Village of Mount Horeb

Stormwater Management Plan

Prepared by:
Village of Mount Horeb
Dane County Land Conservation Department
Held & Associates, Inc.

December 2000

Village of Mount Horeb

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February 13, 2001

The Village of Mount Horeb is pleased to approve the Village of Mount Horeb Stormwater Management Plan. The Plan was approved by the Village Board on February 7, 2001.

We would like to express the Village's appreciation to the Dane County Land Conservation Department and the Wisconsin Department of Natural Resources for their assistance in preparing our plan.

Sincerely,

Patrick E Dann
Village Administrator

Stan Olson, Village President

Trustees:

John Buechner
Gene Craft
Neal Fargo
Duane Hofstetter
Mike McNall
Georgia Post

EXECUTIVE SUMMARY

The United States Environmental Protection Agency now considers pollution from all nonpoint sources, including urban stormwater pollution, to be the most important source of contamination in the nation's waters. The stormwater pollution problem has two main components: the increased volume and velocity of surface runoff and the concentration of pollutants in the runoff. Both components are directly related to development in urban and urbanizing areas. Together, these pollutants and the increased velocity and volume of runoff cause dramatic changes in hydrology and water quality that result in a variety of problems. These include increased flooding, stream channel degradation, habitat loss, contamination of water resources, increased erosion and sedimentation, and changes in water temperature. These changes affect ecosystem functions, biological diversity, public health, recreation, economic activity, and general community well-being. While urban stormwater is not alone in causing these impacts, water quantity and quality problems will not be eliminated until urban stormwater pollution is controlled.

This stormwater management plan addresses water quantity and quality concerns for the Village of Mount Horeb. Stormwater planning is particularly important since the village is experiencing high growth; as the village expands, challenges associated with stormwater management are likely to intensify. Currently, due to its high position in the landscape, Mount Horeb experiences minimal flooding within the village limits. However, runoff from the village may create serious erosion problems as it flows from high ground to low points outside the village, resulting in water quantity and quality problems for downstream areas.

The objectives of the plan were to provide:

1) suggestions on how the village will be able to come into compliance with proposed and existing county, state, and federal regulations and how they can prepare for new regulations as they become mandatory;

2) an assessment of existing drainage conditions and stormwater control structures and recommendations for improving existing or adding stormwater control structures;

3) an inventory of pollution sources that affect water quality and recommend ways for reducing existing and future pollutant loads;

4) digital data layers and maps; and

5) a funding strategy to guide the village in carrying out the recommendations of the plan.

The recommendations and findings of the plan are the following.

1) The village's erosion and stormwater ordinances should be amended to reflect updated performance standards. Enforcement of ordinances should also be improved.

2) The municipal operations of the village are satisfactory and do not significantly contribute to stormwater problems.

3) There are opportunities for the village to develop information and education materials pertaining to stormwater management.

4) Existing stormwater facilities should be modified. Modifications are small and may be completed by village staff at minimal cost.

5) Data were collected and models were run to estimate water quantity (TR-55 model) and water quality (P8 Urban Catchment model). From the results of these models, using existing and future conditions, eleven basins were recommended and construction of five regional basins were identified as a priority. The total cost to construct these priority basins is approximately $455,000.

6) In Mount Horeb, all stormwater is discharged to streams or stream segments classified as either proposed or existing cold water communities by WDNR. Thermal impacts from existing and future development were modeled (TURM model). The results of the model show that thermal reduction structures should be placed in the proposed regional stormwater basins.

7) The village compost site should limit access to the site and construct a berm between the site and the West Branch Sugar River to minimize stormwater impacts.

8) There are many options to fund the recommendations in the report. They include fees, general fund, grants, special assessments, subdivision exactions, and fees in lieu of detention.

This plan outlines a comprehensive stormwater management strategy for the entire village and predicted growth areas. Implementing the recommendations in the report will reduce or prevent problems due to the quantity, quality, and temperature of stormwater runoff.

ACKNOWLEDGEMENTS

This project was a cooperative effort of several agencies and individuals including:

Village of Mount Horeb
- Pat Dann, Village Adminstrator
- Laurel Grindle, Public Works Superintendent
- Tim Dill, Village Building Inspector

Dane County Land Conservation Department
- Kevin Connors, County Conservationist
- Pete Jopke, Watershed Project Management Coordinator
- Michelle Richardson, GIS Specialist
- Jeremy Balousek, Erosion Control Engineer
- Aicardo Roa, Urban Conservationist
- Angela James, Stormwater Specialist

Held & Associates, Inc.
- Greg Held, Professional Engineer

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DISCLAIMER

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Chapter I

INTRODUCTION

Background

Stormwater, or the water that runs over land following rainfall or snowmelt, creates management challenges for municipalities as urbanization increases the amount of impervious land surfaces. After development, water races over asphalt, off of rooftops, and down streets rather than seeping slowly into the ground. As this water picks up speed , it can erode curbsides as the water rips at weak gutters or soft earth. Stormwater runoff picks up debris, sediment, and other contaminants as it seeks low areas, where it can pool and cause flooding problems. Common contaminants of stormwater runoff include sediment, nutrients, toxic substances, oxygen-demanding materials, and bacteria – all of which can seriously degrade the quality of receiving waters.

Stormwater runoff running into a typical storm sewer inlet. This provides direct discharge to area surface waters.

In Mount Horeb, the management challenges associated with Stewart Lake illustrate the problems that stormwater may cause. In a 1995 restoration and watershed management plan, the Dane County Regional Planning Commission identified stormwater as the principle threat to the health of Stewart Lake (DCRPC 1995). Many streets in the village have steep slopes that convey stormwater and associated pollutants directly into Stewart Lake. Stormwater has eroded gullies on the hillsides leading into the Lake, resulting in high levels of sedimentation. Nutrient loads in the lake are high, resulting in algal blooms each summer.

A stormwater plan will help the village address water quantity and quality concerns. Stormwater plans are comprehensive studies of existing networks of stormwater drainage and control structures, accompanied by recommendations for improving stormwater management. Stormwater planning accounts for both present and future land uses since land use changes directly impact system design and its ability to provide safe passage and control of excess water from rainfall or snowmelt. Stormwater planning is particularly important as the village experiences growth. As the village expands, the challenges associated with stormwater management are likely to intensify. A well prepared stormwater management plan will guide the village in their decisions associated with long term planning. Currently, due to its high position in the landscape, Mount Horeb experiences minimal flooding within the village limits. Mount Horeb is unique in that the village straddles the basin divide between the Sugar-Pecatonica River and Lower Wisconsin River basins. Runoff from the village can create serious erosion problems as it flows from high ground to low points outside the village, resulting in problems for downstream areas. In summary, a comprehensive stormwater plan assists in alleviating future stormwater management problems, approving urban service area expansion, and anticipating future budgetary requirements.

Existing and proposed county, state, and federal regulations may impose requirements upon the village to manage the water that flows beyond the municipal limits. For example, stormwater leaving Mount Horeb has the potential to negatively impact the water quality of surrounding streams, which include the headwaters to several streams that the Wisconsin Department of Natural Resources (WDNR) has designated as existing or proposed cold water communities. There is also the possibility that the WDNR could designate the village as a community that needs to acquire a municipal stormwater discharge permit

under NR 216, Wis. Admin. Code. In addition, Dane County is in the process of developing standards for a stormwater management ordinance that will be effective countywide including the Village of Mount Horeb as well as other municipalities. Both a municipal stormwater discharge permit under NR 216 and the Dane County ordinance will require stricter water quantity and quality standards than those which are currently in place.

Purpose and Scope of Plan

The purpose and scope of this plan is summarized below in five major areas:

1. The plan suggests ways in which the village can come into compliance with existing county, state, and federal regulations and how they can prepare for new regulations as they become mandatory.

   The village is currently not in compliance with the existing Dane County Construction Site Erosion Control Ordinance or the proposed Stormwater Management Ordinance.

2. The plan provides an assessment of existing drainage conditions and stormwater control structures and recommendations for improving existing or adding stormwater control structures.

   Mount Horeb's landscape position is unique for stormwater management – all village water leaves the village limits, therefore the village does not need to deal with runoff from surrounding municipalities. Mount Horeb has few problems with getting runoff water out of the village quickly due to its steep slope and location on several watershed divides. However, these same characteristics pose management challenges for water quality protection, erosion control, and stormwater control structures.

3. The plan inventories sources of pollutants that affect water quality and recommends ways to reduce existing and future pollutant loads.

   The water quality of surrounding streams depends on the management of the stormwater leaving the Village of Mount Horeb.

4. Plan development includes the creation of digital data and maps.

   Several data layers and maps have been developed for the stormwater management plan. They will be useful for other planning projects and can be updated for future changes.

5. The plan develops an implementation strategy to guide the village in carrying out the recommendations of the plan through the year 2020.

   The strategy suggested in this plan is designed as a realistic approach to implementing better stormwater management in the village. It is, however, merely a guideline and full implementation will depend on many factors such as budget, availability of land for purchase, and development patterns.

Chapter II

EXISTING RESOURCES AND STORMWATER CONTROL STRUCTURES

Overview of Inventory Methods

This stormwater management plan is based on existing and future development needs of the Village of Mount Horeb and required an inventory of the current village resources and management strategies. To begin the project, the Village of Mount Horeb (Village), Held & Associates (Held), and the Dane County Land Conservation Department (LCD) delineated the study area to include the village limits and nearby land areas likely to affect water quality (Figure 2-1). Within this 2,809-acre study area, information was obtained or created for hydrology, stormwater control structures, sewersheds, topography, land use/land cover, and soil data. These data provided a foundation for the recommendations in this report. Existing digital spatial data from Held and LCD were used whenever possible, while new data sets were digitized using Arc/Info or ArcView Geographic Information Systems (GIS) (ESRI 1999). Some data sets were field-checked for accuracy by LCD or Held staff, or verified by Pat Dann, Village Administrator. The methods for developing each data set is described briefly below (see Appendix A for more information on data set creation).

Hydrology Inventory

The Village of Mount Horeb drains into two river basins according to WDNR geographic management unit (GMU) classifications. The northwestern third of the village drains into the Lower Wisconsin River Basin, while the remaining portion of the village drains to the Grant-Platte-Sugar-Pecatonica River Basin. Within the Grant-Platte-Sugar-Pecatonica River Basin, water draining to the northeast flows into the Upper Sugar River Watershed, while the runoff flowing to the south flows into the West Branch Sugar River/Mt. Vernon Creek Watershed (Table 2-1 and Figure 2-2). Stewart Lake, an important resource to the citizens of Mount Horeb, lies within the Mill and Blue Mounds Creek Watershed in the Lower Wisconsin River Basin.

Table 2-1. Watersheds or subwatersheds and associated basins within the study area.

Watershed Name and Code	Basin
Mill and Blue Mounds Creek (MBC)	Lower Wisconsin River
Upper Sugar River (USR)	Grant-Platte-Sugar-Pecatonica River*
West Branch Sugar River/Mt. Vernon Creek (WMV)	Grant-Platte-Sugar-Pecatonica River
Deer Creek Subwatershed (DCR)	Grant-Platte-Sugar-Pecatonica River
Fryes Feeder Subwatershed (FRY)	Grant-Platte-Sugar-Pecatonica River

* note that runoff flows to the Sugar-Pecatonica portion of this basin

Several streams within the Upper Sugar River and the West Branch Sugar River/Mt. Vernon Creek watersheds have been designated by the WDNR as outstanding or exceptional water resources under NR 102, Wis. Admin. Code and have been identified as either existing or proposed cold water communities. These streams include Sugar River, Schlapbach Creek, Fryes Feeder, Deer Creek, and Mt. Vernon Creek (Figure 2-3). Mount Horeb lies at or near the headwaters of these streams and conveys its stormwater via small tributaries that drain directly into these and other receiving waters.

Figure 2-1. Mount Horeb Study Area with 1995 Digital Orthophoto

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0 1000 2000 3000 Feet

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Figure 2-2. Study Area Watershed Locator

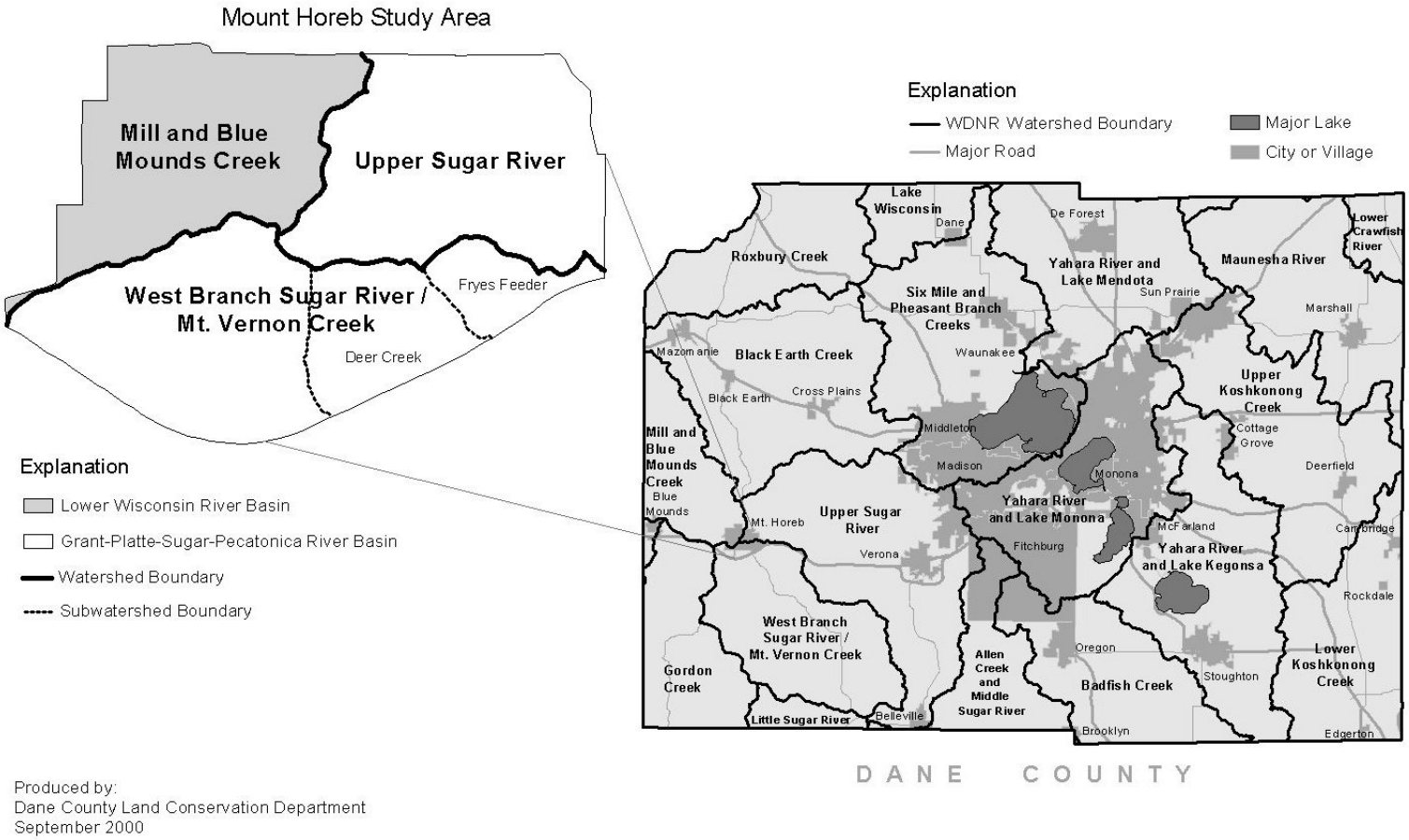

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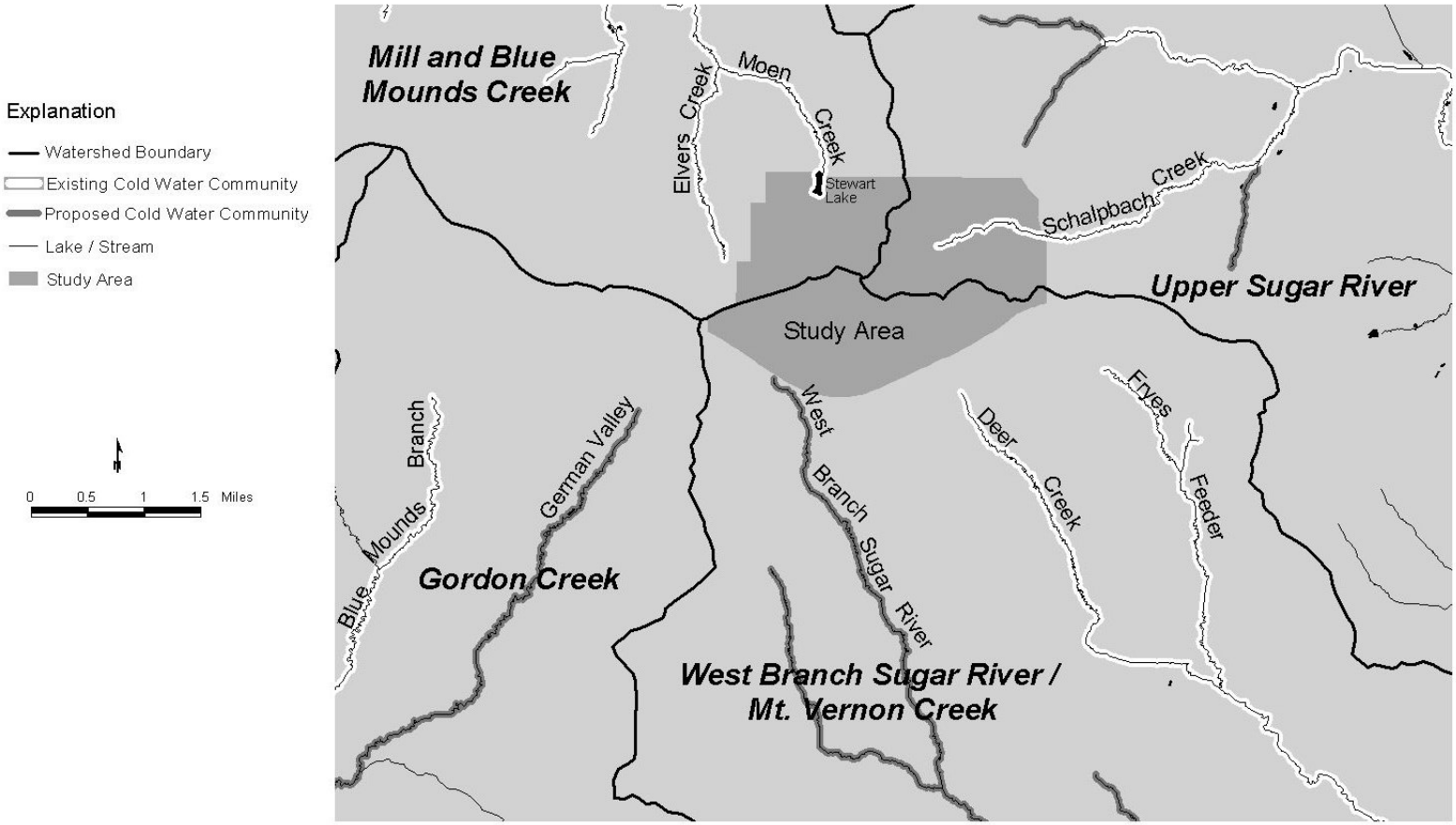
Figure 2-3. WDNR Existing and Proposed Cold Water Communities



