoff so that the current flood prone areas are not worsened by changes in the watershed. The MPCA will also require that future projects limit erosion and prevent sediment from entering into waters of the State (North Fork of the Crow River). Improved water quality can be obtained in the developed areas of the watershed by incorporating various BMPs into the existing storm water system whenever feasible, such as infiltration/filtration basins and vegetated buffer strips throughout the watershed. No other storm water system improvements are recommended for this watershed at this time.

The downstream benefits of the recommended improvements are:

i. Ensure that storm water discharge meets water quality standards for runoff.
ii. Manage flow rates to existing condition and minimize sediment from entering waters of the state in accordance with MPCA regulations.
iii. Manage the water volume entering the North Fork of the Crow River.

b. Watershed 2

This is the southwestern area of the City, including mostly single-family residential land uses, but also some multi-family residential areas and some commercial/industrial areas along Highway 23 and in the western part of the watershed. It also includes a portion of the golf course and some agricultural land use. Area 2 is approximately 353 acres in size. The soil characteristics of this area are best described as mostly Type B with small areas of Type A soils.

Improved water quality can be obtained by incorporating various BMPs whenever feasible, such as infiltration/filtration basins, and vegetated buffer strips throughout the watershed.

The downstream benefits of the recommended improvements are:

i. Makes use of the existing features to reduce peak flow rates and volumes, and therefore flooding, throughout the watershed.
ii. Ensure that storm water discharge meets water quality standards for runoff.
iii. Manage flow rates to existing condition and minimize sediment from entering rivers, wetlands, and lakes.
iv. Minimize the water rate and volume entering the existing storm sewer system, and eventually, the North Fork of the Crow River.

2. Watershed 3

This is the largest watershed in Paynesville. It is 502.8 acres in size. It is in the southeast of the City, and has a large proportion of agricultural, low-density single family residential, and wooded land uses. There are small areas of residential and industrial on the western part of the watershed. The general drainage is toward the north from all directions. The soil characteristics of this area are best described as mostly Type B with small areas of Types A and B/D soils.

The natural water features in and around the City of Paynesville are specifically targeted for protection in this SWMP. Therefore, it is important to maintain high standards for development and storm water management. Improved water quality can be obtained in the existing developed areas of the watershed by incorporating various BMPs into the existing storm water system whenever feasible, such as infiltration basins, and vegetated buffer strips throughout the watershed.

The downstream benefits of the recommended improvements are:

a. Ensure that storm water discharge meets water quality standards for runoff.
b. Manage flow rates to existing condition and minimize sediment from entering wetlands, marshes, lakes and rivers.

3. Area 4 Watershed

This 68.6-acre watershed is on the west side of the City, near but not including the airport. This watershed has mostly industrial land use, with some agricultural land use and wooded areas near the river. The general drainage gradient is from the south to the north. The soil characteristics of this area are best described as Type B.

Improved water quality can be obtained in the existing developed areas of the watershed by incorporating various BMPs into the existing storm water system whenever feasible, such as infiltration basins and vegetated buffer strips throughout the watershed. No other storm water system improvements are recommended for this watershed at this time.

The downstream benefits of the recommended improvements are:

a. Makes use of the existing features to reduce peak flow rates through the watershed.
b. Ensure that storm water discharge meets water quality standards for runoff.
c. Manage flow rates to existing condition and minimize sediment from entering wetlands, lakes and rivers.

4. Area 5 Watershed

This 124.8-acre watershed includes most of the industrial development on the north side of the City. The general drainage gradient is to the north. The soil characteristics of this area are best described as Type B for the majority, with some Type A soils on the north side of the watershed.

It is recommended that a wet retention basin, Regional Basin 1, be built on the west side of the Industrial Loop. Proposed Regional Basin 2 is located on the northeast side of the industrial park in a strategic low area. Figure 14 shows a concept of the proposed pond locations. The preliminary pond design is based on the design requirements set forth in the recommended ordinance of Section 5. The proposed shapes shown in Figure 14 are conceptual, and can be changed if needed.

Basin design requirements are suggested in the standards described herein.

Improved water quality can also be obtained in the existing developed areas of the watershed by incorporating various BMPs into the existing storm water system whenever feasible, such as infiltration/filtration basins throughout the watershed.

The downstream benefits of the recommended improvements are:

a. Makes use of the existing features to reduce peak flow rates and volumes, and therefore flooding, throughout the watershed.
b. Ensure that storm water discharge meets water quality standards for runoff.
c. Manage flow rates to existing condition and minimize sediment from entering wetlands, lakes and rivers.

5. Area 6 Watershed

This 19.9-acre watershed is on the north side of the North Fork of the Crow River, and has low-density single family residential. The general drainage gradient is to the south. The soil characteristics of this area are best described as Type B.

This watershed will be impacted by the proposed Highway 23 Bypass.

The downstream benefits of the recommended improvements are:

a. Makes use of the existing features to reduce peak flow rates and volumes, and therefore flooding, throughout the watershed.
b. Ensure that storm water discharge meets water quality standards for runoff.
c. Manage flow rates to existing condition and minimize sediment from entering rivers, wetlands, and lakes.

6. Area 7 Watershed

This 216.1-acre watershed is on the north side of the North Fork of the Crow River, and is largely undeveloped agricultural land, with a few large agricultural buildings. The general drainage gradient is to the east. The soil characteristics of this area are best described as mostly Type B, with small areas of Type B/D.

The downstream benefits of the recommended improvements are:

a. Makes use of the existing features to reduce peak flow rates and volumes, and therefore flooding, throughout the watershed.
b. Ensure that storm water discharge meets water quality standards for runoff.
c. Manage flow rates to existing condition and minimize sediment from entering rivers, wetlands, and lakes.

E. Summary of Problems and Issues

Some of the storm water related problems and issues identified in and around Paynesville include:

1. The existing developed areas need to provide additional controls associated with the conveyance and treatment of storm water runoff to prevent/manage flooding.

2. Design storm water treatment BMPs that do not jeopardize the City's Highly Vulnerable Drinking Water Supply Management Area.

3. Maintain high quality recreational use of the area lakes and streams, whether it is for maintenance of waterfowl habitat, canoeing, fishing, etc.

4. The need to reduce sediment loading from the new and existing storm water conveyance systems.

5. The need for funding mechanisms to support the recommended projects and programs.

6. The need for community education programs regarding water resource management.

7. The importance of maintaining the City's storm water management system.

8. The importance of planning a Capital Improvement Program (CIP) and an implementation program to adequately address identified problems.

9. The importance of future NPDES storm water permit requirements.

F. Summary of Potential Solutions to Identified Problems

1. Some of the potential solutions to identified problems include:

   a. Improving water quality treatment of storm water runoff through implementation of Best Management Practices (BMPs), such as wet retention basins, dry infiltration basins, infiltration/filtration bioretention basins and rain gardens.

   b. Providing additional water quality treatment as development and/or redevelopment occurs, such as installing storm sewer under existing City streets when they are resurfaced.

   c. Upsizing some storm sewer piping to alleviate flooding in problem areas. Some storm sewer capacity issues should be fixed as soon as possible, and other issues can be considered at such time when other capital improvement projects occur. The upsizing that should take place as soon as possible have had costs estimated for them and are shown below.

   d. Implementing funding sources such as a storm water development charge, a storm water utility, and/or grants to pay for water management projects.

   e. Upgrading the City's storm water system to provide a 100-year level of protection from flooding and 10-year level of service for storm sewer delivery.

f. Development and implementation of an education program. Educational pamphlets could be distributed with City utility bills.

2. The findings of this comprehensive SWMP report are best summarized as follows:

   a. The majority of the City drains to the North Fork of the Crow River, which flows northeast through the City. The majority of the City drainage comes through trunk storm sewer pipe. See Figure 12 for the extent of inundation for the existing conditions due to a 100-year storm event.

   b. Although there are several alternative methods of accommodating continued growth in the southwest and southeast edges of the City, the recommended practice is through the construction of wet retention basins and dry infiltration basins as a requirement of further developing the outlying growth areas. Rain gardens, infiltration/filtration bioretention basins, and vegetated buffer strips can minimize the amount of storm water that must be contained in retention ponds.

   c. The proposed storm water BMPs are one of a multitude of ways in which the ultimate goal of accommodating continued growth can be accomplished. Revisions will undoubtedly occur as unforeseen developer layouts are presented to the City. Although this plan forms a sound basis for future development, it is important to remain flexible in finding ways to manage runoff while still encouraging the continued development of the City. It is also important to continually update this plan and the associated runoff model to ensure that the model remains current as development occurs.

   d. This report is a working document and should be updated as the outlying areas develop to review the differences between the actual and modeled conditions, as well as year-to-year changes in the opinions of probable costs.

