

**RICHFIELD-BLOOMINGTON WATERSHED
MANAGEMENT PLAN**

PREPARED FOR THE

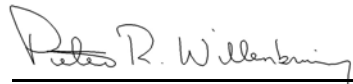
**RICHFIELD-BLOOMINGTON
WATERSHED MANAGEMENT ORGANIZATION**

**Final Plan
July 2008**

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



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I. EXECUTIVE SUMMARY

The Richfield-Bloomington Watershed Management Organization (RBWMO) has prepared this Comprehensive Watershed Management Plan in accordance with Minnesota Rules Chapter 8410, "Metropolitan Area Local Water Management", as administered by the Minnesota Board of Water and Soil Resources.

The Richfield-Bloomington Watershed Management Organization was formed on December 19, 1983, through a joint powers agreement under the authority conferred to the member parties in 1982 through Minnesota Statutes Chapters 471.59, 473.875 to 473.883 (The Metropolitan Surface Water Management Act). The agreement was amended and bylaws were adopted January 23, 1984. The Organization's purpose is to preserve and use natural water storage and retention systems within the Richfield-Bloomington Watershed to meet the purposes set forth in the Surface Water Management Act. The Joint Powers Agreement that established the Richfield-Bloomington WMO is included in **Appendix A** of this plan.

The Richfield-Bloomington Watershed is located in the central portion of the Minneapolis-St. Paul seven county metropolitan area. The watershed covers 7.55 square miles and is located entirely within Hennepin County (**Figure I-1**). Portions of two local governmental units are within the watershed and are listed below:

LOCAL UNITS OF GOVERNMENT

Local Government Unit	Area Within Watershed (Square Miles)	Percent of Watershed
Richfield	4.25	56%
Bloomington	3.3	43%

A Board of Commissioners has been established as the governing body of the Richfield-Bloomington Watershed Management Organization. The Board of Commissioners is comprised of all City Council Members in the Cities of Richfield and Bloomington. Five members represent the City of Richfield, and seven members represent the City of Bloomington. The Richfield-Bloomington Watershed Management Organization administrative contacts are as follows:

Executive Director:
Kristin Asher, PE
Richfield Assistant City Engineer
6700 Portland Avenue South
Richfield, MN 55423
Phone: (612) 861-9792

Assistant Executive Director:
Scott Anderson, PE
Bloomington Sr. Civil Engineer
1700 West 98th Street
Bloomington, MN 55431
(952) 563-4867

SECTION I

The duties of the organization, as enacted by the Board, are as follows:

- Prepare and adopt a watershed management plan meeting the requirements of Minnesota Rules Chapter 8410.
- Review and approve local water management plans as defined in Minnesota Rules Chapter 8410.
- Exercise the authority of a Watershed District or Watershed Management Organization under Minnesota Statutes Chapter 103B to regulate the use and development of land when:
 1. A local water management plan has not been approved and adopted.
 2. A local permit requires an amendment to or variance from the local water management plan.
 3. The Board has been authorized by the local government to require permits for land use.

As identified in the Joint Powers Agreement, personnel of the Cities may be utilized, but no additional compensation will be paid by the WMO. The Board will determine how specific costs, personnel requirements, contracting and bid responsibilities, and other expenses and requirements shall be shared by the Cities, with preference given to a reasonable geographic division.

Under Minnesota Rules Chapter 8410, requirements are outlined for preparing watershed management plans within the Twin Cities Metropolitan Area. Pursuant to the requirements of the law, the plan must focus on preserving and using natural water storage and retention systems to:

- Reduce, to the greatest practical extent, the public capital expenditures necessary to control excessive volume and rate of runoff.
- Improve water quality.
- Prevent flooding and erosion from surface flows.
- Promote ground water recharge.
- Protect and enhance fish and wildlife habitat and water recreational facilities.
- Secure the other benefits associated with the proper management of surface water.

To ensure that these goals are realized, the Metropolitan Surface Water Management Act further specified the basic contents of the watershed management plan.

SECTION I

According to these rules, the watershed management plan shall:

- Describe the existing and physical environment, land use and development in the watershed, as well as the environment, land use, and development proposed in existing local and metropolitan comprehensive plans.
- Present information on the hydrologic system and its components, including any drainage system previously constructed under Minnesota Statutes Chapter 106 (the Public Ditch Laws), and existing and potential problems related thereto.
- State goals and policies, including management principles, alternatives and modifications, water quality, and protection of natural characteristics.
- Set forth a management plan, including the hydrologic and water quality conditions that will be sought and the significant opportunities for improvement.
- Describe the effect of the plan on existing drainage systems.
- Describe conflicts between the watershed plan and existing plans of local government units.
- Set forth an implementation program that is consistent with the management plan and which includes a capital improvement program, as well as standards and schedules for amending the comprehensive plans and official controls of local government units in the watershed to bring about conformance with this watershed plan.

This watershed management plan is divided into the following major sections:

- I. Executive Summary
- II. Land and Water Resources Inventory
- III. Goals and Policies
- IV. Problems and Corrective Actions
- V. Implementation Program/Priorities
- VI. Impact on Local Unit of Government
- VII. Amendment Procedures
- VIII. References/Supplemental Documents
- IX. Glossary

The Executive Summary (**Section I**) states the authority and composition of the Richfield-Bloomington Watershed Management Organization, the purpose of the Surface Water Management Act and the components of this watershed management plan.

The Land and Water Resources Inventory (**Section II**) includes a profile of the watershed's existing environmental conditions. This profile contains descriptions of the area's physiography, topography, soils, land use, and metropolitan systems such as public utilities. This section also contains the information necessary to model the hydrologic system such as watershed and subwatershed boundaries, wetlands, water bodies, conveyance systems and flood plains. Surface and ground water quality, ground water recharge areas, water use and water quality guidelines are also included.

SECTION I

The Goals and Policies Section (**Section III**) describes the goals and policies of the Watershed Management Organization. The goals reflect the purposes set forth in the Surface Water Management Act. Policies developed by the Richfield-Bloomington Watershed Management Organization define the goals and provide a framework in which to address water management issues.

Problems and Corrective Actions (**Section IV**) discusses water resource management issues and identifies the strategies developed for each issue and defines the course of action the Organization will follow to address each issue. Implementation procedures explain how the strategies will be put into effect. Potential impacts associated with each identified alternative are evaluated.

The Implementation Program/Priorities (**Section V**) consists of non-structural, structural, and programmatic solutions to the problems, issues, and goals identified in Section III and Section IV.

The Impact on Local Government (**Section VI**) discusses the conformance of local governmental water resource management plans to this watershed management plan.

The Amendment Procedures (**Section VII**) discusses a procedure to be followed should it be necessary to amend this plan. This procedure would be invoked only for major changes that would directly affect water resource management within the member cities.

References (**Section VIII**) contains a list of all documents incorporated into this plan by reference or other documents which are referred to in this plan as containing information helpful in the management of WMO water resources.

The Glossary (**Section IX**) contains a list of terms used in this plan and their definitions.

**Figure I-1
Watershed Location Map**

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II. LAND AND WATER RESOURCE INVENTORY

As required in Minnesota Rules Section 8410.0060, this section of the plan provides a general description and summary of the climate, geology, surficial topography, surface and ground water resource data, soils, land use, public utility services, water-based area land ownership, fish and wildlife habitat, unique features, scenic areas, and possible pollutant sources. This section also identifies where detailed information can be obtained for many of these areas of concern. This information is provided to the extent necessary to provide guidance to the RBWMO in managing water resources and is not intended to be used for final design or construction within the RBWMO.

A. CLIMATE

The climate within the Minneapolis/St. Paul metropolitan area is described as a humid continental climate with moderate precipitation, wide daily temperature variations, warm humid summers and cold winters. The changeable weather in the Twin Cities is influenced by cold air masses from the north and warm (moist or dry) air from the south and southwest. Successive high and low pressure systems migrate across the area causing fluctuations in temperature, wind direction, cloud cover, and precipitation.

Seasonal temperature variation is quite large and is characterized by long, cold winters and generally mild, subhumid summers. **Table 1** shows the seasonal temperature fluctuation at the Twin Cities International Airport, the closest weather monitoring station to the Richfield-Bloomington Watershed. Mean temperatures range from a high of 73.6 F in July to a low of 11.8 F in January.

The prevailing winds are northwesterly in the winter and spring and shift to east and southeasterly in summer and fall. The average annual wind speed is close to 10 miles per hour. Winds may vary locally, however, due to such features as topography, land use, and water bodies.

B. PRECIPITATION

Precipitation patterns are influenced by moisture from the Gulf of Mexico. Precipitation occurs as rain, freezing rain, hail, and snow. Occasional tornadoes, severe thunderstorms, and hailstorms occur and are of short duration.

The total average annual precipitation is approximately 31 inches, of which approximately one-third occurs in the months of June, July, and August. The annual snowfall average is about 50 inches and is equivalent to approximately five inches of water. The average monthly temperature, precipitation, and snowfall are included in **Table 1**. A rainfall event having a 99% chance of occurrence is approximately 2.4 inches. A rainfall event having a 1% chance of occurrence is approximately 6.0 inches. The 1%, 10-day runoff is 7.2 inches. **Figures 2 and 3** show the 1% rainfall event and the annual normal precipitation within the State of Minnesota. **Table 2** outlines the rainfall events typical for the Richfield-Bloomington Watershed. Other additional climatological information for the area can be obtained from the U.S. Weather Bureau Technical Paper 40.

**TABLE 1
PRECIPITATION AND CLIMATE INFORMATION**

Weather Station	Unit Measured	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mpls-St. Paul International Airport	¹ Mean Temperature (°F)	12.80	16.90	29.80	45.90	58.10	67.80	73.20	70.70	61.50	49.80	33.00	19.30	44.90
Mpls.-St. Paul International Airport	¹ Mean Precipitation (inches)	0.95	0.88	1.94	2.42	3.39	4.05	3.53	3.62	2.72	2.19	1.55	1.08	28.32
Mpls.-St. Paul International Airport	¹ Mean # of Days w/0.10 inches or greater precipitation	4	3	4	6	7	7	5	5	6	6	3	4	59
² Hydrology Guide for Minnesota	Mean free water surface evaporation (inches) /month	0.36	0.72	1.45	3.25	5.00	5.75	6.50	5.40	3.60	2.50	1.05	0.36	36

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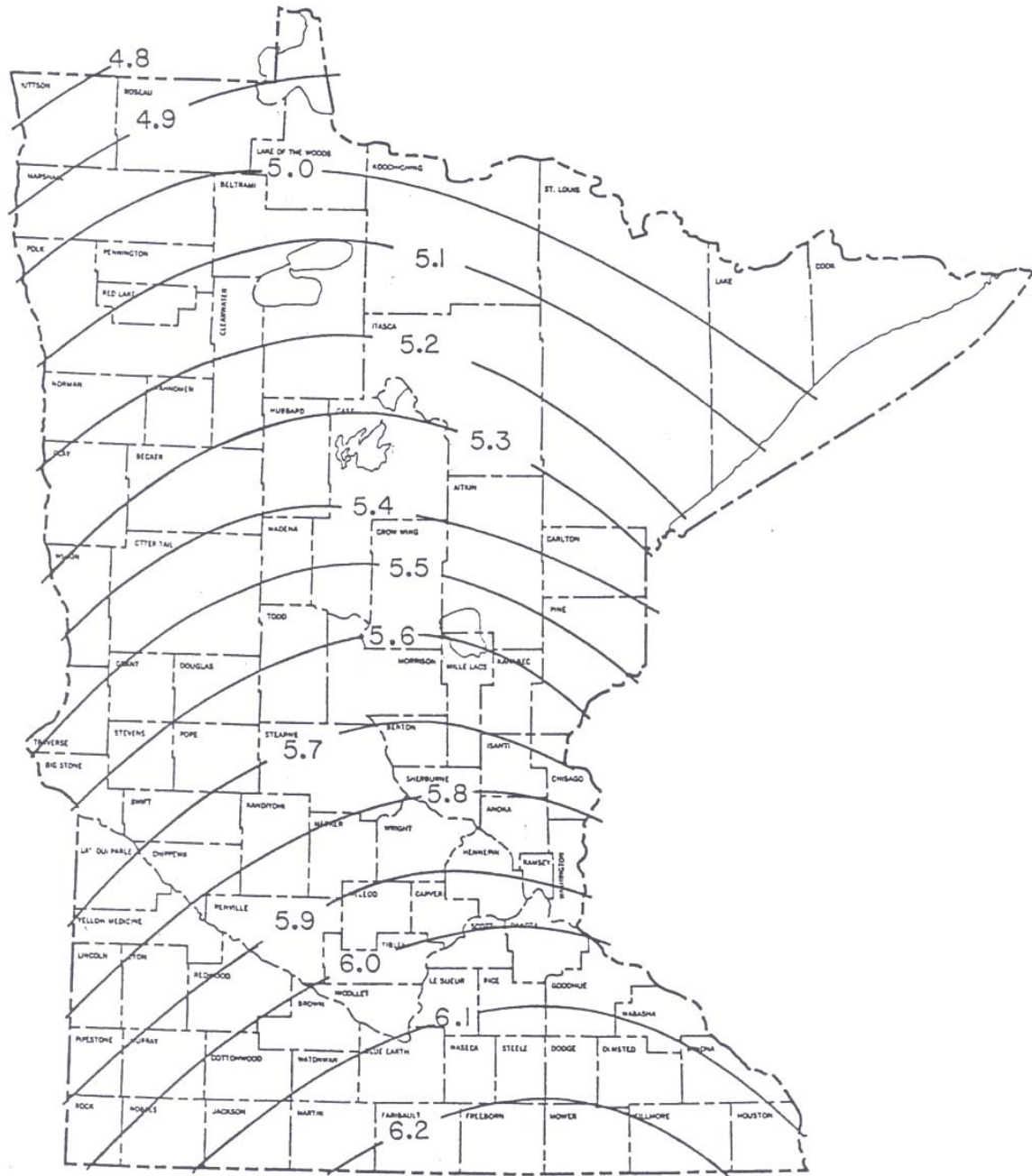
¹Source: U.S. Department of commerce, National Climatic Data Center, 1984