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Sewershed and Stormwater Control Structure Inventory

The village's location at the headwaters of many streams as well as the steep slopes within the village contributed to the development of Mount Horeb's unique storm sewer system, which utilizes open water channels to conduct stormwater to receiving waters. Due to extreme elevation changes in the village, a substantial portion of runoff is conveyed by streets or by the curb and gutter system and does not require underground storm sewers. To map these drainage patterns, LCD first divided watershed areas into sewersheds, defined as stormwater drainage areas served by a storm sewer or other stormwater control structures. A digital data set of the village storm sewer system provided by Held and LCD Water and Sediment Control Basin (WASCOB) data were overlayed onto 10-foot contour data layer of the village (Figure 2-4). LCD then delineated any area drained by a storm sewer pipe 24-inches or larger as a separate sewershed. LCD selected the 24-inch sized pipe as a delineation tool because it was well within proposed regulatory requirements and created sewersheds of a manageable size. After delineating sewersheds for each 24-inch pipe, sewersheds were further subdivided if their sizes were too large, i.e. greater than 150 acres (Table 2-2). LCD then assigned an identification label to each sewershed corresponding to the watershed or subwatershed in which they were located (Figure 2-5). Finally, the sewershed data layer was field-checked for accuracy.

Table 2-2. Summary statistics for sewersheds by watershed.

Watershed	# of Sewersheds	Min. Acres	Max. Acres	Mean Acres	Total Acres
MBC	29	2.2	90.9	26.3	764.1
USR	15	6.0	132.5	58.5	878.1
WMC	16	3.6	130.9	45.5	728.1
DCR	8	1.6	76.1	36.8	294.5
FRY	2	20.8	123.7	72.3	144.5
all	70	1.6	132.5	40.1	2,809.3

To create an accurate picture of the infrastructure currently managing stormwater in the village, LCD conducted an inventory of the stormwater control structures. First, LCD inventoried the sizes and locations of pipes, inlets, and outlets. Detention basins and WASCOBs were also inventoried and design parameters including outlet type, volume, draw-down time, and elevation were recorded for each structure.

Soil Inventory

Example of steep slopes in the Village of Mount Horeb.

Soil mapping units in the Village of Mount Horeb were identified from the Natural Resources Conservation Service (formerly known as the Soil Conservation Service) soils survey, published in 1978 (Glocker and Patzer 1978) and digitized in the mid 80's. Within the study area, there are 30 separate soil mapping units including 9.5 acres of hydric soils located around Stewart Lake and 185 acres of non-hydric soils likely to contain hydric inclusions distributed throughout the study area (Figure 2-6). Appendix A contains more information about the soil layers.

Steep slopes and shallow depth to bedrock are important factors to consider when developing in the Village of Mount Horeb. Although soil survey data indicates hard bedrock within 12 to 60 inches of the soil

Figure 2-4. Existing Stormwater System with Elevation Contours

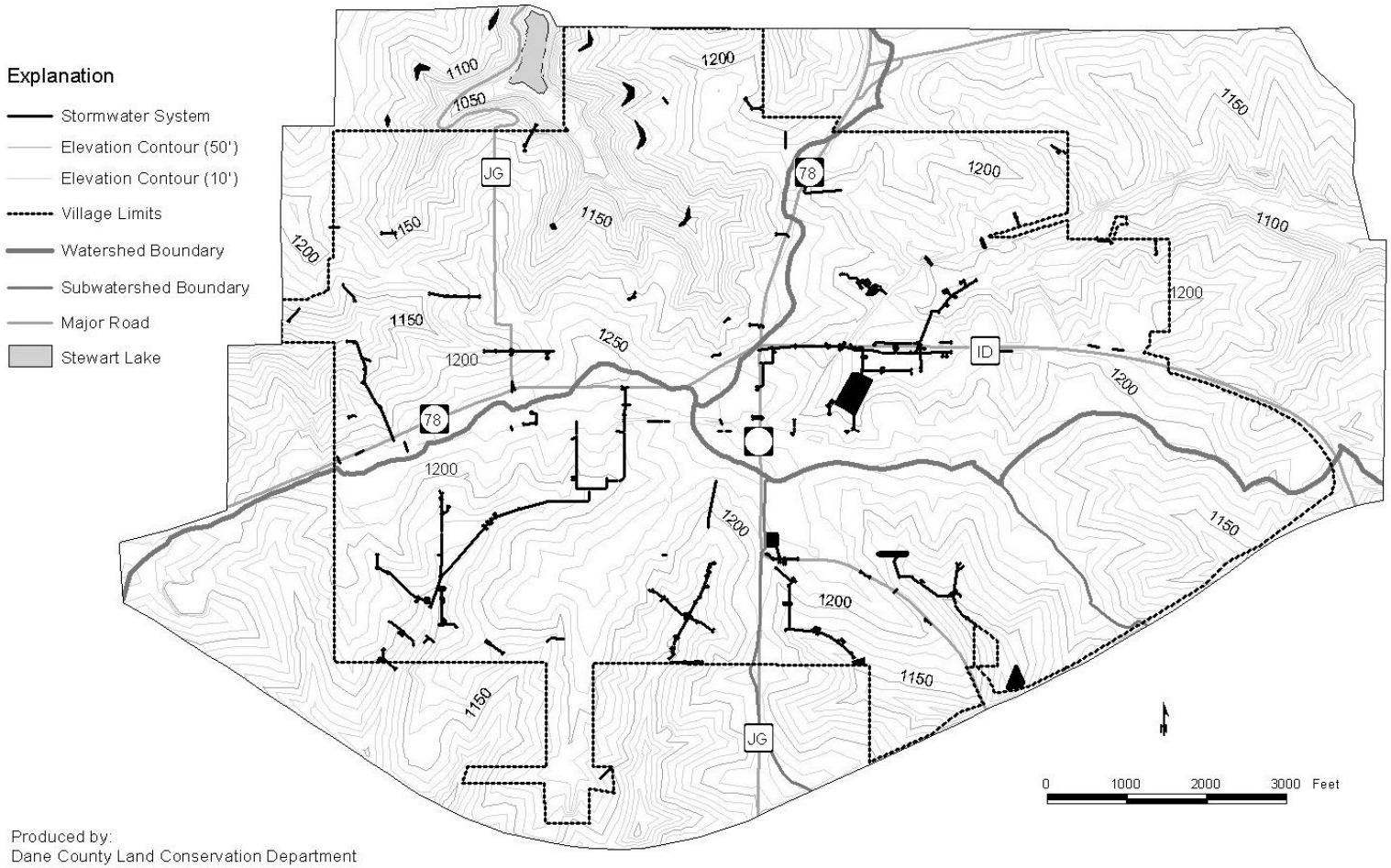

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Figure 2-5. Sewershed Map

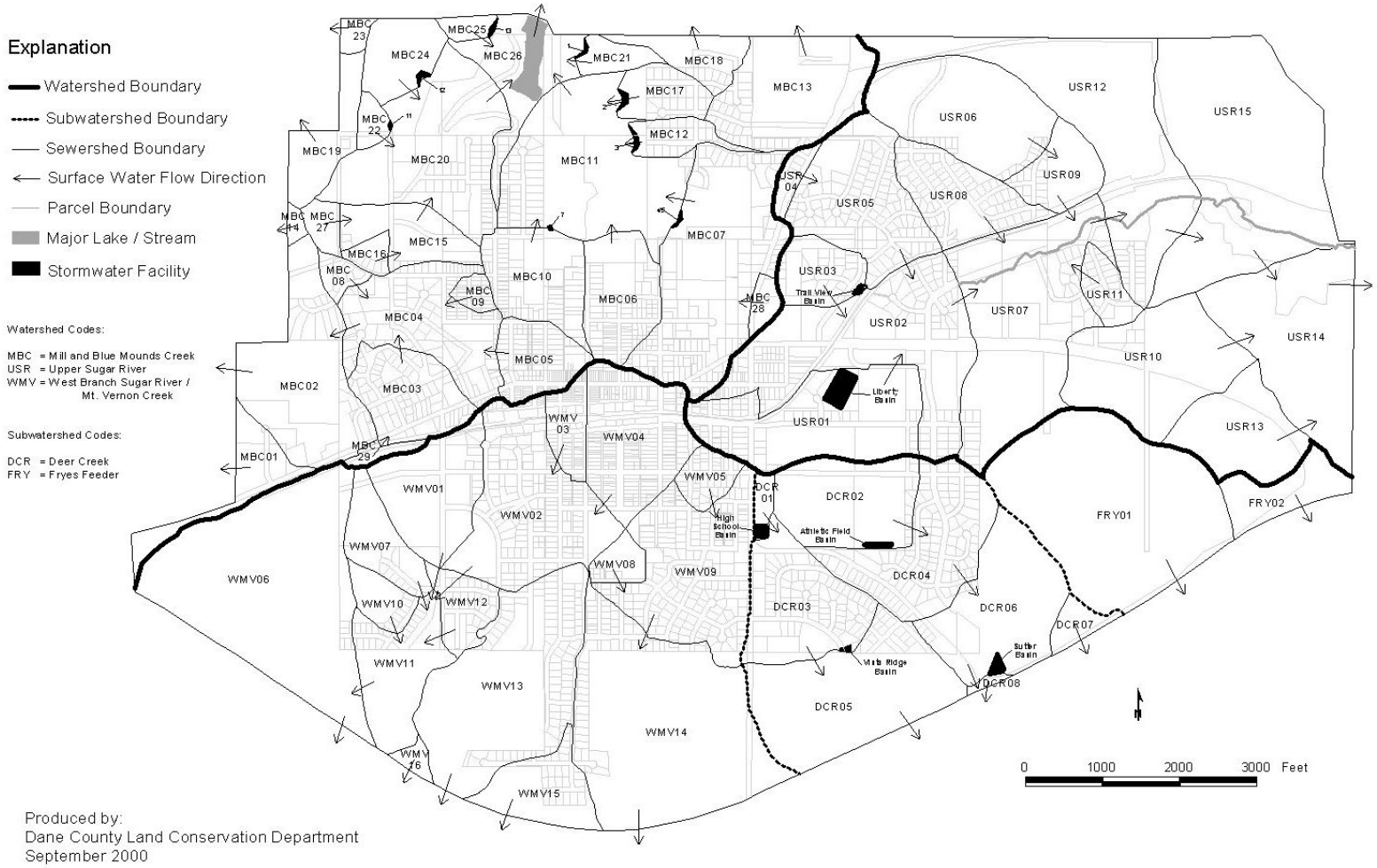

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Figure 2-6. Soil Mapping Units

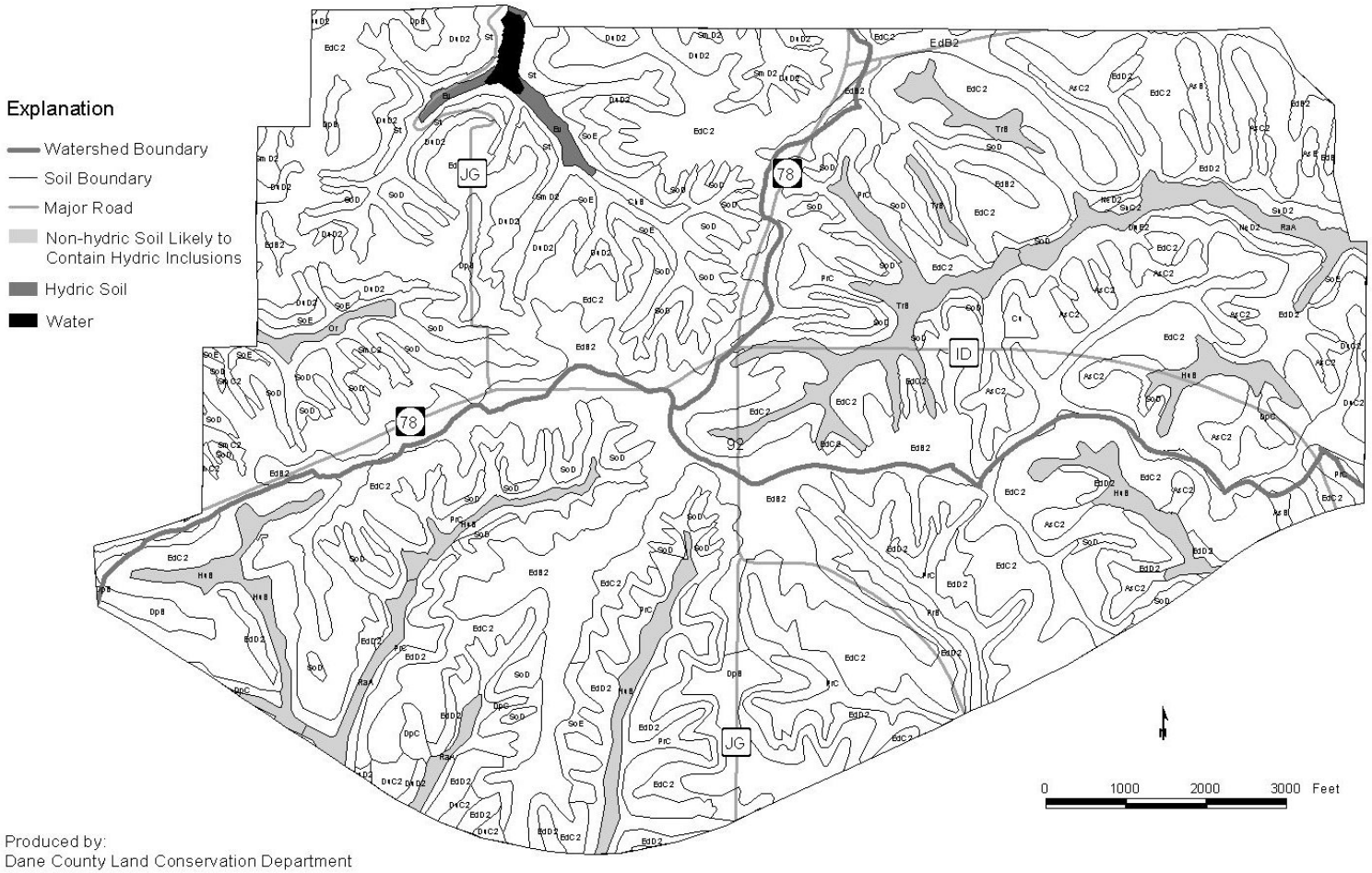

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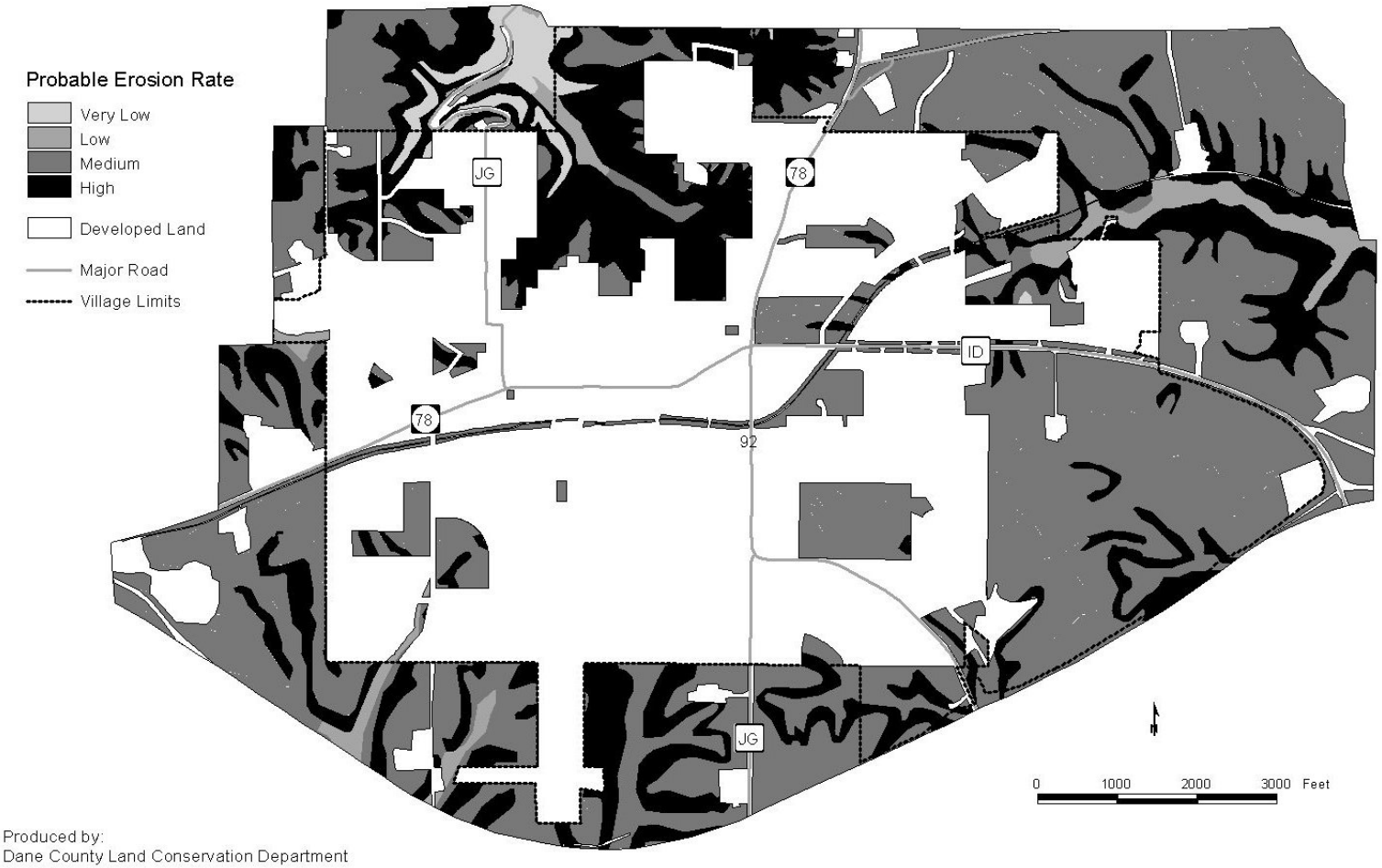
Figure 2-7. Probable Soil Loss for Construction Sites on Undeveloped Lands