8.0 COSTS AND FUNDING

As with all improvements, there is a cost associated with prudent storm water management. To that end, we have prepared a cursory estimate of the costs for:

1. The actual construction.
2. A 10 percent contingency factor.
3. Estimated engineering and administrative services.

The costs associated with each growth area as well as the average costs over all of the proposed development areas has been tabulated. **All estimates of this nature, they are based on current construction costs and should be adjusted annually to account for inflation, bonding costs, legal costs, interest costs, etc. Land acquisition costs should also be added to any area that is planned in private property.**

Based on the hydrologic modeling results and further corroboration and calibration of the results with City staff, several areas were targeted for proposed improvements to the storm water management system. The cost breakdown for each project is based only on the construction cost of

the recommended storm water system improvements. Also, the costs can vary throughout the system depending on the area and topography of the development. Accordingly, a thorough review of these solutions, with consideration of a reasonable contingency beyond that shown here, should be made with the City's financial consultant and planner. Each recommended storm water management system is further described below. Also, the breakdowns of the opinions of probable cost are found in Appendix D.

1. Storm Sewer Outfall Improvements - North Fork Crow River

The City of Paynesville has 8 major storm sewer outfalls to the North Fork of the Crow River. Currently, 4 of these outfalls are perched well above the normal flow line of the river. In turn, after significant rainfall events, the potential for erosion between the outfall invert and the river is relatively high. Therefore, it is recommended that the ultimate outfall be lowered to near the normal river flow elevation in order to dissipate energy prior to discharging to the river. This energy dissipation can be achieved through the use of a drop manhole structure which allows for the mainline storm sewer to remain at the current invert elevation. A new, deeper manhole structure would drop the hydraulic grade line elevation, and in turn dissipate the erosive energy, inside the structure as opposed to on the ground surface.

The recommended outfalls include Richmond St, Oak Park Ave, and two structures at the Haines Ave outfall. It is recommended that the replacement of these outfalls be considered a single improvement project. A breakdown of each outfall can be seen in Appendix D.

ESTIMATED IMPROVEMENT COST…….....$125,000

2. Storm Sewer Improvements – Railroad to River

Based on the hydraulic modeling, several areas were targeted for an increase in storm sewer pipe size in order to meet the current 10-year design storm capacity requirements. For this improvement project, a full road section reconstruct including pipe size increases of 548 feet of pipe from 18-inch to 24-inch, and 313 feet of pipe from 18-inch to 36-inch is recommended. See Figure 12 for exact locations along Railroad and River.

ESTIMATED IMPROVEMENT COST……..... $207,000

3. Storm Sewer Improvements – Mill Street (Between Hudson and Stearns)

For this improvement project, a full road section reconstruct including pipe size increases from 12-inch to 18-inch under Mill Street is recommended. See Figure 12 for exact locations along Mill Street.

ESTIMATED IMPROVEMENT COST……..... $114,000

4. Storm Sewer Improvements – Stearns Avenue to River

It is recommended that the pipe under Stearns Avenue be upsized from 12-inch to 18-inch storm sewer in order to meet current standards. See Figure 12 for exact locations along Stearns Ave.

ESTIMATED IMPROVEMENT COST……..... $70,000

5. Storm Sewer Improvements – Regional Basin 1

It is recommended that a wet retention basin, Regional Basin 1, be built on the west side of the Industrial Loop. Figure 14 shows a concept of the proposed pond location. The preliminary pond design is based on the design requirements set forth in the recommended ordinance of Section 5.

ESTIMATED IMPROVEMENT COST……..... $228,000

6. Storm Sewer Improvements – Regional Basin 2

It is recommended that a wet retention basin, Regional Basin 2, be built on the northeast side of the industrial park. Figure 14 shows a concept of the proposed pond location. The preliminary pond design is based on the design requirements set forth in the recommended ordinance of Section 5.

ESTIMATED IMPROVEMENT COST……..... $375,000

Although the cost associated with these recommendations can be financed locally, the City will pursue all opportunities for outside funding. Without outside financing the City will need to finance the adoption of, and enforcement of, the local controls and standards, implementation of the specified programs, and capital improvements recommended in this SWMP using one or more of the following:

7. Storm water development charges (storm water trunk fees)
8. Storm water utility fees
9. General levy (within levy limits)
10. Storm sewer assessment district
11. Accessing funds from other City projects and funds
12. Assessments

Outside funding is greatly desired as the impact of increasing these taxes, fees and charges will increase tax burden against homes and farmsteads, increase the utility burden for all parcels or postpone other necessary improvements currently scheduled in the City's Capital Improvement Plan.

The following are potential sources of outside funding that may be available to assist in the financing of the various storm water related issues:

1. Minnesota Clean Water Legacy funds
2. Constitutional Amendment funds
3. Clean Water Partnership Funds
4. Federal Clean Water Act, Section 319 funds, administered by the MPCA
5. Minnesota Public Facilities Authority (PFA) grants and low interest loans

There is significant competition for these funding sources. If these sources are pursued by the City, it will likely involve innovative treatment technologies in addition to timely requests for funding. The deadlines for requesting funds vary with each funding source.

A. Local Financing Options

1. Development Charges or Trunk Fees

If the City desires, trunk storm sewer costs can be assessed on an improvement area basis. In lieu of paying a future charge, developers may, before a final plan is signed, agree to pay the City the storm drainage improvement charge. The charge would be based upon the number of total gross square feet in the plat. The developer is typically given a credit for over-sizing storm improvements in the plat. The charges collected are deposited in a special storm drainage improvement fund and used to pay for storm drainage financing and improvements. Maintenance of the storm sewer system is typically paid for through current revenue generated from a Storm Water Utility Fund.

Since the recommended additional costs are predominantly associated with continued new development, it is presumed to be fair and equitable to have the developers pay for their impacts. Hence, the continued use of a storm water area development charge (or trunk fee), based on the cost of rectifying the downstream impact associated with the development is recommended.

In Paynesville's case, it may be more prudent to calculate the development charge based on the area of new impervious surface created and the amount of compensatory mitigation through infiltration efforts. If an impervious area charge is considered over a blanket development area charge, the City should carefully weigh the desired appearance of new developments against the natural tendency of developers to devise improvements that have the least cost. Low impact development should be considered, but the need to incorporate safety, snow storage and emergency vehicle access must also be factored into the development.

2. Increased Storm Water Utility Fees

When a storm water utility is used, the City imposes just and reasonable charges for the use and availability of storm sewer facilities. Rates and charges for the use and availability of the system are determined through the use of a Residential Equivalent Factor ("REF"). Typically, one REF is defined as the ratio of the average volume of surface water runoff coming from one acre of land and subjected to a particular use, to the average volume of runoff coming from one acre of land subjected to typical single-family residential use within the City during a standard five-year rainfall event. Rates and charges for the use and availability of the system are determined through the use of a Residential Equivalent Unit ("REU"). Typically, one REU is defined as the product of the acreage of a particular parcel multiplied by the REF. The REF is based on the relative runoff generated by any land use compared to the expected runoff from a typical half-acre single-family dwelling. This relationship is interpreted as a function of the percent of the total lot area that is impervious.

The City Storm Sewer Utility fee is intended to finance infrastructure maintenance, upgrading, reconstruction and new construction serving previously developed areas. It is not typically used to finance retrofitting the existing system to accommodate new developments. Most cities require the developer to finance the entire new storm sewer system associated with the development. Then, once the new system is accepted and

turned over to the City, the municipal maintenance funds (typically storm sewer utility funds) are used to maintain the new system.

3. Increasing the General Levy

If the City has not yet reached its levy limits, financing could come from increases in the general tax levy across Paynesville. This option is generally not favored because it may duplicate costs for property owners who have either directly or indirectly already financed their own developments. Unless tax expenditures for storm water needs can be uniformly spread to all properties, political opposition should be expected from entities that have already invested in storm water facilities.

4. Creating a Storm Sewer Assessment District or Storm Water Tax District

If a watershed is well defined and the greater majority of the property owners have a share in the benefit of the proposed storm sewer improvement, the City could form a storm water assessment district. When improvements or repairs are needed within the district, an advertisement hearing process is required similar to that used for assessments in Minnesota Statute 429. Many cities are not choosing this financing option because it can be cumbersome. Cities also find it difficult, on occasion, to legally prove the level of benefit associated with the assessment.

