C. Biological Environment

The lakes, watercourses, wetlands and groundwater in the South Washington Watershed are valuable for recreation, flood storage, groundwater recharge, sediment collection and nutrient entrapment. Their aesthetic value, as well as their support of fish and wildlife, can be priceless benefits.

1. Lakes physical discriptionsdescriptions

A total of eight lakes within the watershed were inventoried for general characteristics (size, depth, watershed area) and water quality. These lakes are Armstrong, Markgrafs, Wilmes, Powers, Colby, Bailey, Gables, and Cottage Grove Ravine Regional Park Lake (unnamed).

Armstrong Lake is approximately 39 acres in size and has a contributing watershed of 487 acres. It is divided into two parts by County Road 10. A culvert under the road connects the north and south two parts. The northern portion of the lake has a maximum depth of 3 feet while the southern portion has a maximum depth of 5 feet. The northern portion of the lake has a large area of cattail fringe and is more characteristic of a deep marsh. system than a lake due to its shallow depths. The southern portion of the lake is a deeper water system with macrophytes. The southern portion is considered was assessed as a lake system and the northern portion is part will be considered a lacustrine wetland. Figure XXIV-2 shows the lake depth in several locations.

Markgrafs Lake is approximately 46 acres in surface area and has a contributing watershed of 413 acres. The lake has an storm sewer outlet that was installed in 1990. Access is available via Brookview Road at the south end of the lake. A bathymetric map is presented in Figure IV-3. The lake has a maximum depth of 8 feet.

Markgrafs is occasionally used by the DNR Fisheries as a rearing pond for walleyes. This is possible due to the low dissolved oxygen preventing the survival of game fish during ice over conditions in the winter. Without the predation of game fish such as northern pike, walleye fingerlings are allowed to grow throughout the summer months

~~and are removed prior to ice cover. The DNR will likely continue to use this as a rearing pond for walleyes.~~

Wilmes Lake is divided in~~to~~ two basins separated ~~parts~~ by a berm and ~~. A~~a culvert ~~under the berm~~ connects the two basins. ~~connects the two parts.~~ The northern portion is 15 acres in size and the southern portion is 13 acres. The total future drainage area to Wilmes Lake will be approximately 5,030 acres with a direct drainage area of 670 acres. ~~The ultimate watershed to the northern portion of the lake was completed during the time of this WMP in 1996.~~ A 48" RCP outlet is located at the southern ~~tip~~ end of the lake. ~~There is a public access planned for the northern tip of the lake.~~

A bathymetric map of Wilmes Lake is presented in Figure IV-4. The southern portion of the lake has a maximum depth of 7 feet while the northern portion has a maximum depth of 18 feet.

FIGURE IV-2

FIGURE IV-3

Powers Lake is 56 acres in size with a total planned drainage area of 1,238 acres. The lake has two main inlets: a small stream on the east side and a concrete culvert under Woodbury Drive.

A lift station was installed in 1995 and currently serves as the outlet for this previously land-locked lake. A public access and fishing pier are proposed to be constructed just east of County Road 19. The DNR has done fishery surveys in 1977, 1984, and 1992, but has not conducted fish stocking due to the lack of a public access. Fisheries management could begin following the construction of the public access. Based on the limited fisheries and water quality data, and on conversations with anglers, it appears that the lake can and does possess a fairly good self- propagating game fish population.

A bathymetric map, furnished by the DNR, is presented in Figure IV-5. Powers Lake has a maximum depth of 41 feet and a littoral zone (fringe area from 0 to 15 feet in depth where macrophytes grow) covering about 48 percent of its surface.

Colby Lake is 70 acres in size with a total planned drainage area of 8,088 acres. The DNR successfully used this lake as a rearing pond in 1989 and potentially will use it again in the future. Water quality information for the summer of 1994 is available from the Metropolitan Council as part of its Citizen Assisted Monitoring Program. A bathymetric map recently completed by the DNR is shown in Figure IV-6.

Bailey Lake historically has had fluctuating water levels, but during most years it has been a series of isolated wetlands. Due to landlocked conditions and development occurring upstream, runoff has increased to the basin and caused it to become one large open body of water. In 1994, an outlet and a control structure in combination with a pump station were constructed to manage the water level of the lake. Bailey Lake, North and South, currently is approximately 80 acres in size at a NWL of 870 feet, with a total future contributing watershed of 12,600 acres. The maximum depth of the lake, as of August 1994, was 17 feet. This depth should be conducive to creating a game fishery;

figure iv-4

Figure iv-5

Figure iv-6

however, water quality will dictate which type of fishery becomes established. There currently is no public boat access on the lake. A bathymetric map of Bailey Lake is shown in Figure IV-7.

Gables Lake is 5 acres in size with an existing direct drainage area of 450 acres. No bathymetric map for Gables Lake was developed or is available. It is estimated that the maximum depth is about 5 feet and fluctuates somewhat depending on yearly rainfall. This waterbody may actually be closer to a wetland in characteristics.

Regional Park Lake is referred to as such in this report due to its location in the Cottage Grove Ravine Regional Park; however, this is not an official name. This waterbody is approximately 16 acres in size and currently has a drainage area of approximately 600 acres. This waterbody formerly existed as a Type 4 wetland, but due to higher water levels in recent years, it more closely resembles a lake now. It is not clear whether this waterbody will continue to exist as a lake or revert back to a wetland-type system in the future due to its apparent reliance on groundwater and higher

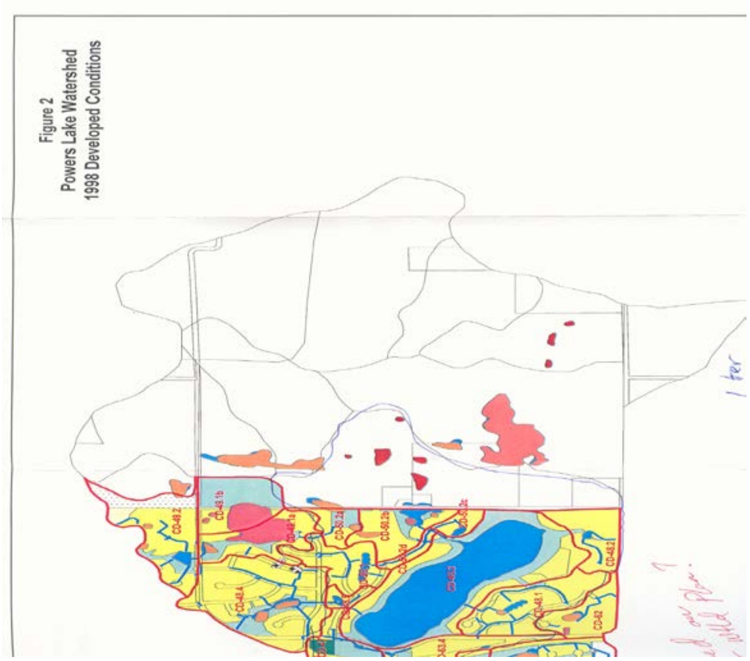
than normal groundwater levels in recent years. The maximum depth of the lake, as of August, 1994, was 19 feet. This depth should be conducive to creating a game fishery; however, water quality will dictate which type of fishery becomes established. Currently there is no formal public boat access to the lake. A simple bathymetric map of the lake is shown in Figure IV-8.

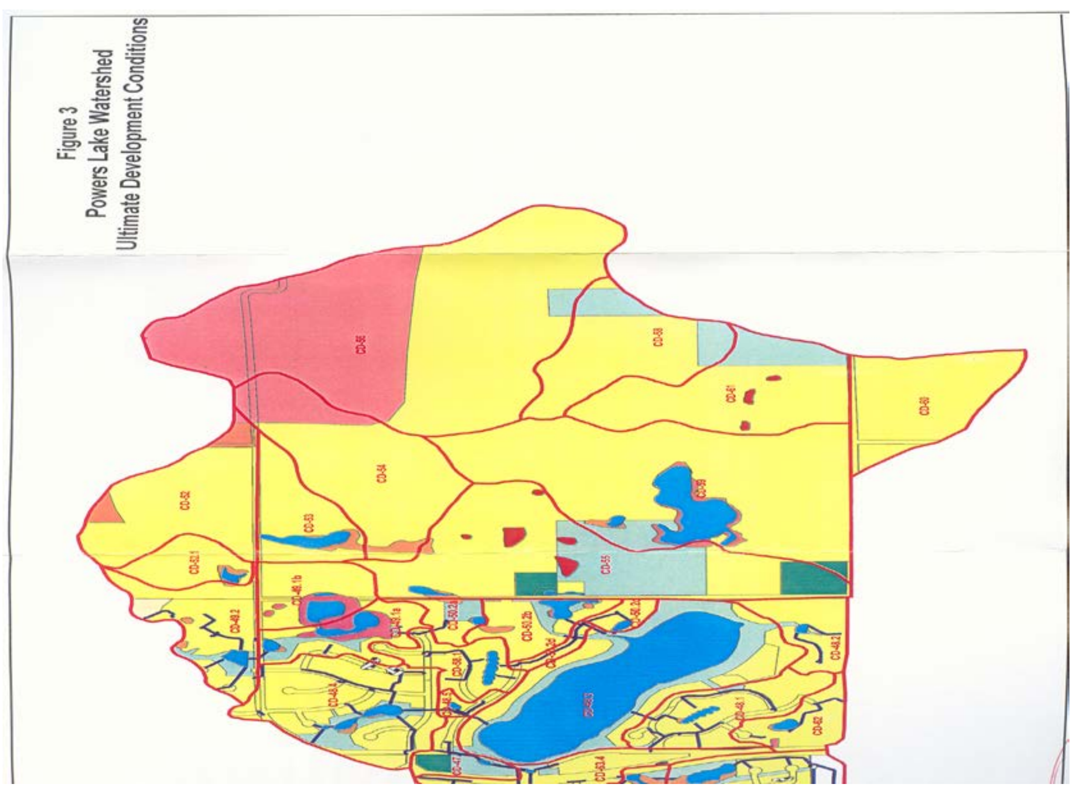
Individual Lake Assessments

Powers Lake

The following Lake Assessment was conducted by Bonestroo, Rosene, and Anderlik Associates. Powers Lake is a 56 acre lake in the City of Woodbury with an ultimate drainage area of 1,230 acres. The lake has several stormwater fed inlets and one natural inlet that receives *runoff* from a developing area. A lift station on the northwest end of Powers Lake serves as an outlet *for* this previously land-locked lake.