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surface, recent soil investigations indicate that there is usually a layer of highly weathered dolostone at least one- to three-feet thick over fractured limestone rock. The depth to bedrock affects the cost and ease of excavation but may also impact groundwater resources. In addition, the steep slopes require intensive erosion control efforts. These characteristics also allow the opportunity for stormwater infiltration and storage. Figure 2-7 shows probable soil loss that may occur by building or disturbing land in undeveloped areas. It is derived from the Universal Soil Loss Equation and estimates soil loss as a function of soil type and slope. Approximately 5% of these undeveloped soils have a probable soil loss for construction sites that is very low or low, while 66% have a medium soil loss and 29% have a high soil loss. Many of the soils that have a high soil loss are located on steeps slopes in the northwestern part of the village – planned to remain as undeveloped land in 2020 (see Figure 2-9).

Land Use / Land Cover Inventory

Land use changes strongly affect drainage patterns, pollutant loading to receiving waters, and other stormwater management issues as development increases impervious surfaces. The study area currently consists of approximately 2,809 acres and encompasses many land uses, including undeveloped land outside village limits which may be developed in future years (Figure 2-8). In this report, the land uses displayed by the GIS-generated maps include the following categories: cropland, grassland/open space, grassland/trees, woodland, wetland, open water, low- or high-density residential, commercial, limited industrial, farmstead/rural building, road, military ridge bicycle trail, and public (schools).

New development in the Village of Mount Horeb.

The land use / land cover data set was created using the lot and block line data from Held. A zoning code was added according to zoning information from the 1999 Held & Associates, Inc. official map. Land use boundaries were delineated for grass, grassland/trees, woodland, open water using a 1995 digital orthophoto as a backdrop. Schools were coded as a public land use. Additional land use boundaries were added based on wetland information from the digital Dane County NRCS Wetland Inventory and preliminary linework data on environmental corridors from the Dane County Regional Planning Commission. Environmental corridors are continuous systems of open space in urban and urbanizing areas that include environmentally sensitive lands and natural resources requiring protection from disturbance and development, and lands needed for open space and recreational use. Finally, field checks were used to verify land use / land cover changes since 1995.

Stormwater runoff can vary within a land use category based primarily on municipal zoning category; therefore, a land cover attribute was added to reflect land cover information where appropriate. For example, although both a strip mall and a golf course are “commercial” land uses, the land cover attribute listed the golf course as “grassland” for purposes of implementing water quantity and quality models as well as map display.

A data set similar to existing land use / land cover was created for future land use / land cover based on the November 4, 1996 Village of Mount Horeb Comprehensive Plan map, with additional modifications provided by Pat Dann, Village Administrator. Figure 2-9 shows projected land uses in 2020, while Figure 2-10 and Table 2-3 show potential changes between existing and future land uses. The most pronounced changes are the decrease in agricultural lands and the increase in low density residential.

Figure 2-8. Existing Land Use / Land Cover (year 2000)

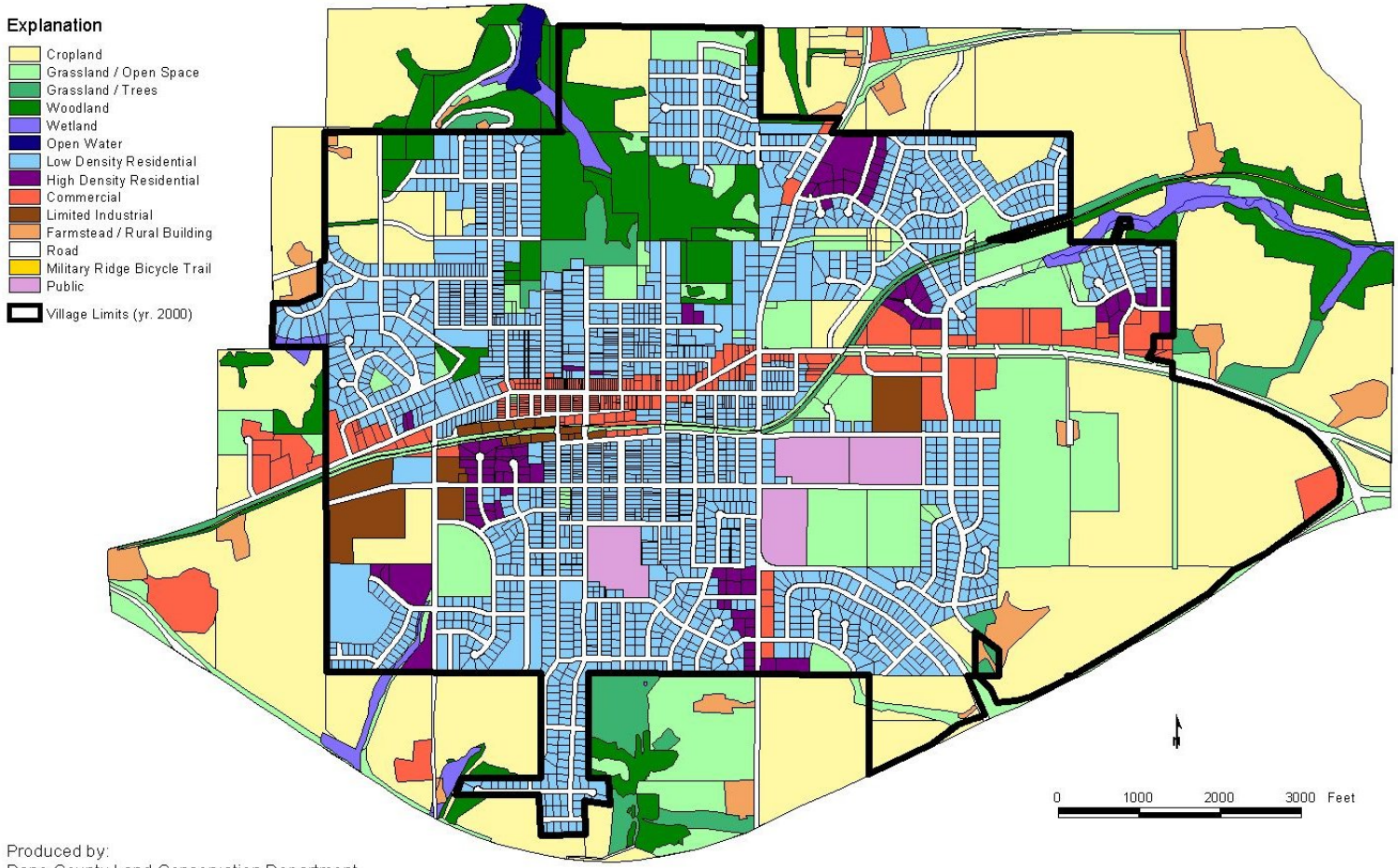

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Figure 2-9. Future Land Use / Land Cover (year 2020)

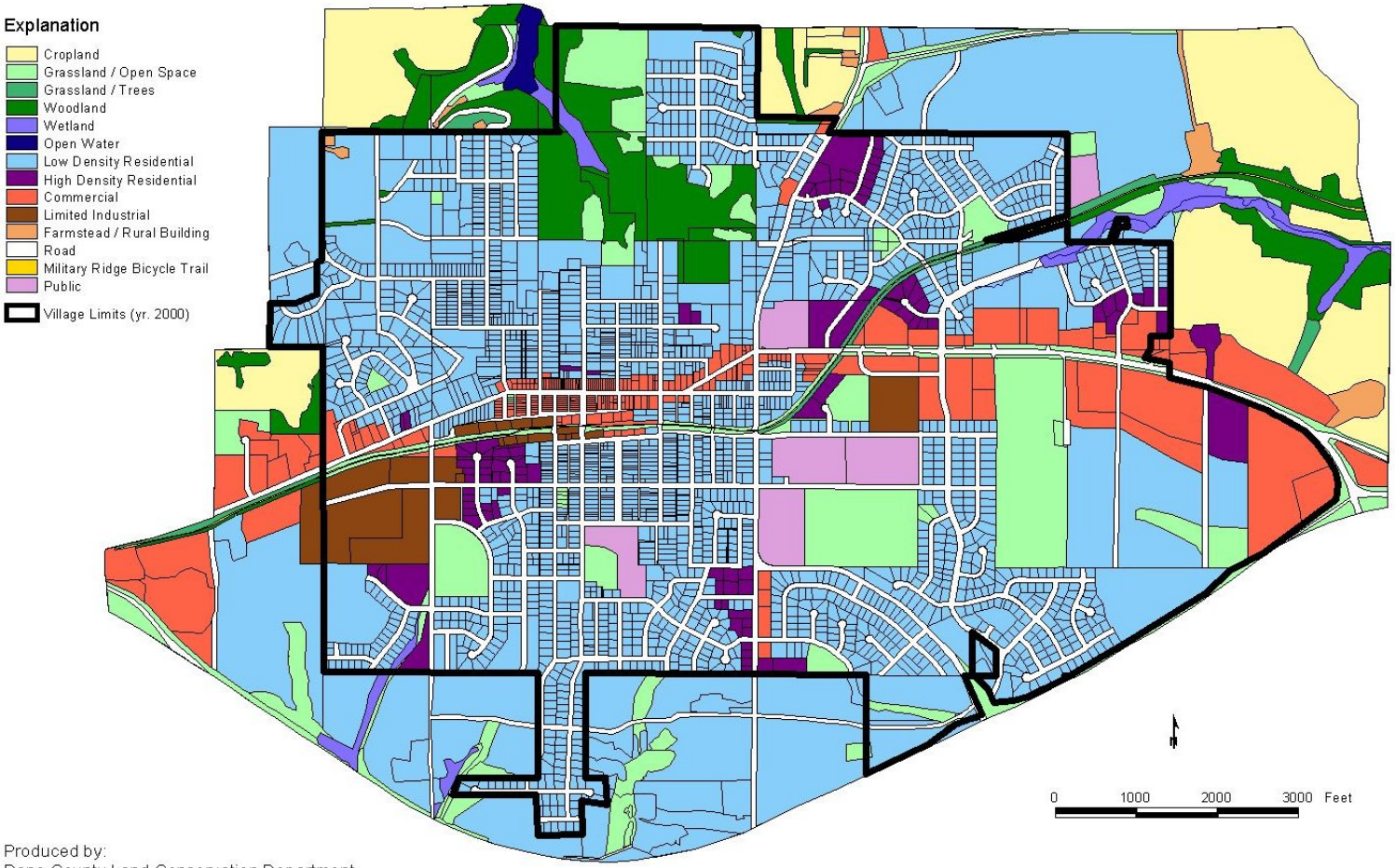

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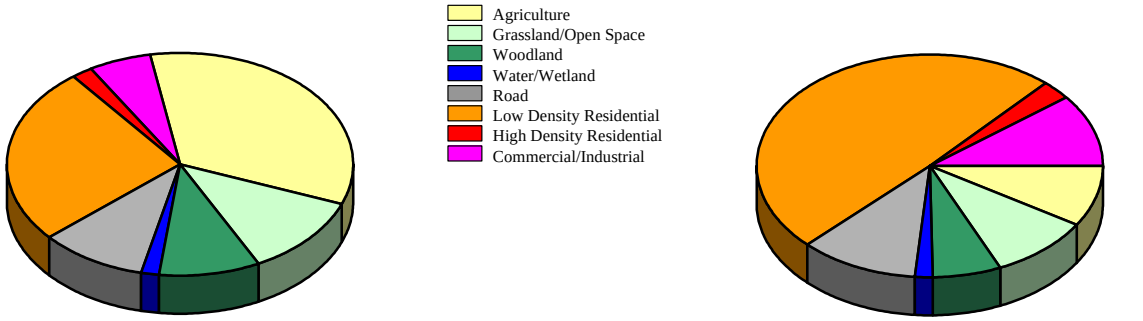
Figure 2-10. Summary of existing and estimated future land uses.



Existing Land Uses (2000)

Estimated Future Land Uses (2020)

Table 2-3. Comparison of land uses between year 2000 and year 2020.

Land Use	Acres (2000)	Acres (2020)**	Acres Changed
Cropland*	940.9	249.3	-691.6 (74%)
Grassland / Conservancy / Open Space	326.4	269.7	-56.7 (17%)
Trees and Grassland	67.9	18.2	-49.7 (73%)
Woodland*	199.0	157.3	-41.7 (21%)
Wetland	39.5	36.1	-3.4 (9%)
Open Water*	6.7	6.7	0 (0%)
Low Density Residential	624.4	1,301.0	+*676.6* (108%)
High Density Residential	57.8	79.90	+*22.1* (38%)
Commercial / Quarry	122.9	235.6	+*112.7* (92%)
Limited Industrial	40.8	62.3	+*21.5* (53%)
Public*	47.9	61.3	+*13.4* (28%)
Farmstead*	50.4	16.9	-33.5 (66%)
Road*	279.8	310.3†	+*30.5* (11%)†
Military Ridge Bike Trail*	4.6	4.6	0 (0%)

* indicates category added by LCD, other categories are from the Comprehensive Plan

† underestimates acres of roads in 2020 due to lack of information

** Land use acres for year 2020 assume a high growth rate.

Chapter III

ANALYSIS OF CURRENT STORMWATER MANAGEMENT PROGRAM

Construction Site Erosion Control

The Village of Mount Horeb manages stormwater by enforcing erosion control standards on new construction projects and by implementing programs aimed to minimize stormwater impacts. Erosion control and stormwater management is governed by local, county, state, and federal regulations.

The village currently has no ordinance structure dedicated solely to stormwater management but relies on the following: Erosion Control Ordinance (Chapter 20 of the Mount Horeb Code of Ordinances), standards in their Subdivision and Platting Chapter (Chapter 18), State of Wisconsin Uniform Dwelling Code (UDC) (Wis. Admin. Code Comm 21), NR 216 (Wis. Admin. Code), and Comm 51.115 (Wis. Admin. Code). Erosion control and stormwater management are closely tied to one another; erosion control activities manage runoff during the active period of construction, while stormwater controls, in addition to their ability to limit erosion, may also serve to address post construction runoff. Therefore, while an erosion control ordinance establishes standards for stormwater control, it does not necessarily create a foundation for long-term runoff management.

Dane County will be creating a new Erosion Control and Stormwater Management Ordinance by combining the existing Erosion Control Ordinance (Chapter 14 of the Dane County Code of Ordinances) with a proposed Stormwater Management Ordinance. All municipalities in Dane County will be required to either adopt the new Dane County Ordinance or amend their existing erosion control ordinance to reflect the new standards. Table 3-1 shows a comparison of the village's current Erosion Control Ordinance with the proposed Dane County Erosion Control and Stormwater Management Ordinance. In summary, the following requirements which are included in the new ordinance are not addressed by the current Village of Mount Horeb Erosion Control Ordinance.

- Watershed size for drainage areas
- Fertilizer and seeding rates
- Prevention of gully erosion and application of minimum standards for sheet and rill erosion: 7.5 tons/acre/year
- No increase in peak discharge for 2- and 10-year 24-hour storms and safely pass the 100-year 24-hour storm
- Reduce the village's pre-development runoff curve number for agricultural land from 70 to 68
- Performance standards for post-construction water quality, oil, grease, and temperature

Throughout the state, construction sites where 5 or more acres of land will be disturbed must comply with state regulations for stormwater management under Chapter NR 216, Wis. Admin. Code or Comm 51.115. In 2003, the acreage threshold will drop to one or more acres. These regulations are administered by the WDNR and Department of Commerce and are derived from US Environmental Protection Agency (USEPA) mandates. In addition, in 2003, the USEPA will be requiring communities within urbanized areas to obtain a municipal stormwater discharge permit, and communities with populations of 10,000 people or more will require evaluation by the WDNR for potential designation as needing a permit. These communities, known as Phase II communities, are identified for permitting based on 1990 census data. Additional communities may be added based upon population changes determined by 2000 census data.