²Source: NOAA Technical Report NWS 34

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Figure 2

24-Hour, 100-Year Precipitation Event in the State of Minnesota

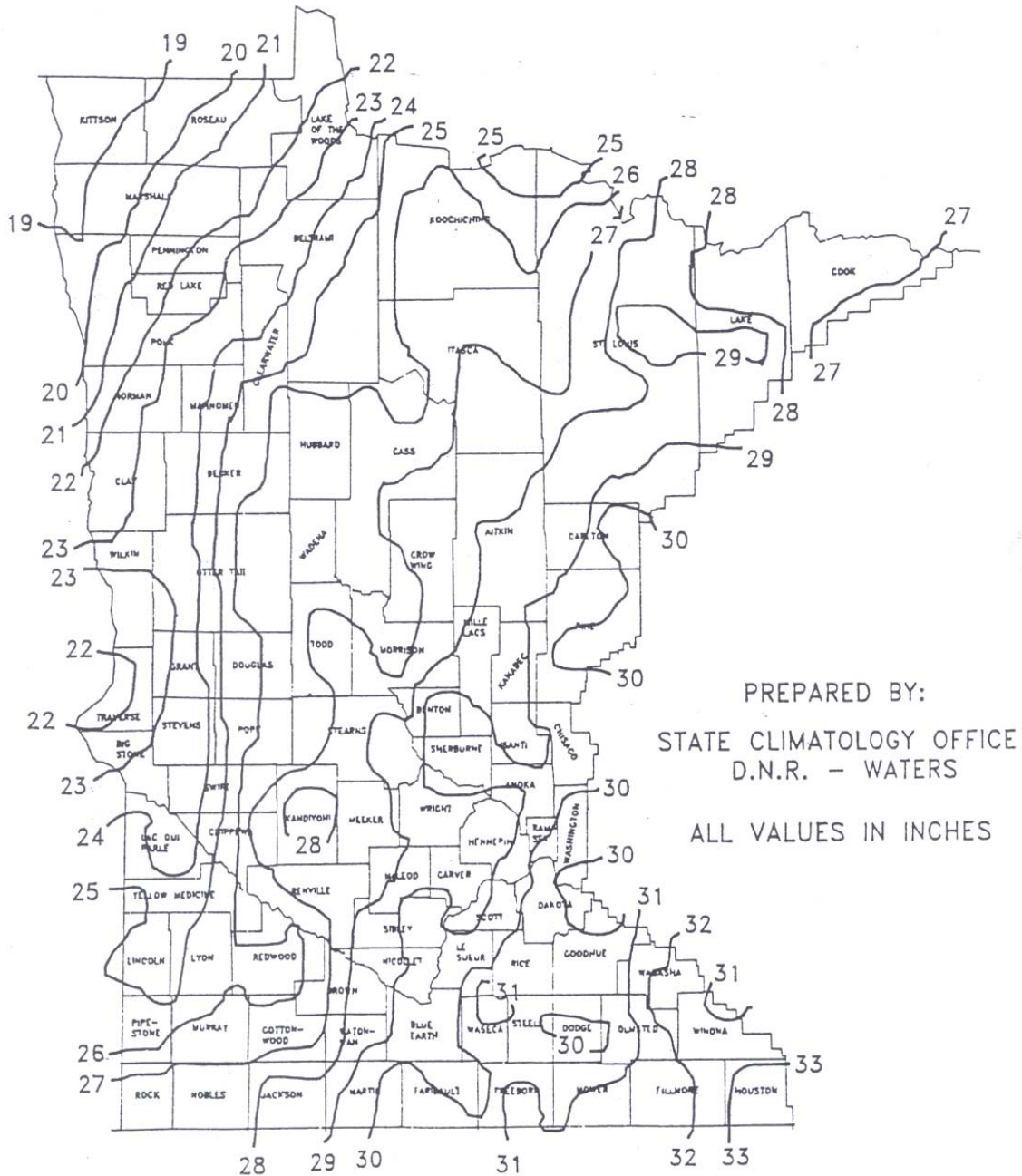


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SECTION II

Figure 3

Average Annual Rainfall in Minnesota



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Figure 3

SECTION II

TABLE 2

RAINFALL EVENTS FOR THE RICHFIELD-BLOOMINGTON WATERSHED

STORM FREQUENCY	STORM DURATION	PROBABILITY OF OCCURRENCE IN ANY GIVEN YEAR	RAINFALL AMOUNT (INCHES)
1 – Year	24 – Hour	99%	2.4
2 – Year	24 – Hour	50%	2.8
5 – Year	24 – Hour	20%	3.6
10 – Year	24 – Hour	10%	4.2
25 – Year	24 – Hour	4%	4.8
50 – Year	24 – Hour	2%	5.3
100 - Year	24 – Hour	1%	6.0
25 – Year	10 – Day	4%	8.8
50 – Year	10 – Day	2%	9.8
100 - Year	10 – Day	1%	10.8
100 - Year	10 - Day Runoff	1%	7.2" of runoff

Source: USWB TP 40 as taken from the Hydrology Guide for Minnesota

C. GEOLOGY

1. Surficial Geology

The geomorphology of the Richfield-Bloomington WMO is comprised of Glacial River Warren Terrace sand and sediment deposits **Figure 4**. These deposits consist of sand, gravelly sand, and loamy sand overlain by thin deposits of silt, loam, or organic sediment. The remainder of the WMO is comprised of outwash from the Des Moines-Grantsburg Sublobe, including sand, loamy sand, and gravel. Compaction of the soils and melting of imbedded ice chunks formed numerous depressions; many of these depressions filled with water and became lakes and ponds. Much of this area is now covered in artificial fill and has been developed.

Local variations in surficial materials may not be apparent based on information provided in this report. Further investigation is warranted for specific land use planning applications. More information on surficial geology may be found in the Hennepin County Geologic Atlas.

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Figure 4
Surficial Geology Map

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2. Bedrock Geology

The bedrock geology of the watershed is shown in **Figure 5**. The map depicts the bedrock units as they are exposed or covered with surficial materials.

The bedrock geology is comprised of Early Paleozoic, sedimentary rock. Three major aquifers are located within the RBWMO boundaries: the Prairie Du Chien-Jordan Aquifer, the Franconia-Ironton-Galesville Aquifer, and the Mt. Simon-Hinckley Aquifer.

The elevations of the uppermost bedrock formation range from 350 feet to 800 feet above mean sea level. **Figure 6** shows that surficial materials range in thickness from 50 feet to over 500 feet.

A generalized geologic column of Hennepin County is shown in **Figure 7**. The figure shows the vertical relationship, thickness, and aquifers of the various geologic units. The relationship of the Quaternary System to the bedrock system is also depicted. The hydrologic characteristics of the geologic units are discussed in detail in **Section II.H**, Ground Water Resources. Additional geologic information for this watershed may be found in the Hennepin County Geologic Atlas and the Hennepin County Ground Water Plan.

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Figure 5
Bedrock Geology

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Figure 6
Depth to Bedrock Map

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**FIGURE 7
GENERAL GEOLOGIC COLUMN OF HENNEPIN COUNTY**

	TIME PERIOD	FORMATION OF GROUP NAME	THICKNESS (Feet)	AQUIFER
MIDDLE ORDOVICIAN	458 to 453 million years ago	Decorah Shale	0-90	
		Platteville and Glenwood Formations	28-31	Platteville Aquifer
		St. Peter Sandstone	128-160	St. Peter Sandstone Aquifer
LOWER ORDOVICIAN	505 to 478 million years ago	Prairie du Chien Group	145-308	Prairie du Chien Aquifer
UPPER CAMBRIAN	523 to 505 million years ago.	Jordan Sandstone	70-125	Jordan Sandstone Aquifer
		St. Lawrence Formation		St. Lawrence Confining Layer
		Franconia Sandstone	107-240	Franconia/Ironton-Galesville Aquifer
		Ironton and Galesville Sandstone	21-63	
		Eau Claire Formation	78-118	Eau Claire Confining Layer
		Mount Simon Sandstone	155-275	Mount Simon Aquifer
MIDDLE PROTERZOIC UNDIVIDED	1,200 to 900 million years ago	Solar Church Formation	10-13,500	
		Fond du Lac Formation		Older bedrock with undetermined hydrologic properties
SOURCE: HENNEPIN COUNTY GEOLOGIC ATLAS, 1990				

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D. SOILS

The predominant soil in the RBWMO is sandy loam **Figure 8**. Such topsoil has a relatively high infiltration capacity. Existing turfed area in this highly developed region is essentially lawn. It is assumed that most of these lawns were improved by the addition of topsoil from elsewhere, making the soils less permeable. The topsoil and underlying glacial river outwash deposits are considered to be of moderate erodability. With the highly developed state of this watershed, erosion is not as much of a problem as elsewhere, but erosion control is necessary in any areas that are redeveloped. Both Bloomington and Richfield have erosion control ordinances.

Further soils information is available from the Hennepin County Geologic Atlas.

Using the Hennepin County Soil Survey and the Hennepin County Geologic Atlas, the hydrologic soil classification map for the WMO was developed and is shown on **Figure 9**. The soils for the WMO have been classified into two hydrologic soil groups, which are defined as follows:

Soil Characteristics

Drainage - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the column, or periodically receive high rainfall, or both.

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Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing seasons. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depths. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing seasons. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors".

Texture - This measure indicates the relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay.

Erosion Factor K - Susceptibility of soil to sheet and rill erosion by water is indicated by this measure. The values are estimated based primarily on percentage of silt, sand and organic matter, and on permeability and soil structure. Values range from .05 to .69 with high values representing a greater degree of soil susceptibility to water induced sheet and rill erosion.

The soils found within the RBWMO have a range of erosion Factor (K) values. These soils present in the watershed range from "K" values of 0.10 to 0.43.

Wind Erodability - This parameter rates soil resistance to wind erosion in cultivated areas. Erodability values range from 1 to 8. The higher the value, the lesser degree of erodability. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

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2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. Calcareous loamy soils that are less than 35% clay and more than 5% finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
5. Clays, silty clays, clay loams, and silty clay loams that are more than 35% clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are less than 18% clay and less than 5% finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5% finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
7. Loamy soils that are 18 to 35% clay and less than 5% finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
8. Silty clay loams that are less than 35% clay and less than 5% finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
9. Stony or gravelly soils or other soils not subject to wind erosion.

Soils within the watershed have typical wind erodability values of 2 to 6.

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission (0.50 in/hr).

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission (0.25 in/hr).

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission (0.10 in/hr).

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Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission (0.03 in/hr).

Soil association characteristics are listed in **Table 3** and describe each in terms of topography, drainage, texture, erosion susceptibility, hydrologic characteristics and parent material. These soils are classified in hydrologic soil Group B. A more detailed description of hydrologic soil classification follows in this section.

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Figure No. 8
Soils Association Map

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Figure 9

Hydrologic Soils Classification Map

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TABLE 3 SOIL ASSOCIATION CHARACTERISTICS							
Soil Association	Topography	Drainage	Texture	<u>Erosion</u> Factor K*	Wind Erodability Group	Hydrologic Soils Group*	Hydrologic Parent Material
Waukegan- Wadena- Hawick	Level to very steep	Well to excessive	Silty, loamy	0.10 - 0.43	3 - 6	B	Outwash
Kingley- Mahtomedi	Gently sloping to very steep	Well to excessive	Loamy, sandy	0.10 - 0.28	2 - 3	A - B	Till

*Based on predominant soil types.
Source: USDA, Soil Conservation Service, 1983

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E. LAND USE

1. General Land Use

Land use within the Richfield-Bloomington Watershed has been and will be influenced by several key factors: proximity to Minneapolis and the Minneapolis-St. Paul International Airport, transportation routes, wastewater systems, and local planning and zoning.

Existing and projected land use for areas within the RBWMO are fully described in the Bloomington Comprehensive Plan and Richfield Comprehensive Plan, which are available in the Water Resource Library of these Cities. The Cities have a land use plan that includes residential, commercial, and industrial development; designated park and open space areas; and public recreational areas. Land use mapping information is available from each City. **Figure 10** are representations of the land use districts for the RBWMO. Redevelopment along the Cedar Avenue corridor is anticipated to occur as a result of the Minneapolis/St. Paul International Airport expansion. **Table 4** depicts the population growth for the Cities.

Parks and open space facilities are located throughout the watershed. Various other recreation facilities are provided by the counties, cities and townships. The larger recreational facilities (QP-Quasi-Public) are shown on **Figure 10**. These areas provide a wide range of activities and focus on court games, field sports and other traditional recreational activities. City parks have been established adjacent to the water bodies within the watershed.

The planned future land use within the watershed is shown in **Figure 10**, and use was provided by the comprehensive plans of the member municipalities. Areas of projected urban growth are also shown on **Figure 10** and have been generalized into four categories; residential, commercial, industrial and recreational. Information on growth was obtained through a review of member City comprehensive plans. These plans are designed to guide growth to ultimate development. The three member municipalities have planned for full development.

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Figure 10
Future Land Use Map

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TABLE 4
POPULATION GROWTH INFORMATION
CITY OF BLOOMINGTON

<u>YEAR</u>	<u>POPULATION</u>
1960	50,498
1970	81,970
1980	81,831
1990	86,335
2000	85,172
Est. 2010	87,632
Est. 2020	90,503

Source: US Census Bureau and Bloomington Planning Division

CITY OF RICHFIELD

<u>YEAR</u>	<u>POPULATION</u>
1960	42,523
1970	47,231
1980	37,851
1990	35,710
2000	36,600
Est. 2010	38,100
Est. 2020	38,300

Source: US Census Bureau and City of Richfield

F. SURFACE WATER RESOURCES

This sub-section combines an inventory of existing data basic to the understanding of the Richfield-Bloomington Watershed hydrologic system. The information collected in this section outlines how surface water runoff is collected, managed, and discharged from the Richfield-Bloomington Watershed.

1. Hydrologic System

The Richfield-Bloomington Watershed contains several depressions. Several of these depressions contain ponds; other depressions have been filled or drained with urbanization and installation of storm sewers. There are no major creeks or rivers within the watershed and the majority of stormwater runoff is conveyed by storm sewer systems in a southeasterly direction through a series of ponds and wetlands to the Minnesota River.

Figure 11 outlines the subwatershed boundaries tributary to lakes and retention basin within the Richfield-Bloomington Watershed. The RBWMO hydrologic system has been analyzed by each community and described in detail in their local stormwater management plans.

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Figure 11
Subwatershed Map

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2. Wetland Inventory

Wetland inventories have been completed by the U.S. Fish and Wildlife Service as published on the National Wetland Inventory Maps, and by the Minnesota Department of Natural Resources as published in their Protected Waters and Wetlands Map. These wetland inventories are shown on **Figure 12**.

The protected waters and wetlands of the watershed have also been identified by the Minnesota Department of Natural Resources (MDNR). This classification includes all Class III, IV and V wetlands (as defined by the Department of the Interior) which are 2.5 acres or greater in incorporated areas. These waters and wetlands are also identified on **Figure 12**.

The City of Bloomington completed a Wetland Protection and Management Plan in 1997 in accordance with MN Rules 8420.0650. A copy of the Bloomington Wetland Protection Management Plan is available in the Bloomington Water Resources Reference Library at Bloomington Public Works. The City of Richfield has also completed a wetland management plan. The results of these planning efforts are summarized in **Appendix D**.

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Figure 12

Protected Waters and Wetlands

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3. Water Quality – Surface Water

Water quality data for the RBWMO has been obtained from the STORET water quality database, which is available through the Minnesota Pollution Control Agency (MPCA). The MPCA storage and retrieval database is utilized by participating agencies to compile water quality testing data. This database is almost entirely used for the storage of water quality parameters.

Figure 13 shows the location of monitoring sites within the RBWMO that have been used in the past or are currently being used to collect water quality or quantity data. **Table 5** contains the water quality information obtained from the MPCA (STORET) and the Cities of Richfield and Bloomington.

The results of surface water monitoring efforts can be found in the Water Resource Library at the member Cities.

4. Surface Water

The water bodies within the RBWMO are as follows:

- Smith Pond
- Wright's Lake
- Running Pond
- Sheridan Pond
- Richfield Lake
- Wood Lake
- Augsburg Pond
- Wilson Pond

Surface water quality of the ponds located in the RBWMO is typical of similar ponds throughout the metropolitan area. Pollutants from runoff can lead to algal blooms during summer months. The ponds and wetlands within the RBWMO are not used for swimming; public concern of these ponds is mainly aesthetic. Concerns have been raised regarding stormwater discharge from the RBWMO in the Airport South area, to the Minnesota Valley National Wildlife Refuge. The cities within the RBWMO have classified each water body. This information is contained in **Table 6**.

The MPCA has assigned water quality standards for all waters of the state. These water quality standards are contained in the draft update to Minn. R. ch. 7050 (anticipated to be promulgated in 2007). As Surface waters within the RBWMO are monitored, they will be assessed by the member communities in accordance with the Minnesota Rules Chapter 7050 requirements. A summary of the Eutrophication Standards in the draft rules for the NCHF Ecoregion are found on **Table 7**

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Table 5 shows the location of monitoring sites listed on the MPCA web-site. Some of the available water quality information is summarized below:

	Mean Total Phosphorus (ppb)	Mean Chlorophyll a (ppb)	Secchi Disk (meters)	Carlson Trophic Status
Wood Lake	144	NA	1.3	Hypereutrophic

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Table 6. Classification of Water Resources within the RBWMO ¹

Water Body Name	Location	Circular 39 Type	DNR Public Water / Wetland	City's Management Classification ²	Management Designation ²
Sheridan Pond	Richfield	3	NA	Manage 2	
Richfield Lake	Richfield	4	21P	Manage 1	
Wood Lake	Richfield	5	26P	Manage 1	
Augsburg Pond	Richfield	5	NA	Manage 2	
Smith Pond	Bloomington	4	1078P	Detention	Utilize
Wright's Lake	Bloomington	5	1082P	Detention	Utilize
Running Pond	Bloomington	5	NA	Detention	Utilize

- 1) Information was obtained from the following sources:
Richfield Comprehensive Surface Water Management Plan – September 2000
Bloomington Wetland Protection and Management Plan - June 1997
- 2) Management classification and designation information is provided within this appendix.