Watershed: In 1999, the contributing watershed was 430 acres. Because of expansion of the storm sewer network with increasing development, the area draining *to* Powers Lake will eventually be 1,230 acres. Figures 2 and 3 show the effected areas.





Shorelands: A unique shoreland feature of Powers Lake is the city owned easement around
the shoreline of Powers Lake. This allows the opportunity *to* keep shoreland conditions natural, attract wildlife, and serve as a water quality buffer. The shoreland currently is in a natural state. '-

Dissolved Oxygen in the lake: Powers Lake stratifies, by temperature, with a wann water *top* layer of 12 *to 30* feet thick in the summer, with the thickest wann water found in late summer. Dissolved oxygen is absent in mid-summer and remains that way until fall turnover.

Water clarity: Water clarity in lakes is typically measured with a secchi disc. Water clarity in Powers Lake has fluctuated from 1994 *to* 1999. In 1994, the summer average was around 11 feet and in 1998 it was about 5 feet, however, in 1999, the summer average improved *to 10.5* feet.

Phosphorus: Phosphorus levels have fluctuated over the last six years, and have *not* noticeably increased or decreased. The phosphorus summer average in 1998 was *30* parts per
billion and in 1999 the summer average was 15 ppb. Phosphorus levels *for* both these years were within the ecoregion range.

Chlorophyll and algae: Chlorophyll readings are an indicator *,of* the amount of algae in a lake. Chlorophyll levels have been checked over the last five years and may have increased,
indicating that algae has increased also. Blue-green algae are the dominant late summer algae.

Zooplankton: Zooplankton are small, mostly microscopic, crustaceans found in all lakes.

They are important in the lake's food chain. Zooplankton feed on algae and, in turn, small fish feed on zooplankton. Powers Lake has a typical assemblage of zooplankton for lakes in this regIon.

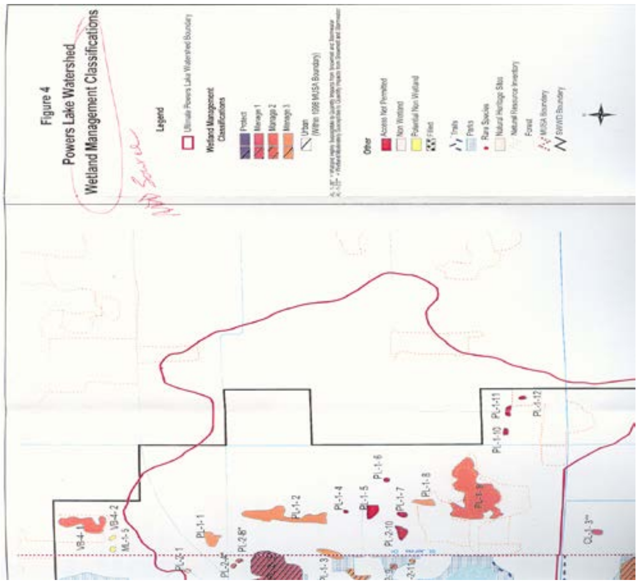
Aquatic Pants: Aquatic plants are essential for maintaining good clarity for moderately fertile lakes in this region. Since water levels have risen at least 10 feet in the last 20 years, the flooded lake sediments do not have an aquatic plant seedbank. Aquatic plant diversity is low and is dominated by 2 exotic plants: Eurasian watermilfoil and curlyleaf pondweed.

Lake Sediment Fertility and Nuisance Plant Growth: Power's Lake sediments were tested for fertility levels in order to predict where nuisance Eurasian watermilfoil might grow. Results show over 60% of the shoreline could support nuisance growth based on high nitrogen levels.

Fish: The fish community is dominated by bluegill sunfish, but they are small, with an average of 5 inches. Gamefish are present, but in low numbers although, northern pike, largemouth bass, and walleyes are found within regional ranges.

Lake Report Card: The report card grades go back to 1994. Total phosphorus has received A's and B's except for 1998 and water clarity got A's and B's except for 1997 and 1998. In 1999 Powers Lake rebounded with higher grades then were recorded in 1998.

Wetlands in Powers lake watershed:



(**note**: Compare 2001 TP lbs /yr loading results at powers lake monitoring site with 1998 TP lb / yr estimates for the subwatershed found in the powers lake assessment. Model estimates seem low. Discuss estimated increase in TP due to development.

Lake Water Quality

Powers, Colby, Wilmes, and Markgrafs Lakes were each sampled 9-13 times from May to September of 1994 through a citizen monitoring program coordinated through the Metropolitan Council. The SWWD and member cities will be sampling Armstrong, Bailey, Gables, and Regional Park Lakes at a frequency similar to the Metropolitan Council monitoring program. A spot check of total phosphorus, chlorophyll-a, water clarity and depth measurements was completed for Armstrong, Bailey and Regional Park Lakes by the SWWD in 1994. These measurements were taken to get an idea of the water quality of these lakes due to the lack of historic data. A more

figure iv-7

Figure iv-8

intensive monitoring plan will be implemented by the watershed if these lakes are not included in the citizen monitoring program in 1995. The following data represents a preliminary assessment of the lakes; this will be adjusted as more data on these systems becomes available in the future.

Ecoregion values were used to evaluate the lakes within the watershed. This allows an evaluation of lakes that should be similar in water quality based on location, land use, soils, land form and potential natural vegetation. The MPCA, in cooperation with the Environmental Protection Agency (EPA), has developed a means to geographically group Minnesota lakes based on the above characteristics. These areas are called aquatic ecoregions. There are seven of these ecoregions in the state, as shown in Figure IV-9 (from Wilson and Walker, 1989). The Twin Cities Metropolitan area is within the ecoregion known as the North Central Hardwood Forest.

Lakes within an ecoregion should be somewhat similar to each other. Ecoregions also provide a means for gathering useful information for setting water quality goals. The potential water quality of a lake may be estimated based on data for the lakes having the best water quality for the ecoregion. The MPCA refers to these lakes as minimally impacted lakes. These minimally impacted lake values were used as a comparison for the lakes within the SWWD.

Phosphorus is a chemical element that is essential for plant growth. Concentrations of total phosphorus indicate the maximum growth potential for algae and macrophytes in a lake. High phosphorus concentrations will generally result in either dense macrophyte or algal blooms. The frequency and severity of these algal blooms is dependent upon phosphorus concentrations. Total phosphorus values for minimally impacted lakes in this ecoregion are between 23 and 50 parts per billion (ppb)[1]. The 1994 summertime (May through September) mean concentrations for Colby, Markgrafs, Powers, and Wilmes Lakes are shown in Figure IV-10. In addition Armstrong, Bailey, and Regional Park Lakes were sampled once in August of 1994 by the SWWD. The results of the total phosphorus sampling for these lakes are included in Figure IV-10.

FIGURE IV-8

FIGURE IV-9

Of the eight lakes assessed, only Powers Lake currently has total phosphorus levels which are within the levels considered as minimally impacted. The 1994 mean summertime (May through September) total phosphorus concentration was 31 ppb. (Number of samples (n)=11).

Wilmes Lake has phosphorus levels which are near the required threshold for minimally impacted lakes. The 1994 mean summertime (May through September) total phosphorus concentration was 58 ppb (n=10).

The rest of the lakes sampled had total phosphorus values which exceed the levels of minimally impacted lakes in this ecoregion. The total phosphorus readings for Bailey, Regional Park, and Armstrong Lakes were 180, 120 and 150 ppb, respectively. The high total phosphorus readings have likely caused the abundant algal amounts which are discussed in the following paragraph.

Chlorophyll-a is a photosynthetic pigment found in all green plants. The concentration of chlorophyll-a is a measure of algal abundance. If the algal populations are dense, the water will become noticeably green or brown and will have low transparency. These conditions limit the recreational and fishery use of a lake. In certain circumstances high algal amounts, which die off under ice covered conditions, can contribute to winter fish kills. Chlorophyll-a values for minimally impacted lakes in this ecoregion are between 5 and 22 ppb.

All of the lakes assessed in 1994, except Powers and Wilmes lake, have chlorophyll-a values which exceed the levels of minimally impacted lakes in this ecoregion which is shown in Figure IV-11. The chlorophyll-a readings for Bailey, Colby, Markgrafs, Regional Park and Armstrong Lakes were 55, 56.7, 44.1, 36, and 55 ppb respectively. These high chlorophyll-a readings have likely caused the decrease in water transparency discussed in the following section.

FIGURE IV-11

Powers and Wilmes Lakes have chlorophyll-a values of 8.1 and 12.7 ppb, respectively. These chlorophyll-a readings are consistent with those found on minimally impacted lakes and have resulted in the greater water clarity of Powers and Wilmes Lakes.

Secchi disc transparency is a measure of water clarity. A Secchi disc is a circular disc with alternating white and black quadrants. It is lowered through the water column on the shaded side of a boat, and the depth at which it disappears is recorded. This is a visual estimate of the clarity of water and the depth of light penetration in a lake. A higher Secchi disc transparency indicates greater water clarity. The Secchi disc values for minimally impacted lakes in this ecoregion are between 4.9 and 10.5 feet.