B. Recommended Local Financing

1. The cost of existing system retrofitting and maintenance projects should be borne by the Storm Sewer Utility fund as this is the primary focus of these funds.
2. The cost of new improvements in undeveloped land should be borne by the developer.
3. The cost of retrofitting the downstream system to accommodate new developments should be borne by newly established New Development Charges or Trunk Fees.
4. Increasing the general levy for storm sewer related costs is not recommended.
5. Creating a storm sewer assessment district is not recommended.

9.0 CONCLUSION

Due to the topography and existing development, regional ponds are not feasible in most of the watersheds. However, the regional retention basin and filtration basins that are feasible could serve a large area and help alleviate flooding, and therefore are very valuable. It is advised that the City seek right-of-first-refusal for the property on which to locate the regional pond.

The proposed basin network and the incorporation of regional ponding, where possible, present one method of accommodating the present growth of Paynesville. However, this report and the

proposed ponding scenario is not necessarily the only method of accomplishing the goal of comprehensive storm water management.

Given this, it is imperative that this plan is updated on a regular basis to ensure that any adjustments in area developments continue to be coordinated. In addition, the proposed funding alternatives including storm water development charges and/or a modification to the current storm water utility could be implemented and updated annually to ensure that the associated City costs are fully financed.

As stated earlier, this report is largely based on survey information of the existing storm sewer system, LIDAR data, the USGS topographic quadrangle maps with a 10-foot contour interval, and field verification of the watershed areas. Since the modeled existing system closely matches that described by observation, we feel that this plan has significant benefit as a planning and design tool. If more detailed topographic and elevation data becomes available (i.e., continued development contour data), we suggest that this plan be revisited to include the new information. In this manner, the plan can maintain its usefulness as a current document.

Finally, the EPA has initiated the NPDES Phase II requirements whereby cities with populations in excess of 10,000 people are required to apply for a Phase II permit. Some additional cities that are actually under 10,000 in population are also included. The City of Paynesville is not required to follow the NPDES Phase II requirements. Given that the NPDES Phase I permits, which applied to cities in excess of 100,000 in population were due in 1991, and that NPDES Phase II permits were due in 2003, it appears that Paynesville will eventually need to apply for a similar permit. One of the requirements of the NPDES permitting process is the existence of a SWMP. This report is one of many steps required in the permitting process.

We wish to thank the City of Paynesville and City staff for their support in this project. We look forward to meeting with the Council and other interested citizens to answer any questions regarding the project and the recommended improvements.

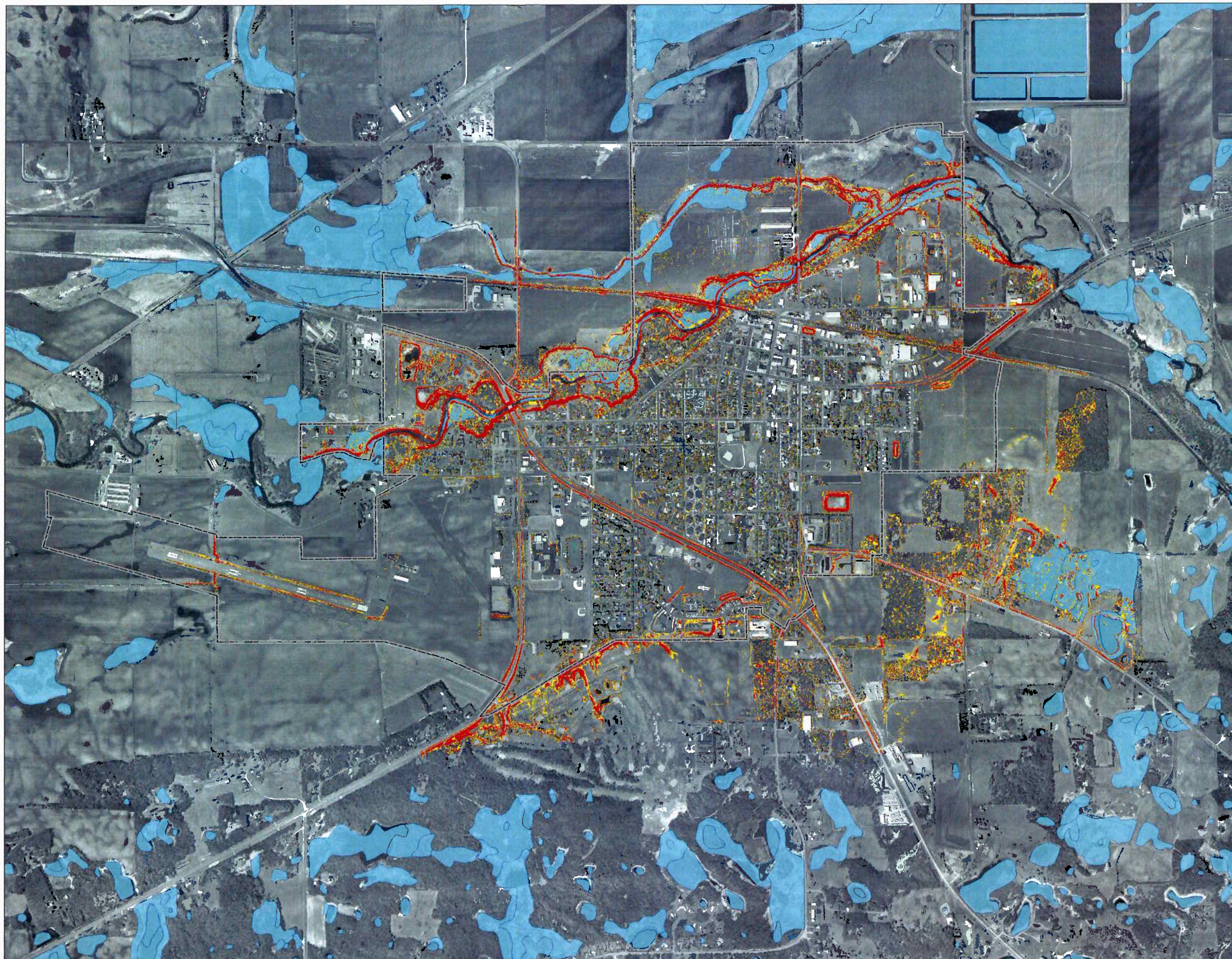
10.0 APPENDICES

Appendix A

Maps:

High Slope Areas Map……. .....Figure No. 1
Public Waters Inventory Map .....Figure No. 2
Hydrologic Soils Map . .....Figure No. 3
NLCD Land Cover Map .....Figure No. 4
Curve Number Map ….....Figure No. 5
FEMA Floodplain Boundary Map .....Figure No. 6
MPCA Water Quality Site Map .....Figure No. 7
Major Watershed and Hydraulic Modeling Elements Map.....Figure No. 8
Proposed TH23 Alignment Map .....Figure No. 9
10-Year Storm Sewer Capacity Map.....Figure No. 10
100-Year Storm Water Pond Capacity Map .....Figure No. 11
10-Year Storm Sewer Capacity/Flooded Area Map.....Figure No. 12
Well Head Protection Area Map .....Figure No. 13
Outfall Locations and Proposed Outfall Restoration Map .....Figure No. 14

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI

High Slope Areas

- 12-18% Slopes
- Greater than 18% Slopes

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

N

0 1,000 2,000 Feet

HIGH SLOPE AREAS MAP

Figure 1

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure01-High Slopes.mxd)
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CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- NWI