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Figure 13.1

Water Quality Monitoring Locations – need to get

Figure 14

Pollution Source Location Map

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Table 7
MPCA Eutrophication Standards for NCHF Ecoregion Water Quality

Water Quality Parameter	Shallow Lake	Deep Lake
Total Phosphorus (ug /L)	<u>< 60</u>	<u>≤ 40</u>
2.Chlorophyll-a(ug /L)	<u>< 20</u>	<u>≤ 13</u>
Secchi Disk Transparency (meters)_	<u>≥ 1.0</u>	<u>≥ 1.5</u>

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Figure 15
Water Clarity

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6. Ground Water

The metropolitan area is developed over an extensive ground water aquifer system that consists of several good sources of water separated and protected by relatively impervious confining layers. These aquifers are the Prairie Du Chien-Jordan aquifer, Franconia-Ironton-Galesville aquifer, and Mt. Simon-Hinckley aquifer. More information about these aquifers can be found in **Section.H.2** and in the Geologic Atlas for Hennepin County

Ground water resource data for areas within the RBWMO are available by reviewing the content of the following reports. These documents are available at the member Cities' Water Resource Library.

- a. The Hennepin County Geologic Atlas, 1989.

The Draft Hennepin County Groundwater Plan, March 1994.

Richfield Wellhead Protection Plan
- b. City of Bloomington Wellhead Protection Plan Parts 1 & 2, completed April, 2004 contains specifics on the six municipal wells in the city as well as the delineated Wellhead Protection Area (WHPA) and Drinking Water Supply Management Area (DWSMA) boundaries as required by Minnesota Rule 4720.

7. Water Resource / Ground Water Appropriations

Municipal wells serve the water supply needs for Bloomington and Richfield. The City of Bloomington also receives water from the City of Minneapolis. The MDNR has identified one permitted well within the WMO. The water appropriations permittee is Woodlawn Terrace. This well is permitted for 80 gallons per minute and 10 million gallons per year. **Figure 15** shows the location of the DNR Water Appropriations Permit site. The MDNR water appropriation list is available in the member Cities' Water Resource Library.

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Figure 16

MN DNR Groundwater Appropriation Location Map

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G. POLLUTANT SOURCES

Pollutant source location information from the MPCA is shown on **Figure 14 (source MPCA)** and available at the MPCA website at: www.pca.state.mn.us/backyard/neighborhood.html. The information on the figure identifies sites that currently have or previously have had leaking underground tanks. Many of these sites have been cleaned up or are in the process of being cleaned up. The MPCA should be contacted for site specific details

The Master Entity List combines 14 state and federal pollutant lists and systems. Four of the 14 primary inventory lists are as follows:

- **National Priorities List (NPL).** A listing of hazardous waste sites which represent a significant threat to public health or the environment and are priorities for remedial action.
- **Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).** The USEPA database of potential or actual hazardous wastes nationwide.
- **Permanent List of Priorities (PLP).** A state listing of verified hazardous waste sites.
- **Brownfield.** MPCA Site Assessment sites where real or perceived contamination stops further development.

The member communities within the RBWMO promotes a program with Hennepin County to ensure that household solid or liquid waste is disposed of properly. This promotion includes providing information to homeowners on proper disposal and/or use of yard waste in an environmentally responsible manner. The program also educates residents on the proper disposal of household waste including waste oil, paints, and solvents. The drop-off site for household hazardous wastes is the South Hennepin Recycling and Problem Waste Drop-Off Center at 1400 West 96th Street. The member communities and RBWMO also publishes information pertaining to recycling, lawn care, hazardous waste and water quality on its website.

H. GROUND WATER RESOURCES

1. Surficial Aquifers

The surficial geology of the Richfield-Bloomington Watershed is composed of sand, gravelly sand, and loamy sand terrace deposits. These terrace deposits vary in both permeability and thickness to bedrock. Within these deposits are unconfined (water table) aquifers of sufficient water bearing capacity to provide municipal and private water.

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The configuration of these surficial aquifers and the position of the water table are highly variable and complex. In general, surficial aquifers are not extensive and rarely continuous. The depth to water table varies between 0 feet in the vicinity of some of the ponds to over 30 feet. These unconfined aquifers are vulnerable to contamination since they are relatively close to the land surface. Contaminants have a direct access to these aquifers after minimal infiltration. Available information does not allow a detailed evaluation and delineation of these aquifers. Site-specific information in the form of well logs does give some indication of depth to water table and characteristics of the surficial material.

Recharge areas for drift aquifers are those locations where water can reach the water table through percolation of water through soil and drift materials. Critical recharge areas are those areas where the drift material is relatively thin, transmissibility is high, and water table depth is minimal. Areas with these characteristics have a greater potential to transport contaminants to the drift aquifers than other areas.

Unconfined aquifers are particularly susceptible to contamination from non-point sources of pollution because of possible high permeability of overlying materials.

Recharge can also occur from surface water bodies. Wetlands and flood plains can function as recharge, discharge, or flow-through areas, depending on the level of the water within the wetland or floodplain relative to the water table. Discharge can occur naturally through springs, seeps, and directly into streams and wetlands. Percolation into underlying aquifers is also a form of discharge from drift aquifers. These sand and gravel aquifers may also be hydrologically connected to the uppermost bedrock aquifer and, hence, may affect underlying water quality by allowing pollutants to migrate downward.

The pumping of sufficient water volumes may induce recharge. This pumping may draw contaminants through the induced recharge area and affect aquifer water quality.

2. Bedrock Aquifers

The bedrock geology of the watershed is presented in this plan. **Table 8** describes the general water bearing characteristics associated with each geologic unit.

Three major aquifers are located within the RBWMO's boundaries: the Prairie Du Chien-Jordan Aquifer, the Franconia-Ironton-Galesville Aquifer, and the Mt. Simon-Hinckley Aquifer. The lowest of the three aquifers is the Mt. Simon-Hinckley. It ranges in elevation from 600-700 feet above sea level in the Bloomington area and is characterized by Mt. Simon & Hinckley Sandstones. The Eau Claire Formation confines it from above. Above this, the Franconia-Ironton-Galesville Aquifer ranges in elevation from 700-800 feet above sea level in the Bloomington area. It is composed of the Franconia Formation and Ironton & Galesville Sandstones. The St.

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Lawrence Formation confines it in most areas. The upper most aquifer, the Prairie Du Chien-Jordan, ranges in elevation from 700-800 feet above sea level in this area. It is composed of Jordan Sandstone and the Prairie Du Chien Group.

Within the watershed, the Prairie du Chien/Jordan aquifer is the most significant in terms of water supply, as most municipal water wells draw from this aquifer. The recharge of the Prairie du Chien/Jordan aquifer and other aquifers is a complex process. To some degree, recharge occurs everywhere within the metropolitan area. Downward seepage is greatest where soils are highly permeable and surficial materials are relatively thin and highly porous.

Downward leakage is more likely to reach the aquifer where the aquifer unit lies directly beneath permeable soils and surficial material than where confining layers exist to impede penetration. Once in the system, recharge water may flow into a surface water body or further into the ground water system. Within most of the watershed, the Prairie du-Chien/Jordan aquifer is in contact with terrace deposits. The absence of an upper confining unit makes it susceptible to contamination percolating through the drift.

Pumping, a form of discharge, can induce aquifer recharge under certain conditions. For example, induced recharge occurs where wells are pumping from an aquifer near a hydraulic connection to a stream and are drawing the water level of the aquifer below that of the stream. Pumping may cause water from the overlying stream sediments to be induced into the aquifer by reversal in head differences. These flow reversals (from discharge to recharge) are gradual occurrences where ground water discharge is first lessened -- affecting stream base flow -- before actual flow reversal occurs.

Until site-specific data is collected to fully understand critical areas of ground water recharge, the entire watershed area has the potential, to some degree, to recharge bedrock aquifers, particularly the Prairie du Chien.

Ground water movement has been studied on a regional basis by the Minnesota Geological Survey and by the MPCA at selected areas surrounding the watershed in association with investigations of potential ground water contamination sites. Water movement in the Prairie du Chien aquifer moves generally in a south and southeasterly direction toward the Minnesota River. However, local flow patterns can be extremely complex because of varying degrees of development of the aquifer. Documented or potential sources of contamination of the Prairie du Chien/Jordan aquifer were discussed earlier.

According to the Minnesota Geological Survey, the Prairie du Chien/Jordan aquifer in the Richfield-Bloomington Watershed primarily has a moderate potential for contamination with a high to moderate potential in the bedrock valleys. This indicates that it may take several years for a pollutant spilled on the surface to enter the ground water. It is important to note that the

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sensitivity of an area is based on natural conditions, whereas the potential sensitivity of an area becoming contaminated is the result of the cumulative influence of natural sensitivity, land use, aquifer drawdown, and contaminant properties. More information on ground water susceptibility to contamination can be found in the Hennepin County Geologic Atlas and the Hennepin County Groundwater Plan located in the Bloomington and Richfield Water Resource Libraries.

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**TABLE II-8
GEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS**

System	Geologic Unit	Approx. Range in Thickness (Feet)	Description	Water-Bearing Characteristics	Hydrogeologic Unit
Quaternary	Undifferentiated terrace deposits	0-450	Sand, gravelly sand, and loamy sand; overlain by thin deposits of silt, loam, or organic sediment.	Distribution of aquifers and confining beds within drift is poorly known. Stratified well-sorted deposits of sand and gravel yield moderate to large supplies of water to wells (240 to 2,000 gal/min). Unconformity	Terrace deposits.
	Decorah Shale	25	Shale, bluish-green to bluish-gray; blocky.	Confining bed.	
	Platteville Limestone	35	Dolomitic limestone and dolomite, dark gray, hard, thin-bedded to medium-bedded.	Fractures and solution cavities in rock generally yield small supplies to wells (less than 20 gal/min). Not considered to be an important source of water in metropolitan areas.	Decorah-Platteville-Glenwood confining unit.
Ordovician	Glenwood Shale		Shale, bluish-gray to bluish-green; generally soft but becomes dolomitic and harder to the east.	Confining bed; locally some springs issue from the Glenwood-Platteville contact in the river bluffs.	
	St. Peter Sandstone	160	Sandstone, white, fine- to medium-grained, well-sorted, quartzose; 50-50 feet of siltstone and shale near bottom of formation.	Most wells completed in the sandstone are of small diameter and used for domestic supply. They yield 9 to 100 gal/min. Water occurs under both confined and unconfined conditions. Confining bed near bottom of formation separates sandstone from underlying Prairie du Chien-Jordan aquifer. Not considered to be an important source for public supplies in area of study.	St. Peter aquifer. Basal St. Peter confining unit.
	Prairie du Chien Group	120	Dolomite, sandstone, sandy dolomite; light brown, buff, gray; thinly to thickly bedded.	Prairie due Chien: Permeability is due to fractures, joints, and solution cavities in the rock. Yields small to large supplies of water to wells. Pumping rates of up to 1,800 gal/min have been obtained.	

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**TABLE II-8
GEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS**

System	Geologic Unit	Approx. Range in Thickness (Feet)	Description	Water-Bearing Characteristics	Hydrogeologic Unit
Cambrian	Jordan Sandstone	95	Sandstone, white to yellowish, fine- to coarse-grained, massive to bedded, cross-bedded in places, quartzose; loosely to well cemented.	Jordan: Permeability is mostly intergranular but may be due to joint partings in cemented pats. Main source of water for public supply in metropolitan area. Recorded yields are from 36 to 2,400 gal/min. Prairie due Chien-Jordan aquifer: Supplies about 75 percent of ground water pumped in the metropolitan area. Yields from 85 to 2,765 gal/min.	Prairie du Chien-Jordan aquifer.
	St. Lawrence Formation	45	Dolomite siltstone and fine-grained dolomite sandstone, gray to greenish, glauconitic.	Confined unit regionally. May yield small quantities to domestic wells locally.	St. Lawrence-Franconia confining unit
	Franconia Sandstone Ironton Sandstone	140	Sandstone, gray to greenish, glauconitic, very fine grained; some interbedded micaceous shale and dolomitic sandstone. Sandstone, yellow to white- medium- to coarse-grained, poorly cemented.	Confining unit regionally may yield small quantities to domestic wells locally. An important aquifer beyond the limits of the Prairie du Chien-Jordan aquifer. Yields of wells range from 40 to 400 gal/min.	St Lawrence - Franconia confining unit. Ironton-Galesville aquifer.
	Galesville Sandstone	55	Sandstone, yellow to white, medium- to coarse-grained, poorly cemented.	Confining unit regionally. May yield small quantities to domestic wells locally.	Eau Claire confining unit.
	Eau Claire Sandstone	80	Sandstone, siltstone and shale, gray to reddish-brown, fossiliferous.	A secondary major aquifer that supplies about 10 percent of ground water pumped in the metropolitan area. Recorded yields range from 125 to 2,000 gal/min.	Mount Simon aquifer.
	Mount Simon Sandstone	160	Sandstone, gray to pink, medium- to coarse-grained. Some pebble zones and thin shaley beds. Unconformity		
Precambrian	Undivided		Sandstone, buff to red, medium- to coarse-grained; well sorted and cemented.		

Hennepin County Geologic Atlas, Scott County Geologic Atlas

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I. WATER-BASED RECREATION

There are several park facilities within or adjacent to the RBWMO which offer hiking, biking, and picnicking facilities as passive forms of water-based recreation.

The following parks are located within the WMO and include ponds within their boundaries:

Augsburg Park
Richfield Lake Park
Sheridan Park
Smith Park
Wilson Park
Wood Lake Nature Center
Wright's Lake Park
Running Park

Smith Park also contains a fishing pier and is stocked with pan fish on an annual basis as part of the finishing in the neighborhood (FIN) program to encourage youth family fishing.

J. FISH AND WILDLIFE HABITAT

Within the RBWMO, parks and open spaces with water bodies provide wildlife habitat for migratory birds and waterfowl. The ponds in the RBWMO are generally too shallow to consistently maintain game fish populations.

K. UNIQUE FEATURES AND SCENIC AREAS

The RBWMO has many natural areas, water resources, and local parks. Some of these areas contain rare and endangered species and special habitats. Updated 2007 Information from the DNR Natural Heritage Database can be found Appendix E and is also provided within each member City's plan. The updated DNR Natural Heritage Database review identified 25 known occurrences of rare species or native plant communities occurring within an approximately a one-mile radius of the WMO. The RBWMO has no wild and scenic areas as defined by the State.

The following areas are of particular interest within the RBWMO.

- **Wood Lake Nature Center**

The 150-acre Wood Lake Nature Center, located on the north end of Wood Lake, was opened to the public by the City of Richfield in 1971. Most of Wood Lake Nature Center is a freshwater marsh. The water is very shallow (less than four feet deep), and the bottom is mostly organic material. Cattails, dogwood, and willow ring the shoreline, while cottonwood, silver maple, and box elder trees populate higher grounds. There are also 11 acres of created prairie. Over 200 different kinds of birds and 30 different mammals can be seen at the Center.

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There are 3 miles of hiking trails throughout the Center, including a 0.9-mile “inner” loop and a 1.8-mile “outer” loop. The inner loop features a 600-foot long floating boardwalk that crosses the marsh. The boardwalk puts visitors in the middle of the cattail marsh for a close-up experience with snapping turtles, red-wing blackbirds, and muskrats. Two-and-a-half miles of the trails are surfaced with crushed limestone, making them wheelchair accessible. In the winter, ski trails are provided for recreation.

A Blanding's turtle sighting was recorded at Wood Lake in 1993. These turtles are on the state-listed threatened species list in Minnesota, however, none have been sighted since 1993, and it is assumed that a sustainable population of this species is not present within the Nature Center.

- **The Minnesota Valley National Wildlife Refuge**

The Minnesota Valley National Wildlife Refuge is located to the south and southeast of the RBWMO. The Minnesota Valley National Wildlife Refuge provides a wildlife habitat corridor along the Minnesota River. The refuge contains threatened and endangered species as well as the floodplain, Long Meadow Lake, and associated wetlands of the Minnesota River.

The refuge also provides recreational activities such as fishing, hiking, horseback riding, and nature interpretation.