Secchi disc transparencies for lakes within the SWWD are shown in Figure IV-12. Powers and Wilmes Lakes, with 1994 Secchi disc readings of 7.5 and 10.5 feet, respectively, are the only lakes in the watershed which fall within the minimally impacted lake values. Armstrong, Bailey, Colby, Markgrafs and Regional Park Lakes had Secchi disc values which did not meet the standards of minimally impacted lakes in this ecoregion. The Secchi disc readings for Armstrong, Bailey, Colby, Markgrafs, and Regional Park Lakes were 1, 2, 1.6, 3.3 and 1.5 feet, respectively. It may not be possible or realistic for some of these basins to meet minimally impacted standards, but this serves as a uniform standard for comparison purposes between lake basins.

Trophic state is a type of lake classification. It is based on Carlson's Trophic State Index (Carlson, 1977). This index indicates nutrient enrichment and is calculated based on measured values for total phosphorus, chlorophyll-a and Secchi disc transparency. This index is used to assess the quality of a lake. It provides a quantitative means of assessing lake changes after protection and restoration practices have been implemented. Trophic State Index (TSI) values for the lakes sampled along with the corresponding recreational suitability are shown in Figure IV-13.

FIGURE IV-12

FIGURE IV-13

The TSI for Powers Lake is 49, which is the lowest of the lakes studied in the watershed. This value indicates the lake is mesotrophic (moderate nutrients) and thus has relatively good water quality. Mesotrophic lakes are considered moderately clear and fully swimmable by the users of these lakes.

Wilmes Lake has a TSI of 56. This value indicates the lake is eutrophic and has relatively moderate water quality. Eutrophic lakes are often perceived as having poorer water clarity then a mesotrophic lake and often are swimmable, but may be considered nonswimmable by some users of these lakes.

The other lakes within the watershed are hypereutrophic. Hypereutrophic lakes are considered nonswimmable by the users of these lakes. The values for Armstrong, Bailey, Colby, Markgrafs and Regional Park were 69, 72, 71, 67 and 68, respectively. These values indicate the potential for heavy algal blooms throughout the summer and/or dense macrophyte beds. Hypereutrophic lakes are perceived as having very poor water clarity and normally are considered nonswimmable.

The Lake Grade system is a relative measure of the water quality of lakes within the SWWD to other lakes in the metropolitan area (Metropolitan council, 2001). Table (A) displays the overall lake grades from 1994 to 2001 for each lake, and the management category assigned to each lake by this plan. Data for Table (A) was provided in the Washington Soil and Water Conservation District's (SWCD) 2000 and 2001 monitoring memorandums (Washington, 2000 and 2001) and Metropolitan Councils 2001 Metro Lake Water Quality Report (Met Council, 2001).

Table (A)

Lake Grade Ranking

Lake	**Management category**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Average**
Armstrong	Concern							D+	C	**C-**
Wilmes	Stormwater 1-2	B	C	C	D	D	C	C	D	**C**
Markgrafs	Concern	D	C	C	D	F	D	C	D	**D**
Powers	Priority	A	B	A	B	C	A	B	C	**B**
Colby	Stormwater 2	D	F	F	D	F	D	D	F	**D-**
Bailey	Stormwater 1									
Gables	Concern					D	D			**D**
Regional Park	Concern					D	C	D	D	**D**

2. **Intermittent stream** flows monitored by the SWCD at the MS1 and MS2 sites in SWWD have revealed high concentrations of various metals in the flows. Tables (B&C) display times when these concentrations have exceed the MPCA's water quality standards (Washington, 2001). Table (D) summarizes the two year high and average Total Phosphorous concentrations measured at the District's stream sites.

Table B

MS1:

Sample Type	Start Date/Time	End Date/Time	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)	Cadmium (mg/L)	Ammonia Nitrogen (mg/L)
Snowmelt Grab	3/21/01 14:00	NA	**0.0096**	**0.0027**	0.0178	<0.0001	**0.10**
Snowmelt Grab	3/29/01 14:00	NA	**0.0142**	**0.0055**	0.0450	0.0002	**0.53**
Snowmelt Grab	4/3/01 14:50	NA	0.0044	0.0010	0.0088	<0.0001	**0.69**
Snowmelt Grab	4/4/01 12:30	NA	NA	NA	NA	NA	**0.70**
Snowmelt Grab	4/4/01 12:30	NA	NA	NA	NA	NA	**0.63**
Storm Grab	4/12/01 9:10	NA	0.0023	<0.0005	0.0059	<0.0001	**0.19**
Storm Grab	4/23/01 14:39	NA	0.0029	0.0009	0.0073	0.0006	*NA*
Base Composite	4/27/01 13:34	4/30/01 10:06	0.0024	<0.0005	0.0044	0.0002	<0.02
Storm Composite	5/3/01 13:22	5/4/01 13:04	**0.0070**	<0.0005	0.0052	0.0002	<0.02
Storm Composite	5/6/01 19:30	5/6/01 19:30	**0.0266**	**0.0224**	**0.071**	**0.0008**	<0.02
Storm Grab	5/22/01 13:30	NA	NA	NA	NA	NA	<0.02
Storm Composite	5/22/01 13:54	5/22/01 19:18	**0.0084**	**0.0015**	0.0152	0.0002	<0.02
Storm Grab	6/6/01 12:00	NA	0.0020	<0.0005	0.0058	<0.0001	<0.02
Storm Composite	**6/11/01 18:18**	**6/11/01 20:16**	**0.0600**	**0.0670**	**0.1560**	**0.0010**	**0.17**
Storm Composite	6/13/01 15:40	6/14/01 6:52	**0.0076**	**0.0037**	0.0169	**0.0009**	**0.09**
Storm Composite	6/18/01 15:00	6/19/01 22:30	0.0029	<0.0005	0.0034	0.0005	~0.04
Quality Control	6/29/01 12:40	NA	NA	NA	NA	NA	<0.02
Base Grab	6/29/01 12:40	NA	0.0026	<0.0005	0.0036	<0.0001	**~0.05**
Base Grab	7/18/01 11:15	NA	**0.0096**	0.0008	0.0103	<0.0001	**0.41**
Storm Grab	8/1/01 15:15	NA	**0.0076**	**0.0027**	0.0145	<0.0001	~0.02
Storm Composite	8/18/01 5:26	8/18/01 6:46	**0.0167**	**0.0068**	0.0360	0.0006	~0.03
Chronic Standard			**0.0064**	**0.0013**	**0.0590**	**0.00066**	**0.04**
# of Exceedences/# of Samples			10/17	8/17	2/17	3/17	10/20
Maximum Standard			**0.0092**	**0.0340**	**0.0650**	**0.01500**	**No Standard**
# of Exceedences/# of Samples			6/17	1/17	2/17	0/17	NA

Table C

MS2

Sample Type	Start Date/Time	End Date/Time	Copper (mg/L)	Chromium (mg/L)	Ammonia Nitrogen (mg/L)
Snowmelt Grab	3/23/01 13:15	NA	**0.0070**	**0.0007**	**1.53**
Snowmelt Grab	3/29/01 14:30	NA	**0.0073**	0.0006	**1.07**
Snowmelt Grab	4/4/01 14:15	NA	NA	NA	**0.75**
Storm Grab	4/12/01 10:35	NA	0.0040	0.0005	**0.22**
Storm Grab	4/23/01 15:25	NA	0.0030	0.0005	NA
Base Composite	4/27/01 11:45	4/29/01 10:30	**0.0123**	0.0005	**0.08**
Storm Composite	5/3/01 13:10	5/4/01 11:55	0.0059	**0.0011**	NA
Storm Grab	5/22/01 16:20	NA	NA	NA	**~0.06**
Storm Composite	5/23/01 5:10	5/24/01 13:55	0.0042	**0.0012**	**0.11**
Storm Grab	6/6/01 13:45	NA	0.0024	<0.0005	<0.02
Storm Composite	6/11/01 20:10	6/13/01 14:10	0.0058	**0.0010**	**~0.05**
Storm Composite	6/13/01 15:10	6/14/01 21:40	0.0057	<0.0005	**0.07**
Storm Grab	6/21/01 12:40	NA	0.0024	<0.0005	<0.02
Quality Control	6/29/01 13:50	NA	NA	NA	~0.03
Base Grab	6/29/01 13:50	NA	0.0025	<0.0005	<0.02

Base Grab	7/16/01 14:00	NA	0.0020	<0.0005	<0.02
Base Grab	7/18/01 12:35	NA	0.0022	<0.0005	<0.02
Storm Composite	8/1/01 15:25	8/2/01 14:40	0.0060	0.0006	<0.02
Base Composite	8/13/01 11:25	8/14/01 11:10	0.0030	<0.0005	<0.02
Storm Composite	8/18/01 8:00	8/19/01 21:00	0.0038	<0.0005	**0.28**
Base Composite	8/28/01 15:40	8/29/01 8:30	0.0037	0.0005	<0.02
Base Composite	9/18/01 13:30	9/20/01 12:15	0.0033	<0.0005	~0.02
Storm Composite	9/22/01 17:30	9/24/01 0:30	0.0053	<0.0005	**0.11**
Chronic Standard			**0.0064**	**0.00066**	**0.04**
# of Exceedences/# of Samples			3/20	4/20	11/21
Maximum Standard			**0.0092**	**0.015**	**No Standard**
# of Exceedences/# of Samples			1/20	0/20	NA

Recommendations:

- Conduct a study to determine source of high metals concentrations.
- Establish projects or programs to reduce metals concentrations

Table D

Phosphorus Concentrations 2000 & 2001 Monitoring results

Site	2 (yr) High	2 (yr) Average
MS1	2400 ppb	350 ppb
Powers Lake	420* ppb	60* ppb
MS2	440 ppb	160 ppb
100th St.	210 ppb	80 ppb

*2001 data only

3. Wetlands

Bonestroo engineering has provided the District with a Comprehensive Wetland Management Plan that provides an inventory, functional assessment, and management classification of all known wetlands in the watershed. It also presents management standards and technical guidelines for wetland buffers, storm water quality, storm water bounce, sequencing, reclamation and restoration. Figure XX identifies all of the wetlands found within SWWD (.Bonestroo, Rosene, and Anderlik Associates, 2002).