Streams

- Stream (Intermittent or Perennial)
- Drainage Ditch

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

PUBLIC WATERS INVENTORY MAP

Figure 2

December, 2010

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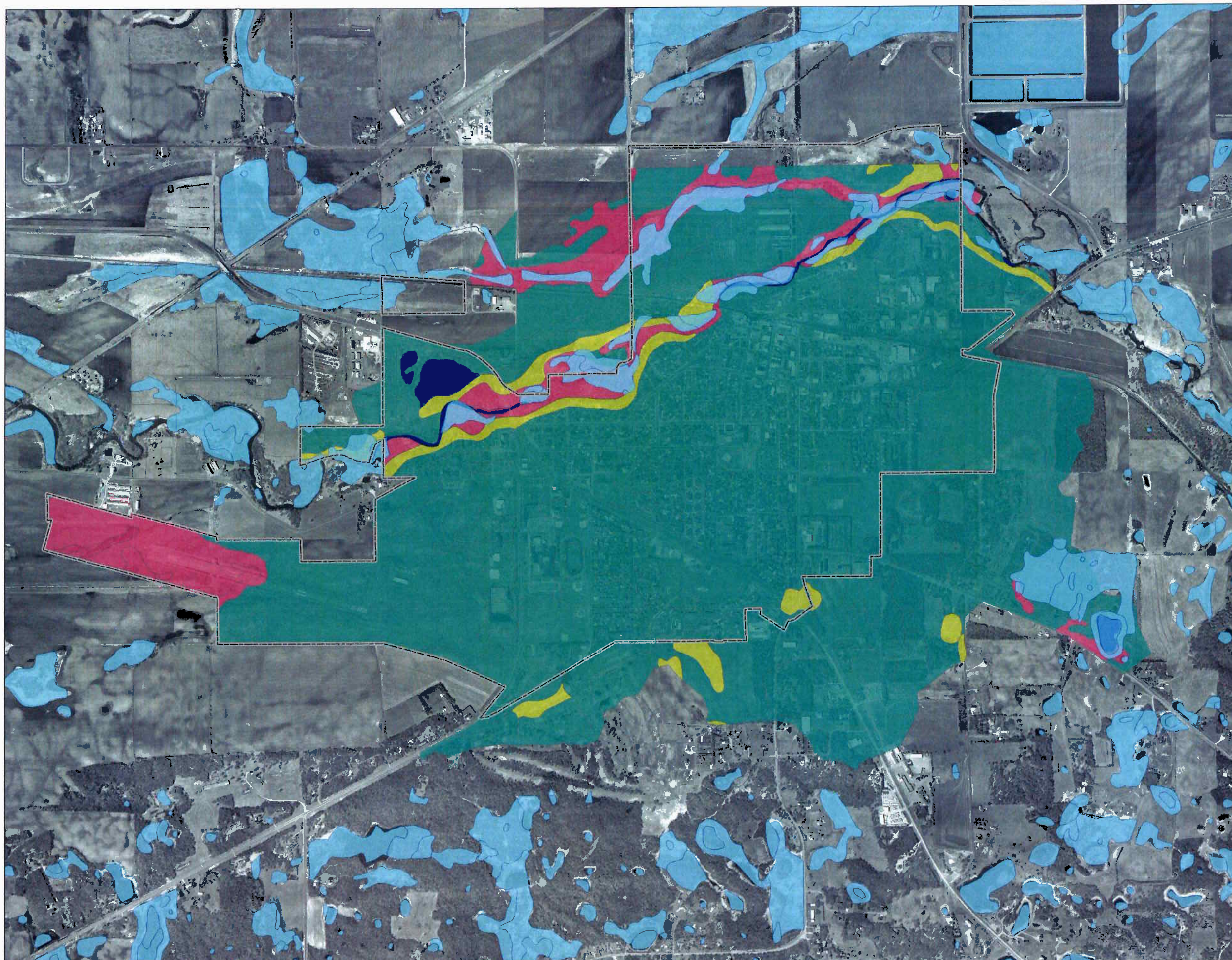
CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI

Hydrologic Soil Groups

- A
- A/D
- B
- B/D
- Water

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

N

0 1,000 2,000 Feet

HYDROLOGIC SOILS MAP

Figure 3

December, 2010

BOLTON & MENK
DESIGNING FOR A BETTER TOMORROW
Engineers & Surveyors

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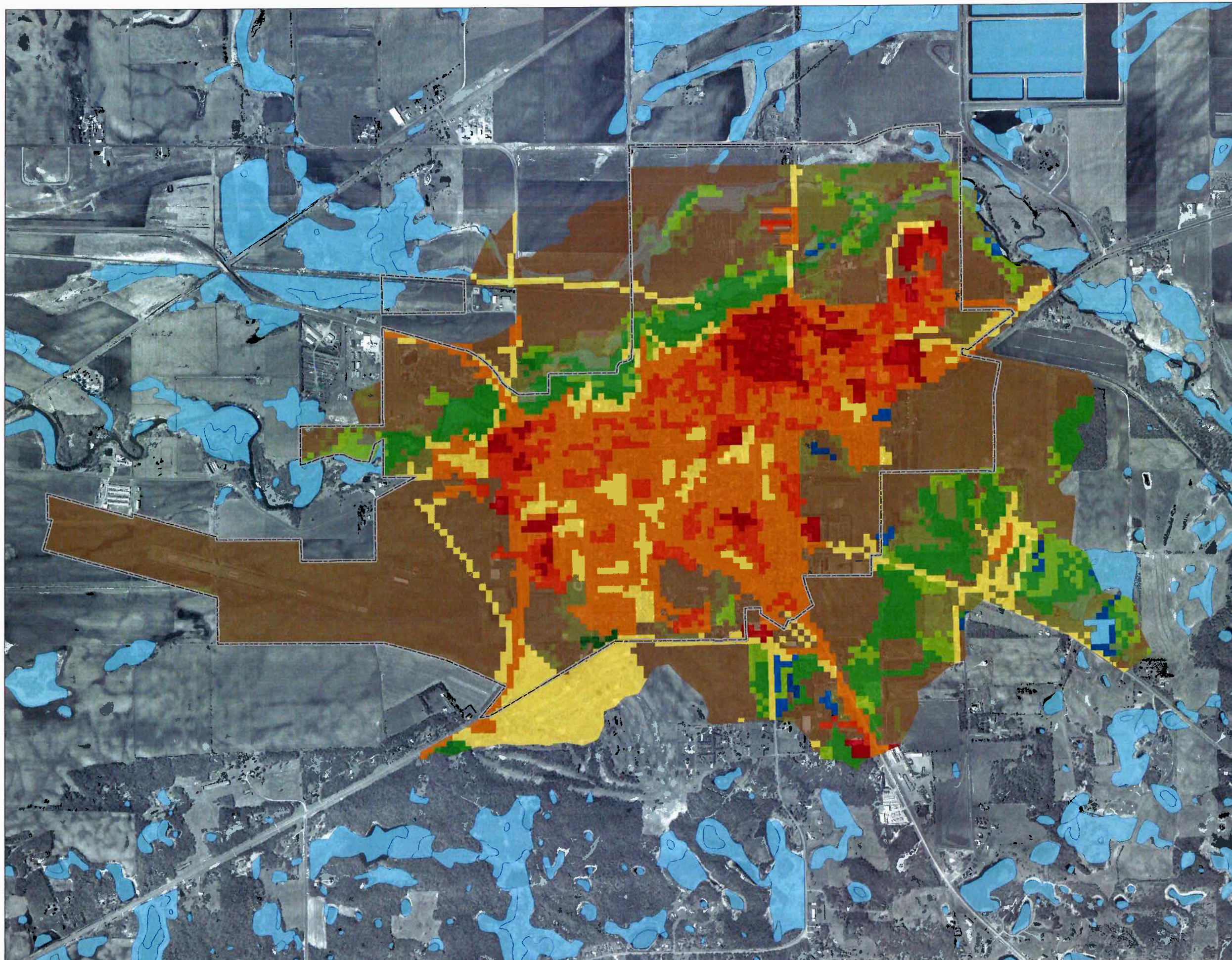
CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI

NLCD Land Cover

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grasland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceious Wetlands