Table 3-1. Comparison of the village's current Erosion Control Ordinance with the proposed Dane County Erosion Control and Stormwater Ordinance.

Issue	Village Ordinance	Proposed Dane County Ordinance
Watersheds	No requirements	Requires listing watershed size for each drainage area
Fertilizer/Seeding Rates	No requirements	Requires fertilizer and seeding rates and recommendations
Gully, Sheet and Rill Erosion	No standards	Prevent gully erosion and apply minimum standards for sheet and rill erosion: 7.5 tons/acre/year
Prevention of Increases in Peak Discharges	No standards	Requires no increase in peak discharges for the 2- and 10- year, 24-hour storm. Must safely pass the 100-year, 24-hour storm.
Calculating Detention Requirements	Rational method may be used to calculate detention; pre-development runoff curve number (RCN) is 70	All runoff calculations shall be according to the methods described in TR-55 with a maximum RCN of 68
Regulatory "Trigger" for Stormwater Controls	Requires detention for sites disturbing more than 10 acres at a time	Requires application of stormwater controls to sites disturbing 20,000 ft^2 or more
Oil and Grease Control	No standards	For all uses where the potential for pollution by oil and grease exists, the first 0.5 inches of runoff must be treated
Thermal Impacts	No standards	Requires provisions to reduce the temperature of runoff for sites located in the watershed of a river or stream identified by WDNR as an existing or proposed cold water community

The Village of Mount Horeb is not located in an urbanized area and does not currently meet the 10,000 or more population criteria for potential designation. However, the village may be designated by the WDNR as a Phase II community based upon other criteria, such as the quality of receiving waters and potential water quality impacts. Major components of a municipal stormwater discharge permit include effective construction site erosion control and long term stormwater management for new development. If the village meets the requirements of the new Dane County Erosion Control and Stormwater Ordinance, it is anticipated that future Phase II requirements for construction site erosion control and long term stormwater management for new development will be met.

The Permit Process

Four full-time employees in the Public Works Department and one full-time building inspector are responsible for implementing the current stormwater program. The Parks Department, with two full-time employees, may also assist in stormwater management when requested by the Public Works Department. Under both the Mount Horeb Chapter 20 and the State (UDC), the Village Building Inspector performs inspections and enforcement of erosion control standards on all land disturbing activities including plat disturbance and residential and commercial construction.

Although the enforceable standards differ between village and state programs (Table 3-2), both require a site diagram (erosion control plan) before commencing construction. With plat developments or land disturbing activities covered by NR216 and Comm 51.115, the developer must submit a stormwater and erosion control plan for approval by the Village Engineer. Under NR 216, non-commercial building sites greater than 5 acres in size must submit a notice of intent to WDNR outlining the management of construction site runoff. Under Comm 51.115, commercial building sites greater than 5 acres in size must submit a notice of intent to the Department of Commerce. After plan approval, the Village Building Inspector assumes enforcement and inspection authority. The inspector checks for plan compliance, notes any violations in a log, and warns the appropriate party of noncompliance. If the party fails to implement the erosion control plan, a notice of noncompliance is issued, resulting in a citation or stop work order. According to the Village Building Inspector, stop work orders or fines when parties fail to comply with plan requirements are seldom issued.

Table 3-2. Types of construction and applicable ordinances regulating erosion control in the village.

Type of Construction	Applicable Ordinance	Who Reviews/ Approves Plan?	Plan Enforcement
Single or Two Family Residential	Uniform Dwelling Code	State-certified Building Inspector	Village Building Inspector
Multifamily/Commercial disturbing less than 5 ac.	Mount Horeb Chapter 20 Erosion Control	Village Engineer	Village Building Inspector
Multifamily/Commercial disturbing more than 5 ac.	Mount Horeb Chapter 20 or Comm 51.115	File notice of intent (NOI) with Dept. of Commerce	Dept. of Commerce-construction site erosion control, WDNR-stormwater
Plat and Subdivisions	Mount Horeb Chapter 18 and NR 216	Village Engineer	Village Engineer

Municipal Operations ("Housekeeping Practices")

Non-structural stormwater best management practices (BMPs) include such activities as street sweeping, drainage way maintenance, solids collection (leaves, yard waste, brush, trash, etc.), and an information and education strategy on how the general public can reduce local stormwater impacts. These activities help prevent or limit pollutants from contaminating runoff which can affect the quality of receiving waters.

For the 2000 season, the village purchased a new street sweeper and instituted a comprehensive street sweeping program. Each year, the entire village is swept once following snowmelt and again just before snowfall. During the summer, the entire village is swept at least once and other areas are swept as needed. In addition, the village sweeps Main Street (The Trollway) and arterial side streets once or twice a week during early morning hours to avoid traffic conflicts and parked cars. After storm events, the Public Works Department examines low areas for debris and sweeps as necessary. Material missed by the street sweeper collects in catch basins, which are cleaned annually. Finally, the village collects debris from rock channels on a annual basis to maintain free flow of stormwater runoff.

Weekly curbside collection of brush and yard waste begins in April. Curbside leaf pick up begins in October and continues weekly until leaf fall is complete. Residents are asked to pile leaves on the terrace next to the curb, where they can be collected by a vacuum. The village maintains a compost site for brush, leaves, and yard waste, which is roughly sorted into one of two areas depending on quality. The

larger area receives the dirtier material from catch basins and miscellaneous yard waste. The second site, intended to receive only leaves, is smaller and cleaner. This site is allowed to rest and creates compost available to residents. The village compost site is located outside the village limits above a tributary to the West Branch Sugar River and has only a limited forested buffer to prevent polluted runoff from entering the stream. The compost site receives many unwanted items such as unchipped brush, trash, appliances, road-killed animals, and furniture which is mixed in with the dirtier compost. Currently, there is no enforcement of dumping restrictions and access to the property is unlimited.

Each year, the village allocates 600 tons of a 75% salt and 25% sand mix to de-ice streets in winter. This mixture is stored and covered in a two-story storage shed at the village garage. In times of heavy snowfall, excess snow is piled in the Church of Our Risen Savior parking lot on Brandywein Street, just outside of town. There are no measures to prevent salinated runoff from leaving the site when the snow melts. Municipal vehicles are stored inside garages or sheds, thereby preventing grease and oil from leaving the site. Overall, the municipal garage is well managed and has little or no runoff concerns.

Chapter IV

ANALYSES

Background

The United States Environmental Protection Agency (USEPA) now considers pollution from all nonpoint sources, including urban stormwater pollution, to be the most important source of contamination in the nation's waters. The stormwater problem has two main components: the increased volume and velocity of surface runoff and the concentration of pollutants in the runoff. Both components are directly related to development in urban and urbanizing areas. Together, these pollutants and the increased velocity and volume of runoff cause dramatic changes in hydrology and water quality that result in a variety of problems. These include increased flooding, stream channel degradation, habitat loss, contamination of water resources, increased erosion and sedimentation, and changes in water temperature. These changes affect ecosystem functions, biological diversity, public health, recreation, economic activity, and general community well-being. Urban stormwater is not alone in causing these impacts. Industrial and agricultural runoff are equal or greater contributors. However, the environmental, aesthetic, and public health impacts of nonpoint pollution will not be eliminated until urban stormwater pollution is controlled (Lehner et al. 1999).

Water Quantity Considerations

Impervious surfaces increase the speed and volume of runoff as it drains off the land. Unlike grassy meadows or forests, hard, impervious cover, such as parking lots and rooftops, offers little resistance to water flowing downhill, allowing it to travel faster across these surfaces while allowing for little or no infiltration. The increased velocity and volume greatly magnifies the erosive power of water as it flows across the land surface and/or enters a stream (Lehner et al. 1999). This may also result in decreased base flow of streams which leads to alterations in habitat in the interstitial zone.

The impacts of small (2-year, 24-hour) storm events cause different potential problems than larger (100-year, 24-hour) events. Small storms are responsible for streambank and gully erosion along with increased temperatures in streams because they occur frequently. On the other hand, the impact of large storms is most often seen as flooding and property damage.

TR-55 Model Description

Technical Release 55 (TR-55), or Urban Hydrology for Small Watersheds (SCS 1986), is a model that calculates storm runoff volume, peak rate of discharge, hydrographs (relationship between flow and time), and storage volumes for stormwater facilities. This model was developed for small watersheds (10 mi^2 or less), especially urbanizing watersheds, in the United States. First issued by the Soil Conservation Service (SCS) in January 1975, TR-55 incorporated SCS procedures at that time. A revision was made in June of 1986 that incorporated results of recent research and other changes based on experience with the original edition. TR-55 begins with a rainfall amount distributed uniformly over a watershed over a specified time period. Mass rainfall is converted to mass runoff and runoff travel time routed through segments of a watershed are used to create a runoff hydrograph. Results of the model include peak flow rates and runoff volume. Heastad Pond-Pack Version 7 was the commercially available TR-55 model that was used for this report.

Several GIS data layers were used to acquire inputs to run TR-55 (see Chapter II for a description of GIS layers or Appendix A for more information). The sewershed layer divided the study area into stormwater drainage areas served by a storm sewer or other stormwater control structures. The land use / land cover layer was combined with the soils layer; a runoff curve number (RCN) was assigned to each land use-soil polygon based on the type of land cover and hydrologic soil group. For each sewershed, an area-weighted RCN was calculated by summing the fraction of RCN (RCN divided by the polygon area) for each land use-soil polygon in the sewershed. The area-weighted curve number and total acres for each sewershed were then used to run TR-55.

TR-55 Model Results

Tables 4-1 and 4-2 show the results from the TR-55 model. Peak flow runoff rates in cubic feet per second (cfs) and volumes in acre-feet were calculated for the 1, 2, 10, and 100-year, 24-hour storm events. For some of the basin outfalls, the time of concentration is left blank because the information was unavailable. Composite acres (in Tables 4-1 and 4-2) refers to the total acres from all sewersheds that drain to the basin outfall, not just the sewershed at the outfall. Results show that there are substantial increases in peak flow rates and volumes of runoff expected with future development. If these increases are not managed, impacts to property and natural resources can be expected.

Figure 4-1 is a map of the study area representing the 10-year 24-hour peak flow event using the year 2020 data. Drainage areas shaded in dark blue have higher peak rates of runoff. Figure 4-2 shows the runoff volume from the same storm event. Although year 2000 results were available, they were not displayed on a map because the shading is similar to results from year 2020.

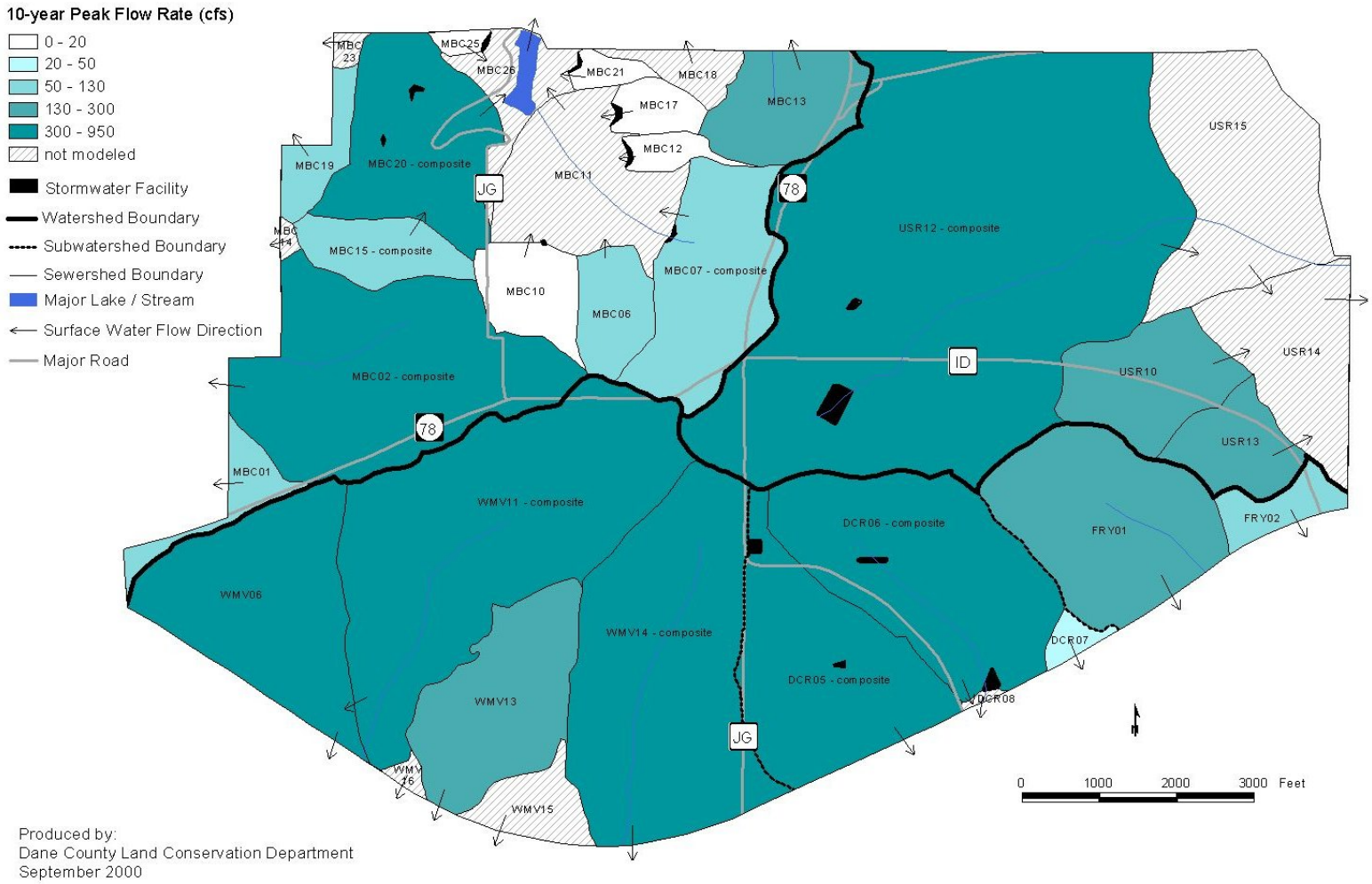
Table 4-1. Model results from TR-55 for existing land use (year 2000).

Basin Outfall	Composite Acres	Composite RCN	Time of Concentration (hours)	1 yr. Peak (cfs)	1 yr. Volume (ac-ft)	2 yr. Peak (cfs)	2 yr. Volume (ac-ft)	10 yr. Peak (cfs)	10 yr. Volume (ac-ft)	100 yr. Peak (cfs)	100 yr. Volume (ac-ft)
MBC01	21.1	78	0.27	18.5	1.4	25.4	1.9	50.5	3.7	88.0	6.3
MBC02	188.2	83	0.34	206.1	16.6	269.1	21.4	486.4	38.6	799.6	64.2
MBC06	32.5	80	0.27	32.7	2.4	43.8	3.2	83.6	6.0	142.4	10.3
MBC07	90.9	79		4.3	5.9	7.5	8.2	73.0	16.7	210.0	30.5
MBC10	34.8	77		2.0	0.9	3.0	1.3	4.6	3.0	30.0	5.9
MBC12	11.4	82		1.0	0.7	1.5	0.9	2.3	1.7	25.0	2.9
MBC13	56.1	78	0.32	45.8	3.7	63.2	4.9	125.8	9.6	220.0	16.7
MBC15	35.1	79	0.39	33.8	2.9	44.6	3.8	82.4	6.9	137.3	11.7
MBC17	16.3	78		0.5	0.7	0.7	1.0	1.3	2.0	11.0	3.7
MBC19	20.4	77	0.32	15.2	1.3	21.2	1.7	43.0	3.4	76.1	5.9
MBC20	99.7	78	0.63	76.6	9.4	105.0	12.5	208.5	23.9	364.2	41.3
MBC21	8.5	71		0.2	0.2	0.3	0.3	0.5	0.6	9.6	1.2
USR10	63.9	74	0.73	21.8	3.3	32.3	4.6	71.8	9.4	133.9	17.1
USR12	566.5	75	0.51	367.9	45.0	487.4	58.8	906.0	108.1	1524.1	182.8
USR13	38.1	71	0.53	12.0	1.5	18.0	2.2	43.0	4.9	86.0	9.2
DCR05	127.9	75	0.44	97.7	8.9	132.4	11.9	257.3	22.5	445.0	38.9
DCR06	157.7	76	0.27	97.0	10.3	134.0	13.9	274.0	26.8	494.0	46.8
DCR07	7.4	77	0.33	5.5	0.5	7.6	0.6	15.6	1.2	27.7	2.1
FRY01	123.7	71	0.56	29.9	5.0	47.3	7.2	116.6	15.7	230.0	29.7
FRY02	20.8	77	0.35	14.9	1.3	20.8	1.7	42.4	3.4	75.3	6.0
WMV06	130.9	77	0.63	63.8	8.1	90.1	10.9	186.5	21.5	334.2	38.0
WMV11	258.2	76	0.43	280.5	25.4	360.4	32.4	632.5	56.7	1019.7	92.6
WMV13	93.7	79	0.46	67.0	6.7	91.3	8.9	177.9	16.8	307.2	29.0
WMV14	215.7	72	0.61	107.8	13.3	151.7	18.8	312.1	35.4	557.2	62.6

Table 4-2. Model results from TR-55 for future land use (year 2020).