Insert Figure xx here

The wetlands within SWWD have been labeled as Protect, Manage I, Manage II. Table VI-3.3 explains the management classes.

Wetland Man. Class	Characteristic Wetland Type and Quality	Guiding Management Principal
Protect	Good to Excellent Quality - Rich Fen, Minerotrophic Tamarack Swamp, Wet Meadow, Wet Prairie, Sedge Meadow, Hardwood Seepage Swamp, Shrub Swamp, Floodplain Forest. Generally dominated by native species with invasive species (e.g., reed canary grass, buckthorn, cattail, giant reed, purple loosestrife, etc.) sometimes present, but not dominant.	Preservation – avoid and buffer direct/indirect impacts per technical guidelines
Manage I	Low to Moderate Quality - Wet Meadow, Shrub Swamp, Sedge Meadow, Mixed Emergent Marsh, Cattail Swamp. Generally with significant, but not total, invasion by invasive species.	Minimize Impacts – limit storm water impacts per technical guidelines Within SWWD Greenway Corridor – Reclamation or Restoration
Manage II	Low to Degraded Quality - wetlands dominated by invasive species, extensively drained, filled or otherwise altered.	Utilize for storm water management, provided pretreatment for sediment and phosphorus removal is provided.

		Reclamation or Restoration

All inventoried wetlands within the study area have been assigned a wetland management class. For each wetland management class, standards have been developed for water quality, water quantity (changes to hydro period), wetland buffers and general standards that apply to wetland replacement and wetland excavation.

Wetland Water Quality Standards

The wetland water quality standards of this CWMP are designed to fit into the framework of future NPDES Phase II Permitting requirements using a "TMDL approach". The TMDL approach sets an annual load limit, expressed in total pounds/per year for each pollutant. Phosphorus, generally considered to be the "limiting nutrient" for wetlands and lakes in Minnesota, is the focus of these wetland water quality standards. Phosphorus loading limits are established for wetland management classes in accordance with Table 3.4.1.

Table 3.4.1. **Storm water Management Standards for Phosphorus**

Wetland Management Classification	Storm water **Management Standards for Phosphorus**	
	Loading Standard - Weighted Average (Lbs/Acre)	**Event Mean Concentration - Weighted Average (ug/L)**
Protect	**0.0135**	**40**
Manage 1	**0.0371**	**110**
Manage 2	**0.0607**	**180**

Restoration/Enhancement Opportunities

Wetland restoration/enhancement sites were identified during the field inventory. Typically, wetlands that were identified for restoration/enhancement had either a hydrologic impact that could easily be rectified or a plant community that was of exceptional to high quality. The areas with exceptional to high quality native plant populations could, with some minor management, have their ecological integrity enhanced and exotic species minimized. Wetlands that have hydrologic restoration proposed would likely qualify as wetland banking sites if restored.

Wetland #	Public Land Y/N	<u>**Restoration Activity**</u>
WD-1- 6	Y	Block minor ditching to restore hydrology
WD-1-11	Y	Block ditch or install control structure to restore hydrology
WD-1-C	Y	Flora indicates that active management of plant community would further improve quality. It is currently one of the more species rich wetlands in the area.
WD-1-D	Y	Formerly a wet swale. Blocking ditch that outlets to the east would restore hydrology to this wetland and help to improve the wetland to the west as well.
WD-1-12	Y	The plant community of this wetland is of exceptional quality. This area should be managed to maintain integrity and minimize establishment of purple loosestrife, which is found in adjacent wetlands. Ecological restoration of adjacent upland areas would greatly enhance the landscape-level value of this site.
WD-1-15	Y	Similar to recommendations for WD-1-12. Slightly less species richness and overall quality in this wetland compared to WD-1-12
WD-1-16	N	Hydrologic restoration of this wetland would be easily accomplished by blocking small outlet ditch. Surrounding area is ecologically significant for area with Oak woodland/savanna and wetland complex.
WD-1-18	N	Hydrologic restoration of this wetland would be easily accomplished by blocking small outlet ditch. Surrounding area is ecologically significant for area with Oak woodland/savanna and wetland complex.

WD-1-G	Y	Hydrologic restoration of this wetland would be easily accomplished by blocking small outlet ditch. Surrounding area is ecologically significant for area with Oak woodland/savanna and wetland complex.
WD-1-22	Y (partial)	This wetland represents one of the best remaining examples of a slope swale wet/sedge meadow in the study area. Ecological restoration should include retention of hydrologic characteristics of the area as well as management of the purple loosestrife and reed canary grass present.

Wetland #	**Public Land Y/N**	**Restoration Activity**
MR-6- 8	Future SNA	Will likely have restoration of plant community through the use of fire and/or brush cutting once the land is transferred to the MN DNR SNA.
PL-1- 2	N	Most of the wetland is dominated by reed canary grass. There are some remnant pockets of native grasses including a pocket of soft stem bulrush. A prescribed burn in combination with raising the outlet elevation would aid in enhancing this wetland.
PL-2-2	Y	Enough pockets of native vegetation present that vegetative restoration using prescribed fires would enhance this wetland. It is located within a park so this wetland should be ranked high for ecological restoration.
PL-2-8	Y (north tip)	This site is dominated by reed canary grass. Raising the outlet approximately 1-foot under the road is likely the best alternative for enhancement of this site.
PL-2-9	Y	This wetland was formerly inundated to a depth of approximately 1 – 2 feet by beaver dam. Restoration to the historic beaver dam elevation with an outlet that has rate control would help reduce erosion of a ravine and would provide additional treatment for Powers Lake.
WD-1-17	N	Ditching through wetland. Restoration would involve ditch blocks in several locations to reduce the scope and affect of the ditch.
WL-1- 3, WL1-B, WL 1-C, WL 1-D	N	These wetlands occur along the same drainage-way located within a Primary Greenway corridor that extends from Armstrong Lake through the core of the Woodbury Parks. Restore ditch to the historic swale would restore hydrology to the wetlands. Would likely need prescribed burn management to aid in setting back reed canary grass and establishment of natives.
WD-1- E	Y	Block minor ditching to restore hydrology.

AL-1B	N	Block ditching to restore hydrology
WL-4-B	Y	Enhance wetland through prescribe burn management and native seeding

Wetlands are a valuable resource. Research results over the past 20 to 30 years have documented various ecological and socially beneficial functions that are performed by wetlands. Among these are water quality improvement, flood control, fish and wildlife habitat, cultural and recreational resource values, education and interpretation values, habitat for unique plant and animal species, groundwater recharge, nutrient removal, and perhaps others that have yet to be discovered.

Wetlands are widely divergent in their quality. Many have been marginally to substantially impacted by surrounding land uses. Wetlands will vary in quality depending on past and present land uses. This variation can be useful in evaluating what types of future land uses are appropriate as well. The key consideration in determining future uses is water quality, since water is the means by which sediment and nutrients enter and leave the wetland. Depth and persistence of water also can determine the types of vegetation that will dominate. Wetlands are highly dynamic hydraulically, but a wetland without vegetation is a rare sight, even during the most severe drought. The plant species seed bank within a wetland is highly diverse in order to respond to the changing hydrologic conditions.

Wetlands, lakes and rivers are part of a dynamic system which has been in the making for hundreds, thousands and sometimes even millions of years. Water resources have been impacted more in the last 400 years than in the previous 4000 years. Wetland deterioration can be caused by the earth's natural erosion process. This erosion is mainly caused by the following:

- Wind
- Precipitation

- Freeze/Thaw Cycles

Human activity accelerates the erosion process and threatens the existence of many of our water resources. A waterbody's water quality is in large part a reflection of the human activities taking place in its watershed. Whatever reaches the storm sewer will reach the wetlands, streams, lakes and rivers.

Having an understanding of wetland hydrology and ecology along with the influences of past land uses is essential in developing a system of wetland evaluation that will permit the wise planning and long term use of wetlands within an urbanizing area. The first steps in creating a management plan for wetlands are to inventory, evaluate, and classify the resource.

National Wetlands Inventory

The National Wetlands Inventory (NWI) maps use high altitude (40,000 feet) aerial photography to determine wetland boundaries and classifications. While this may be appropriate for regional inventories, these photographs lack the accuracy required for use at a watershed level other than as a general guide for what wetlands can be expected in an area.

The SWWD wetland inventory methodology was developed within a Geographic Information System (GIS) framework. The data sources used were digital NWI data obtained from the state of Minnesota Land Management Information Center and hydric soil information derived from the SCS soil survey. The NWI boundaries were combined with the hydric soil boundaries using GIS. Including the hydric soils on the NWI map aids in locating potential wetland areas not shown on the NWI map.

The wetland acres presented in Table IV-2 were determined using the NWI data. These often have a margin of error on the low side, so it is likely the watershed has a larger acreage of wetlands than indicated in Table IV-2.

Table IV-2 . Wetland Areas

Wetland Type	Acres	% of Total Wetlands
Type 1 - Type 4	474	66
Type 5	220	31
Type 6	10	1
Type 7	14	2

The wetland types shown in the Table IV-2 are described in the appendices along with the other major wetland hydrologic classification scheme, the Cowardin Classification.

SWWD Wetland Classification System

The SWWD has classified wetlands within the watershed according to a functional value classification system called the Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire (1991), or simply the New Hampshire Method. Wetland function depends on the specific biological and physical features of each wetland site. The method addresses 14 functional values of wetlands, which are listed in Table IV-3. A description of the New Hampshire Method and samples of its data sheets is given in Appendix F. Not all the functional values shown below were needed or deemed appropriate, so select functional values were used. The results of the limited inventory and evaluation of wetlands is presented in Appendix D.