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

N

0 1,000 2,000 Feet

NLCD LAND COVER MAP

Figure 4

December, 2010

BOLTON & MENK
DESIGNING FOR A BETTER TOMORROW
Engineers & Surveyors

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure04-NLCD Land Cover.mxd)
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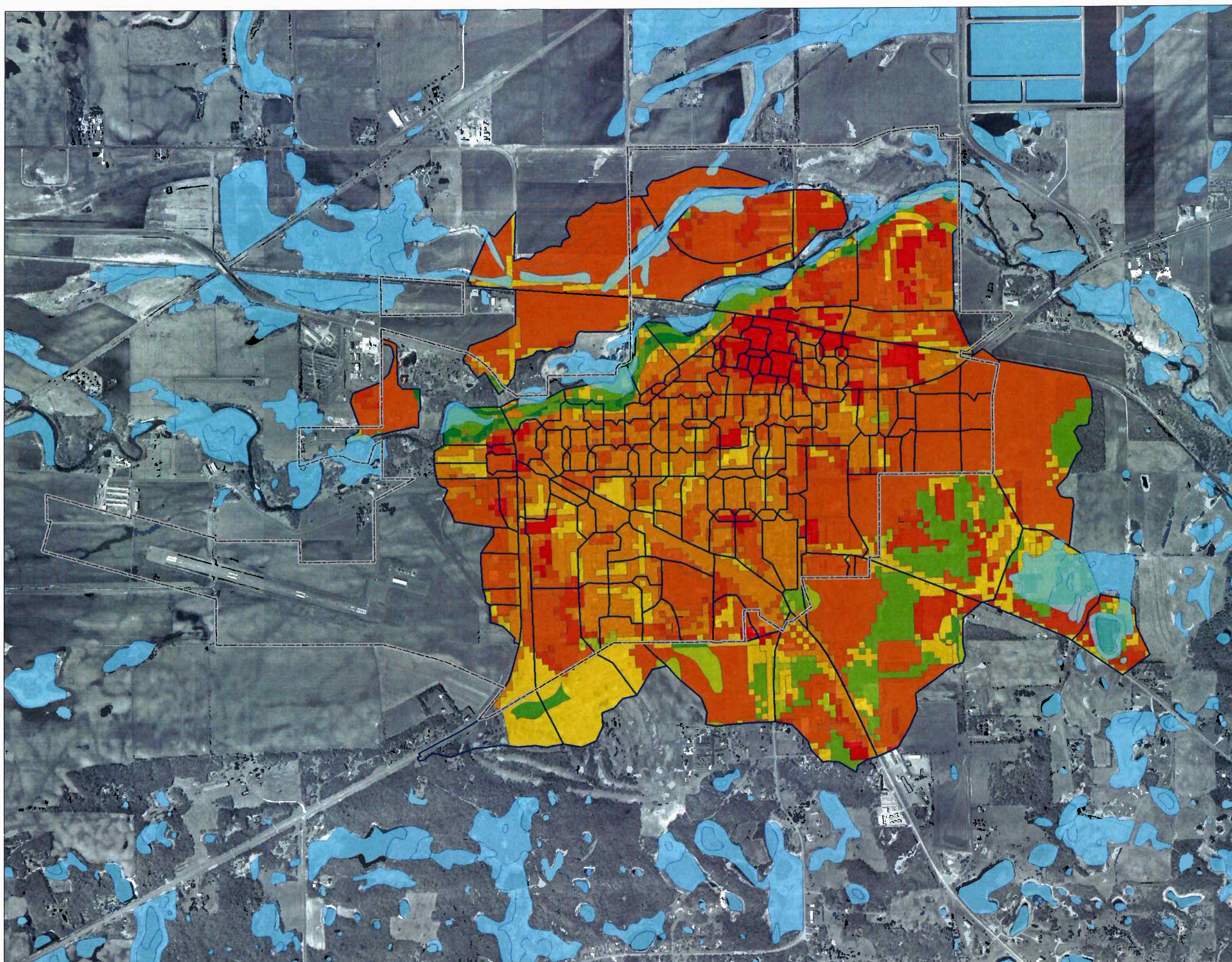


CITY OF PAYNESVILLE, MN STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- NWI
- Subbasin

Curve Number

- 0 - 36
- 37 - 49
- 50 - 57
- 58 - 63
- 64 - 69
- 70 - 72
- 73 - 75
- 76 - 79
- 80 - 98

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

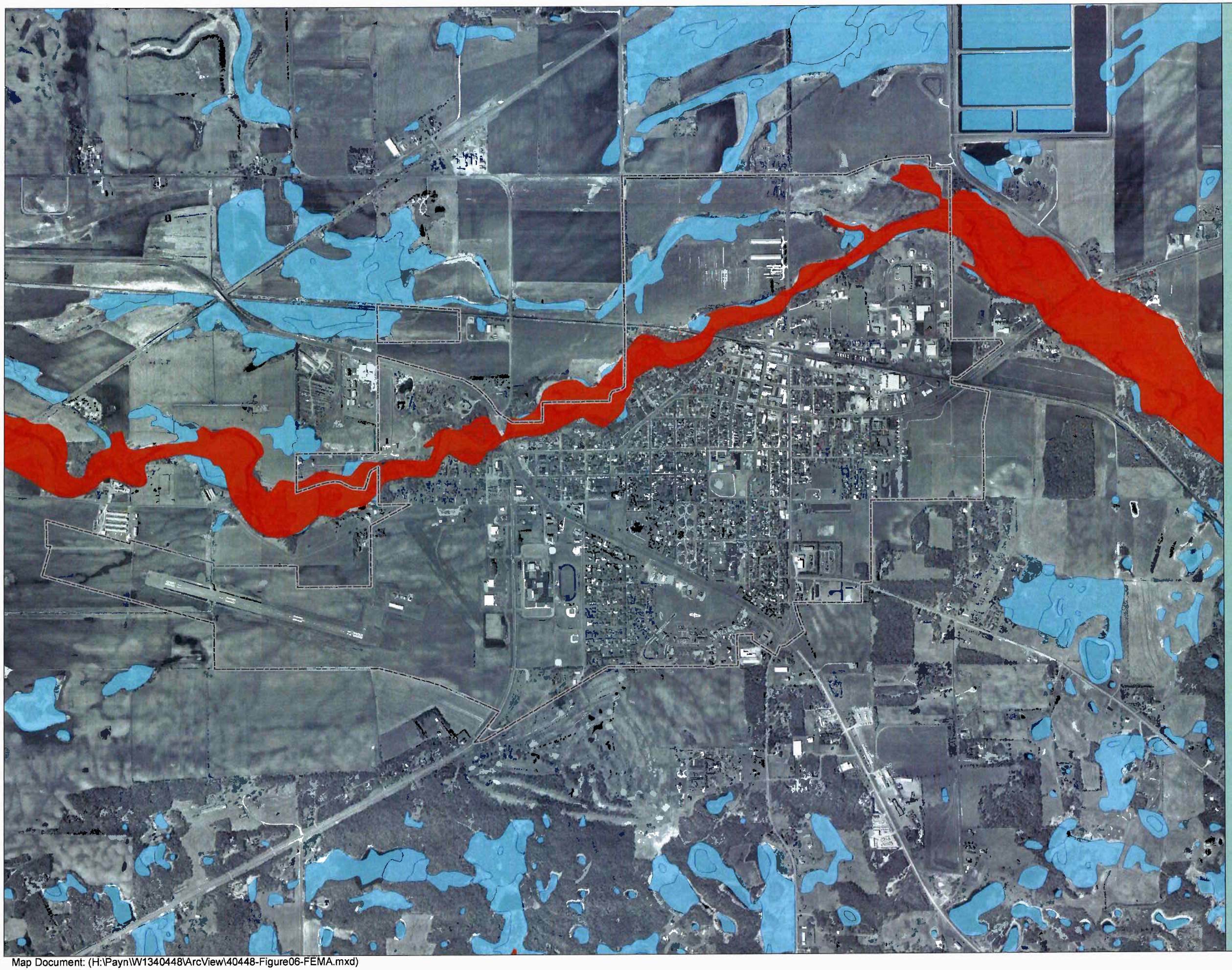
CURVE NUMBER MAP

Figure 5

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure05-Curve Number.mxd)
12/28/2010 -- 9:21:39 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI
- FEMA 100 Year Floodplain

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT
Floodplain Boundary - FEMA

0 1,000 2,000 Feet

FEMA FLOODPLAIN BOUNDARY MAP

Figure 6

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure06-FEMA.mxd)
12/28/2010 -- 9:22:45 AM

CITY OF PAYNESVILLE, MN STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- NWI
- Water Quality Monitoring Station

MPCA Delta Program Intersts

- Air stationary source
- Closed Sanitary Landfill
- Construction Stormwater Permit
- Feedlot
- Hazardous Waste Interest
- Industrial Stormwater Permit
- Leak Site
- Permitted Facility, General Permit
- Permitted Facility, Individual Permit
- Significant Industrial User to WWTP
- Unpermitted Dump Site
- VIC Site
- WQ Project