- **Smith Park**

The MDNR's Fishing in the Neighborhood (FiN) Program has been annually stocking Smith Pond with Blue Gills and Black Crappies since 2001. A fishing pier is located at the southeast side of the lake. Smith Park also includes walking trails, beaches, and a pavilion.

- **Other Lakes, Wetlands, and Parks**

The WMO also includes various wetlands. These water bodies provide natural habitat as well as stormwater storage for the RBWMO. Additionally, the, Running Park, Richfield Lake, and Wood Lake areas contain walking trails and other amenities such as playground equipment, playfields and running trails.

L. FLOOD PROBLEM AREAS

Some flood problem areas have been identified within the RBWMO. The following reports/summaries are available from the member Cities and address the problem areas in greater detail:

- Property Damage and Flood Elevation Comparisons, City of Bloomington, 1988
- Smith Pond Wright's Lake Storm Sewer System, Barr Engineering 1978.

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- Stadium Area Storm Drainage Study, TKDA, 1981
- Mall Of America FEIS, 1986
- Feasibility Study Diversion of Richfield Storm Sewer Into I-494 (Smith Pond) TKDA, 1988.
- I-494 Reconstruction Preliminary Draft Water Resources Technical Report, BRW, 1991.
- I-494 Reconstruction FEIS Review Draft, SRF, 2000
- AUAR Airport South, SRF, 2001
- Smith's Pond – Wright's Lake Drainage Study, TKDA, 1988
- Hydraulic Analysis of Selected Areas within the City of Richfield, 1988
- Smith Pond – Wright's Lake XP-SWMM Analysis, WSB & Associates, 2000
- Wood Lake Monitoring results. Wood Lake Management Plan

Many of the improvements outlined in these studies have been implemented and have subsequently reduced or eliminated the flood problems.

M. EXISTING FLOOD INSURANCE STUDIES

A Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) has been completed for the participating cities in the RBWMO. The cities of the watershed are participating members in the National Flood Insurance Program. These reports identified the boundaries of the floodway and floodplain. Copies of these flood insurance studies are available at the member Cities' Water Resource Libraries.

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Storm Sewer

Figure I7

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N. SHORELAND PROTECTION AND FLOODPLAIN MANAGEMENT ORDINANCES

The City of Bloomington has adopted Flood Hazard Overlay District and Shore Area Regulations. The City of Bloomington City Code 19.87.01 – 19.87.08 Shore Area Regulations are in compliance with the Directives and requirements of Minnesota Statutes, Section 103F.221, Subd1. and regulations adopted pursuant thereto. These regulations are adopted in order to protect the natural characteristics of such shore areas adjacent to water to prevent pollution of surface and groundwaters, minimize flood damage and manage the effects of shore area development.

The City of Richfield is working with the DNR to develop these ordinances. These ordinances will be available for review from the RBWMO and the individual member cities.

The RBWMO encourages member cities to coordinate their ordinance efforts with the MDNR.

III. GOALS AND POLICIES

The Richfield-Bloomington Watershed Management Organization (RBWMO) has developed a number of goals and policies that conform to the overall purpose that is specified in Minnesota Statutes Section 103B.201. These goals and policies have been developed to complement any county, regional, or state goals and policies. They have also been developed to preserve and use natural water storage and retention systems in order to:

- A. Protect, preserve, and use natural surface water and groundwater storage and retention systems.
- B. Minimize public capital expenditures needed to correct flooding and water quality problems.
- C. Identify and plan for means to effectively protect and improve surface water and groundwater quality.
- D. Establish more uniform local policies and official controls for surface water and groundwater management.
- E. Prevent erosion of soil into surface water systems.
- F. Promote groundwater recharge.
- G. Protect and enhance fish and wildlife habitat and water recreational facilities.
- H. Secure the other benefits associated with the proper management of surface water and groundwater.

Through the watershed management planning effort, the RBWMO will support the use of Nationwide Urban Runoff Program (NURP) standards for the design of new stormwater management ponds and the use of the Minnesota Pollution Control Agency's (MPCA) Best Management Practices (BMP) and the Minnesota Stormwater Manual for all new developments and redevelopments to reduce non-point source pollution associated with stormwater runoff. The RBWMO will incorporate these standards and requirements in this Watershed Management Plan by reference. This Watershed Management Plan represents the WMO's primary strategy for attempting to reach the regional and statewide goals of reducing non-point source pollution in the Minnesota River.

The goals and policies that the WMO has developed address issues related to water quantity, water quality, recreation, fish and wildlife, enhancement of public participation, information and education, public ditch system management, ground water management, shoreland management, wetland management, and soil erosion management. Outlined below are the goals and policies that have been developed for each of the above areas of concern.

A. WATER QUANTITY

Goal:

Coordinate intercommunity and/or interagency storm water runoff, flooding, and other water quantity issues.

Policies:

1. The RBWMO requires member communities to limit the storm water runoff rate to existing conditions for discharges across municipal boundaries unless it is subject to agreement or cooperative projects.
2. The RBWMO requires that future discharge rates from new development and redevelopment will, at a minimum, not exceed the existing discharge rates. Discharge rates shall be consistent with the discharge rates outlined within the member communities approved Water Resource Management Plan.
3. The RBWMO will defer to the local communities the responsibility of addressing storm water runoff management needs and problems provided that the impact of the problem and the source of the impact are wholly contained within a given community and the affected community is in conformance with the RBWMO policies.
4. In cases where surface water impacts or the source of impacts transcend municipal boundaries, or the community is found to not be in compliance, the RBWMO shall review such problems and issue directives to the appropriate local government unit(s) for resolution. It will be the responsibility of the local communities to implement a project that is acceptable to the RBWMO.
5. In cases where the local community refuses to implement a project per the directives of the RBWMO, or requests the RBWMO to facilitate resolution of the problem, the RBWMO shall complete improvements in conformance with the terms of the RBWMO Joint Powers Agreement.
6. The RBWMO requires that local plans include a maintenance plan of their storm sewer system.
7. Changes in the local water resource management plans which alter intercommunity storm water rates and volumes will require the review and approval of the RBWMO.
8. Member municipalities shall forward to the RBWMO plans and other information concerning all projects and/or new developments that will affect approved local plans related to intercommunity discharge rates, or degrade the quality of water transcending the boundaries of an adjoining community.

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9. Upon receipt of development plans for projects that may effect inter-community rates and water quality, the RBWMO will review these plans and forward their comments and directives to the local community within a 30-day period. If the local community fails to fully implement the directives of the RBWMO within the prescribed time period, the RBWMO shall take appropriate action per the terms of the RBWMO Joint Powers Agreement.
10. The RBWMO requires that the design of all major storm water storage facilities shall attempt to accommodate a critical duration event with a 1% chance of occurrence in any given year. These facilities include ponds and their outlets. New storm sewer systems shall be designed to accommodate discharge rates associated with a critical duration event with a 10% chance of occurrence in any given year. It is the RBWMO's position that it is impractical and financially not feasible to construct drainage systems to accommodate runoff from rainfall events having lesser probabilities of occurrence than those identified above.
11. The RBWMO requires that the design storm events shall be defined as having the following Soil Conservation Service (SCS) Type II distributions:

Event Frequency	Event Duration	Probability of Occurrence in Any Given Year	Rainfall Amount (inches)
1-Year	24-Hour	99%	2.4
2-Year	24-Hour	50%	2.8
5-Year	24-Hour	20%	3.6
10-Year	24-Hour	10%	4.2
100-Year	24-Hour	1%	6.0
100-Year	10-Day Runoff	1%	7.2 (inches of runoff)

12. The critical 1% chance event will be defined as the event that requires the greatest storm water storage volume in a storage facility. These facilities include lakes, ponds, and their outlets.
13. The development of enhanced infiltration practices and low impact development techniques should be implemented to limit runoff volumes from the redevelopment area to 1988 levels or lower, provided the soils and the site are suitable for such practices, and that past and existing land use practices do not have a significant potential to contaminate groundwater.
14. The RBWMO allows landlocked depressions which presently do not have a defined outlet and do not typically overflow to be allowed a positive outlet, provided it is in conformance with an approved local water resource management plan. However, enhanced infiltration or other LID techniques must be a component of the development/surface water management system.

B. WATER QUALITY

Goal:

Maintain or improve the quality of water in lakes, streams or rivers within or in proximity to the RBWMO boundary.

Policies:

1. The RBWMO shall improve the availability of surface water quality information and data within its jurisdiction. The RBWMO shall make this information available to member communities for placement onto the City's and RBWMO Website.
2. The RBWMO will require that member communities (which act as the LGU for the WCA) maintain an up to date inventory of wetlands and public water bodies to assist in the management of these resources.
3. The RBWMO will coordinate with MPCA and other agencies efforts regarding monitoring, maintaining and improving surface water quality within the watershed.
4. The RBWMO will include educational information on the RBWMO website to promote greater public understanding of, and participation in, protecting water quality.
5. The RBWMO shall defer to the local communities all responsibilities for addressing storm water runoff water quality issues, provided that the impacts or source of impacts are wholly contained within a given community and the local community is in conformance with the approved local plan. If the impacts or source of water quality impacts transcend municipal boundaries, local government units must submit to the RBWMO plans and information concerning the project or development for review. Upon completion of this review, the RBWMO shall submit its comments and findings to the appropriate governmental unit for implementation.
6. Should a water quality problem that transcends municipal boundaries be identified, the RBWMO shall review the problem and issue directives to the member communities to take action to address the problem. If appropriate action is not taken by the member communities after notification by the RBWMO, the RBWMO shall take action to correct the problem. The cost of such work will be assessed to the appropriate community or communities.
7. In the design and construction of all new or modifications to existing storm water conveyance systems, pretreatment of storm water runoff to NURP recommendations should be provided prior to discharge where feasible and appropriate.

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NURP recommendations as recognized by the RBWMO are taken from "Phosphorus Removal by Urban Runoff Detention Basins", Walker, 1987, and are as follows:

- a. A permanent pool ("dead storage") volume below the principal spillway (normal outlet) which shall be greater than or equal to the runoff from a 2.5 inch storm over the entire contributing drainage area assuming full development.
 - b. A permanent pool average depth (basin volume/basin area) shall be a minimum 4 feet, with a maximum depth of 10 feet.
 - c. An emergency spillway (emergency outlet) adequate to control the one percent (1%) frequency/critical duration rainfall event.
 - d. Basin side slopes above the normal water level should be no steeper than 3:1, and preferably flatter. A basin shelf with a minimum width of 10 feet and one foot deep below the normal water level is recommended to enhance wildlife habitat, reduce potential safety hazards, and improve access for long-term maintenance.
 - e. To prevent short-circuiting, the distance between major inlets and the normal outlet shall be maximized.
 - f. Retardance of peak discharges for the more frequent storms can be achieved through a principal spillway design which may include a perforated vertical riser, small orifice retention outlet, or compound weir.
8. The RBWMO adopts the MPCA Manual "Protecting Water Quality in Urban Areas" as part of the RBWMO Watershed Management Plan by reference.
 9. The RBWMO adopts the Minnesota Stormwater Manual as part of the RBWMO Watershed Management Plan by reference.
 10. The RBWMO will require local units of government to provide street sweeping pursuant to NPDES requirements as defined in the local SWPPP's. Furthermore, future purchases of street sweeping units should give consideration to street sweepers which have the greatest ability to remove nutrients from the streets within the communities.
 11. The RBWMO will require the inclusion of skimmers in the construction of new pond outlets, and add skimmers to the existing system whenever feasible and practical. The designs shall provide for skimmers that extend a minimum of four inches below the water surface and minimize the velocities of water passing under the skimmer to less than 0.5 feet per second for rainfall events having a one-year return frequency. The use of weirs in standpipes and submerged pipes as skimmers are also acceptable.

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12. The RBWMO requires local government units to include provisions for coarse sedimentation and skimming of oil and floatable materials prior to allowing any discharge to the Minnesota River. This requirement will apply in all cases except where it is deemed not feasible or not practical to do so. Considerations for variance to this policy will only be made in cases where the direct drainage area is limited in size and the probability that a spill or significant pollutant discharge from the area to areas outside the RBWMO would be extremely unlikely.
13. The RBWMO will require that member communities distribute educational information to its residents on responsible practices they could employ to protect water resources within the community. Educational information should include the following components:
 - Opportunity for Public Participation
 - Illicit Discharge Detection and Elimination
 - Construction Site Storm Water Runoff Control
 - Post-Construction Storm Water Management in New Development and Redevelopment
 - Pollution Prevention/Good Housekeeping for Municipal Operations

Further information about the educational program should be contained within each member community's MS4 permit and annual reports.

14. The RBWMO supports property owners adjacent to water resources to establish a native vegetative buffer strip in conformance with existing municipal buffer policies or guidelines. This strip should consist of suitable plants to limit erosion and nutrient transport across the buffer strip. The RBWMO shall make available on its website educational material aimed at fostering responsible water quality management practices. Topics are anticipated to include:
 - Shoreland restoration and best management practices for property owners;
 - Wetland buffers and maintenance planting;
 - Water quality monitoring.
 - Rain gardens

The RBWMO shall make this information available to member communities for placement onto the City's and RBWMO Website.

15. The RBWMO will require communities to develop a retention/treatment basin cleanout and maintenance plan that will address maintenance pursuant to NPDES requirements.
16. The development of enhanced infiltration practices and low impact development techniques should be implemented to limit Total Phosphorus and Total Suspended Solids to 1988 levels or lower for the redevelopment area, provided the soils and the site are suitable for such

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practices, and that past and existing land use practices do not have a significant potential to contaminate groundwater.

17. The RBWMO will require as part of the RBWMO annual evaluation and reporting process that member cities implement their pollution prevention measures outlined in their NPDES MS4 SWPPPs. These include, but are not limited to the following:
 - a. Illicit Discharge Detention and Elimination
 - b. Construction Site Storm Water Runoff Control
 - c. Post Construction Storm Water Management Measures
 - d. Pollution Prevention / Good Housekeeping Measures

C. RECREATION, FISH, AND WILDLIFE

Goal:

Protect and enhance water-based recreational facilities and fish and wildlife habitat.

Policies:

1. The RBWMO will support the City of Richfield's pursuit of grants for wildlife habitat protection and enhancement opportunities at the Wood Lake Nature Center.
2. The RBWMO will require and support efforts of the municipalities to promote wildlife habitat and recreational opportunities. The municipalities, in their local water management plans, must identify efforts to improve and preserve habitat areas and recreation resources as part of their approach to water management.
3. The RBWMO requires wetlands to be protected in conformance with the goals and policies outlined in **Section G**, the Wetland Conservation Act, and in the member city wetland management plans.
4. The RBWMO will work with member communities in continuing to implement s Mn/DNR fish stocking programs and public fishing opportunities where appropriate within the RBWMO.

D. ENHANCEMENT OF CITIZEN INVOLVEMENT, PUBLIC PARTICIPATION, INFORMATION, AND EDUCATION

Goal:

Educate and involve the public on pertinent water resource management issues and increase public participation in water management activities pursuant to MR 8410.0090.

Policies:

1. The RBWMO shall undertake completion of a website to provide public education on current events and programs of the RBWMO. Water resource management topics and information on the website would include sample articles for local communities and adding the updated watershed management plan to the site.
2. The RBWMO staff will provide an annual update to each member community's advisory planning or parks commissions or related advisory commission on the RBWMO Plan and/or WMO programs and projects.
3. The RBWMO shall prepare and make available to residents information through the web site pertinent water management issues. This information will provide an opportunity for residents to participate in watershed management activities.
4. The RBWMO will require as part of the RBWMO annual evaluation and reporting process that member cities implement their education measures in their NPDES MS4 SWPPPs.
5. The RBWMO shall undertake, via member cities, or participate in projects that seek to educate the public on water management issues.

E. PUBLIC DITCH SYSTEMS

Goal:

Provide a mechanism through which public ditch systems will be managed.

Policies:

1. No officially established public or judicial ditch systems have been identified within the RBWMO.

F. GROUND WATER

Goal:

Protect and conserve the ground water resource and encourage the infiltration of properly treated surface water to recharge groundwater.