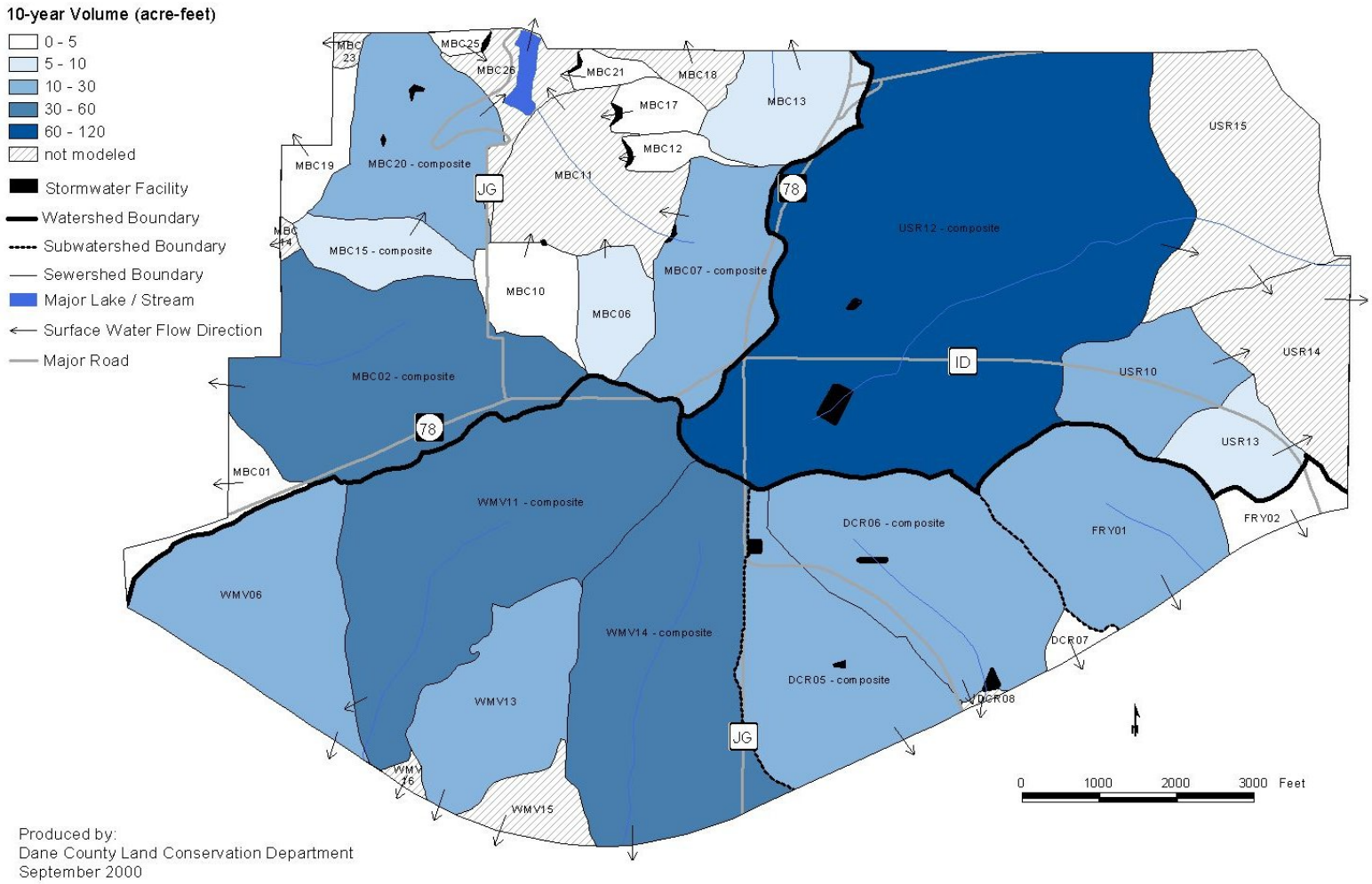
Basin Outfall	Composite Acres	Composite RCN	Time of Concentration (hours)	1 yr. Peak (cfs)	1 yr. Volume (ac-ft)	2 yr. Peak (cfs)	2 yr. Volume (ac-ft)	10 yr. Peak (cfs)	10 yr. Volume (ac-ft)	100 yr. Peak (cfs)	100 yr. Volume (ac-ft)
MBC01	21.1	87	0.14	39.3	2.3	49.5	2.9	83.5	4.9	130.9	7.9
MBC02	188.2	84	0.34	218.9	17.5	283.2	22.5	503.0	40.0	817.3	65.8
MBC06	32.5	82	0.21	38.8	2.6	51.5	3.4	95.8	6.2	160.4	10.5
MBC07	90.9	82		4.3	5.9	7.5	8.2	73.0	16.7	210.0	30.5
MBC10	34.8	81		2.0	0.9	3.0	1.3	4.6	3.0	30.0	5.9
MBC12	11.4	83		1.0	0.7	1.5	0.9	2.3	1.7	25.0	2.9
MBC13	56.1	78	0.18	57.0	3.7	77.8	4.9	152.5	9.6	265.6	16.7
MBC15	35.1	82	0.15	45.7	2.8	60.5	3.6	112.4	6.7	188.2	11.4
MBC17	16.3	79		0.5	0.7	0.7	1.0	1.3	2.0	11.0	3.7
MBC19	20.4	78	0.16	21.7	1.3	29.6	1.8	57.9	3.5	100.8	6.1
MBC20	99.7	80	0.26	130.6	9.4	177.1	12.5	342.1	23.9	589.9	41.3
MBC21	8.5	74		0.2	0.2	0.3	0.3	0.5	0.6	9.6	1.2
USR10	63.9	90	0.10	144.7	8.2	177.6	10.1	286.6	16.6	437.1	25.8
USR12	566.5	77	0.20	399.3	49.2	521.3	63.6	942.5	114.6	1564.7	190.9
USR13	38.1	90	0.23	69.0	4.9	85.0	6.0	140.0	9.9	218.0	15.4
DCR05	127.9	84	0.27	130.7	10.1	173.5	13.3	323.5	24.5	543.0	41.4
DCR06	157.7	82	0.21	134.0	12.3	180.0	16.2	348.0	30.0	595.0	50.8
DCR07	7.4	82	0.15	10.3	0.6	13.5	0.8	24.6	1.5	40.8	2.5
FRY01	123.7	79	0.56	75.9	8.6	103.8	11.5	205.0	21.9	358.0	37.9
FRY02	20.8	87	0.17	37.4	2.3	43.6	2.9	78.6	4.9	123.3	7.8
WMV06	130.9	82	0.23	160.2	10.9	210.4	14.2	384.8	25.9	640.0	43.5
WMV11	258.2	85	0.41	287.5	25.4	369.0	32.4	646.1	56.7	1042.4	92.6
WMV13	93.7	80	0.23	101.3	6.9	135.4	9.2	257.2	17.2	437.6	29.5
WMV14	215.7	81	0.31	220.4	16.9	293.5	22.2	549.9	41.2	925.3	69.8

Figure 4-1. 10-year Peak Flow Rates for Future Land Use / Land Cover (year 2020)



Produced by:
Dane County Land Conservation Department
September 2000

Figure 4-2. 10-year Volume for Future Land Use / Land Cover (year 2020)



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Water Quality Considerations

Another aspect of urbanization that contributes to urban stormwater pollution, is the increased discharge of pollutants. As human activity increases in a given area, the amount of waste material deposited on the land and in drainage systems increases. The principal contaminants of concern for stormwater fall into seven categories (Table 4-3). Everyday activities, including driving and maintaining vehicles, maintaining lawns and parks, disposing of waste, and even walking pets, often cover these impervious surfaces with a coating of various harmful materials. Sediments, toxic metal particles, pesticides and fertilizers, oil and grease, pathogens, excess nutrients, and trash are common stormwater pollutants. Many of these constituents end up on roads and parking lots during dry weather only to be washed into waterbodies when it rains or when snow melts (Lehner et al. 1999).

Table 4-3. Categories of principal contaminants in stormwater (Lehner et al. 1999).

Category	Examples
Metals	Zinc, cadmium, copper, chromium, arsenic, lead
Organic Chemicals	Pesticides, oil, gasoline, grease
Pathogens	Viruses, bacteria, protozoa
Nutrients	Nitrogen, phosphorus
Biochemical Oxygen Demand (BOD)	Grass clippings, fallen leaves, hydrocarbons, animal waste
Sediment	Sand, silt, clay, organic matter
Salts	Sodium chloride, calcium chloride

P8 Urban Catchment Model Description

P8 is a model for predicting the generation and transport of stormwater runoff pollutants in urban watersheds (Walker 1990). P8 is short for “Program for Predicting Polluting Particle Passage through Pits, Puddles & Ponds” and consists primarily of algorithms derived from other urban runoff models (SWMM, STORM, HSPF, D3RM, TR-20). For the Mount Horeb Stormwater Plan, two runoff pollutants were modeled: total suspended solids (TSS) and total phosphorus (TP).

These pollutants were modeled because of their impacts on water quality. Sediment is the largest pollutant by volume in the State of Wisconsin (WDNR 1994) and TP is the limiting factor for the growth of algae, especially in lakes. Water quality impacts can include reduced dissolved oxygen concentrations and habitat destruction. The P8 model predicts the concentrations of other pollutants (including nitrogen, copper, lead, zinc, and hydrocarbons). The plan analysis does not consider these other pollutants because currently there are no accepted maximum limits for these types of discharges. However, studies have shown that there are reductions in pollutants attached to TSS. For example, under proposed NR 151, Wis. Admin. Code, it is stated that reducing total suspended solids by 80% will achieve about a 50% reduction in heavy metals.

There are limitations of P8 and other urban runoff models in general. For example, runoff quality is highly variable from site to site and from storm to storm at a given site. Often site-specific data sufficient for model calibration are not available and thus runoff models, including P8, rely on generalized data sources for the calibration of key parameters. While P8 does not solve the data availability problem, it does provide a reasonable starting point for calibration and a consistent frame of reference for evaluating proposed developments. It is also important to keep in mind that runoff model predictions are more accurate in a relative sense than in an absolute sense. For example, the prediction of suspended solids

removal efficiency in a detention pond is likely to be more accurate than predictions of inflow or outflow concentrations of suspended solids or other water quality components (Walker 1990).

Similar to TR-55 inputs, several GIS data layers (see Chapter II for a description of GIS layers or Appendix A for more information) were used to acquire inputs to run P8 including total acres for each sewershed. In addition, the RCN assigned to each land use-soil polygon was used to calculate a pervious curve number (curve number from pervious land uses plus indirectly connected impervious land uses). An impervious fraction (percent of impervious area) of each sewershed was also determined and this fraction was divided into two parts: swept (roads) and not swept (rooftops, etc.). In order to route pollutants through the study area, numbers were given to each sewershed (assigned previously, see Chapter II) while a separate number was assigned to each sewershed outlet. Each outlet was assigned a device type as either a detention pond or a pipe/manhole. Pipe/manhole devices were used as a placeholder when the sewershed had no actual outlet device – this allows the model to obtain output at each sewershed device or outlet. Each sewershed and device were routed to a downstream device to obtain a routing drainage path. Other data needed to run P8 included street sweeping period (estimated from April 1st through November 1st) and an estimate of weekly street-sweeping frequency (estimated at 0.1 times per week). Finally, the model's impervious runoff coefficient was reduced from 1 to 0.95 due to infiltration that may occur in some of the study area's older, cracked streets. Precipitation and temperature data for over 30 years at Madison, WI were used as well as a distribution of particle settling velocities derived from Nationwide Urban Runoff Program (NURP) studies – with concentrations calibrated to the NURP 50th percentile (median) sites.

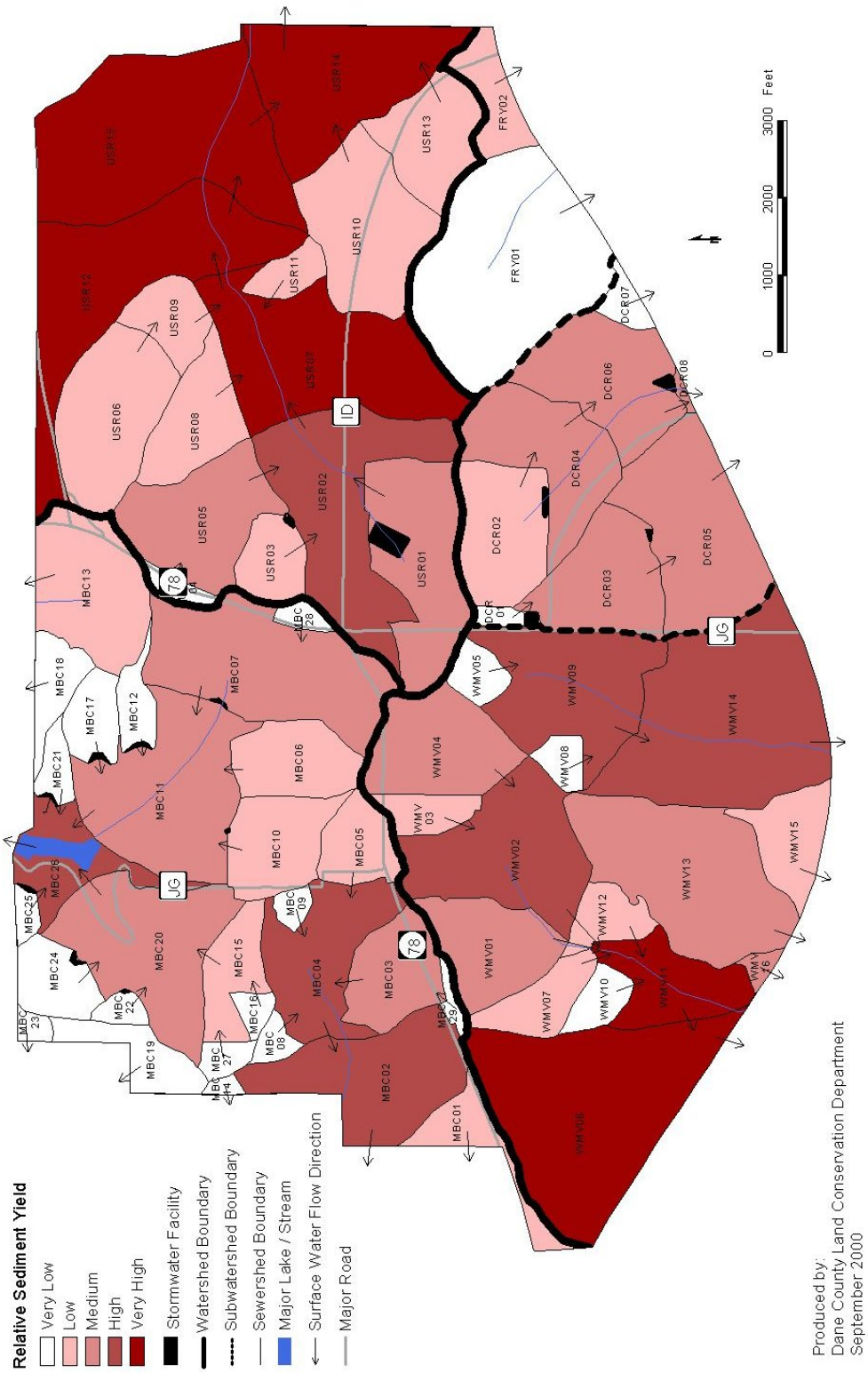
P8 Urban Catchment Model Results

The study area was divided into 70 sewersheds. Of these, 14 have detention ponds at their outlets. Figures 4-3, 4-4, 4-5 and 4-6 show the relative sediment and phosphorus yields by sewershed for both existing and future land uses. In general, sewersheds that have a higher percent of impervious land uses have higher sediment and phosphorus yields.

The model results indicate that the sewersheds draining to Stewart Lake and eventually to Elvers Creek will not have large increases in sediment and phosphorus yields in the next 20 years. One reason for this is that most of these sewersheds are fully developed. In addition, an aggressive program of constructing water quality structures to control sediment and phosphorus entering the lake, has been established by the Dane County Parks Department and the Village of Mount Horeb.

Tables 4-4 and 4-5 show the outputs from the water quality model for existing and future conditions for Water and Sediment Control Basins (WASCOBs) and other existing basins. Trapping efficiencies and pounds trapped are shown for both sediment (TSS) and phosphorus (TP). WASCOBs 4 and 5 and 2 have the largest volume of TSS; removal efficiencies for all WASCOBs ranged from 61.5 to 70.7%. The detention basins have a TSS removal efficiency that varies between 32.5 to 77.6%. For existing basins, the largest removal efficiency occurs at the Trail View Basin and the lowest at the Sutter Basin. Removal efficiencies of TP for the WASCOBs varied from 21.3 to 34.6%; removal efficiencies of TP for existing basins ranged from 6.1 to 42.9%. In general, the existing basins perform well in removing sediment and phosphorus, although opportunities exist to improve trapping efficiencies.