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

N

0 1,000 2,000 Feet

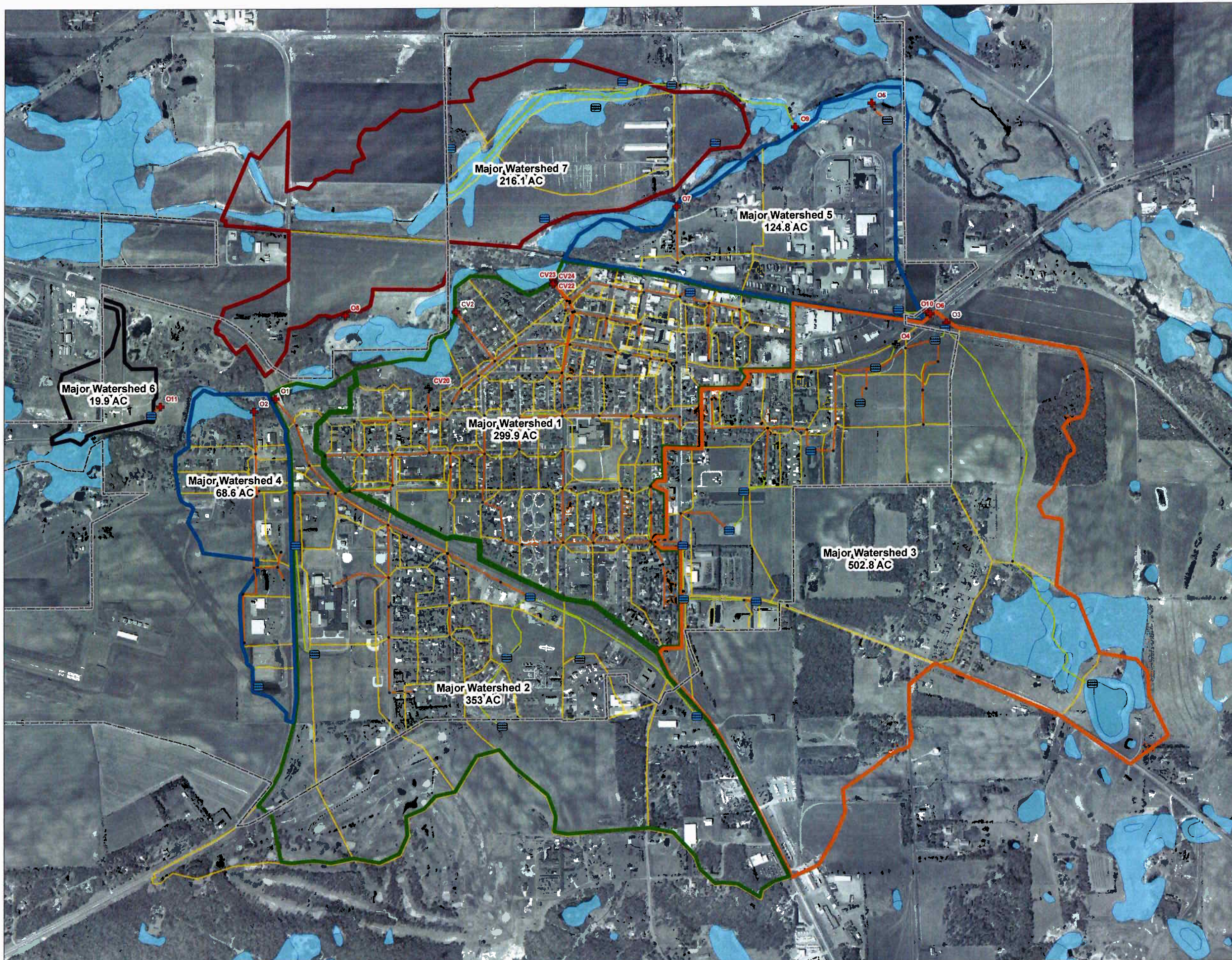
MPCA WATER QUALITY SITE MAP

Figure 7

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure07-MPCA.mxd)
12/28/2010 -- 9:30:21 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- Junction
- Pipe
- City Limits
- NWI
- Subbasin
- Channel
- Outfall
- Pond

Major Watershed Dominant Landuse

- High Density Residential
- Low Density Residential
- Industrial
- Largely Open Space
- Future Develpment

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

MAJOR WATERSHED AND HYDRAULIC MODELING ELEMENTS MAP

Figure 8

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure08-MajorWatersheds.mxd)
1/6/2011 -- 7:07:16 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- NWI
- Subbasin
- Existing TH23
- TH 23 Subbasins
- Proposed TH23 Alignment
- Proposed Wetland
- Proposed Ponds

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 2,000 4,000 Feet

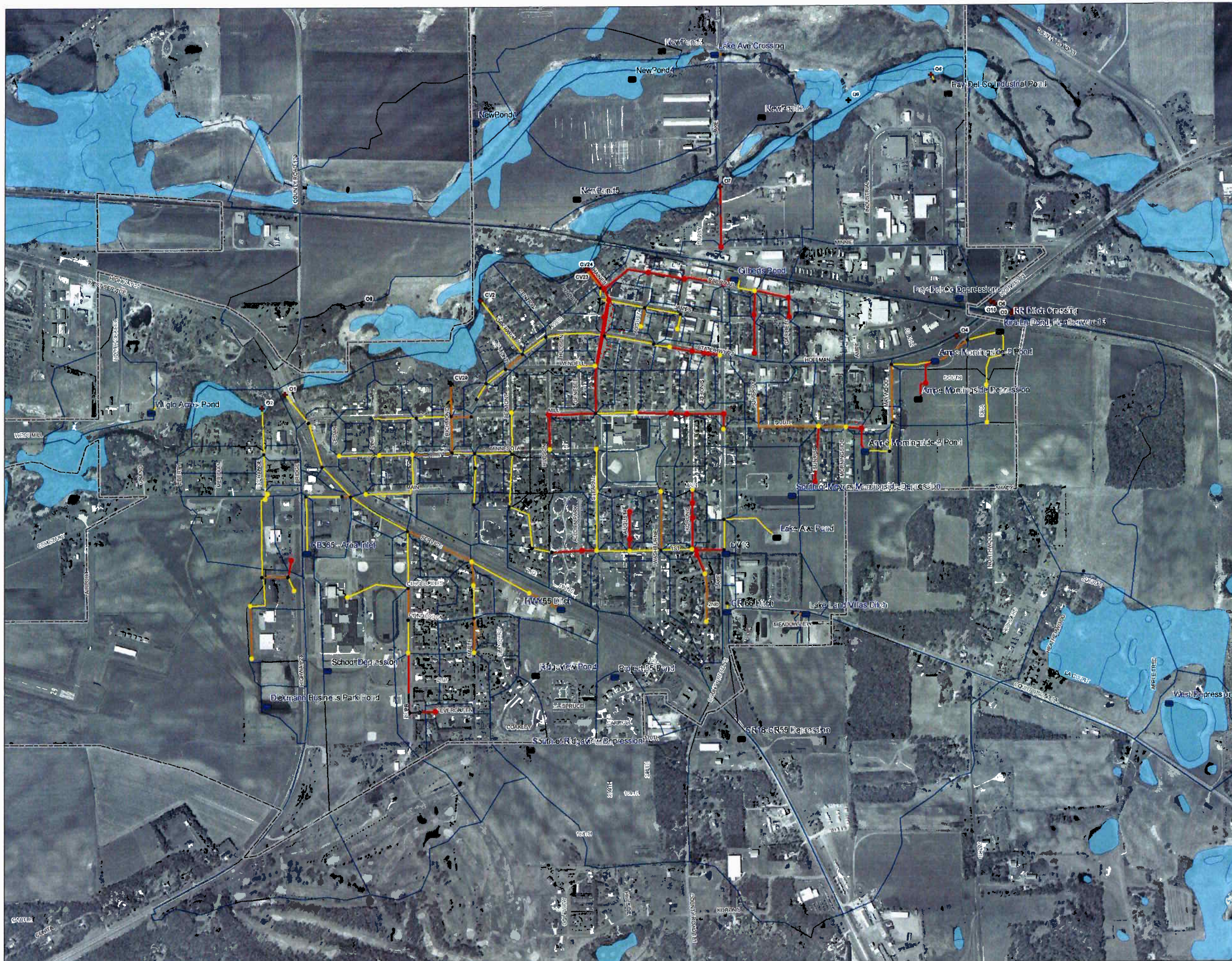
PROPOSED TH23 ALIGNMENT MAP

Figure 9

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure09-TH23.mxd)
12/28/2010 -- 10:36:16 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI
- Subbasin
- Outfall
- Pond

Junction*

- Junction
- Junction Surcharged
- Junction Flooded

Pipe**

- Pipe
- Pipe Flowing Full
- Pipe Surcharged

*Junction = Stormwater contained in structure
Junction Surcharged = Overland flow contained in street
Junction Flooded = Potential threat to adjacent structures

**Pipe = Available capacity
Pipe Flowing Full = Flowing full BUT not causing flooding in adjacent storm sewer structures
Pipe Surcharged = Flowing full AND causing flooding in adjacent storm sewer structures

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

10-YEAR STORM SEWER CAPACITY MAP

Figure 10

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure10-Pipe Capacity.mxd)
1/6/2011 -- 7:41:33 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- NWI
- Subbasin
- Channel
- Pipe
- Outfall
- Junction

Pond

- Functioning Properly
- Utilizing EOF
- Potential Threat to Structures

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

100-YEAR STORM WATER POND CAPACITY MAP

Figure 11

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure11-Ponds.mxd)
12/28/2010 -- 10:40:19 AM

CITY OF PAYNESVILLE, MN
STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- Subbasin
- Channel
- Outfall
- Pond

Future Junction Conditions

- Junction
- Junction Surcharged
- Junction Flooded

Future Pipe Conditions

- Pipe
- Pipe Flowing Full
- Pipe Surcharged
- Proposed Pipe Size

Flooded Areas*

- Hydraulic Head Issue*
- Future Improvement**

*Refers to potential problem areas at low points where simple storm sewer pipe upsizing does not affect flooding for the 10-year rainfall event. The flooding is due to some downstream mechanism that forces the water surface to back up to the low point and overtop the manhole or catch basin rim. Other hydraulic solutions are required.