Policies:

1. The RBWMO will coordinate with other agencies and local units of government to identify sources or potential sources of ground water pollution. Required clean-up, if any, will be completed in conformance with State law.
2. The RBWMO requires local communities to develop and implement well head protection plans as required by the Minnesota Department of Health.
3. The RBWMO will assist where necessary in efforts to gather further information on the hydrogeology of the region. When such information becomes available, including information on the location of ground water recharge areas, the RBWMO will take into consideration these areas for the purpose of maintaining their recharge capabilities in protecting ground water quality.
4. The RBWMO will assist where necessary in the efforts of Hennepin County and member communities in their current effort to develop a ground water flow model for the Prairie du Chien/Jordan aquifer.
5. The RBWMO will cooperate with the Hennepin County Environmental Health Department to ensure that all unsealed or improperly abandoned wells within the watershed are properly sealed. Technical requirements for the abandonment of these wells will be in conformance with the Minnesota Department of Health Water Well Code.
6. The RBWMO will require member communities to develop and implement ground water conservation measures consistent with DNR and Metropolitan Council guidelines for public water supplies.

G. WETLANDS

Goal:

Protect existing wetlands and restore diminished or drained wetlands.

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Policies:

1. The RBWMO will prohibit filling, draining, and altering of wetlands pursuant to the WCA.
2. The RBWMO will require the member municipalities to manage wetlands in conformance with the rules developed by the Board of Water and Soil Resources.
3. The RBWMO will utilize wetland inventory information developed by the U.S. Fish and Wildlife Service, and Cities in locating wetlands in the area.
4. Wetlands will be protected within the RBWMO boundaries to assure that the value of the wetland in relation to its surface water quantity benefits are not significantly impacted as defined in local Wetland Protection and Management Plans.
5. Prior to any site development activities, the LGU requires determination and identification of the location and extent of any wetlands present. If any wetland encroachment is proposed sequencing must take place and any proposed wetland impacts will be evaluated on a case by case basis in conformance with the rules associated with the Wetland Conservation Act which is administered by the local government units and Mn/DOT on their projects.
6. The RBWMO requires that any review of a proposed wetland encroachment will initially address the issue of sequencing. It will be the municipality's responsibility to ensure that prior to allowing any wetland encroachment, all reasonable attempts to avoid such alteration must be demonstrated pursuant to WCA. This avoidance review must also consider the reasonableness of the no-build alternative.
7. The RBWMO requires communities to restrict mowing, burning, or other non-filling related alteration to an existing wetland without LGU approval.
8. The RBWMO requires member communities to address control of the invasive weed purple loosestrife at construction sites and elsewhere. Information on Best Management Practices for this and other invasive species is available from the Mn/DNR.
9. The RBWMO or local governments may develop wetland management plans. The RBWMO supports wetland banking so that high value wetlands in appropriate areas may be created in lieu of requiring replacement of low value wetlands in unsuitable or inappropriate areas within the RBWMO.
10. Wetland assessments of wetlands shall be in accordance with MnRam 3.0, the most recent version of MnRam, or other modified version as accepted by the BWSR.

H. EROSION

Goal:

Prevent the effects of sedimentation from erosion-prone areas and minimize erosion through aggressive implementation and enforcement of erosion control requirements by its member communities.

Policies:

1. For activities that disturb one acre or more of land, the member communities shall require the submission and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in conformance with the MPCA NPDES rules to the City. These plans shall conform to the general criteria set outlined in the Minnesota Pollution Control Agency "Protecting Water Quality in Urban Areas", Surface Water Management Ordinance, and the NPDES Construction Site permit.
2. The member communities shall have a program to regularly inspect construction sites for erosion and sedimentation control for all new developments and redevelopments one acre and larger in size **OR** sites that require a City grading permit.

The RBWMO requires member communities to adopt an erosion and sediment control ordinance. A model erosion and sediment control ordinance is available on the MPCA's website at www.pca.state.mn.us/publications/wq-strm2-16b.pdf.

3. The RBWMO requires member municipalities to identify a permit program or document the modification of an existing program to increase the awareness of erosion issues and promote compliance.
4. The RBWMO recommends that municipalities give consideration to obtaining surety or identifies other measures to provide adequate safeguards to ensure the plan is carried out by the developer.
5. The RBWMO will require that communities sweep streets consistent with the BMP requirements of their NPDES MS4 permit. Furthermore, future purchases of street sweeping units should give consideration to street sweepers which have the greatest ability to remove nutrients from the streets within the community.

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I. **RBWMO ADMINISTRATION**

Goal:

Conduct RBWMO business in accordance with the Joint-Powers Agreement and the Watershed Management Plan.

Policies:

1. The RBWMO shall maintain twelve (12) active managers with five (5) managers appointed by the City of Richfield, and seven (7) manager appointed by the City of Bloomington.
2. The RBWMO shall notify the Minnesota Board of Water and Soil Resources of all manager appointments and vacancies.
3. Vacancies on the RBWMO Board shall be filled by the local government within ninety (90) days.
4. At the annual meeting of the RBWMO Board the managers shall elect a chairperson, vice chairperson, secretary, treasurer, and other officers as deemed necessary.
5. The RBWMO shall prepare an annual report and distribute annually a newsletter that meets the requirements of Minn. Statutes 103B.227 and Minnesota Rule 8410.0100.
6. The Board shall coordinate its planning activities with contiguous watershed management organizations and counties conducting water planning and implementation.
7. On or before April 1, the Board shall file with the Board of Water and Soil Resources and the clerk of each member governmental unit a financial activity and audit report of the previous fiscal year meeting the requirements of Minn. Stat. 103B.231 and Minnesota Rule 8410.0150.
8. The RBWMO will keep regulation at the local level and will not administer a permit program unless local communities fail to develop and implement their local Water Resource Management Plans.
9. The RBWMO will assess the performance of the member cities toward achieving the goals stated in this Plan. Starting in 2009, member communities shall prepare and submit an annual status report, similar to the annual NPDES report, to the RBWMO for review.
10. Upon final approval of the RBWMO Plan, the member communities shall re-submit their Local Water Plans to the WMO by November 2009 for adoption within two-years of final RBWMO Plan approval by the BWSR.

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11. The RBWMO will establish a TAC in 2009. The TAC will meet at least annually and include membership of at least two technical staff from each member community. The TAC will:
 - a) Complete a peer review of each member community's local Plan activities and compliance with RBWMO plan in even numbered years.
 - b) Annually the TAC will review for conformance with each member community's local Plan and RBWMO Plan, a minimum of 2 site development permits from each member community (1 municipal reconstruction and 1 private development) issued during that calendar year for each community.
 - c) Annually review each member community's NPDES annual report for compliance with education and maintenance requirements of the RBWMO.
 - d) The TAC will annually provide to the RBWMO Board a summary of local activity and compliance concerns.
 - e) The TAC will prepare an annual financial, activity, and audit report to be submitted to BWSR.
12. The RBWMO will establish a website in 2009 and utilize the web site to provide member cities with information about the RBWMO, its activities, and Water Resource Management Plan.
13. The RBWMO will continue to use the Community Services Commission (Richfield) and the Planning Commission (Bloomington) as its storm water advisory commission. As RBWMO issues come forward, they will be presented to the CAC for comment.

IV. PROBLEMS AND CORRECTIVE ACTIONS

Outlined below is an assessment of existing and potential water resource-related problems that are known at this time. These problems have been identified based on an analysis of the land and water resource data collected as part of this watershed management plan preparation and through the member cities input.

The RBWMO defers to the member cities the responsibility of addressing stormwater runoff management needs and problems, provided that the impact of the problem and the source of the impact are wholly contained within a given community and the affected community is in conformance with the Richfield-Bloomington Watershed Management Plan. In addition, RBWMO will require that flood problems recognized within this plan be recognized for capital improvements where feasible and appropriate within the appropriate member cities' surface water management plan.

A description of any existing or potential problem within the topic area has been listed.

A. LAKE AND STREAM WATER QUALITY PROBLEMS

1. The RBWMO has recognized a lack of water quality monitoring data for lakes and other water bodies within the watershed.

Corrective Actions:

- a. RBWMO requires local communities to develop Water Quality monitoring program. This program, at a minimum, shall monitor Total Phosphorus, Ortho-phosphorus, and Total Suspended Solids at each basin, wetland, or lake within the RBWMO. Grab samples shall be collected a minimum of every three years. No in-lake monitoring is proposed as no basin, wetland, or lake within the RBWMO is used for public contact. The information gathered shall be forwarded to MPCA for inclusion in the STORET database.
 - b. Continue to seek funding for and coordinate with the member communities to implement the local water quality monitoring program to ensure that storm water treatment goals and design removal efficiencies are met within storm water treatment basins. This will include application to the MPCA for a 2009-11 Surface Water Assessment Grant.
2. The water quality of Richfield Lake has been noted as a concern.

Corrective Action: Support the City of Richfield in pursuing state and federal grants for the construction the Richfield Lake Water Quality improvement project perimeter system. Future projects will provide retrofit opportunities, wetland riparian restoration, and buffer establishment adjacent to and within the Wood Lake and Richfield Lake resources.

3. The water quality of Wood Lake has been noted as a concern.

Corrective Action: The City of Richfield has identified funding for implementation of the remaining projects in the Water Resource Management Plan for Wood Lake including developing/maintaining a water quality monitoring program for the watershed.

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A copy of this Management Plan is available at Richfield City Hall.

4. Currently no waterbodies are identified as impaired and therefore no work on total maximum daily loads is required at this time. Some ponds, lakes and wetlands within the watershed have been subjected to potential degradation as a result of erosion and sediment deposition into these ponds and basins.

Corrective Actions:

- a. The RBWMO has required that local municipalities include within their storm water management plans a storm water pond maintenance plan which defines and schedules necessary maintenance actions on storm water basins to assure these basins are capable of meeting the rate control and treatment functions for which they were designed, both now and in the future. If regularly identified upon annual evaluation that a member community has failed to address the local pond maintenance plan the RBWMO may consider development of rules to regulate this activity in the future.
 - b. The RBWMO TAC will include a annual report to the RBWMO Board identifying an update on any TMDL's and pollutant load allocations as required by the MPCA.
5. Portions of the RBWMO discharge into the Minnesota River, which is impaired for Fecal Coliform and Turbidity, low oxygen, mercury water column, mercury FCA, and PCB FCA.

Corrective Actions:

- a. The CIP in Section V identifies numerous improvements that will be completed by the member communities to provide for necessary BMPs to address regulatory requirements. The RBWMO will evaluate final outcomes through its programs.
- b. Implement water quality monitoring program to identify baseline conditions and track trends.
- c. Coordinate with Lower MN River Watershed District for cooperation on monitoring efforts.

B. FLOODING AND STORMWATER RATE CONTROL CONCERNS WITHIN THE WATERSHED

1. Member communities have identified temporary flooding occurs occasionally at right-of-way locations throughout the City as well as areas of I-494 in the vicinity of Portland Avenue.

Corrective Action: The RBWMO and/or member community Public Works Departments will identify those sites where flooding has occurred. Member communities recognize the need to accept temporary flooding in non-designated areas such as public right-of-ways and low points. RBWMO and/or member communities will work with MnDOT to evaluate alternatives to address flooding issues potentially in conjunction with future improvements.

2. The RBWMO recognizes that regular maintenance of the storm system is required to preserve the system's intended use to convey storm water runoff to control rates and volumes and provide treatment. Local maintenance activity will be incorporated into the RBWMO oversight and annual reporting program.

Corrective Action: Member communities shall prepare and submit an annual status report, similar to the annual NPDES report, to the RBWMO for review.

3. If flood problem areas have been identified within the RBWMO, the locations of the flood problem areas should be discussed in the Local Surface Water Management Plans for each city.

Corrective Action: In cases where surface water impacts or the source of impacts transcend municipal boundaries, or the community is found to not be in compliance, the RBWMO shall review such problems and issue directives to the appropriate local governmental unit or units for resolution. It will be the responsibility of the member cities to implement a project that is acceptable to the RBWMO. In cases where the member city is not able to implement a project per the directives of the RBWMO, or requests the RBWMO to facilitate resolution of the problem, the RBWMO shall perform such a function in conformance with the terms of the RBWMO Joint Powers Agreement.

C. FLOODING OR STORMWATER RATE CONTROL ISSUES BETWEEN THE MEMBER CITIES

1. No flooding or stormwater rate control issues exist between the member cities of the RBWMO.
2. I-494 regulator in place along with agreement detailing operation parameters.
3. I-494 at Portland Avenue occasionally experiences flooding.

Corrective Action: Work with MnDOT to identify feasible alternatives to address flooding along the I-494 and/or other locations within state right-of-way, most likely in conjunction with or as part of future improvements.

D. IMPACTS OF WATER QUANTITY OR QUALITY MANAGEMENT PRACTICES ON RECREATIONAL OPPORTUNITIES

1. It has been recognized that there is concern regarding the quality of stormwater discharged from the RBWMO to the Minnesota Valley National Wildlife Refuge (MVNWR).

Corrective Actions:

- a. The City of Bloomington recently completed the Airport South (Pond C) Water Quality and the East American Boulevard Improvement Projects to reduce floatables and sediment and improve quality of storm water prior to discharge to Minnesota River and Minnesota Valley National Wildlife Refuge.
 - b. Additional measures to improve the quality of surface water will be implemented in construction with new development, street improvements, or other capital projects to be identified.
2. A concern was noted regarding the quality of stormwater discharged to Wood Lake and Richfield Lake from outfalls receiving stormwater runoff from I-35W and other areas of Richfield.

Corrective Action: The City of Richfield is currently undertaking the Richfield Lake Improvement Project to reduce floatable, sediment and improve quality of storm water prior to Richfield Lake.

3. A concern was noted regarding the presence of floatables being discharged into Smith Pond and Wright's Lake in the City of Bloomington.

Corrective Action: The City of Bloomington recently completed the Smith Pond Water Quality Improvement Project to reduce floatable, sediment and improve quality of storm water prior to discharge to Minnesota River through the Smith Pond and Wrights Lake subwatershed.

4. Trails around Richfield Lake and Wood Lake flood during high rainfall events.

Corrective Action: In late 1990s/early 2000s, the City of Richfield completed a project to raise the trails and fix the bridges at Wood Lake Nature Center. In 2007, trail work is anticipated at Richfield Lake. The City will continue to monitor the situation and determine if additional corrective actions are needed. No specific actions are recommended at this time.

5. The over abundance of Canada geese on local ponds, wetlands, and lakes is contributing to the degradation of water quality and affects the recreational opportunities available for residents.

Corrective Actions:

- a. Work with the member communities to review and implement the local goose management policy.
- b. The City of Bloomington has an existing policy and direction in place.

E. IMPACTS OF STORMWATER QUANTITY ON FISH AND WILDLIFE RESOURCES

1. Impacts to fish and wildlife resources have been identified, including decreased floristic diversity and impacted wildlife habitat.

Corrective Actions: The RBWMO requires that member cities implement the programs, studies, and capital improvements outlined in their local stormwater management plans.

- a. The RBWMO encourages member cities to implement appropriate maintenance programs to maintain the function and values of the wetlands and water bodies within the RBWMO as defined in the local wetland protection and management plans. **Table 10** in **Section V** lists several studies that are programmed through the member community's CIP.
- b. The RBWMO encourages member cities to implement appropriate maintenance programs to maintain the function and values of the wetlands and water bodies within the RBWMO as defined in the local wetland protection and management plans.

F. IMPACTS OF SOIL EROSION ON WATER QUALITY AND WATER QUANTITY

1. Concern was noted regarding the need for adequate erosion control measures to be utilized within the watershed and that the implementation of Best Management Practices should be addressed in this plan.

Corrective Actions:

- a. Continue to implement the erosion control programs currently in place within the watershed for areas where construction activity is taking place. The RBWMO will require member cities to adopt erosion and sedimentation control ordinances that must be contained within their local stormwater management plan. If the community is found on a continual basis to fail to implement their ordinances, the RBWMO will adopt rules to enforce the ordinances.

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- b. The RBWMO will require member cities to adopt erosion and sedimentation inspection programs and to document the results of the inspections.