Figure 4-3. Sediment Yield by Sewershed for Existing Land Use / Land Cover (year 2000)



Produced by:
Dane County Land Conservation Department
September 2000

Figure 4-4. Phosphorus Yield by Sewershed for Existing Land Use / Land Cover (year 2000)

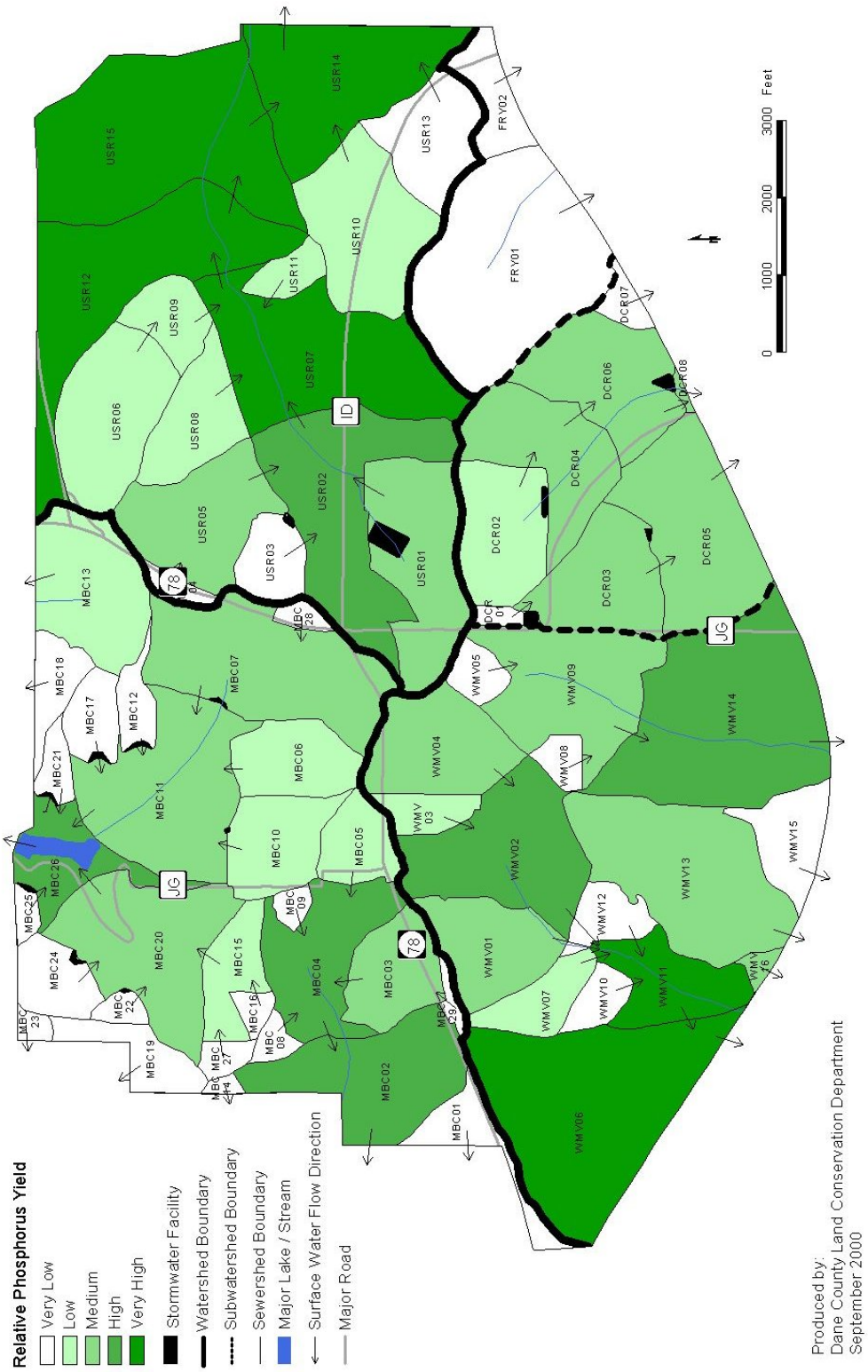


Figure 4-5. Sediment Yield by Sewershed for Future Land Use / Land Cover (year 2020)

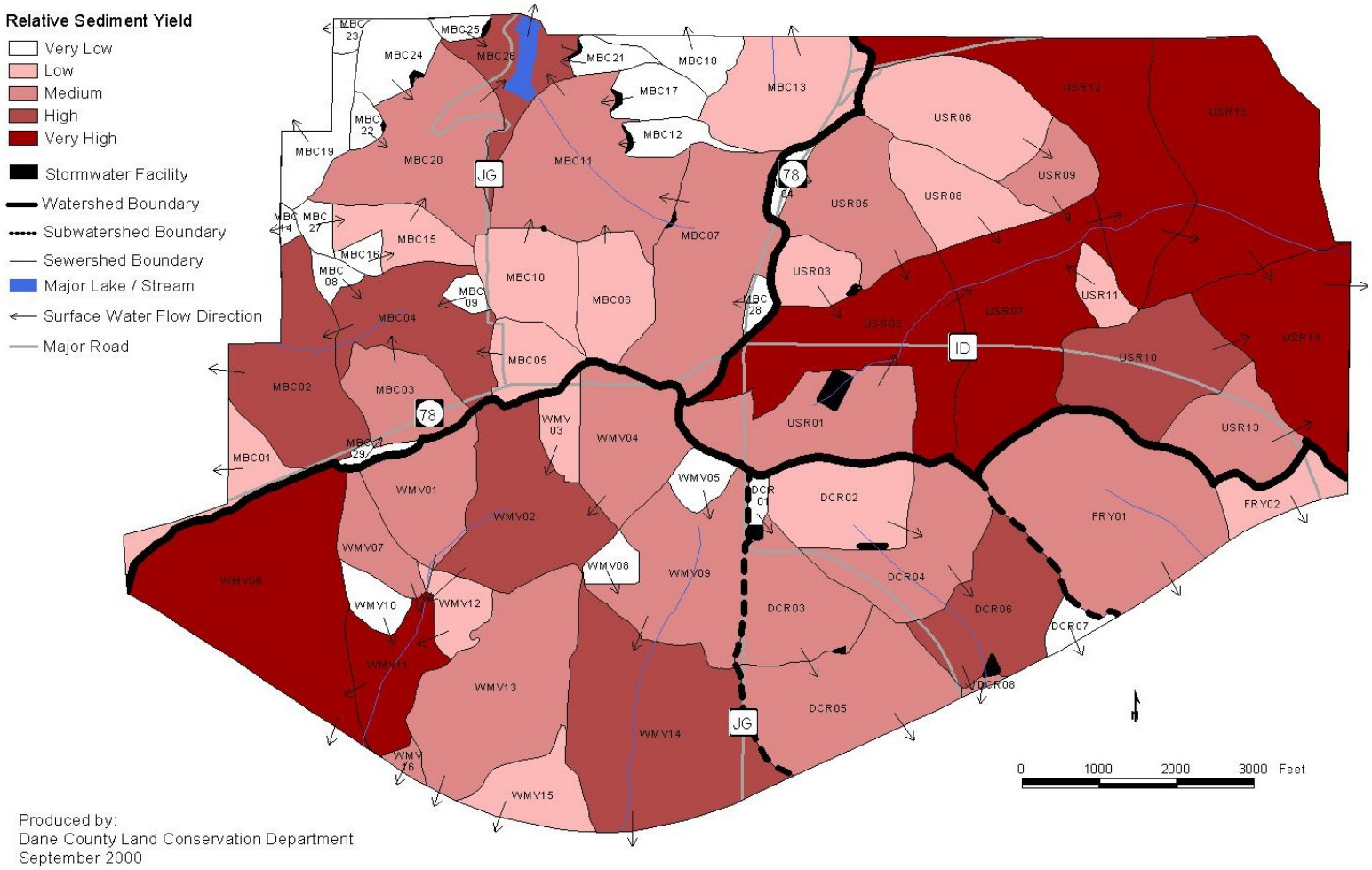


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Figure 4-6. Phosphorus Yield by Sewershed for Future Land Use / Land Cover (year 2020)

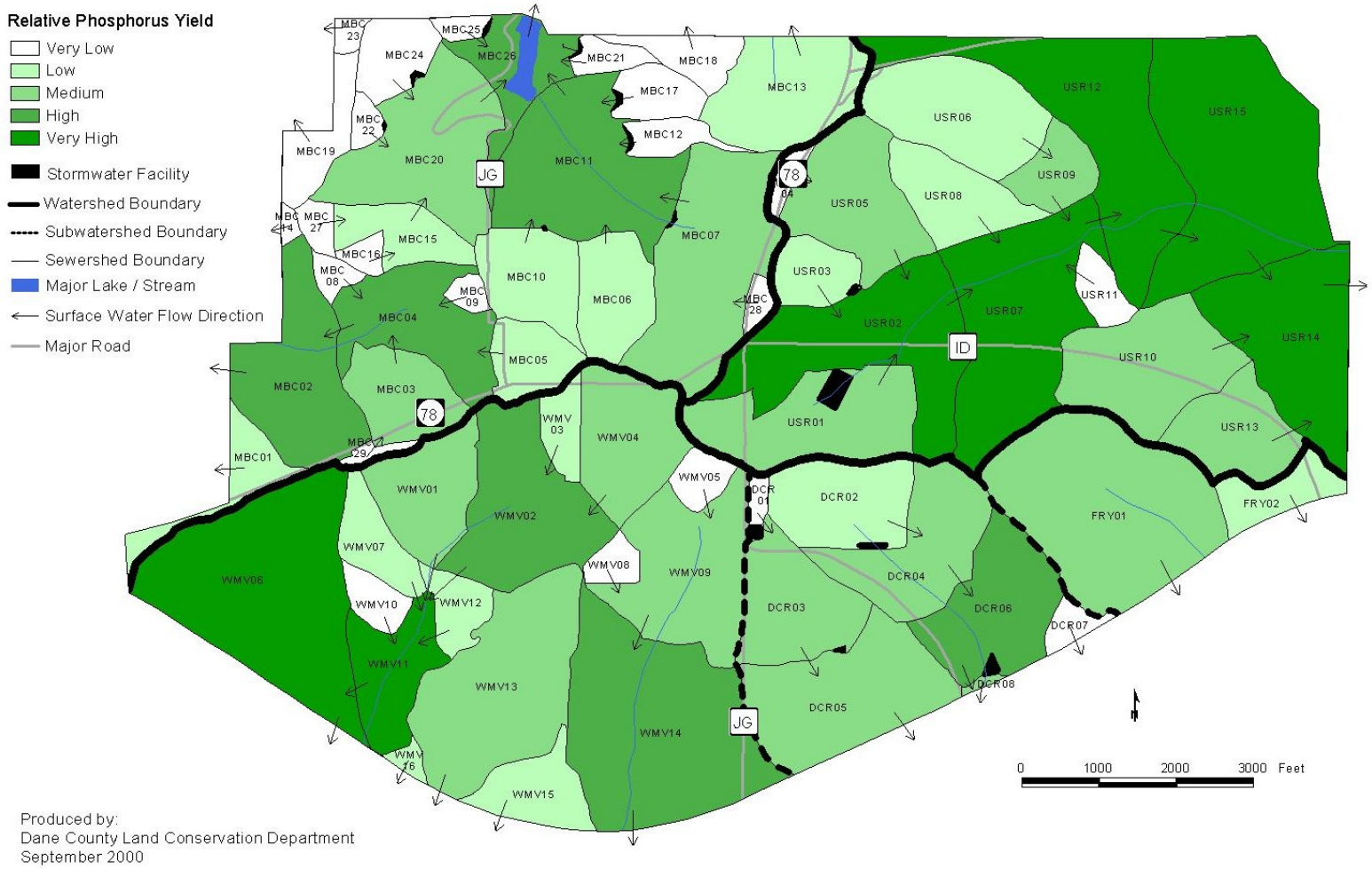

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Table 4-4. Summary of P8 Model results for detention basins using 2000 data.

Detention Pond	Watershed	TSS Trapped (lbs/yr)	TSS Removal Efficiency	TP Trapped (lbs/yr)	TP Removal Efficiency
WASCOB #1	MBC	132.4	67.5%	0.2	24.4%
WASCOB #2	MBC	1966.3	70.7%	3.4	34.6%
WASCOB #3	MBC	1450.5	61.6%	2.1	25.7%
WASCOB #4 and 5	MBC	12269.8	67.4%	20.1	31.6%
WASCOB #7	MBC	3742.5	68.3%	6.3	32.7%
WASCOB #11	MBC	128.1	67.3%	0.2	25.8%
WASCOB #12	MBC	460.1	61.5%	0.7	21.3%
WASCOB #13	MBC	119.3	69.4%	0.2	27.8%
Liberty Basin	USR	13770.9	60.9%	19.5	25.4%
Trail View Basin	USR	3284.0	77.6%	6.3	42.9%
High School Basin	DCR	633.2	39.3%	0.5	8.4%
Athletic Field Basin	DCR	3320.3	53.2%	3.9	17.9%
Vista Ridge Basin	DCR	5037.4	35.6%	3.5	7.0%
Sutter Basin	DCR	6679.6	32.5%	4.8	6.1%

Table 4-5. Summary of P8 Model results for detention basins using 2020 data.

Detention Pond	Watershed	TSS Trapped (lbs/yr)	TSS Removal Efficiency	TP Trapped (lbs/yr)	TP Removal Efficiency
WASCOB #1	MBC	228.2	70.1%	0.4	29.0%
WASCOB #2	MBC	2069.4	70.4%	3.5	34.3%
WASCOB #3	MBC	1507.9	61.5%	2.2	25.6%
WASCOB #4 and 5	MBC	13246.8	67.1%	21.6	31.5%
WASCOB #7	MBC	4209.7	66.5%	6.9	31.1%
WASCOB #11	MBC	197.0	73.6%	0.4	33.4%
WASCOB #12	MBC	460.1	61.5%	0.7	21.3%
WASCOB #13	MBC	119.3	69.4%	0.2	27.8%
Liberty Basin	USR	13856.7	61.0%	19.6	25.4%
Trail View Basin	USR	3735.1	76.2%	7.0	41.7%
High School Basin	DCR	633.2	39.3%	0.5	8.4%
Athletic Field Basin	DCR	3431.0	53.2%	4.1	17.9%
Vista Ridge Basin	DCR	5148.5	35.6%	3.6	7.0%
Sutter Basin	DCR	10217.1	33.5%	7.1	6.3%

Thermal Considerations

Discussions about stormwater impacts often focus on flooding, erosion, and pollutants such as sediment, phosphorus, or bacteria. Urbanization results in the increase of impervious area and may result in other permanent changes including an increase in runoff volume and temperature. Research has shown that stormwater runoff from urban areas can increase the temperature of receiving waters (Galli 1990 and WDNR 1999). Aquatic organisms have specific water temperature preferences and tolerance limits. Changes in water temperature can have a serious impact on aquatic ecosystems. Not only do impervious surfaces prevent infiltration, they often warm stormwater as it runs off. Unshaded rooftops, parking lots, and other impervious areas can be warmer than fields and forests and consequently can heat the stormwater passing over them even before it reaches a stream or lake. Research has found that the average stream temperature increases directly with the percentage of impervious cover in the watershed. One study documented a temperature difference of almost 20° F between a wooded section of a Maryland stream and an open section of the same stream 7/10ths of a mile downstream. Furthermore, trees shade waterbodies keeping them cool, while development often replaces trees with impervious surfaces (Lehner et al. 1999). As development increases, the cumulative impact from hundreds of individual development sites will slowly increase water temperature and may affect the entire stream. Impacts of the temperature generally depend on the distance of the outfall to the stream. The longer the distance from the urban outfall to the stream the less the impact of the runoff temperature will have on the receiving stream.

In Mount Horeb, all the stormwater is discharged to streams or stream segments that are classified as either existing or proposed cold water communities by WDNR and thus may be more susceptible to thermal impacts. Practices such as increasing infiltration, construction of rock catchment basins, vegetative buffers or swales, deep tilling, wetland restoration creation or enhancement, as well as increasing tree canopy are all effective stormwater management practices to reduce thermal impacts.

Thermal Model Description

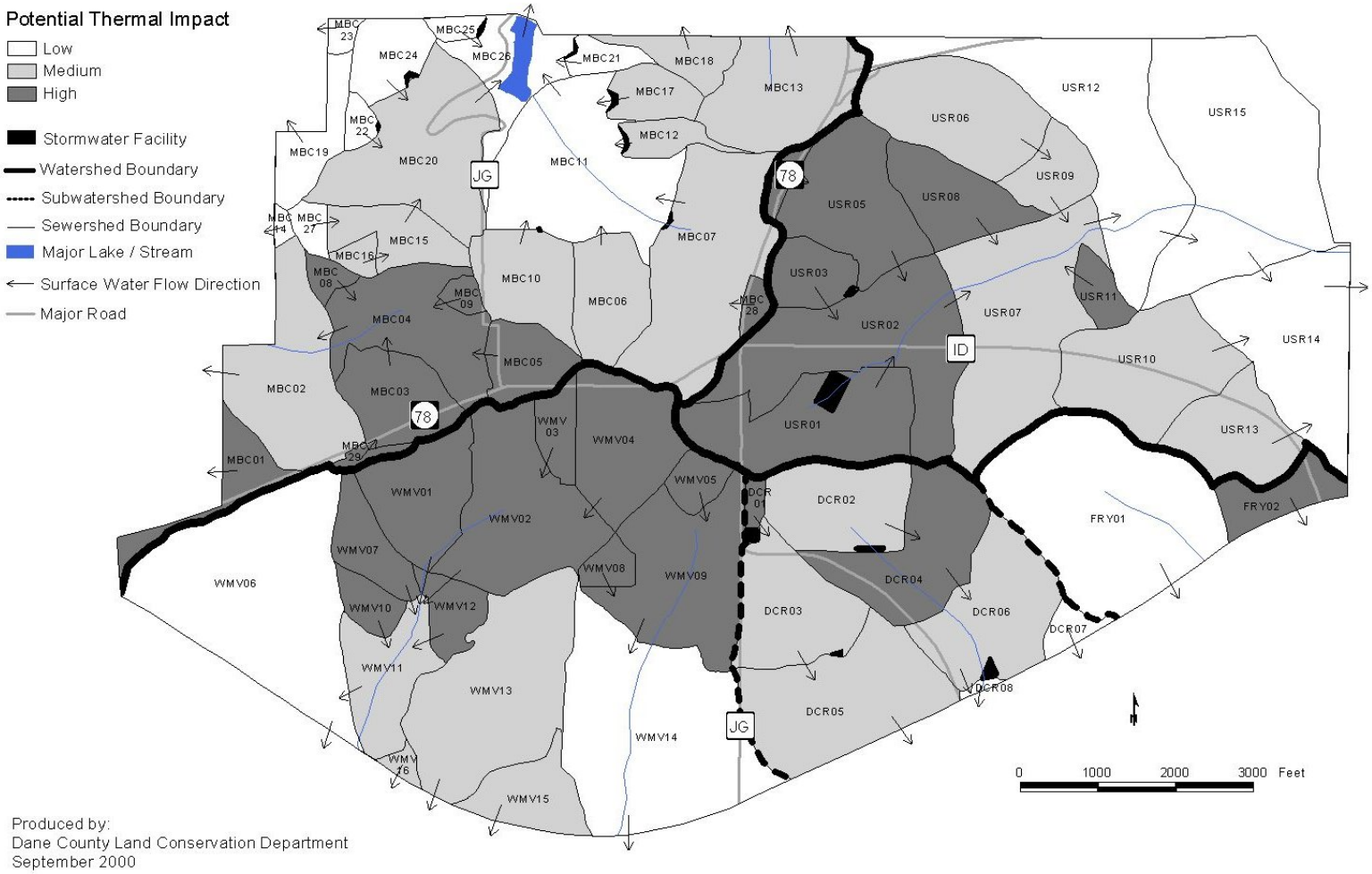
The model used to estimate thermal impacts was the Thermal Urban Runoff Model (TURM) (Norman and Roa 2000). The model was developed by the University of Wisconsin and LCD to estimate runoff temperature from urban sewersheds. It accounts for the fact that stormwater not only picks up heat from impervious surfaces but that stormwater cools these surfaces and reduces the ability of the impervious surface to heat the runoff from additional rainfall. Other model considerations include the amount and temperature of impervious area, ambient air temperature, gain or loss of heat through passage of water through streams or detention basins, gain or loss of heat due to tree canopy, heat loss through evaporation, and the time and duration of storm events (see Appendix B for a more detailed description of TURM). Preliminary data from TURM indicates that stormwater runoff from highly urbanized areas has the potential to increase the temperature of receiving waters as much as 23° F.