**Refers to a storm sewer capacity issue that could be considered at such time when other capital improvement projects occur. At that time, other options could be considered with alternative costs.

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 400 800 Feet

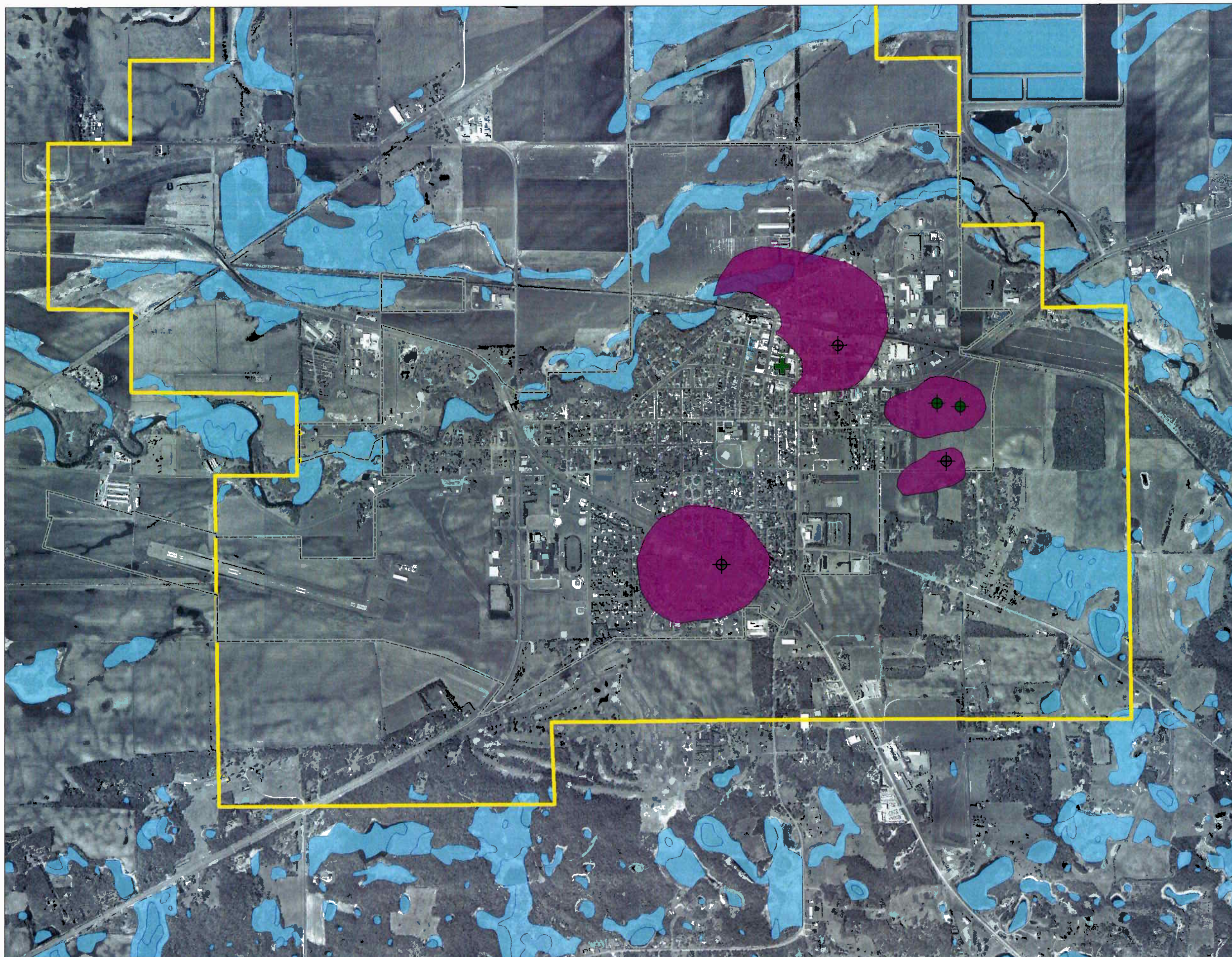
10-YEAR STORM SEWER CAPACITY W/ FUTURE IMPROVEMENTS AND FLOODED AREA MAP

Figure 12

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure12-Proposed Pipe.mxd)
1/6/2011 -- 8:30:02 AM

CITY OF PAYNESVILLE, MN STORM WATER MANAGEMENT PLAN



Legend

- City Limits
- NWI
- DWSMA
- 1-Year Well Head Protection Area

CityWells

- Primary City Well
- City Well #4

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 1,000 2,000 Feet

WELL HEAD PROTECTION AREA MAP

Figure 13

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure13-WHP Area.mxd)
12/28/2010 -- 10:43:50 AM

CITY OF PAYNESVILLE, MN STORM WATER MANAGEMENT PLAN

Legend

- City Limits
- Subbasin
- Outfall*
- Junction
- Pipe
- Proposed Regional Pond
- Proposed Outfall Drop Structure

*See Appendix C for outfall photos.

Source:
2005 FSA Aerial Photo
NWI - MnDNR
Roads - MnDOT

0 500 1,000 Feet

OUTFALL LOCATIONS & PROPOSED OUTFALL RESTORATION

Figure 14

December, 2010

Map Document: (H:\Payn\W1340448\ArcView\40448-Figure14-Photo Numbers.mxd)
12/28/2010 -- 2:39:40 PM

Appendix B

- Glossary

Glossary

Bioretention Basin - A depression designed to capture stormwater and allow it to infiltrate into the ground instead of flowing overland into lakes or streams. The soil underneath the rain garden must be able to absorb the rainwater, and to assist with this there is a gravel layer with a drain tile installed at the bottom of the basin. The plants in the bioretention basin must be tolerant to fluctuations in water level. It is designed to handle larger watersheds, and is designed to drain within 72 hours. According to the MPCA's Stormwater Manual, bioretention basins can remove 85% of suspended solids, 65% of total phosphorus, and 50% of total nitrogen.

Infiltration Basin - Dry infiltration basins are natural or constructed impoundments that capture, temporarily store, and infiltrate the design volume of water over several days. They function like a bioretention basin, but without the gravel underdrain. According to the MPCA's Stormwater Manual, infiltration basins can remove 95% of suspended solids, 65% of total phosphorus, and 50% of total nitrogen. It is designed to handle larger watersheds, and is designed to drain within 72 hours.

Localized Development Retention Pond – A pond containing and treating only runoff from a (generally small) development area.

Rain garden – A depression designed to capture stormwater and allow it to infiltrate into the ground instead of flowing overland into lakes or streams. The soil underneath the rain garden must be able to absorb the rainwater, and the plants in the rain garden must be tolerant to fluctuations in water level. It is designed to handle smaller watersheds, and is designed to drain within 72 hours.

Regional Retention Basin – A constructed pond containing and treating runoff from a large area, which could consist of existing and new construction.

BMP - Best Management Practice
BWSR - Board of Water and Soil Resources
CIP - Capital Improvement Program
CSAH – County and State Aided Highway
DNR – Department of Natural Resources
GIS - Geographic Information System
IUP - Intended Use Plan
LIDAR - Light Detection and Ranging
MPCA - Minnesota Pollution Control Agency
NPDES – National Pollutant Discharge Elimination System
NWI - National Wetland Inventory
PFA - Minnesota Public Facilities Authority
SCS - Soil Conservation Service
SCS TR-20 - Soil Conservation Service Technical Release No. 20
SWMP - Surface Water Management Plan
TH – Trunk Highway
USGS – United States Geological Survey
WCA - Wetlands Conservation Act