G. GENERAL IMPACT OF LAND USE PRACTICES AND IN PARTICULAR, LAND DEVELOPMENT AND LAND ALTERATION ON WATER QUALITY AND WATER QUANTITY

- 1. Selected areas of the watershed have been exposed to increased rates and volumes of stormwater runoff as a result of an increase in impervious surface area due to past development.

Corrective Action:

- a. The RBWMO will review loading assessments and non-degradation plans developed by each City if required by the MS4 Permit to help determine significant impacts.
- b. The RBWMO will require new development to reduce runoff volume and pollutant loading to 1988 levels.

H. THE ADEQUACY OF EXISTING REGULATORY CONTROLS TO MANAGE OR MITIGATE ADVERSE IMPACTS ON PUBLIC WATERS AND WETLANDS

- 1. The RBWMO has recognized that a public educational program targeted at educating the public about wetlands and their functions is important.

Corrective Actions:

- a. The RBWMO will utilize the member communities' education programs in particular education programs associated with member cities storm water Pollution Prevention Programs. These education programs individually address each minimum control measure (part V. G. 1-6) From the NPDES permit MN rules 040000 effective June 1, 2006.
 - b. Update the functional and value assessment for wetlands in the WMO through the local communities.
- 2. The RBWMO feels that the existing regulatory controls contained within this watershed plan are adequate to manage or mitigate adverse impacts on public waters and wetlands.

Corrective Action: No corrective action required.

- 3. The RBWMO has recognized that a public educational program targeted at educating the public about wetlands and their functions is important.

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Corrective Action: The RBWMO requires, and will review as part of the RBWMO oversight and annual reporting program, that member cities implement a water resources public education plan to increase residents' awareness concerning proper water resource management.

I. THE ADEQUACY OF PROGRAMS TO LIMIT SOIL EROSION AND CORRESPONDING WATER QUALITY DEGRADATION

1. It is the position of the RBWMO that the existing programs are adequate to limit soil erosion and corresponding water quality degradation.

Corrective Actions:

- a. The watershed will require member municipalities to develop soil erosion and sedimentation ordinances or other regulatory mechanism concerning construction activities within the watershed. In addition, these ordinances or mechanisms must be contained within the local surface water management plans which will be reviewed by the RBWMO.
- b. The RBWMO will work with member communities in reviewing and implementing recommendations from the Minnesota Storm Water Steering Committee's NPDES Construction Site Erosion Control Compliance Workgroup.

J. THE ADEQUACY OF PROGRAMS TO MAINTAIN THE TANGIBLE AND INTRINSIC VALUES OF NATURAL STORAGE AND RETENTION SYSTEMS

1. The RBWMO feels that goals and programs must be established to maintain the tangible and intrinsic values of natural storage and retention systems.

Corrective Action: The member municipalities in the RBWMO will complete diagnostic feasibility studies, reference existing studies or analyses, or utilize the standards within the wetland protection and management plans to implement corrective actions where these cities feel that the tangible and intrinsic value of natural storage and retention systems within their communities are in jeopardy due to influence from water quality and quantity problems.

2. It is the position of the RBWMO the member community's goals and classifications outlined in the City's Surface Water Management Plan and Wetland Protection and Management Plan are sufficient.

Corrective Action: No corrective action is required.

K. THE ADEQUACY OF PROGRAMS TO MAINTAIN WATER LEVEL CONTROL STRUCTURES

1. The existing programs within the RBWMO are adequate to maintain water level control structures.

Corrective Action: No corrective action is required.

L. THE ADEQUACY OF CAPITAL IMPROVEMENT PROGRAMS TO CORRECT PROBLEMS RELATING TO WATER QUANTITY, WATER QUALITY MANAGEMENT, FISH AND WILDLIFE HABITAT, PUBLIC WATERS AND WETLAND MANAGEMENT, AND RECREATIONAL OPPORTUNITIES

1. The capital improvements program outlined within the member community stormwater plans and the general operating procedures of each City are sufficient to address water resource- related concerns. However, the storm water utility fund may not be an adequate funding source to allow full implementation of the capital improvement projects.

Corrective Action: The RBWMO, through its member communities, will actively seek outside grant funding and assistance to implement these programs including those listed in Section V. Some grant resources that the RBWMO will pursue include:

- The MPCA's 2009-11 Surface Water Assessment Grant.
- Various state grant programs to continue wetland riparian restoration and buffer establishment adjacent to and within the Wood Lake and Richfield Lake resources.
- Various state grant programs to retrofit opportunities within the Wood Lake/ Richfield Lake watershed.
- Grant programs for homeowner-initiated BMPs such as rain barrels and infiltration gardens.

M. IDENTIFICATION OF POTENTIAL PROBLEMS WHICH ARE ANTICIPATED TO OCCUR WITHIN THE NEXT 20 YEARS BASED ON GROWTH PROJECTIONS AND PLANNED URBANIZATION

1. The RBWMO anticipates that there will be increased pressure to improve the quality of water within the WMO and the appearance of storm water retention areas. Additional funding sources will need to be sought by the RBWMO or member communities to address this demand.

Corrective Actions:

- a. Provided leadership in acquiring grant dollars to continue wetland riparian restoration and buffer establishment adjacent to and within the Wood Lake and Richfield Lake resources. The RBWMO, through the City of Richfield will pursue state and federal grants to provide retrofit opportunities within the Wood Lake/ Richfield Lake watershed.
- b. The RBWMO requires member cities to include within their stormwater management plans a stormwater basin maintenance plan that defines and schedules necessary maintenance actions on stormwater basins.

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- c. The RBWMO established a policy for new development limiting runoff volume and pollutant loading to 1998 levels. The RBWMO will continue to review/monitor this policy and amend it as necessary to adjust to surrounding changes and/or rule modifications.

N. THE ADEQUACY OF EXISTING TECHNICAL AND BACKGROUND INFORMATION ON SYSTEMS IN THE WATERSHED THAT ARE USED TO MANAGE WATER RESOURCES

1. The RBWMO has recognized that there is insufficient technical and background information on various water bodies within the RBWMO that are experiencing water quality and quantity problems resulting from increased development within the watershed.

Corrective Actions:

- a. Undertake an effort to acquire the necessary technical and background information required to establish capital improvements and programs which may assist in improving the quality of these wetlands and water bodies.
 - b. RBWMO requires local communities to develop Water Quality monitoring program. This program, at a minimum, shall monitor Total Phosphorus, Ortho-phosphorus, and Total Suspended Solids at each basin, wetland, or lake within the RBWMO. Samples shall be collected a minimum of every three years. No in-lake monitoring is proposed as no basin, wetland, or lake within the RBWMO is used for public contact.
2. Both Bloomington and Richfield have completed hydrologic/hydraulic modeling that meets the standards of the RBWMO. The member communities believe that the existing information is adequate to manage water resources.

Corrective Action: No corrective action is required.

v. IMPLEMENTATION PROGRAM/PRIORITIES

Based on the information developed in **Sections II through IV**, the WMO has developed a water resource management program that reflects the needs and concerns of the WMO. A prioritized listing of the studies, programs and capital improvements that have been identified, as necessary to respond to all of the water resource needs within the WMO, is outlined on the following tables. The WMO anticipates implementing, at least to some extent, the regulatory programs or improvements identified within this plan by the year 2017.

The studies and capital improvements identified in this section of the plan may be entirely or partially completed by the local government unit, the WMO, or joint effort between the WMO or any other government unit. It may not be necessary to complete a full diagnostic study for each of the lakes or water bodies indicated in the listing of studies to reasonably construct capital improvements. Those capital improvements which have been found to be effective with other water bodies with similar watershed characteristics within the RBWMO may be implemented without a detailed diagnostic study. Local government units or the WMO may partially or entirely undertake the capital improvements necessary to improve water quality within the watershed.

As of 2007, the RBWMO has identified that programs, policies, or capital improvements related to the issues identified below will be the top priority for the RBWMO :

1. Provided leadership in acquiring grant dollars to continue wetland riparian restoration and buffer establishment adjacent to and within the Wood Lake and Richfield Lake resources. The RBWMO through the City Richfield will pursue state and federal grants to provide retrofit opportunities within the Wood Lake/ Richfield Lake watershed.
2. Creation, maintenance and expansion of the RBWMO website for water resource management education and material aimed at fostering responsible water quality management practices
3. Distribution of educational material aimed at fostering responsible water quality management practices. Topics are anticipated to include shoreland restoration and Best Management Practices for home and property owners, wetland buffer and maintenance, and water quality monitoring.
4. Analyze and develop a stormwater quality monitoring program which will establish a program of long-term water quality monitoring for the direct storm sewer discharges to either Wood Lake, Richfield Lake system, or Smith and Wright Ponds. Monitoring would include grab samples for Total Phosphorus and Total Suspended Solids. Monitoring samples will be processed at the City of Bloomington Labs and analyzed by City staff.
5. Implement a policy on enhanced infiltration practices and low impact development that will reduce runoff volume, Total Phosphorus loading, and Total Suspended Solids loading to 1988 levels.
6. Implement establishment of a TAC in 2009. The RBWMO TAC would provide bi-annual peer review of the implementation of the member community stormwater management plans, review, of at least 2 permits (1 municipal reconstruction and 1 private development) which have RBWMO jurisdictions, and review of each member communities NPDES annual report and summarizing staff review of each report to the RBWMO Board.

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7. Define the Citizen's Advisory Commission to be comprised of the Community Services Commission (Richfield) and the Planning Commission (Bloomington) for citizen input on storm water issues that come before the RBWMO.
8. Implement an annual update to each member community's advisory planning or parks commissions or related advisory commission on the RBWMO Plan and/or WMO programs and projects.
9. Work with member communities to promote, educate, and possibly assist with site specific landowner BMP implementation program within the Cities of Richfield and Bloomington. These activities may include establishment of a grant program for homeowner lead BMPs such as rain barrels and infiltration gardens.
10. Review and provide guidance on management of buffer habitat and aquatic plants management to the City and staff at the Wood Lake Nature Center.
11. Update function and value assessment of wetlands in RBWMO
12. Establish an evaluation and reporting process to determine local plan compliance with performance framework consistent with RBWMO goals.

SECTION V

TABLE 9a											
STORM WATER MANAGEMENT PROGRAMS - CITY OF RICHFIELD											
TABLE 11					Proposed Expenses for Year						
No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
1	Perform LGU and permitting authority role	\$62,000	Richfield	Development fees	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$31,000	Prorated from City-wide total (62%)
2	Perform water quality and quantity management and routine pond cleanout to meet water quality and TMDL standards	\$1,240,000	Richfield	Storm water utility	\$124,000	\$124,000	\$124,000	\$124,000	\$124,000	\$620,000	Prorated from City-wide total (62%)
3	Conduct erosion control inspections of construction sites	\$62,000	Richfield	Storm water utility; Development fees	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$31,000	Prorated from City-wide total (62%)
4	Maintain and update GIS database, storm sewer map, and hydrologic model	\$31,000	Richfield	Storm water utility	\$3,100	\$3,100	\$3,100	\$3,100	\$3,100	\$15,500	Prorated from City-wide total (62%)
5	Maintain and update website for surface water management education per NPDES permit	\$12,400	Richfield	Storm water utility	\$1,240	\$1,240	\$1,240	\$1,240	\$1,240	\$6,200	Prorated from City-wide total (62%)
6	Prepare and distribute annual newsletter and distribute information in City mailing regarding surface water management	\$62,000	Richfield	Storm water utility	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$31,000	Prorated from City-wide total (62%)
7	Sweep streets twice per year	\$992,000	Richfield	Storm water utility	\$99,200	\$99,200	\$99,200	\$99,200	\$99,200	\$496,000	Prorated from City-wide total (62%)
8	Inspect 20% of storm sewer system including outfalls, ponds, and structural pollution control devices	\$62,000	Richfield	Storm water utility	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$31,000	Prorated from City-wide total (62%)
9	Conduct water quality monitoring for major water bodies	\$93,000	Richfield	Storm water utility	\$9,300	\$9,300	\$9,300	\$9,300	\$9,300	\$46,500	Prorated from City-wide total (62%)

SECTION V

TABLE 9a											
STORM WATER MANAGEMENT PROGRAMS - CITY OF RICHFIELD											
TABLE 11					Proposed Expenses for Year						
No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
10	Prepare and submit annual SWPPP report and MCWD report	\$49,600	Richfield	Storm water utility	\$4,960	\$4,960	\$4,960	\$4,960	\$4,960	\$24,800	Prorated from City-wide total (62%)
11	Continue management of Wood Lake Perimeter Treatment System	\$46,500	Richfield	Storm water utility	\$3,100	\$3,100	\$3,100	\$3,100	\$3,100	\$31,000	Prorated from City-wide total (62%)
Totals			Richfield Contribution		\$ 269,700	\$ 269,700	\$ 269,700	\$ 269,700	\$ 269,700	\$ 1,364,000	
			Bloomington Contribution								

1) Cost estimates provided are for planning purposes only. Cost estimates are subject to change and/or updates.

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TABLE 9b

SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON

TABLE 11

No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
A. In-Place Programs												
SMP-1	Storm Sewer Mainline Inspections.	\$26,100	Bloomington	Storm water utility	\$2,250	\$2,250	\$2,700	\$2,700	\$2,700	\$13,500	27	Prorated from City-wide total (9%)
SMP-2	Annual Storm Sewer Inspections.	\$31,500	Bloomington	Storm water utility	\$3,150	\$3,150	\$3,150	\$3,150	\$3,150	\$15,750	30	Prorated from City-wide total (9%)
SMP-3	Storm Sewer Maintenance Projects.	\$270,000	Bloomington	Storm water utility	\$27,000	\$27,000	\$27,000	\$27,000	\$27,000	\$135,000	29	Prorated from City-wide total (9%)
SMP-4	Sweep streets twice annually in all areas, and early in priority areas.	\$585,000	Bloomington	Storm water utility	\$58,500	\$58,500	\$58,500	\$58,500	\$58,500	\$292,500	47	Prorated from City-wide total (9%)
SMP-5	Work cooperatively with the activities of the watershed districts & watershed management organizations	\$10,800	Bloomington	Storm water utility	\$1,800	\$1,800	\$1,800	\$1,800	\$1,800	\$1,800		Prorated from City-wide total (9%)
SMP-6	Provide review of all plans for new development or redevelopment of sites within the City to meet all applicable standards. Includes cost for City staff as well as any consultant review time.	\$13,500	Bloomington	Storm water utility	\$1,350	\$1,350	\$1,350	\$1,350	\$1,350	\$6,750	36	Prorated from City-wide total (9%)
SMP-7	Review certificate of surveys for each building site proposed for development.	\$3,600	Bloomington	Storm water utility	\$360	\$360	\$360	\$360	\$360	\$1,800	37	Prorated from City-wide total (9%)
SMP-8	Continue the program of permitting and inspecting privately owned storm sewer connections to the City system.	\$9,000	Bloomington	Public Works	\$900	\$900	\$900	\$900	\$900	\$4,500	26	Prorated from City-wide total (9%)
SMP-9	Perform Local Government Unit (LGU) Role for Wetland Conservation Act	\$7,200	Bloomington	Storm water utility	\$720	\$720	\$720	\$720	\$720	\$3,600		Prorated from City-wide total (9%)
SMP-10	Sponsor Curb-side-clean-up day	\$598,500	Bloomington	Solid Waste Division	\$59,850	\$59,850	\$59,850	\$59,850	\$59,850	\$299,250	9	Prorated from City-wide total (9%)

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TABLE 9b

SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON

TABLE 11

No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
SMP-13	Engineering staff inspection & enforcement of erosion control measures required for site development activities within the City with the NPDES Erosion Control Program now being administered by the MPCA.	\$45,000	Bloomington	Storm water utility	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$22,500	39	Prorated from City-wide total (9%)
SMP-14	Revisit and redefine water quality monitoring program to establish existing quality, identify concerns and/or needs for Corrective Actions. It is anticipated that the monitoring program would help determine the quality of water discharged from the City,	\$13,500	Bloomington	Storm water utility	\$1,350	\$1,350	\$1,350	\$1,350	\$1,350	\$6,750	From 2000 Plan	Prorated from City-wide total (9%)
SMP-15	Continue implementation of the Wetland Vegetation Treatment Policy	\$9,000	Bloomington	Storm Water Utility	\$900	\$900	\$900	\$900	\$900	\$4,500		Prorated from City-wide total (9%)
SMS-16	Update City's GIS system to show infrastructure improvements	\$22,500	Bloomington	Storm water utility	\$2,250	\$2,250	\$2,250	\$2,250	\$2,250	\$11,250	19	Prorated from City-wide total (9%)
SMP-17	Continue implementation of Drainage and Erosion Control Ordinance and determine if any revisions are needed.	\$4,500	Bloomington	Storm water utility	\$450	\$450	\$450	\$450	\$450	\$2,250	35	Prorated from City-wide total (9%)
Subtotal:		\$1,649,700			\$165,330	\$165,330	\$165,780	\$165,780	\$165,780	\$821,700		