Currently, model limitations include the fact that it does not route temperature values from one sewershed to another. Therefore, the thermal impact of a particular sewershed to a receiving water may vary depending on thermal attenuation that may occur in downstream sewersheds. The model results are only based on summer months (June, July, August, September) the months with the highest rainfall and highest temperatures on impervious surfaces. Runoff volumes for development were calculated using 0.5-inches of runoff over 4 hours. The ratio of rainfall depth to percent of imperviousness was used to compute the flow rate to the outfall of each sewershed

Thermal Model Results

TURM was run on each sewershed using inputs of acres, impervious fraction (percentage of impervious cover) and 0.5-inches of runoff over a 4 hour duration. The model results were classified as low, medium, or high depending on the temperature increase in the runoff of each sewershed (Figure 4-7). In general, the results show that stream water temperature is strongly affected by changes in land use from rural to urban. Sewersheds MBC04, MBC05, MBC29, USR04, USR11, DCR01, WMV01, WMV04, and WMV07 have the highest potential thermal contribution and may require structures to reduce the runoff temperature.

Figure 4-7. Potential Thermal Contribution by Sewershed



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Chapter V

RECOMMENDATIONS

This chapter outlines recommendations for managing existing and proposed stormwater issues for the Village of Mount Horeb. They are grouped into non-structural recommendations which include education and administrative management (street sweeping frequency, sand/salt usage etc.) or structural recommendations which include the construction of stormwater Best Management Practices (detention basins, grassed swales, etc.).

Non-Structural Recommendations

The village's current housekeeping measures are satisfactory based on the objectives of the plan. As reported by the Director of Public Works, the village's street sweeping, curb side brush pick up, and leaf collection regimes are regularly implemented. The village maintains its storm sewers, ditches and catch basins, and has a program for checking street conditions and cleaning up debris following storms.

1. Update the Mount Horeb Code of Ordinances to Reflect Revised Stormwater Standards

The Mount Horeb Code of Ordinances should be amended to include stormwater management provisions meeting or exceeding standards in the proposed Dane County Erosion Control and Stormwater Ordinance. The village will need to decide whether or not to adopt a chapter solely dedicated to stormwater management, or add stormwater standards to the existing Chapter 20 (construction site erosion control). There are advantages to each approach – a combined stormwater management/erosion control ordinance is easier for permittees to determine regulation requirements while a chapter dedicated solely to stormwater management may clarify permanent and temporary practice requirements.

The following requirements which are included in the proposed Dane County Erosion Control and Stormwater Management Ordinance will need to be addressed in the Village of Mount Horeb Code of Ordinances.

- Require watershed size for drainage areas affected by a development project.
- Require fertilizer and seeding rates, date, and schedule for site stabilization.
- Prevent gully erosion by applying minimum standards for sheet and rill erosion: 7.5 tons/acre/year.
- Require no increase in peak discharges for 2- and 10-year, 24-hour storm events and that all designs must safely pass the 100-year, 24-hour storm.
- Calculate detention requirements according to the methods described in TR-55; change the village's pre-development runoff curve number for agricultural land from 70 to 51, 68, 79, 84 for soil hydrologic groups A, B, C, and D, respectively.
- Require that stormwater controls be implemented on sites with a new impervious surface area of 20,000 ft^2 or more.
- Require the treatment of the first 0.5 inches of runoff from commercial and industrial developments and all other uses where the potential for pollution by oil and/or grease exists
- Include provisions and practices to reduce temperature of runoff for sites located within a watershed or a stream identified by the WDNR as either an existing or proposed cold water community

2. Improve Enforcement of Construction Site Erosion Control Ordinance

Construction site erosion has been identified as a significant source of suspended solids in runoff in the United States (Owens et al. 2000). When erosion is compared on a rate basis, construction site erosion generates more erosion in a short time period that any other land disturbing activity (Johnson and Juengst 1997). Therefore, strict enforcement of erosion control plans is a vital component of any stormwater management program. In addition, monitoring for plan implementation and maintenance is a necessity.

The village is encouraged to adopt an aggressive enforcement policy. If a building inspector identifies that a plan is in noncompliance, a warning should be issued to the permittee. If the plan is not brought into compliance in the specified time frame, the building inspector should issue a stop-work-order. When a sediment clean-up violation occurs, the village may issue a stop-work-order immediately. Fines and other forfeitures may be used to encourage compliance.

3. Maintain Complete and Accurate Records of Stormwater Management Structures

Comprehensive planning requires accurate data including stormwater management structure information. The village is encouraged to work with its engineer to develop a complete database of all the information relating to these structures. The database should include information about each structure, including the following:

- name and location (include upstream and downstream sewersheds)
- area of sewershed draining to structure
- permanent pool area, maximum flood storage, and maximum flooded areas
- type and design of outlet
- stage storage information
- maintenance schedule

This list is not all-inclusive but shows an example of the types of information that should be readily available for all stormwater control structures. Information for new construction could be collected at the time of plat review. As the village updates information in the database, they should also update corresponding GIS layers and maps.

4. Implement Stormwater Information and Education Programs

The Village of Mount Horeb should develop and implement a stormwater information and education program to foster an understanding of the impact stormwater has on natural resources and property, and to initiate public participation in stormwater management. This section outlines broad objectives for informing village residents on ways they can minimize their respective contribution to stormwater management problems, and offers some strategies for increasing communication to citizens. These strategies are also designed to assist the village with fostering the community–wide support needed to protect and improve the health of area waterbodies.

Experience demonstrates that local governments need, and can get, the support of the broader population in addressing stormwater pollution. Individuals play a key role in reducing stormwater impacts both in their own day-to-day activities and in showing support for municipal programs and ordinances. Case studies have suggested that the effectiveness of Best Management Practices (BMPs) in other categories is often tied to the effectiveness of the public education program. Public education, outreach, and

participation form the link between the local governments and its citizens. Education programs encouraging citizens to change their habits in activities such as caring for lawns, driving and maintaining cars, and cleaning up after pets, and to contribute to cooperative efforts often form an early element of a municipal stormwater program (Lehner et al. 1999). The following are types of educational topics that can be addressed.

Promote infiltration of stormwater on private properties
- Redirect downspouts away from paved areas
- Construct rain gardens
- Keep paved areas to a minimum
- Protect slopes
- Maintain dense, healthy plant cover on yards

Encourage Pollution Prevention
- Low Maintenance / Low Input Landscaping
- Integrated Pest Management
- Vehicle Maintenance
- Home Composting

Promote Participation in Civic Activities
- Volunteer Water Quality Monitoring
- Volunteer Inspectors
- Stream and Wetland Restoration and Clean-up
- Storm Drain Stenciling
- Public Hearings

In order to be effective, informed support for the Mount Horeb Stormwater Management Plan must be widespread. Therefore, in addition to the citizens of the Village of Mount Horeb, builders and developers working in the area should be knowledgeable about the findings and recommendations found within the Mount Horeb Stormwater Management Plan.

Concepts to consider when creating an information and education strategy:

- Provide a list of contacts for assisting individuals with stormwater-related issues
- Describe the relationship between planned urbanization and stormwater management
- Provide education on the benefits and methods of increasing stormwater infiltration on annual basis to citizens and businesses
- Use local media outlets to provide regular awareness of issues concerning stormwater management and what citizens can do to help
- Utilize existing community groups that may have an inherent interest in stormwater management (i.e. Mound Vue Garden Club, Mount Horeb High School Ecology Club, Scout troops, local environmental groups)

The village should utilize all available and existing tools to implement this educational strategy and develop new outreach tools. The village should also participate with other units of government in watershed management planning activities in the Upper Sugar Watershed. Village officials should work with the Mount Horeb Mail to develop a series of media releases explaining the purpose of the plan, the recommendations contained within the plan, and ways in which citizens can become part of management solutions. Informational workshops could be presented to general audiences, or targeted to citizens or developers affected by stormwater management decisions. Stormwater issues can be added to the agenda

at public meetings, with citizens invited to comment. Mount Horeb may wish to consider forming a citizen's committee dedicated solely to stormwater management issues. Fact sheets could be included in mailings to all citizens, such as with water bills or the semi-annual municipal newsletter, or simply be made available at the Village Hall or other public areas. One of these publications advocates stenciling storm drains with the message *Dump No Waste, Drains to Stream* and a picture of a fish, or some other graphic to illustrate that stormwater flows to surface water bodies. Examples of information that could be used to create an information and education strategy are listed in Table 5-1 and the benefits of engaging in various educational activities are given in Table 5-2.

Table 5-1. Examples of information that could be used to create an information and education strategy.

Document	Source
Various stormwater fact sheets stormwater stenciling equipment and staff assistance	University of Wisconsin-Extension (UWEX) Publications Office (608) 262-3346 and Dane County UWEX (608) 224-3718
The Wisconsin Stormwater Manual	Department of Natural Resources Bureau of Watershed Management
Center for Watershed Protection	web site: http://www.cwp.org
Stormwater Strategies: Community Responses to Runoff Pollution	Natural Resources Defense Council web site: http://www.nrdc.org/water/pollution/storm/stoinx.asp
Stormwater Web Links	USEPA Office of Wastewater Management web site: http://www.epa.gov/owm/sw/links/
Education Resources	US Geological Survey Water Resources web site: http://water.usgs.gov/education.html

Table 5-2. Examples of outreach activities and benefits.

Outreach Activity	Benefits
Media Releases through the Mount Horeb Mail	Provides a cost-effective means of reaching a wide audience. Can encourage simple, individual actions with high impact, such as redirecting downspouts to pervious surfaces.
Informational Workshops (provided by UWEX)	Allows detailed information exchange between citizens and government. Can be tailored to audience.
Public Meetings (adding stormwater to agendas of already-scheduled meetings)	Increases awareness of village commitment to stormwater management without added costs.
Citizen's Committee	Encourages citizen participation in local decision-making.
Fact Sheets	Can provide detailed information, available to all citizens, in a format that is easily understood.
Storm Sewer Stenciling Activities	Encourages public participation in stormwater management while creating a permanent reminder of stormwater impacts.

Structural Recommendations

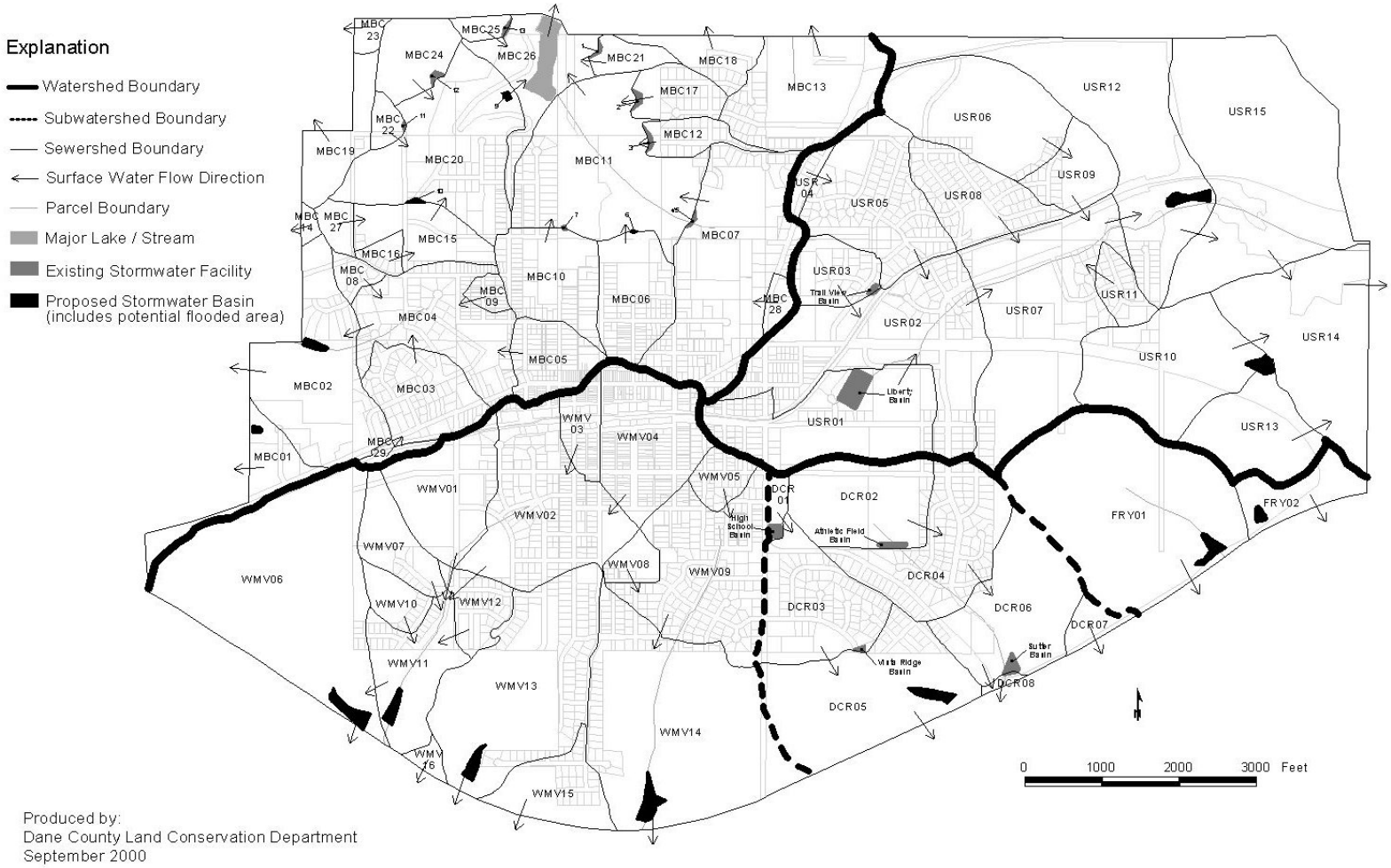
1. Modify Existing Stormwater Basins

The Village of Mount Horeb currently has six stormwater basins that are municipally owned and maintained. These basins were designed and constructed to retain stormwater runoff and release it at slow rates. For the most part, these basins were designed only to control runoff rates and not to remove suspended solids. An opportunity exists to evaluate these stormwater basins and determine cost-effective methods of retrofitting them to improve the removal of suspended solids while maintaining control of peak flow rates (Table 5-3).

Table 5-3. Recommendations for improving the existing stormwater basins to provide additional water quality benefits (for locations see Figure 5-1).

Existing Basin	Recommendations for Improvement
Liberty Basin	Runoff enters the basin only during large storm events. If all runoff in the drainage area entered the basin, the expected trapping efficiency of TSS would be 61%. Explore opportunities to direct more runoff to the basin.
Trail View Basin	The outlet of this basin currently drains through a cattle crossing and overland across a commercial lot. This lot is developed and a permanent stable easement is needed for drainage. A stone weeper should be installed around the outlet of the basin to enhance sediment trapping and prevent the outlet pipe from plugging. The minimum weeper dimensions are 1.5 feet tall, 2 foot top, and 4-inch clear stone. Considerations for thermal control should also be explored.
High School Basin	No recommendations.
Athletic Field Basin	P8 predicts that the basin has a trapping efficiency for TSS of 53%, but inlets are too close to the outlet, causing short-circuiting. One solution to this problem is to build a baffle into the basin, increasing the effective distance between the inlets and the outlet. The stone weeper at the outlet should be maintained.
Vista Ridge Basin	This basin is temporary. A permanent regional basin should be constructed that has an expected trap efficiency of 80%. Location and size of the permanent basin are described later in this report.
Sutter Basin	The modeled trapping efficiency for TSS for this basin is 32%. If a stone weeper is installed that is 2 feet tall with 1-inch clear stone in the front and 6-inch clear stone in the back, the trapping efficiency would increase to 61%. A stone basin should be installed to reduce runoff temperature.