Table IV-3 . Functional Values By The New Hampshire Method

1. Ecological integrity	8. Groundwater use potential
2. Wetland wildlife habitat	9. Sediment trapping
3. Fish habitat	10. Nutrient attenuation
4. Educational potential	11. Shoreline anchoring

5.	Visual/aesthetic quality	12.	Urban quality of life
6.	Water-based recreation	13.	Historical site potential
7.	Flood control potential	14.	Noteworthiness

A functional value classification will aid in the management of the wetland resources within the watershed. Management of the wetland resources is discussed later in the report.

DNR Wetlands

At the State level, lakes and Types 3, 4, and 5 wetlands (see Appendix B) above certain size thresholds are protected by the DNR. Wetlands generally characterized by open water and cattails throughout most of the year are the type most likely to be protected by the DNR. The DNR has jurisdiction only over those wetlands appearing on the State's Inventory of Protected Waters.

The minimum size criteria used to establish the wetlands under DNR jurisdiction and compile the State's inventory and maps was 10 acres in rural areas and 2.5 acres in incorporated areas. If an area meets the jurisdictional criteria, but is not on the State's inventory, it is not regulated. If it does not meet the statutory criteria, but is listed on the inventory, it is still subject to DNR regulations. There is presently no mechanism for adding or deleting waterbodies. The inventory was begun in the late 1970s and all DNR inventories were completed during the early 1980s. The boundary of DNR jurisdiction is defined by the Ordinary High Water Levels (OHWL) elevation. The DNR has OHWL elevations defined for many of its protected waters but not all.

The DNR protected waterbodies within the watershed are presented in Appendix C , along with their location and OHWL if available from the DNR. For those DNR wetlands that do not have a defined OHWL, one must request that the DNR make a determination on an as-needed basis for the elevation. The DNR protected waterbodies are shown on Map 1 at the back of the WMP.

DNR rules specify that permits for work in Protected Waters and Wetlands may not be issued for any project except those that provide for public health, safety and welfare.

Priority Wetlands

Based on Minnesota Statutes 103B.231 Subd. 6(a)(b), a watershed management plan must identify high priority areas for wetlands. High priority areas are to be areas where preservation, enhancement, restoration, and establishment of wetlands would have high public value by providing benefits for water quality, flood water retention, public recreation, commercial use, and other public uses. These wetland areas are subject to a property tax relief which is administered by the county.

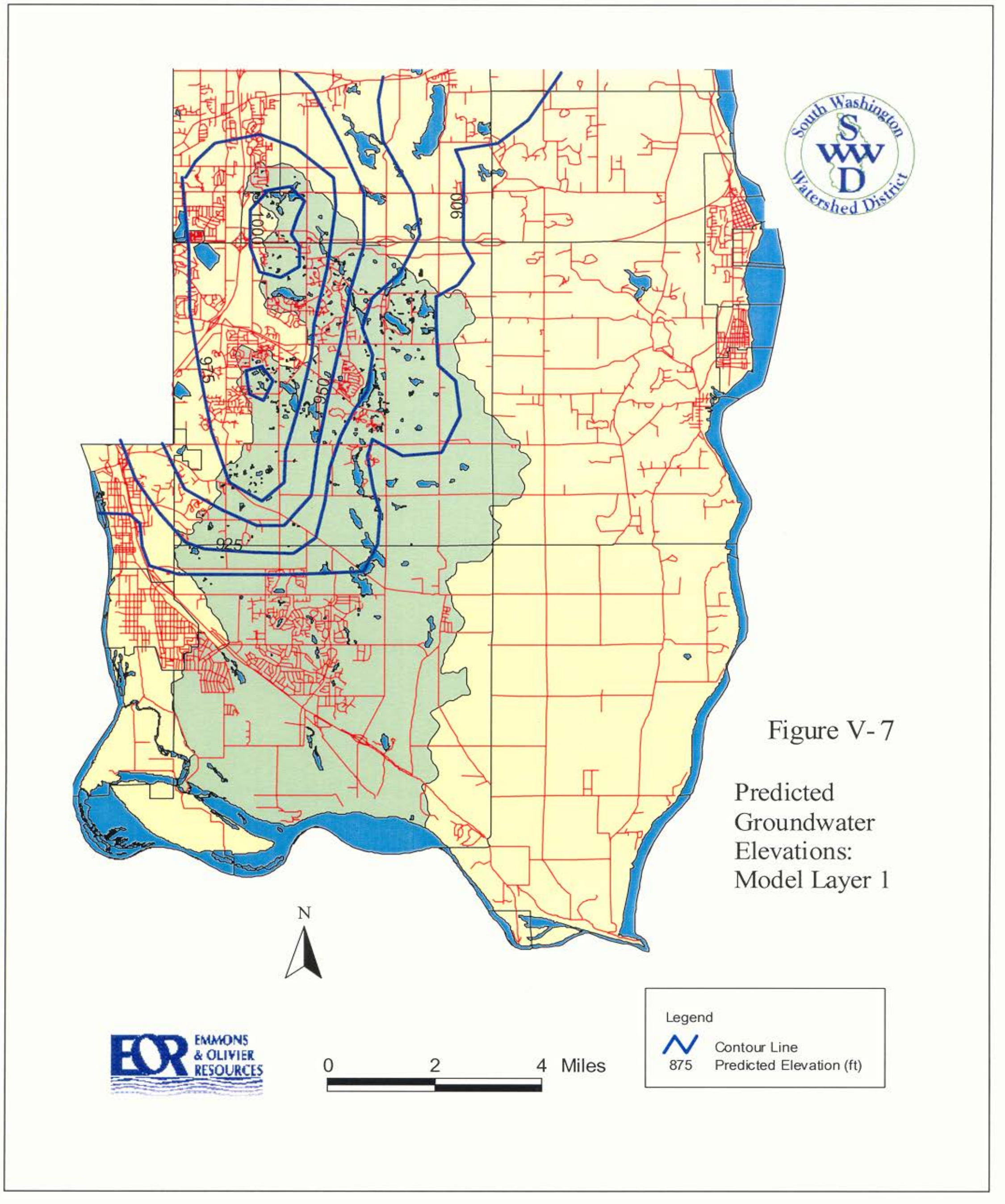
The wetland inventory and evaluation performed by the SWWD looked at all the wetlands shown on the NWI map that were greater than three acres in size but were not already designated as DNR Protected Wetlands. The rationale for the size element is that the protection efforts initially have to be prioritized to focus on larger, regional resources. The SWWD wanted these resources identified immediately due to the rapid development that is occurring within the watershed. Provisions for the future inventory of all the wetlands in the watershed are discussed later in the report.

4.Groundwater Quantity and Quality

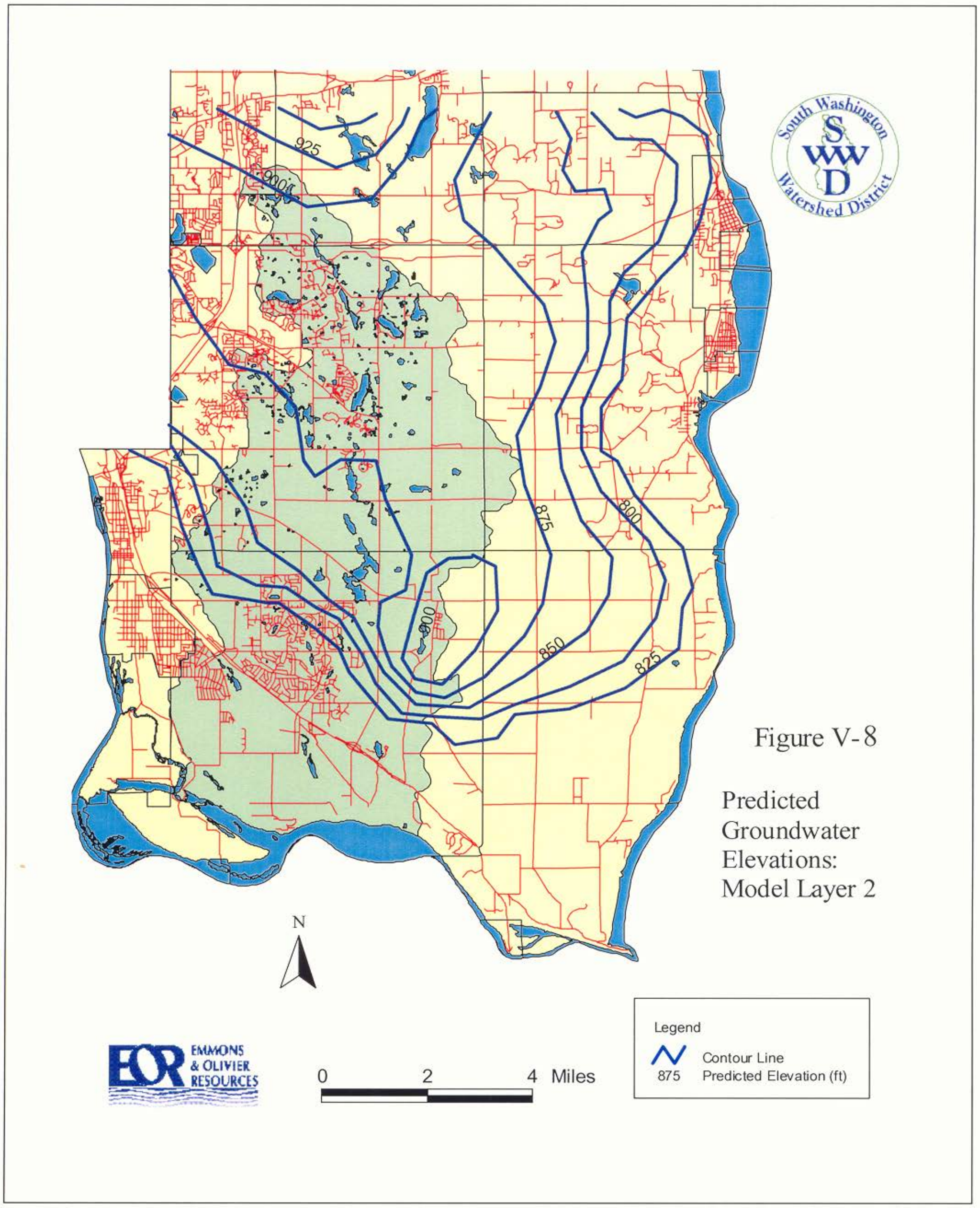
Error! Not a valid link.