B. Programs identified in the Wetland Protection and Management Plan Also InPlace

SECTION V

TABLE 9b

SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON

TABLE 11

No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
SMP-18	Implementation of community education plan to increase the residents awareness concerning proper water resource management	\$13,500	Bloomington	Storm water utility	\$1,350	\$1,350	\$1,350	\$1,350	\$1,350	\$6,750	4	Prorated from City-wide total (9%)
SMP-19	Adopt-a-Wetland Program	\$1,800	Bloomington	Park maintenance	\$180	\$180	\$180	\$180	\$180	\$900	12	Prorated from City-wide total (9%)
SMP-20	Wetland Health Evaluation Program	\$4,500	Bloomington	Storm water utility	\$450	\$450	\$450	\$450	\$450	\$2,250		Prorated from City-wide total (9%)
SMP-21	Implement invasive exotic species vegetation control program	\$1,350	Bloomington	Park maintenance	\$135	\$135	\$135	\$135	\$135	\$675		Prorated from City-wide total (9%)
	Subtotal:	\$21,150			\$2,115	\$2,115	\$2,115	\$2,115	\$2,115	\$10,575		

C. New programs identified in the Surface Water Management Plan

SMP-21	Work with Three Rivers, US Fish & Wildlife Service, and Watershed District to address water quality issues of Bush Lake, Minnesota River Valley, and Hyland Lake.	\$1,350	Bloomington	Storm water utility, Watershed Districts, Three Rivers Parks	\$135	\$135	\$135	\$135	\$135	\$675		Prorated from City-wide total (9%)
SMP-22	The education coordinator will administer the education activity implementation plan to address each minimum control measure.	\$13,500	Bloomington	Public Works	\$1,350	\$1,350	\$1,350	\$1,350	\$1,350	\$6,750	1, 4	Prorated from City-wide total (9%)
SMP-23	Public notice of annual report and annual public meeting to inform the public on the status of SWPPP and annual report.	\$1,350	Bloomington	Storm Utility	\$135	\$135	\$135	\$135	\$135	\$675	2, 15	Prorated from City-wide total (9%)

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TABLE 9b												
SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON												
TABLE 11												
No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
SMP-24	Publish water resources articles in the Bloomington Briefing.	\$1,800	Bloomington	Storm Utility	\$180	\$180	\$180	\$180	\$180	\$900	8	Prorated from City-wide total (9%)
SMP-25	Maintain the City's website as a tool for residents to research water resources related topics.	\$2,250	Bloomington	Storm Utility Public Works	\$225	\$225	\$225	\$225	\$225	\$1,125	11	Prorated from City-wide total (9%)
SMP-26	Establish an erosion control hotline number for receiving erosion control related calls.	\$6,750	Bloomington	Storm Utility	\$675	\$675	\$675	\$675	\$675	\$3,375	13	Prorated from City-wide total (9%)
SMP-27	Promote the use of Hennepin County Hazardous Waste Disposal Center.	\$900	Bloomington	Public Works	\$90	\$90	\$90	\$90	\$90	\$450	14	Prorated from City-wide total (9%)
SMP-28	Develop a complaint line for the public to report suspected illicit discharges, spills, or illegal dumping.	\$1,620	Bloomington	Storm Utility/ Envl. Health	\$0	\$180	\$180	\$180	\$180	\$900	16	Prorated from City-wide total (9%)
SMP-29	Implement the Zero Phosphorus Fertilizer Ordinance.	\$450	Bloomington	Public Works/ Legal	\$45	\$45	\$45	\$45	\$45	\$225	18	Prorated from City-wide total (9%)
SMP-30	Develop a map of the City's existing storm sewer system in GIS, and continually update private storm sewer systems.	\$25,650	Bloomington	Storm Utility	\$1,350	\$2,700	\$2,700	\$2,700	\$2,700	\$13,500	19, 25	Prorated from City-wide total (9%)
SMP-31	Develop an inspection program to detect non-storm water discharges.	\$5,850	Bloomington	Storm Utility	\$0	\$2,250	\$450	\$450	\$450	\$2,250	22	Prorated from City-wide total (9%)
SMP-32	Sanitary sewer video inspections to reduce the risk of raw sewage entering the storm sewer system..	\$54,000	Bloomington	Utility Div.	\$13,500	\$4,500	\$4,500	\$4,500	\$4,500	\$22,500	23	Prorated from City-wide total (9%)
SMP-33	Annual sanitary sewer maintenance to reduce the risk of raw sewage entering the storm sewer system.	\$315,000	Bloomington	Utility Div.	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$157,500	24	Prorated from City-wide total (9%)

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TABLE 9b												
SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON												
TABLE 11												
No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
SMP-34	Develop and implement an operations and maintenance program and training component to reduce pollutant loading from municipal operations.	\$4,500	Bloomington	Storm Utility Public Works	\$450	\$450	\$450	\$450	\$450	\$2,250	31	Prorated from City-wide total (9%)
SMP-35	Provide erosion control training for City staff responsible for erosion control inspections.	\$4,500	Bloomington	Storm Utility/ Engineering	\$450	\$450	\$450	\$450	\$450	\$2,250	32	Prorated from City-wide total (9%)
SMP-36	Continue to provide turf reestablishment/permanent erosion control plans on all City improvement projects.	\$45,000	Bloomington	Storm Utility/ Engineering	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$22,500	38	Prorated from City-wide total (9%)
SMP-37	The use of inlet protection on all storm sewer inlets are required on City construction projects.	\$4,500	Bloomington	Storm Utility/ Engineering	\$450	\$450	\$450	\$450	\$450	\$2,250	40	Prorated from City-wide total (9%)
SMP-38	Implement the Shore Area Regulations within the City to protect shore areas and adjacent water bodies.	\$1,350	Bloomington	Community Development	\$135	\$135	\$135	\$135	\$135	\$675	41	Prorated from City-wide total (9%)
SMP-39	Implement the special zoning overlay districts for Planned Development Overlay Policy, Flood Hazard Overlay District, and Bluff Protection Overlay District.	\$4,500	Bloomington	Community Development	\$450	\$450	\$450	\$450	\$450	\$2,250	42	Prorated from City-wide total (9%)
SMP-40	Continue routine meetings with other water resources staff from neighboring communities and agencies to discuss storm water issues and accomplishments.	\$1,350	Bloomington	Storm Utility	\$135	\$135	\$135	\$135	\$135	\$675	46	Prorated from City-wide total (9%)

SECTION V

TABLE 9b												
SURFACE WATER MANAGEMENT OPERATION AND MAINTENANCE PROGRAMS - CITY OF BLOOMINGTON												
TABLE 11												
No.	Project Description	Cost Estimate ^a		Funding Sources	2008	2009	2010	2011	2012	2013-2017	BMP # from SWPPP	Comments
SMP-41	Maintain records of inspection activities and results, and other pertinent information as required by SWPPP.	\$4,500	Bloomington	Storm Utility	\$450	\$450	\$450	\$450	\$450	\$2,250	47	Prorated from City-wide total (9%)
	Subtotal:	\$500,670			\$56,205	\$50,985	\$49,185	\$49,185	\$49,185	\$245,925		
Totals		\$2,171,520	Richfield Contribution									
			Bloomington Contribution		\$223,650	\$218,430	\$217,080	\$217,080	\$217,080	\$1,078,200		

a) Cost estimates based on year 2006 dollars. Estimates do not take inflation into account. Estimates are for planning purposes only and are not based on engineering feasibility reports.

Notes: The funding sources identified do not necessarily reflect the sources identified in the Wetland Protection and Management Plan and are subject to change.

SECTION V

TABLE 10											
STORM WATER MANAGEMENT STUDIES											
TABLE 11					Proposed Expenses for Year						
SMS No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
1	Develop buffer management plan for wetlands	\$5,000	Richfield	Storm Water Utility	\$5,000						Prorated from City-wide total (62%)
2	Complete Adam's Hill Pond water quality feasibility study to identify options to provide additional water quality treatment for area.	\$35,000	Richfield	Storm Water Utility		\$35,000					
3	Complete Wood Lake water quality feasibility study to identify options to provide additional water quality treatment for area.	\$35,000	Richfield	Storm Water Utility					\$35,000		
4	Review and update erosion control ordinance to be in conformance with this Plan and NPDES	\$4,300	Richfield	Storm Water Utility	\$4,300						Prorated from City-wide total (62%)
5	Update Water Resource Management ordinance to be in conformance with this plan	\$4,300	Richfield	Storm Water Utility		\$4,300					Prorated from City-wide total (62%)
6	Develop wetland ordinance (or include with water resource management ordinance)	\$3,100	Richfield	Storm Water Utility		\$3,100					Prorated from City-wide total (62%)

SECTION V

STORM WATER MANAGEMENT STUDIES											
TABLE 11					Proposed Expenses for Year						
SMS No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
7	Complete water quality and quantity feasibility study to address improvements in for Problem Area 26: Wilson Pond to the west of 15th Avenue between 73rd and 75th Streets and Washington Park areas.	\$35,000	Richfield	Storm Water Utility					\$35,000		
8	Review road salt application practices and review alternative products (as available)	\$4,800	Richfield	Storm Water Utility		\$1,200		\$1,200		\$2,400	
9	Develop shoreland ordinance	\$6,200	Richfield	Storm Water Utility					\$6,200		
10	Complete TMDL feasibility study once TMDL studies are complete	\$31,000	Richfield	Storm Water Utility						\$31,000	Funding has been included here as a placeholder since actual costs are unknown.
11	Support Mn/DOT in addressing Problem Area 46: I-494 and Portland Avenue area	\$3,100	Richfield	Storm Water Utility						\$3,100	
	Implement the illicit discharge elimination regulatory mechanism.	\$10,000	Bloomington	Storm Utility/ Env'l. Health	\$10,000						

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STORM WATER MANAGEMENT STUDIES											
TABLE 11					Proposed Expenses for Year						
SMS No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
	Publish and distribute brochures or post information on City's web site about hazards of illegal discharges and improper disposal of wastes.	\$7,500	Bloomington	Public Works	\$7,500						
	Update wetland function and value inventory	\$25,000	Bloomington	Storm Utility	\$25,000						
	Administer a regulatory mechanism to control the post-construction runoff rate to level equal or below pre-construction rates.	\$10,000	Bloomington	Storm Utility/Engineering	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$5,000	
	Erosion control ordinance	\$10,000	Bloomington	Storm water utility/General fund	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$5,000	
	Update wetland function and value inventory	\$25,000	Bloomington	Storm Utility	\$25,000						

SECTION V

STORM WATER MANAGEMENT STUDIES											
TABLE 11					Proposed Expenses for Year						
SMS No.	Project Description	Cost Estimate¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
	Totals	\$219,300	Richfield Contribution		\$ 9,300	\$ 43,600	\$ -	\$ 1,200	\$ 76,200	\$ 36,500	
			Bloomington Contribution		\$69,500	\$2,000	\$2,000	\$2,000	\$2,000	\$10,000	

1) Cost estimates provided are for planning purposes only. Cost estimates are subject to change and/or updates.

SECTION V

TABLE 11											
CAPITAL IMPROVEMENT PROJECTS											
Capital Improvement Projects					Proposed Expenses for Year						Comments
No.	Project Description	Cost Estimate ¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	
1	Construct Richfield Lake Water Quality perimeter system	\$650,000	Richfield	Storm Water Utility	\$ 325,000	\$ 325,000					
2	Undertake improvements to address Problem Area 9: 68th Street between Newton and Oliver	\$150,000	Richfield	Storm Water Utility			\$ 150,000				
3	<u>Smith's Pond/Wright's Lake Drainage Area.</u> Install trap manhole at <u>Wright's Lake</u> (04-01)	\$10,000	Bloomington	Storm Water Utility			\$ 10,000				
4	Undertake improvements to address Problem Area 12: Girard alley flooding	\$200,000	Richfield	Storm Water Utility		\$ 200,000					
5	Undertake improvements to address Problem Area 40: 65th and 66th at Newton and Morgan Avenues	\$200,000	Richfield	Storm Water Utility					\$ 200,000		
6	Construct Augsburg Pond Lift Station and Forcemain	\$375,000	Richfield	Storm Water Utility		\$ 375,000					

SECTION V

CAPITAL IMPROVEMENT PROJECTS											
Capital Improvement Projects					Proposed Expenses for Year						
No.	Project Description	Cost Estimate¹	Community Responsible for Implementing	Potential Funding Sources	2008	2009	2010	2011	2012	2013-2017	Comments
7	Construct active treatment system at Adam's Hill Pond	\$800,000	Richfield	Storm Water Utility; NMCWD; grants				\$ 800,000			
	Airport South Long Meadow Outlet	\$3,000,000	Bloomington	TIF	\$ 1,400,000						
	Airport South Pond C.	\$1,400,000	Bloomington	TIF			\$ 3,000,000				
Totals			Richfield Contribution		\$ 325,000	\$900,000	\$150,000	\$800,000	\$200,000		
			Bloomington Contribution		\$1,400,000		\$3,010,000				

1) Cost estimates provided are for planning purposes only. Detailed feasibility analyses have not been completed for these projects; therefore, cost estimates are subject to change upon final design

SECTION V

TABLE 12									
SUMMARY									
TABLE 11			Proposed Expenses for Year						
Improvements, Programs, and Studies	Totals¹		2008	2009	2010	2011	2012	2013-2017	Comments
Totals for Management Programs:	\$3,582,020	Richfield	\$269,700	\$269,700	\$269,700	\$269,700	\$269,700	\$1,364,000	
		Bloomington	\$223,650	\$218,430	\$217,080	\$217,080	\$217,080	\$1,078,200	
Totals for Management Studies:	\$219,300	Richfield	\$9,300	\$43,600	\$0	\$1,200	\$76,200	\$36,500	
		Bloomington	\$69,500	\$2,000	\$2,000	\$2,000	\$2,000	\$10,000	
Totals for Capital Improvements:	\$6,785,000	Richfield	\$325,000	\$900,000	\$150,000	\$800,000	\$200,000	\$0	
		Bloomington	\$1,400,000	\$0	\$3,010,000	\$0	\$0	\$0	
	\$10,586,320	Richfield	\$604,000	\$1,213,300	\$419,700	\$1,070,900	\$545,900	\$1,400,500	
		Bloomington	\$1,693,150	\$220,430	\$3,229,080	\$219,080	\$219,080	\$1,088,200	

1) Cost estimates provided are for planning purposes only. Detailed feasibility analyses have not been completed for these projects, programs, and studies; therefore, cost estimates are subject to change upon final design and/or updated information.

SECTION VI

VI. IMPACT ON LOCAL UNIT OF GOVERNMENT

As required by Minnesota Rules, Part 8410.0110, this section outlines the impact implementation of this watershed management plan will have on local governmental units, regulatory programs, other water resource-related programs, studies, and capital improvements. A discussion of the financial impact of implementing this watershed management plan on local units of government is also included in this section.