Figure 5-1. Existing and Proposed Stormwater Basins



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2. Address Stormwater in New Development and Redevelopment

According to Dane County's proposed Stormwater and Erosion Control Ordinance it is recommended that all new development use the following criteria:

1. Implement the proposed Dane County Stormwater and Erosion Control Ordinance

   (i) Hydrologic calculations. All runoff calculations shall be according to the methodology described in the Natural Resources Conservation Service's Urban Hydrology for Small Watersheds, commonly known as TR-55, or other methodology approved by the Dane County Conservationist. For agricultural land, the maximum runoff curve number (RCN) used in such calculations shall be 51 for Hydrologic Soil Group (HSG) A, 68 for hydrologic soil group B, 79 for HSG C, and 84 for HSG D. The TR-55 specified curve numbers for other land uses should be used.

   (ii) Design standards. All stormwater facilities shall be designed, installed and maintained to effectively accomplish the following:

      (1) maintain predevelopment peak runoff rates for the 2-year, 24-hour storm event (2.9 inches over 24 hours duration);
      (2) maintain predevelopment peak runoff rates for the 10-year, 24-hour storm event (4.2 inches over 24 hours duration); and
      (3) safely pass the 100-year, 24-hour storm event (6.0 inches over 24 hour duration).

   (iii) Outlets. Discharges from new construction sites must have a stable outlet capable of carrying designed flow at a non-erosive velocity. Outlet design must consider flow capacity and flow duration. This requirement applies to both the site outlet and the ultimate outlet to stormwater conveyance or waterbody.

   (iv) Infiltration. Where possible, all downspouts and driveways and other impervious areas shall be directed to pervious areas.

2. Require a reduction of sediment loads by retaining the 5-micron particle from the developing sites.

3. Heavily disturbed sites will be lowered one permeability class for hydrologic calculations. Lightly disturbed areas require no modification. Where practices have been implemented to restore soil structure to pre-developed conditions, no permeability class modification is required.

4. Stormwater conveyance systems shall include the following design criteria: 1) the open channel should completely contain the peak flow for the 10-year, 24-hour storm event, with a retardance class of C for capacity and retardance class D for velocity within the designed channel; 2) the design storm event for the 10 year 24 hour period shall be completely contained within the pipes with no surcharging; and 3) for storms greater than the 10-year, 24-hour duration and up to 100-year, 24-hour duration measures shall be incorporated to control the out of bank flow within the identified right away.

3. Construct Remaining WASCOBs as Proposed in Stewart Lake Watershed Management Plan

As part of the Stewart Lake Watershed Management Plan (Lake (DCRPC 1995), twelve Water and Sediment Control Basins (WASCOBs) were planned for construction (for locations see Figure 5-1). Up to this date, all but three of the basins have been constructed. WASCOBs 6 and 9 should be constructed to treat the runoff from sewersheds MBC06 and MBC20 (and upstream), respectively. WASCOB 10 should be constructed as part of the proposed development in sewershed MBC15.

4. Construct New Regional Stormwater Basins

The results of the water quantity analysis showed that there will be an increase in the rate in which stormwater runs off the land due to potential development. In order to protect property and natural resources, the increased runoff rates need to be managed. It is recommended that the village construct eleven regional stormwater basins to control runoff rates (for locations see Figure 5-1). Of the eleven proposed basins, five were rated as high priority because the contributing sewersheds are expected to be developed soon. The high priority basins are those located at the outfall of the following sewersheds:

1. WMV13
2. USR10 and USR13 (two sewersheds at one outfall)
3. WMV11
4. DCR05
5. USR12

Large regional basins are recommended as opposed to small ponds because they are more cost effective to build and fewer structures are easier to maintain. Regional basins are also advantageous because larger pools of water limit the amount of re-suspension of sediment that may occur, allowing for increased trapping efficiencies.

Preliminary Regional Basin Designs

Table 5-4 outlines design and cost parameters for the proposed regional basins and was prepared using the peak runoff rates and runoff volumes results from TR-55. The proposed basins were preliminarily designed to the minimum size necessary to provide an 80% reduction in TSS by retaining the 5-micron particle and to reduce the peak runoff rate for the 10-year storm event to pre-developed conditions.

Table 5-4. Storage volume, land area requirement, and estimated cost for proposed basins.

Sewershed at Outfall	Sewersheds Draining to Outfall	Drainage Area	Required Storage (ac-ft)	Estimated Flooded Acres	Estimated Land Requirement	Estimated Cost of Construction
MBC01	MBC01	21.1	2.0	0.5	1.0	$29,700
MBC02	MBC02, MBC03, MBC04, MBC05, MBC08, MBC09, MBC29	188.2	2.0	0.5	1.0	$55,700
USR10 / USR13 (combined)	USR10, USR13	101.9	17.6	2.4	4.8	$117,800
USR12	USR01, USR02, USR03, USR04, USR05, USR06, USR07, USR08, USR09, USR11, USR12	566.5	6.5	1.5	3.0	$92,700
DCR05	DCR01, DCR03, DCR05	127.9	8.3	2.5	5.0	$107,700
FRY01	FRY01	123.7	9.1	1.8	3.6	$89,400
FRY02	FRY02	20.8	2.2	0.6	1.2	$33,500
WMV06	WMV06	130.9	12.3	2.1	4.2	$111,700
WMV11	WMV01, WMV02, WMV03, WMV04, WMV07, WMV10, WMV11, WMV12	258.2	1.8	0.6	1.2	$69,000
WMV13	WMV13	93.7	6.3	1.0	2.0	$68,100
WMV14	WMV05, WMV08, WMV09, WMV14	215.7	17.4	2.4	4.8	$132,600

Runoff volumes for year 2020 and peak flow rates for year 2000 and year 2020 (see Table 4-1 and Table 4-2 in Chapter IV) were used to relate peak outflow rate (Q_o) to the peak inflow rate (Q_i) and the storage volume (V_s) to runoff volume (V_{ro}) for each design storm event. The required basin outflow rate for trapping the 5-micron particle was calculated by using the peak inflow rate of the 1-year storm event and settling time necessary for the particle to fall out of suspension. Finally, required basin storage volumes were estimated using floodrouting methodology from TR-55.

The equation to design basin outlets for 5-micron particle settling:

$$\frac{V_{ro}\text{ (1-year storm)}}{\text{Settling Time (5}\mu\text{m particle)}} = Q_o \text{ (Outflow Rate of Basin)}$$

After estimating storage volumes for the 2- and 10-year storm events and 5-micron particle settling, the largest required volume was selected. This volume was multiplied by 1.66 to account for the extra storage necessary to provide both flood retention and particle settling. Potential basin dimensions were estimated using the total basin volume required and the 10-foot elevation contour data. From these dimensions, the area that would be flooded by large storm events was calculated. The land area needed to be purchased by the village to construct the proposed basins was assumed to be two times the estimated flooded area.

Cost estimates for the proposed basins were calculated using assumptions for: 1) land costs; 2) cost of excavation 3) inlet and outlet construction costs; 4) design costs; 5) fencing costs; 6) access road costs; and 7) costs to seed and mulch (see Table 5-4). The assumptions were developed using information from similar projects in consultation with the Village Administrator and the Village Engineer. For a detailed breakdown of specific cost assumptions see Appendix B.

5. Construct Regional Temperature Reduction Structures

The Thermal Urban Runoff Model (TURM) analysis showed that there is an increase in runoff temperature due to proposed future land use changes (urban development). In order to protect the cold water streams and natural resources, increased runoff temperature needs to be reduced.

It is recommended that the village construct eleven rock catchment basins connected with the proposed regional stormwater basins. Rock catchment basins are designed to minimize thermal impacts during the first 30 minutes that runoff is generated. The catchment basins are planned to be constructed on the same land as the regional ponds. This will reduce the amount of land that is required for construction and locates the basins where they can easily be maintained.

Preliminary Temperature Reduction Structure Designs

The first 0.5 inches of runoff was used to estimate the potential increase in stormwater runoff temperature from year 2020 land use / land cover data. Rock catchment basins were designed to reduce runoff temperature and to allow no more than a 6˚ F increase in a 58˚ F stream temperature (assumed average summer stream temperature). In order to be conservative, the model assumed a maximum base flow of 1.5 cfs for all streams. The volume of the rock catchment basins (V_{rock}) was calculated using an assumed rock size of D_{50} = 6 inches and a volume of rock assumed to have 50 % pore space. The temperature of the rock in the basin was assumed to be 50˚ F and will absorb heat from warmer runoff water, cooling the runoff. Eventually, the rock in the basin will become the same temperature as the runoff water. Due to

the warming of the basin rock and the limited size of the rock catchment basin, the catchment basins are expected to only treat the first 30 minutes of a runoff event.

Table 5-5 shows the results of the TURM model - including the proposed volume of rock required for the catchment basins, assuming a minimum 2-foot depth.

Table 5-5. Proposed thermal reduction and volume requirements for rock catchment basins.

Sewershed at Outfall	Drainage Area (acres)	Composite Impervious Fraction	Time of Concentration (hours)	Temp. of Runoff to Basin (˚ F)	Temp. at Outlet of Basin (˚ F)	Thermal Reduction (˚ F) (from Basin)	Volume of Rock (cubic feet)
MBC01	21.1	57%	0.14	81.8	63.5	18.3	3,000
MBC02	188.2	26%	0.34	81.8	65.2	16.6	4,000
USR10 / USR13	101.9	65%	0.18	81.4	65.9	15.5	4,000
USR12	566.5	41%	0.2	81.8	66.9	14.9	8,000
DCR05	127.9	26%	0.27	81.8	64.0	17.8	4,000
FRY01	123.7	16%	0.56	82.1	64.4	17.7	4,000
FRY02	20.8	59%	0.17	81.7	63.3	18.4	3,000
WMV06	130.9	36%	0.23	81.7	65.5	16.2	3,000
WMV11	258.2	43%	0.41	81.9	68.2	13.7	6,000
WMV13	93.7	22%	0.23	81.7	64.3	17.4	3,000
WMV14	215.7	17%	0.31	82.1	64.2	17.9	3,000

Table 5-6 shows the volume of rock necessary and the estimated costs for the proposed rock catchment basins. For a detailed breakdown of specific cost assumptions see Appendix B.

Table 5-6. Storage volume, land area requirement, and estimated cost for proposed rock catchment basins.

Sewershed at Outfall	Sewersheds Draining to Outfall	Drainage Area (acres)	Required Rock Basin Area (square feet)	Estimated Cost of Construction
MBC01	MBC01	21.1	1,500	$16,900
MBC02	MBC02, MBC03, MBC04, MBC05, MBC08, MBC09, MBC29	188.2	2,000	$22,200
USR10 / USR13 (combined)	USR10, USR13	101.9	2,000	$22,200
USR12	USR01, USR02, USR03, USR04, USR05, USR06, USR07, USR08, USR09, USR11, USR12	566.5	4,000	$43,500
DCR05	DCR01, DCR03, DCR05	127.9	2,000	$22,200
FRY01	FRY01	123.7	2,000	$22,200
FRY02	FRY02	20.8	1,500	$16,900
WMV06	WMV06	130.9	1,500	$16,900
WMV11	WMV01, WMV02, WMV03, WMV04, WMV07, WMV10, WMV11, WMV12	258.2	3,000	$32,900
WMV13	WMV13	93.7	1,500	$16,900
WMV14	WMV05, WMV08, WMV09, WMV14	215.7	1,500	$16,900

Special Recommendations - Village Compost Site Modifications

The village compost site is located southwest of the village limits, outside the study area boundary for this plan. However, it was decided that recommendations for managing the compost site should be included in this comprehensive stormwater plan because the site poses a potential threat to the water quality of the West Branch Sugar River, located immediately downstream of the site. A sign at the site states which materials are allowed at the site and which are prohibited; however, there is no enforcement of these restrictions and the site has unrestricted access from Docken Road. Therefore, the compost site receives a variety of unwanted materials from unmonitored dumping. Within the site, there are no clear instructions on where different materials should be dumped. The following recommendations for managing the compost site, address the types of materials entering the site and/or are intended to control runoff exiting the site.

Village compost site looking east from Docken Road.

1. Construct a berm between the compost site and the West Branch Sugar River to prevent polluted runoff from reaching the stream. This will help to protect the water quality of the stream.

2. Erect a fence around the perimeter of the site or along Docken Road to limit public access. This should deter illicit dumping and simplify monitoring efforts at the site.

3. Limit access to the site to specific hours, convenient for village staff and acceptable to residents. For example, the site could be open from 1:00 pm - 4:00 pm daily, and then 8:00 am -12:00 pm on Saturday. By setting defined hours for dumping, citizens will be more aware that this is an actively managed site. Limiting access to prescribed times will encourage citizens to find other ways to dispose of their waste, such as using curbside pick up for brush and leaves. Village staff have expressed a preference for curbside yard waste pick up because it is often a more efficient way to manage the waste.

4. Within the site, clearly define and mark areas within the site that are to receive different kinds of materials. This will help prioritize composting efforts by separating materials that can decompose rapidly from more slowly degrading materials. Increased management within the site will reinforce to residents that this is an actively managed and maintained site.

Chapter VI

FUNDING OPTIONS

In order to implement the stormwater management plan recommendations, funding mechanisms need to be in place. The costs of stormwater infrastructure for new developments can be included in the price of the development through subdivision fees or impact and in-lieu fees. However, Mount Horeb will likely need to finance the continuing expenses associated with program administration and some elements of infrastructure operation and maintenance. While the general fund is the obvious source of revenue to cover these costs, there are also alternative sources (Table 6-1). This plan does not advocate the use of one funding source over another and only provides this list as a guide for fiscal decision-making for the future.

Table 6-1. Stormwater management funding sources.

Funding Alternatives	**Program Elements**		
	Management, Administration and Practice Design	Construction of Practice(s) and Infrastructure	Operation and Maintenance
Fees/Penalties/Fines	X		
General Fund	X	X	X
Grants	X	X	
Special Assessments	X	X	X
Subdivision Exactions/ Fees-In-Lieu	X	X	X

Description of Funding Alternatives:

Fees/Penalties/Fines — Municipalities may charge for permit review, stormwater control plan review, inspections, permit processing, and expansion of government services to new users (impact fees). Plan review and inspection charges may be in the form of a set fee, or charging developers the hourly rate of an independent engineering or inspecting firm. Penalties and fines for non-compliance with the stormwater management standards may supplement income in this area.

General Fund/ Property Tax — Property tax revenue is placed in a general fund to be used by the town or village for all municipal programs and projects. The general fund is the most common way of funding stormwater projects and infrastructure operation and maintenance.

Grants — Communities may be eligible for Local Water Quality Management Planning Aids from the WDNR, and/or a variety of Federal grants from agencies such as the EPA, USDA, and DOT. For more information, visit the DNR website, www.dnr.state.wi.us, the EPA's *Catalog of Federal Funding Sources for Watershed Protection, Second Edition* at www.epa.gov/owow/watershed/wacademy/fund.html, and the federal governments *Catalog for Federal Domestic Assistance* at www.cfda.govT.

Special Assessments	An area is designated “special” for a specific reason, and assessed for the purpose of charging a targeted tax.
Subdivision Exactions	As a condition of approval for development, municipalities can require developers to construct stormwater management facilities, to operate and maintain them during development, and to dedicate them to the village upon completion. Municipalities may also require developers to donate easements or parcels of land for stormwater purposes.
Fees-in-Lieu of On-Site Detention	In-lieu fees allow the developer to pay a fee rather than instituting on-site control measures on a site where stormwater controls may be difficult to implement. For example, if an ordinance requires on-site water detention for sites disturbing more than 5 acres, fees-in-lieu of detention allow the developer to pay the municipality a fee that can be put in a dedicated fund for the construction, operation, and maintenance of regional or multipurpose detention facilities.

Chapter VII

CONCLUSIONS

This document outlines a comprehensive stormwater management plan for the Village of Mount Horeb. The plan presents both non-structural and structural recommendations to address existing and future stormwater issues. Major findings of the plan include the following.

- The village is currently not in compliance with the existing Dane County Erosion Control Ordinance or the proposed Stormwater Management Ordinance. The village's erosion and stormwater ordinances should be amended to reflect updated performance standards. In addition, enforcement of ordinances should be improved.

- The report also included suggestions to improve non-structural practices. Although, the municipal operations of the village are satisfactory and do not significantly contribute to stormwater problems, there are opportunities for the village to develop information and education materials pertaining to stormwater management.

- Existing stormwater facilities should be modified. Modifications are small and may be completed by village staff at minimal cost.

- Through water quantity and quality modeling for current and future conditions, it is recommended that eleven regional stormwater basins be constructed to improve water quality and release runoff at reduced rates. Five regional basins were identified as a priority. The total cost to construct these priority basins is approximately $455,000.

- Thermal pollution from runoff has been identified as a concern. In Mount Horeb, all the stormwater is discharged to streams or stream segments that are classified as either proposed or existing cold water community by WDNR and thus may be more susceptible to thermal impacts**.** It is recommended that eleven thermal reduction structures be constructed and incorporated into the proposed regional stormwater basins.

- A special recommendation was made for the village compost site which included limiting access to the site and constructing a berm between the site and the West Branch Sugar River to minimize stormwater impacts.

- Options to fund the recommendations in this report were discussed. They include fees, general fund, grants, special assessments, subdivision exactions, and fees in lieu of detention.

In summary, the plan outlines a comprehensive stormwater management strategy for the entire village and predicted growth areas. Implementing the recommendations in the report will reduce or prevent problems due to the quantity, quality, and temperature of stormwater runoff.

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