For an accurate description of the groundwater flows in SWWD the discussion must range beyond the District and into the entire southern half of Washington County, because the groundwater flow system can only be defined within the context of the surrounding regional groundwater flow system. In Washington County, the St. Croix River to the east and the Mississippi River to the south and west are the major points of discharge for regional groundwater flow, although tributary streams such as Valley Creek can also be significant. Discharge to these streams and rivers essentially drains water from the aquifers, thereby lowering the water table and potentiometric surfaces of deeper aquifers in the vicinity of streams and rivers. Consequently, the water table and potentiometric surfaces of deeper aquifers are mounded in the central part of the county and slope toward the streams and rivers. As a result, groundwater in central and southern Washington County generally flows from the central part of the county outward toward the major rivers to the east, south, and west. The depth of groundwater flow is not well known, but water from the central part of the county may penetrate to the deeper bedrock aquifers before moving toward the St. Croix or Mississippi Rivers, where it must migrate vertically back upward to discharge. Water that recharges closer to the rivers may only penetrate to the uppermost aquifers before reaching the discharge point. On a broader scale, there is a large vertical gradient downward throughout most of the model area and regional groundwater flows are moving downward from the water table to deeper aquifers before being discharged to the Mississippi and St. Croix Rivers.

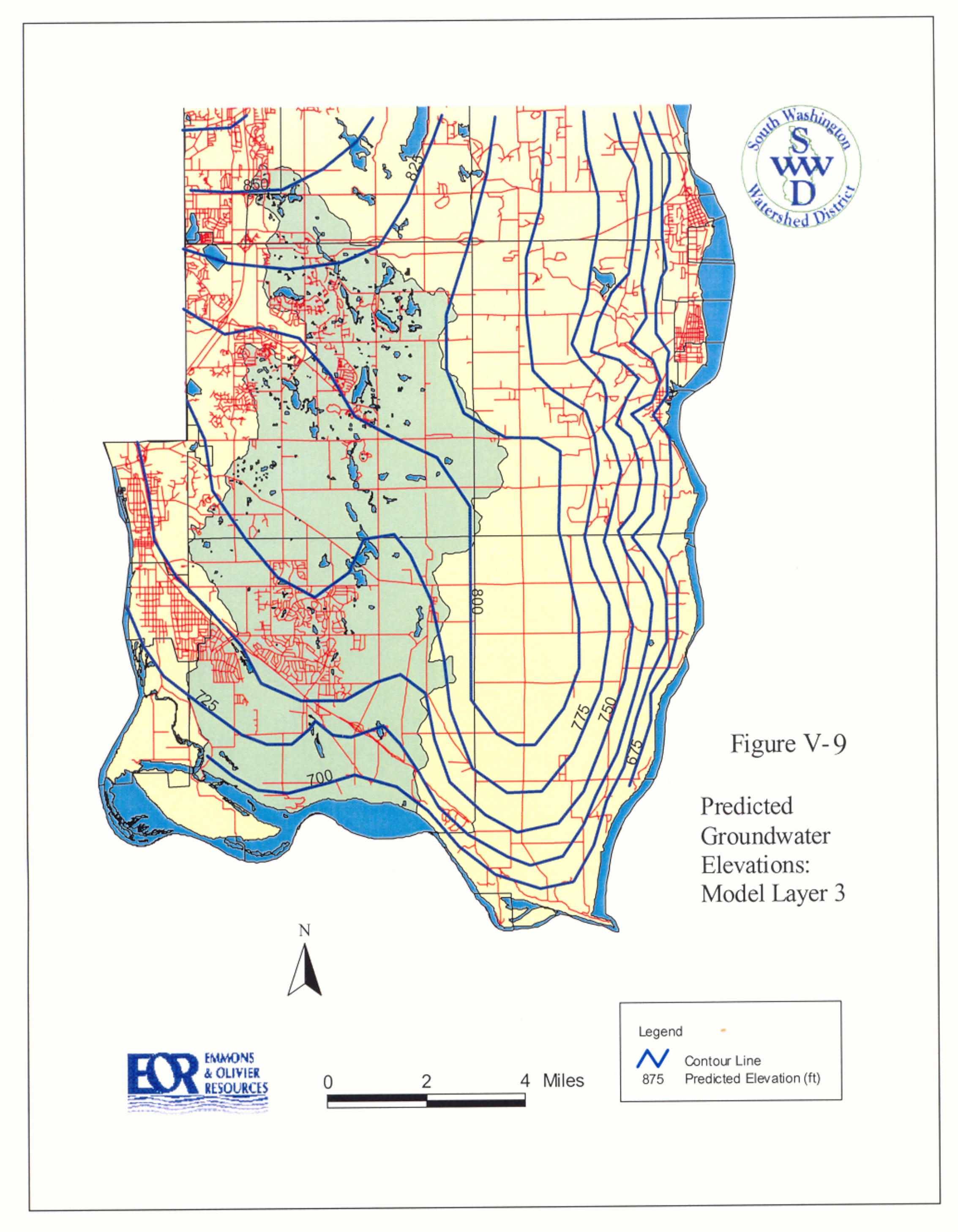
In this study groundwater levels in aquifers (potentiometric surfaces) were mapped from surface-water bodies and individual well level data sources. The reader is cautioned that the maps of potentiometric surfaces are interpretations of point data, the quality and spatial distribution of which are variable. Static water levels of wells were taken from drillers' logs collected over many years and subject to prevailing conditions in the aquifer at that time, artifacts due to drilling, and the judgment of the driller (Emmons & Oliver Resources,2001). Figures V – 7, V – 8, and V – 9 displays the predicted groundwater elevations found within SWWD. Each figure displays a different major aquifer layer.



Layer 1 represents an aquifer of unconsolidated glacial materials



Layer 2 represents groundwater flow through the St. Peter Sandstone.



Layer 3 represents groundwater flow in the Prairie du Chein-Jordan Aquifer.

b. Predicted effects on groundwater infiltration sites

The groundwater modeling results on Figure VI-l through VI-3 show the infiltrated water being discharged to nearby surface water bodies and wells. It is important to note that much of the infiltrated water will migrate vertically downward to lower aquifers. As the water migrates through the layers, its flow path may change directions several times until it is ultimately discharged to a well, lake, or the Mississippi or St. Croix River.

While the results show that groundwater flow patterns in the area of the basins will be altered, no problem areas were identified. The conditions simulated in this analysis will probably never occur because the high water levels are transient and would recede before the simulated steady- state flow patterns could be established (Emmons & Oliver Resources, 2001).

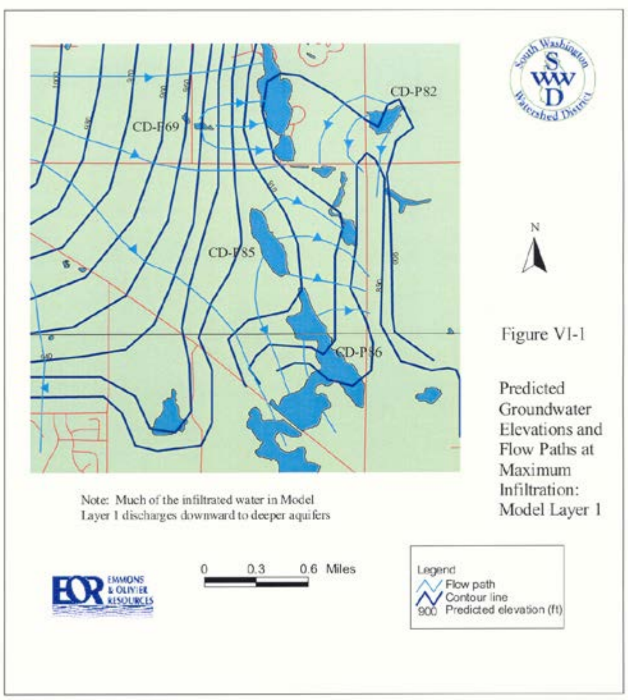
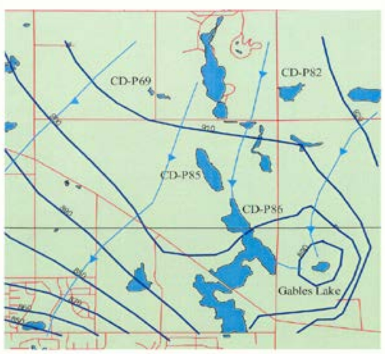


Figure VI-1

Predicted Groundwater Elevations and Flow Paths at Maximum Infiltration: Model Layer 1



Note: Much of the infiltrated water in Model Layer 1 discharges downward to deeper aquifers

Figure VI-2

Predicted Groundwater Elevations and Flow Paths at Maximum Infiltration: Model Layer 2

0 0.4 0.8 Miles

Legend
Flow path
Contour line
900 Predicted elevation (ft)

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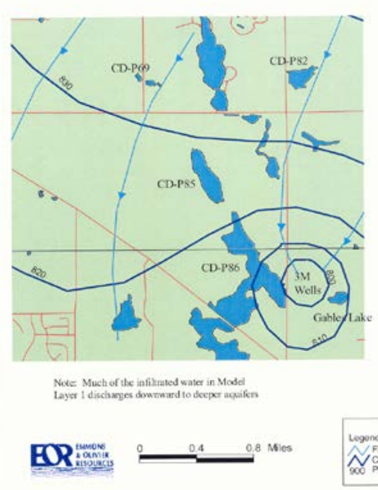


Figure VI-3

Predicted Groundwater Elevations and Flow Paths at Maximum Infiltration: Model Layer 3

c. Groundwater Mounding

The issue of elevated groundwater levels and mounding of the groundwater beneath infiltration areas was previously addressed in the Infiltration Management Study (IMS) (EOR, 2000). A theoretical, transient model (Hantush, 1967) was used to calculate peak heights of the groundwater mounds beneath the infiltration basins. While the height of the peak of the mound is useful information, the shape of the mound is also of concern, particularly how far the mound extends laterally. Although the infiltration basins are generally removed from the developed areas, there are some areas where development is or will be near the basin. In these areas, the mound could impact basements, sewers or other underground structures.