A. REGULATORY PROGRAMS

The implementation of the Richfield-Bloomington Watershed Management Plan (RBWMO) requires the adoption of several regulatory programs by the member cities. Pursuant to state requirements member communities shall revise their local water plans and submit the plan to the RBWMO on or before November 2009. Upon RBWMO approval of the revised local water plan, which would occur on or before February 2010, the member community will have 180 days (June 2010) to review and update, where necessary, its local controls and regulatory program. The regulatory programs, which the RBWMO will require from member cities, are as follows:

1. Adoption of shoreland ordinances in compliance with the Minnesota Department of Natural Resources (MDNR).
2. Adoption of erosion and sediment control policies in compliance with those established by the MPCA.
3. Continue to implement the wetland classification system in conformance with **Section III** of this plan.
4. Adoption and approval of a storm water system maintenance plan which meets or exceeds the requirements as described in **Section III**. **See City of Bloomington and Richfield Draft CSMP for a detailed description the City's storm water maintenance system.**
5. Development and adoption of an approved Water Resources Management Plan.
6. Administration of the local government unit role in the implementation of the 1991 Wetland Conservation Act when applicable.
7. Development and adoption of a well head protection program for member cities.
8. For new development, require major storm water storage facilities to accommodate a critical duration event with a 1% chance of occurrence
9. For new development, require new storm sewer systems to accommodate discharge rates of a critical duration event with a 10% chance of occurrence

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10. For new development, require pretreatment of storm water runoff to the Nationwide Urban Runoff Program (NURP) recommendations or MPCA guidelines in the design and construction of new or modifications to existing storm water conveyance systems wherever possible and feasible.
11. Placement of skimmers in the construction of new storm water pond outlets and addition to the existing system whenever feasible and practical.
12. Implementation of an education program aimed at fostering responsible water quality management practices by residents.
13. Develop and implement a water quality monitoring and pollutant load allocations reporting system capable of evaluating pollutant loads to downstream waters.
14. Require new development to provide storm water management facilities that reduce runoff volume, Total Phosphorus loading, and Total Suspended Solids to 1988 levels or lower.

Table VI-1 shows the current status of member city regulatory programs for conformance with requirements as established in this Watershed Management Plan.

SECTION VI

TABLE VI-1

STATUS OF LOCAL MUNICIPAL REGULATORY PROGRAMS

Regulatory Program	Bloomington	Richfield
Adoption of Shoreland Ordinances in compliance with the DNR	Yes	Yes
Adoption of Erosion and Sedimentation Control policies in compliance with those established by the Hennepin Conservation District and the MPCA Best Management Practices	Yes	Yes
Acceptance of the LGU role in the implementation of the 1991 Wetland Conservation Act	Yes	Yes
Adoption and approval of a Wetland Classification System	Yes	Yes
Development and approval of a Storm water System Maintenance Plan	Yes	Yes
Development and adoption of an approved Water Resources Management Plan	Yes	Yes (update pending)
Development and adoption of a Wellhead Protection Plan	Yes	Yes
Require major storm water storage facilities to accommodate a critical duration event with a 1 % chance of occurrence	Yes	Yes
Require new storm sewer systems to accommodate discharge rates of a critical duration event with a 10 % chance of occurrence	Yes	Yes
Pretreatment of storm water runoff to the Nationwide Urban Runoff Program (NURP) recommendations in the design and construction of new or modifications to existing storm water conveyance systems	Yes	Yes
Placement of skimmers in the construction of new pond outlets and addition to the existing system whenever feasible and practical.	Yes	Yes
Development of an education program aimed at fostering responsible water quality management practices by residents.	Yes	Yes
Develop and implement a water quality monitoring and pollutant load allocations reporting system capable of evaluating downstream loads to downstream impaired waters.	Under development	No
Require new development to provide storm water management facilities that reduce runoff volume, Total Phosphorus loading, and Total Suspended Solids to 1988 levels or lower.	Under development	Under development

B. CAPITAL IMPROVEMENT PROGRAM

Table 11 in Section V lists capital improvement programs that the RBWMO proposes to undertake between 2007 and the year 2018. The primary source of funding to implement these capital improvements is the member cities. The RBWMO defers the lead role in undertaking these projects to member cities.

The RBWMO role in the implementation of the capital improvements, programs, and studies will be limited to that of securing and allocating grant funding, as well as overseeing projects which may impact more than one local city in the Watershed Management Organization. **Table VI-2** provides a summary of the proposed member community financial contribution.

SECTION VI

C. WATER RESOURCES RELATED PROGRAMS

Section V, Table 9, outlines anticipated water resource-related programs that the RBWMO will implement between 2007 and the year 2018. The cost associated with implementing these programs is estimated at \$965,050. **Table VI-2** provides a summary of the proposed member community financial contribution.

D. WATER RESOURCE MANAGEMENT STUDIES

The RBWMO lists the programs and studies in **Section V, Table 10**. The WMO may undertake studies at the request of the local cities. **Table VI-2** provides a summary of the proposed member community financial contribution.

Table VI-2		
Summary of Member Community Financial Contribution		
Implementation Program		Proposed Contribution *
<u>Proposed Capital Improvement Program</u>	City of Bloomington	\$4,410,000
	City of Richfield	\$2,375,000
	TOTAL	\$6,785,000
<u>Proposed Water Resource Programs</u>		\$3,582,020
<u>Proposed Water Resource Management Studies</u>		<u>\$219,300</u>

*Cost estimates provided are for planning purposes only. Cost estimates are subject to change and/or updates. Costs reflect an estimate of proportion of City of Richfield and Bloomington Costs. RBWMO will become involved as funding becomes available.

E. STAFF RESOURCES TO IMPLEMENT POLICIES AND PROGRAMS

It is anticipated that existing member community staff will be utilized to implement the policies and programs identified in the Plan.

SECTION VII

VII. AMENDMENT PROCEDURES

It is the intention of the Richfield-Bloomington Watershed Management Organization (RBWMO) to have this water management plan reviewed and approved by the Board of Water and Soil Resources (BWSR). Once approved, no significant changes to this plan can be facilitated without the approval of the proposed revisions by the BWSR pursuant to Minnesota Rules Chapter 8410.0140 and the review process provided in MS 103B.231. Significant changes to the RBWMO plan shall be made known to the following parties:

1. The Cities of Richfield and Bloomington.
2. The Metropolitan Council.
3. RBWMO Board.
4. Minnesota Board of Water and Soil Resources and all review agencies as set forth in Minnesota Rules, Chapter 8410.
5. A public meeting must be held to explain the amendments and a legal notice of this public meeting must be published twice at least seven (7) days and (14) days prior to the date of the public meeting.

Following notification of the above parties, they shall have 45 days to comment on the proposed revisions. Failure to respond within 45 days constitutes approval.

It is anticipated that the RBWMO will review the long term implementation (CIP) plan on a biennial cycle starting in 2010.

Minor changes to the plan shall be defined as recodification of the plan, revision of a procedure meant to streamline administration of the plan, clarification of the intent of a policy, the inclusion of additional data not requiring interpretation, or any other action that will not adversely affect the member cities or diminish the RBWMO's ability to achieve the plan goals or implementation program. Adjustment to subwatershed boundaries will be considered minor changes, provided that the change will have no significant impact on the rate or quality in which stormwater runoff is discharged from the WMO boundaries. Minor changes to this plan can be made by the RBWMO Board with the above-noted public notification process. This plan will be in effect through December 2018 unless significant changes to the plan are deemed necessary prior to that date.

SECTION VIII

VIII. REFERENCES/SUPPLEMENTAL DOCUMENTS

The following documents have been referenced within the text of the Plan and are available within the Appendices of the Plan, the Water Resource Library at Public Works, or from the Public Works Staff.

1. Barr Engineering. 1998. Nine Mile Creek Use Attainability Analysis.
2. Barr Engineering. 1997. Engineer's Report – Bush Lake Outlet Project; Basic Water Management Plan.
3. Barr Engineering. 1995. Wellhead Protection Area Delineation.
4. Barr Engineering. 1990. Storm Water Management Analysis, Oxboro Lake Drainage Basin.
5. Barr Engineering. 1983. Stormwater Management Plan – Normandale Center Area.
6. Barr Engineering. 1978. Oxboro Lake to Nine Mile Creek Storm Sewer System.
7. Barr Engineering. 1978. James Avenue Storm Sewer System.
8. City of Bloomington. City of Bloomington Comprehensive Plan.
9. City of Bloomington. 1999. 1999 Storm Water Monitoring Results.
10. City of Bloomington. 1998. 1998 Storm Water Monitoring Results.
11. City of Bloomington. 1998. City of Bloomington Comprehensive Sanitary Sewer Plan.
12. City of Bloomington. 1997. Wetland Protection and Management Plan.
13. City of Bloomington. 1997. 1997 Storm Water Monitoring Results.
14. City of Bloomington. 1988. Property Damage and Flood Elevation Comparisons.
15. City of Bloomington – Environmental Services. 1975. Report of Skriebakken Pond.
16. Federal Emergency Management Agency. 1981. Flood Insurance Rate Maps.
17. Federal Emergency Management Agency. 1981. Flood Insurance Study.
18. Hansen, Thorp, Pellinen, Olson, Inc. 1989. CSAH 1 and 18 Area Storm Sewer Improvements, City of Eden Prairie, Minnesota.
19. Hennepin County. 1994. Draft Hennepin County Groundwater Plan.

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20. Hennepin Conservation District. 1989. Erosion and Sediment Control Manual.
21. Hickok & Associates. 1988. Drainage Analysis for the York-Nine Ponds Area.
22. Hickok & Associates. 1988. Pond C Detention Basin Water Quality Study.
23. Jones Environmental Consulting Service. 1977. City of Bloomington Wetland Survey.
24. Lower Minnesota River Watershed District. 1999. Lower Minnesota River Watershed District Plan.
25. Minnesota Board of Water and Soil Resources. Minnesota Rules Chapter 8420. Wetland Conservation Act Rules.
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29. Minnesota Department of Natural Resources. Local Water Planning and Environmental Review Program Summary.
30. Minnesota Department of Natural Resources. 1999. DNR Water Appropriations Permits.
31. Minnesota Department of Natural Resources. 1998. Mississippi River Guide.
32. Minnesota Department of Natural Resources. 1998. Twin Cities Water Recreation.
33. Minnesota Department of Natural Resources. 1990-94. Aquifer Summaries for water year 1990-1994.
34. Minnesota Department of Natural Resources. 1992. An Ecological Classification of Minnesota Lakes with Associated Fish Communities.
35. Minnesota Department of Natural Resources. 1989. Protecting Water Quality in Urban Areas.
36. Minnesota Department of Natural Resources – Natural Heritage Database report for City of Bloomington.
37. Minnesota Geological Survey. 1989. Hennepin County Geologic Atlas.
38. Minnesota Historical Society. 1999. Geographical search of archeological inventory.

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39. Minnesota Pollution Control Agency. 1999. List of pollutant sources within the City of Bloomington.
40. Montgomery Watson. 1997. Airport South Drainage Area Water Quality Study.
41. Nine Mile Creek Watershed District. 1996. Nine Mile Creek Watershed District Plan.
42. Schoell & Madson, Inc. 1979. Drainage Study for I-494 and Penn Avenue Interchange.
43. Soil Conservation Service. 1974. Hennepin County Soil Survey.
44. Summit Envirosolutions. 1998. Technical Memorandum of Groundwater Conditions and Potential Wellfield Expansion.
45. TKDA. 1988. Smith's Pond-Wright's Lake Drainage Study.
46. TKDA. 1981. Stadium Area Storm Drainage Study.
47. US Environmental Protection Agency/Minnesota Pollution Control Agency. 1999. STORET Database
48. US Fish and Wildlife Service-Minnesota Valley National Wildlife Service. Comprehensive Conservation Management Plan, draft.
49. US Fish and Wildlife Service. 1994. Survey of contaminants in sediments and fish on the Minnesota Valley National Wildlife Refuge.
50. US Fish and Wildlife Service. Long Meadow Lake water quality summary.
51. US Fish and Wildlife Service. 1994. Sediment toxicity of Long Meadow Lake Minnesota Valley National Wildlife Refuge.
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53. US Fish and Wildlife Service. 1987. Current status of the aquatic vegetation and invertebrate fauna of Long Meadow Lake, Minnesota.
54. US Fish and Wildlife Service. 1994. Stormwater runoff and associated sediment contamination in the Pond C Watershed.
55. US Weather Bureau. Technical Paper 40
56. Water Resource Related Agreements. See **Section II.C** of City of Bloomington Surface Water Management Plan.

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57. Water Resource Regulatory Agreements with Mn/DOT regarding Interstate 494 and Trunk Highway 77 drainage areas.
58. WSB & Associates, Inc. 2000. XPSWMM/P8 Analysis of Smith Ponds/Wright's Lake
59. WSB & Associates, Inc. 2000. XPSWMM/P8 Analysis of Riley Purgatory DA
60. I-494 Reconstruction Final EIS Review Draft. 2000
61. SRF Consulting. 2001. AUAR Airport South
62. Barr Engineering. 2001. Nine Mile Creek/Bloomington UAA
63. Barr Engineering. 2002. Bush Lake UAA
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66. Barr Engineering. 2005. Normandale Lake UAA
67. Barr Engineering. 2006. Oxboro Lake Hydrologic and Hydraulic Modeling

SECTION IX

IX. GLOSSARY

1% CHANCE RAINFALL EVENT	A rainfall event that has a 1 % chance of being equaled or exceeded during any given year.
ALLUVIUM	Material, such as sand, silt, or clay, deposited on land by streams.
AQUIFER	A formation, group of formations, or part of a formation that contains enough saturated permeable material to yield significant quantities of water.
ARTESIAN AQUIFER	An aquifer which is bounded above and below by formations of impermeable material or relatively impermeable material.
BEDROCK	The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
CONVEYANCE SYSTEM	A surface water transport system that may include rivers, streams, man-made channels, grass waterways, storm water sewers, culverts, and other man-made control structures.
CRITICAL EVENT STORM	When comparing the 100-year, 24-hour high water level and discharge rate to the 100-year, 10-day high water level and discharge rate, the event that produces the highest high water level and discharge rate is defined as the critical event storm.
DRIFT (GLACIAL)	Rock material transported by glacial ice or material deposited by streams from glaciers.
EUTROPHIC	A condition where a body of water has a reduced level of dissolved oxygen producing an increased level of plant life. A water body with a Trophic State Index from 51 to 70.
FLOOD PLAIN	A nearly level alluvial plain that borders a river or stream and is subject to flooding.
GEOMORPHOLOGY	The geologic study of the configuration and evolution of land forms.
HWL	High Water Level. The highest water level achieved in a pond is predicted by the 100-year critical event model.
HYDRAULIC	Involving, moved, or operated by a fluid, especially water, under pressure.
HYDROLOGIC BOUNDARY	The boundary defining watershed or subwatershed units.

SECTION IX

HYDROLOGY	The science concerned with waters of the earth, their occurrence, distribution, and circulation; their physical and chemical properties; and their reaction to the environment.
LOCAL CITY	The member communities of Richfield and Bloomington.
MEAN	Average. The sum of the magnitudes of all items of a set, divided by the items.
NWL	Normal Water Level. The lowest controlling elevation of the pond.
100-YEAR FLOOD PLAIN	That flood plain associated with a storm that has a 1 percent chance of being equaled or exceeded during any year (100-year recurrence interval). Usually calculated assuming a rainfall event of 24 hours in duration.
ORDINARY HIGH WATER MARK (OHWM)	The boundary of protected waters as defined in Minnesota Statutes.
OUTWASH	Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.
OUTWASH PLAIN	A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.
PERMEABILITY	A characteristic of soil that enables water to move downward through the profile. Measured in inches per hour.
PROTECTED WATERS AND WETLANDS	Those waters of the state identified as Public Waters or Wetlands under Minnesota Statutes. Generally, all lakes and Type III, IV, and V wetlands as identified in the Department of Interior Circular 39, Wetlands of the United States, 1971. Public wetlands are generally those 10 or more acres in size in unincorporated areas, or 2.5 or more acres in size in incorporated areas.
SOIL ASSOCIATION	A group of soils geographically associated in a characteristic repeating pattern defined and delineated as a single map unit.
SUBWATERSHED	A minor drainage unit and a hydrologic component of a watershed.
SURFICIAL MATERIAL	Unconsolidated deposits of variable content and texture that overlie the bedrock surface. Major textural categories include alluvium, terraced sands and gravels, loess, till and outwash.
WATER RESOURCE LIBRARY	A compilation of information from various agencies used in the preparation of the Surface Water Management Plan. This library is available at Public Works.

SECTION IX

WATERSHED

All lands that are enclosed by a continuous hydrologic drainage divide and lie upslope from a specified outlet point.