Appendix C

- Photographs

Photo 1

Photo 1

Photo 1

Photo 1

Photo 2

Photo 2

Photo 3

Photo 2

Photo 2

Photo 3

Photo 3

Photo 4

Photo 4

Photo 4

Photo 5

Photo 5

Photo 5

Photo 5

Photo 5

Photo 5

Photo 6 – Lake Ave

Photo 6 – Lake Avenue

Appendix D

- Opinion of Probable Costs

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
CROW RIVER OUTFALL STURCTURES
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED	UNIT PRICE	AMOUNT
RICHMOND STREET OUTFALL					
1	MOBILIZATION	LS	1	$6,750.00	$6,750.00
2	CONNECT TO EXISTING STORM SEWER	EACH	1	$1,350.00	$1,350.00
3	72-4020 STM MANHOLE	LIN FT	10	$675.00	$6,750.00
4	48" STORM SEWER PIPE (CLASS III)	LIN FT	100	$101.25	$10,125.00
5	REMOVE, SALVAGE, & REPLACE 48" FLARED CULVERT END	LS	1	$1,350.00	$1,350.00
6	COMMON EXCAVATION	CY	1000	$6.75	$6,750.00
7	SEDIMENT AND EROSION CONTROL	LS	1	$1,350.00	$1,350.00
				SUBTOTAL	**$34,425.00**
OAK PARK AVENUE OUTFALL					
1	MOBILIZATION	LS	1	$6,750.00	$6,750.00
2	CONNECT TO EXISTING STORM SEWER	EACH	1	$1,080.00	$1,080.00
3	54-4020 STM MANHOLE	LIN FT	10	$297.00	$2,970.00
4	30" STORM SEWER PIPE	LIN FT	50	$101.25	$5,062.50
5	REMOVE, SALVAGE, & REPLACE 30" FLARED CULVERT END	LS	1	$1,350.00	$1,350.00
6	COMMON EXCAVATION	CY	1000	$6.75	$6,750.00
7	SEDIMENT AND EROSION CONTROL	LS	1	$1,350.00	$1,350.00
				SUBTOTAL	**$25,312.50**
HAINES AVENUE OUTFALL					
1	MOBILIZATION	LS	1	$6,750.00	$6,750.00
2	CONNECT TO EXISTING STORM SEWER	EACH	1	$1,350.00	$1,350.00
3	54-4020 STM MANHOLE	LIN FT	10	$297.00	$2,970.00
4	48-4020 STM MANHOLE	LIN FT	10	$270.00	$2,700.00
5	30" STORM SEWER PIPE (CLASS III)	LIN FT	50	$81.00	$4,050.00
6	24" STORM SEWER PIPE (CLASS III)	LIN FT	50	$67.50	$3,375.00
7	REMOVE, SALVAGE, & REPLACE 30" FLARED CULVERT END	LS	1	$1,350.00	$1,350.00
8	REMOVE, SALVAGE, & REPLACE 24" FLARED CULVERT END	LS	1	$1,350.00	$1,350.00
9	COMMON EXCAVATION	CY	2000	$6.75	$13,500.00
10	SEDIMENT AND EROSION CONTROL	LS	1	$1,620.00	$1,620.00
				SUBTOTAL	**$39,015.00**
				10% CONTINGENCY	**$9,875.25**
				TOTAL CONSTRUCTION COSTS	**$108,627.75**
				ENGINEERING AND ADMINISTRATION	**$16,294.16**
				TOTAL PROJECT COST	**$125,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
RAILROAD ST TO RIVER STORM SEWER IMPROVEMENTS
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	TRAFFIC CONTROL	LS	1	$3,000.00	$3,000.00
3	REMOVE BITUMINOUS PAVEMENT	SY	5000	$2.50	$12,500.00
4	BITUMINOUS PAVEMENT	TON	140	$50.00	$7,000.00
5	AGGREGATE BASE CLASS 5	CY	7500	$30.00	$225,000.00
6	CONNECT TO EXISTING STM STRUCTURE	EACH	2	$1,000.00	$2,000.00
7	24" STORM SEWER PIPE	LIN FT	950	$50.00	$47,500.00
8	30" STORM SEWER PIPE	LIN FT	285	$70.00	$19,950.00
9	COMMON EXCAVATION	CY	9000	$5.00	$45,000.00
10	SEDIMENT AND EROSION CONTROL	LS	1	$3,000.00	$3,000.00
				SUBTOTAL	$372,950.00
				10% CONTINGENCY	$37,295.00
				TOTAL CONSTRUCTION COSTS	$410,245.00
				ENGINEERING AND ADMINISTRATION	$61,536.75
				TOTAL PROJECT COST	**$472,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
RAILROAD ST TO GILBERTS POND STORM SEWER IMPROVEMENTS
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	TRAFFIC CONTROL	LS	1	$3,000.00	$3,000.00
3	REMOVE BITUMINOUS PAVEMENT	SY	1100	$2.50	$2,750.00
4	BITUMINOUS PAVEMENT	TON	30	$50.00	$1,500.00
5	AGGREGATE BASE CLASS 5	CY	1650	$30.00	$49,500.00
6	CONNECT TO EXISTING STM STRUCTURE	EACH	1	$1,000.00	$1,000.00
7	24" STORM SEWER PIPE	LIN FT	277	$50.00	$13,850.00
9	COMMON EXCAVATION	CY	2000	$5.00	$10,000.00
10	SEDIMENT AND EROSION CONTROL	LS	1	$2,000.00	$2,000.00
				SUBTOTAL	$91,600.00
				10% CONTINGENCY	$9,160.00
				TOTAL CONSTRUCTION COSTS	$100,760.00
				ENGINEERING AND ADMINISTRATION	$15,114.00
				TOTAL PROJECT COST	**$116,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
STEARNS AVE STORM SEWER IMPROVEMENTS
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	TRAFFIC CONTROL	LS	1	$3,000.00	$3,000.00
3	REMOVE BITUMINOUS PAVEMENT	SY	5600	$2.50	$14,000.00
4	BITUMINOUS PAVEMENT	TON	154	$50.00	$7,700.00
5	AGGREGATE BASE CLASS 5	CY	8400	$30.00	$252,000.00
6	CONNECT TO EXISTING STM STRUCTURE	EACH	2	$1,000.00	$2,000.00
7	15" STORM SEWER PIPE	LIN FT	257	$30.00	$7,710.00
8	18" STORM SEWER PIPE	LIN FT	444	$40.00	$17,760.00
9	COMMON EXCAVATION	CY	9500	$5.00	$47,500.00
10	SEDIMENT AND EROSION CONTROL	LS	1	$3,000.00	$3,000.00
				SUBTOTAL	$362,670.00
				10% CONTINGENCY	$36,267.00
				TOTAL CONSTRUCTION COSTS	$398,937.00
				ENGINEERING AND ADMINISTRATION	$59,840.55
				TOTAL PROJECT COST	**$459,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
HUDSON AND MILL ST STORM SEWER IMPROVEMENTS
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	TRAFFIC CONTROL	LS	1	$3,000.00	$3,000.00
3	REMOVE BITUMINOUS PAVEMENT	SY	5900	$2.50	$14,750.00
4	BITUMINOUS PAVEMENT	TON	165	$50.00	$8,250.00
5	AGGREGATE BASE CLASS 5	CY	8850	$30.00	$265,500.00
6	CONNECT TO EXISTING STM STRUCTURE	EACH	2	$1,000.00	$2,000.00
7	15" STORM SEWER PIPE	LIN FT	365	$30.00	$10,950.00
8	24" STORM SEWER PIPE	LIN FT	336	$50.00	$16,800.00
9	COMMON EXCAVATION	CY	9800	$5.00	$49,000.00
10	SEDIMENT AND EROSION CONTROL	LS	1	$3,000.00	$3,000.00
				SUBTOTAL	$381,250.00
				10% CONTINGENCY	$38,125.00
				TOTAL CONSTRUCTION COSTS	$419,375.00
				ENGINEERING AND ADMINISTRATION	$62,906.25
				TOTAL PROJECT COST	**$482,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
REGIONAL BASIN 1
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	OUTLET STRUCTURE	LS	1	$5,000.00	$5,000.00
3	COMMON EXCAVATION	CY	13,713	$12.00	$164,560.00
4	SEDIMENT AND EROSION CONTROL	LS	1	$3,000.00	$3,000.00
				SUBTOTAL	$180,560.00
				10% CONTINGENCY	$18,056.00
				TOTAL CONSTRUCTION COSTS	$198,616.00
				ENGINEERING AND ADMINISTRATION	$29,792.40
				TOTAL PROJECT COST	**$228,000**

OPINION OF PROBABLE COST
STORM WATER MANAGEMENT PLAN
REGIONAL BASIN 2
CITY OF PAYNESVILLE, MN

ITEM NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	AMOUNT
1	MOBILIZATION	LS	1	$8,000.00	$8,000.00
2	OUTLET STRUCTURE	LS	1	$5,000.00	$5,000.00
3	COMMON EXCAVATION	CY	23,393	$12.00	$280,720.00
4	SEDIMENT AND EROSION CONTROL	LS	1	$3,000.00	$3,000.00
				SUBTOTAL	$296,720.00
				10% CONTINGENCY	$29,672.00
				TOTAL CONSTRUCTION COSTS	$326,392.00
				ENGINEERING AND ADMINISTRATION	$48,958.80
				TOTAL PROJECT COST	**$375,000**