HDR reached the following conclusions regarding the groundwater mounding (HDR, 2002):

- Theoretical calculations of the mound height indicate the height of the mound will dissipate rapidly beyond the bounds of the infiltration basins. It does not appear there will be adverse impacts due to the groundwater mounding.

- The actual infiltration rate could be less than has been achieved thus far with smaller volumes of water and pumping durations. However, the storage requirements for CD-P85 and CD-P86 have been established using an infiltration loss of 15 cfs (~1 ft/day) from CD-P85 and no infiltration losses from CD-P86. The modeling indicates these rates will be exceeded, confirming the storage design is conservative.

- Field data contain some unexplained results that indicate the actual conditions could be somewhat different that the theoretical predictions.

d. Effects on groundwater quality

The degradation of groundwater quality by the potential introduction of pollutants via the infiltrated storm water was previously discussed in the original Bailey Lake EAW and the IMS (EOR, 2000). Ranges and averages of contaminant concentrations in storm water runoff of U.S. urban areas, including the Twin Cities, were evaluated against state and federal drinking water standards. These studies concluded that, based on these typical values, storm water runoff is potable.

HDR reviewed water chemistry data collected from the infiltration basins CD-P82 and CD-P85 and groundwater data collected from four aquifers in Cottage Grove (HDR, 2002). From this data the following inferences were drawn about the effects of storm water infiltration on localized groundwater potability:

- None of the chemical concentrations in the surface water samples exceed the Minnesota Department of Health (MDH) Health Risk Limits (HRLs) confirming the infiltrated water is chemically potable.

- The infiltration basin water generally has a higher chloride concentration than the ambient groundwater. This may be attributable to road salts.

- The infiltration basin water is higher in phosphorous than the groundwater. This could be related to fertilizer use.

- The groundwater has a greater nitrate concentration than the surface water. The MPCA water quality study documents a groundwater nitrate problem in Cottage Grove. The cause of the elevated nitrated concentrations has not been identified.

- There is no consistent evidence of organic constituents in the infiltration basin water.

The infiltration basin chemistry data supports the previous studies' conclusions that the storm water runoff is potable.

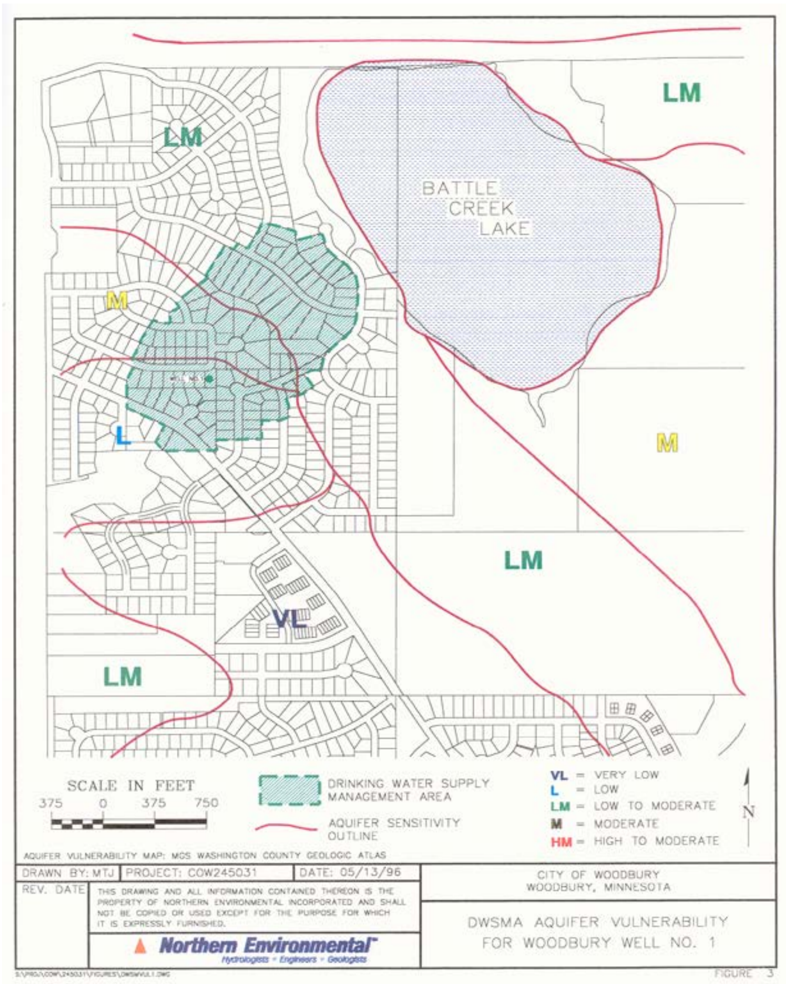
e. Woodbury Wellhead Protection Area

Wellhead protection is a means of safeguarding public water supply wells by preventing contaminants from entering the area that contributes water to the well or wellfield over a period of time.

The City of Woodbury currently operates a total of ten production wells for municipal water supply purposes. All the wells are within City limits and are completed in the Prairie du Chien/Jordan Aquifer system.

Figures 3 and 4, present a summary of the vulnerability assessment for Woodbury's drinking water supply management area (DWSMA), Figures 5 and 6 show actual land use within the DWSMAs.

Figure 3



1. VL: Areas designated as exhibiting a very low vulnerability will require that an inventory of wells or other borings or excavations which penetrate bedrock confining units be conducted;

2. L: Areas designated as exhibiting a low vulnerability must be evaluated for the presence of sources of fuels, solvents, or other chemicals and require the same inventory approach as identified for very low vulnerability areas; and
3. HM, M, LM: Areas designated as exhibiting a high moderate, moderate, or low moderate vulnerability assessment must be inventoried as to the types of land and water uses, as discussed below.

Fig 4

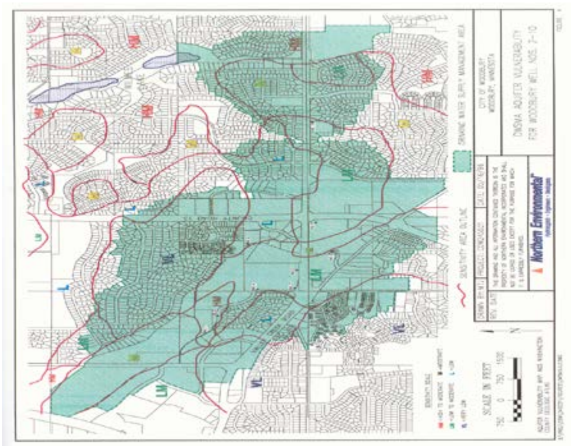


fig 5

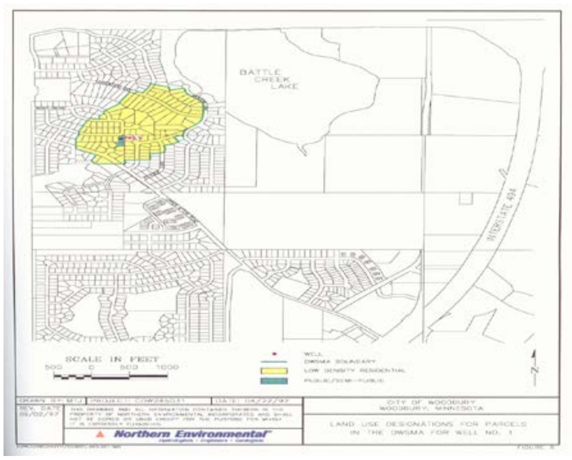
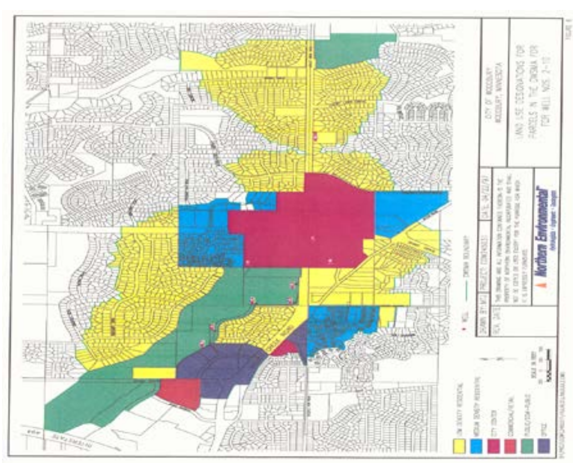


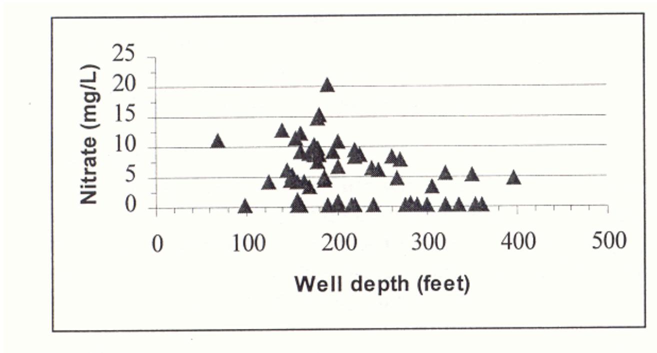
Fig 6



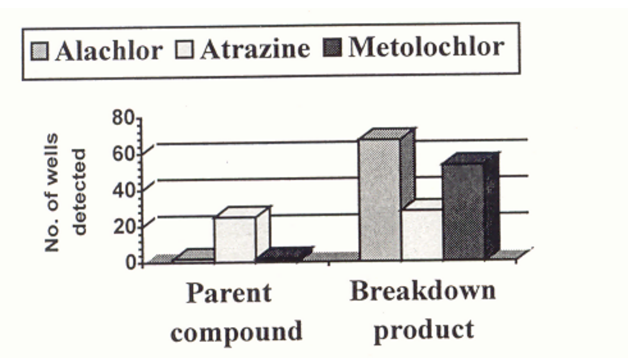
f. Cottage Grove Ground Water Quality

What Did We Find?

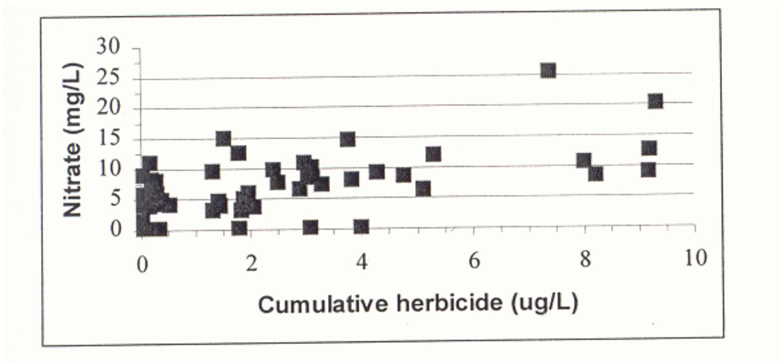
. The overall median nitrate concentration was 5.25 mg/L, with 17 percent of the samples exceeding the drinking water standard.
. Nitrate was persistent in ground water, with concentrations decreasing slowly with depth,



. Nitrate concentrations were similar in the Prairie du Chien (5.6 mg/L) and Jordan (5.8 mg/L) aquifers.
. Herbicides and their breakdown products were detected in 68 percent of the domestic wells. Breakdown products accounted for about 95 percent of the total herbicide mass detected in ground water samples. Concentrations were typically well below drinking water criteria.



. As concentrations of herbicide in a well increased, concentrations of nitrate increased. This suggests an agricultural source for much of the nitrate in the study area.



. Dichlorodifluoromethane (Freon 12) was the only VOC detected. It was found in two wells at concentrations of 0.8 and 1.2 ug/L. Freon 12 in ground water is probably associated with use of chlorofluorocarbon-containing compounds, such as refrigerants and aerosols.

. There was no correlation between concentrations of nitrate or herbicide and well depth, thickness of overlying sand, age of ground water, or land use. The lack of a correlation with land use may reflect historic inputs of nitrate and herbicide from agriculture in areas that are now residential.

. Nitrate and herbicides introduced into these aquifers are very persistent, but there is weak evidence that concentrations are slowly decreasing.

5. Greenway Corridor

Missing Links

While much of the Conidor is already established by local communities or identified under existing local plans as open space, several significant gaps were identified. Missing Links are described with respect to location and existing condition. Missing Links are shown in Figure II-2. Table II.3 summarizes the location and key features/issues along with the level of priority (from I, highest to 5, lowest). (Emmons & Oliver Resources,2000).

Fig II-2

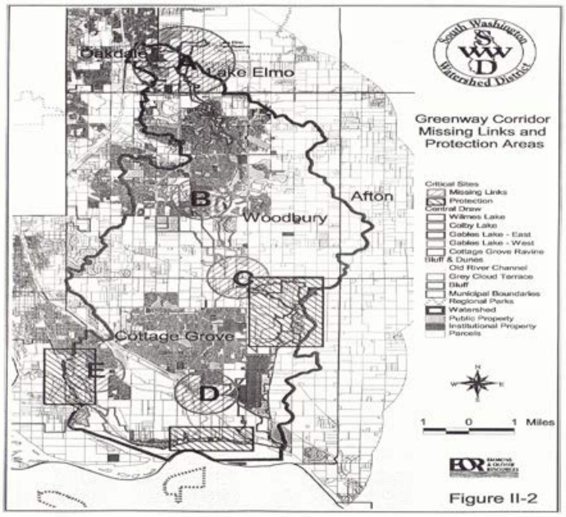


Figure II-2

Table II-3

Missing Link	Location	Comments	Urgency Level
A	Lake Elmo Regional Park to State Farm Office Bldg.	Requires road crossing at CSAH 10 and Interstate 94. Interstate 94 poses significant problem for wildlife crossing. State Farm Insurance headquarters has large prairie planting along south side of Interstate 94.	1
B	Colby Lake to Bailey Lake	Natural flowage between two lakes within existing golf course. Woodbury School property to west offers possible route.	5
C	CD-P85 to Cottage Grove Ravine Park	SWWD currently negotiating with property owners to obtain stormwater infiltration and conveyance facilities. Large area along slopes slated for reclamation to prairie and oak savanna. City of Cottage Grove in process of preparing Master Plan for portions of this area. Road crossings required at Military Road and CSAH 19.	4
D	SW Corner Cottage Grove Ravine Park to old river channel via Langdon Pond	Road crossings at CSAH 19 and Highway 61. Highway 61, in particular, poses concerns for wildlife crossing. Langdon Pond area south of Hwy 61 may be difficult to connect to due to industrial park development. Bluffline above Hwy 61 (near drive-in theater), contains degraded sand gravel prairie with restoration potential.	2
E	Grey Cloud terrace N. of Mississippi Dunes SNA.	Extension of same terrace upon which Grey Cloud Dunes SNA occurs. While most prairies degraded, offers excellent opportunity to expand and link into one of the largest and best quality prairies in the Twin Cities. Most of this ridge, steep and unbuildable with excessively well-drained soils.	3

Protection Areas :
Several natural areas within the proposed corridor are currently unprotected, yet are either worthy of protection or provide excellent opportunities for reclamation/restoration.

Table II-3 summarizes protection areas within the corridor.

Table II-3

Protection Area	Comments
Gables Lake to Cottage Grove Ravine Regional Park. Northeast corner of Cottage Grove	This area contains remnant oak savanna with good restoration potential. Other community types such as forest, prairie and wetland are also found. Most of the land is privately held in small parcels. Potential for Kitten-tails is likely within this area.
Mississippi River Bluff	This area is heavily wooded and contains many steep slopes. MCBS has identified stands of Maple-Basswood Forest, Oak Openings, cliff communities, Floodplain Forest and prairies. Most of the land is held by 3M and the remainder by small private parties.
Grey Cloud Terrace	This area is in close proximity to the Grey Cloud Dunes SNA. Reclamation of many of the brushy old fields could provide additional habitat for the many state listed species, which are known to occur in the area.

5. Analysis of Biological Surveys and Reconnaissance Studies

A search of existing information was done by the DNR to determine if any rare plant or animal species or other significant natural features are known to occur within the boundaries of the watershed. The following paragraphs include a general location and the species or areas of concern within the watershed. Detailed information on the species is found in Appendix D. The natural heritage information is shown on Map 2 at the back of the report.

The DNR's Natural Heritage Program inventory of the natural resources within the watershed revealed three main areas of concern due to the existence of rare features occurring within the watershed. The three areas are the Cottage Grove Ravine Regional Park, areas along the Mississippi River across from Grey Cloud Island, and areas along the Mississippi River in the eastern part of the Watershed.

Cottage Grove Ravine Regional Park

The first area of concern is the Cottage Grove Ravine Regional Park and areas west of the park boundaries. The legal description for this area is T27N, R21W, Sections 22 and

23, the NW1/4 of Section 26 and the NE1/4 of Section 27. The park itself includes three unique natural features: a Dry Prairie, a Mixed Emergent Marsh, and a state endangered plant, kitten-tails (*Besseya bullii)* . West of the park is a unique Dry Prairie community. The prairie in the East 1/2 of the NW 1/4 of Section 22 supported a rare but unlisted plant, long-bearded hawkweed (*Hieracium longipilum*), but this area appears to have been lost due to recent development activities.

Mississippi River across from Grey Cloud Island

The second significant area of concern is located along the Mississippi River within the boundaries of the Mississippi National River and Recreation Area. The legal description is T27N, R21W, Sections 29, 30, and 32. Three Dry Prairie natural communities exist here which support eight rare plants including the following species listed as special concern in Minnesota: Hill's thistle (*Cirsium hillii)*, Louisiana Broom-rape (*Orobanche ludoviciana)*, sea-beach needlegrass (*Aristida tuberculosa*), and purple sand-grass (*Triplasis purpurea)*. Illinois tick-trefoil (*Desmodium illinoense*), a state threatened species, occurs on the prairie in the SW 1/4 of Section 29 and the NE1/4 of the NW1/4 of Section 32. A special concern snake species, blue racer *(Coluber constrictor)*, has also been found in the area.

Mississippi River in the East

The third biologically significant area occurs along the Mississippi River in T27N, R21W,Sections 33, 34 and 35. A Dry Prairie community is located just west of the wastewater treatment plant. East of the treatment plant is a Dry Oak Savanna community. The location of the significant natural areas are shown in the Greenway and Natural Features map which is Map 2 at the back of the report.

State Management Plans for Wildlife Areas

There is no land in the watershed owned by the State, which eliminates the potential for state management. There is a Regional Park, which is managed by Washington County Parks, and the Mississippi National River and Recreation area, includes areas along the Mississippi River within the watershed.

The Mississippi National River and Recreation Area has guidelines set up to protect, preserve, and enhance nationally significant resources in the Mississippi River corridor through out the Twin Cities Metropolitan area. The area designated as the Mississippi National River and Recreational area within the watershed boundaries is not owned by the Federal or State governments. If an area is designated as a Mississippi National River and Recreation area, there are management guidelines that have been written in a

Comprehensive Management Plan provided by the National Park Service. These were written to provide a management framework to assist the State of Minnesota and its units of local governments in the development and implementation of integrated resource management programs for the Mississippi River corridor in order to ensure orderly public and private development in the area. The SWWD supports these efforts and encourages the cities to use land use planning as a means of protecting the natural character of the Mississippi River.