

1.0 Executive Summary

The Valley Branch Watershed District (VBWD) Watershed Management Plan (Plan) sets the vision, guidelines, and proposed tasks for managing surface water within the boundaries of the VBWD. This Executive Summary summarizes the highlights of the VBWD Plan, including introductory information, the VBWD vision and mission, goals, policies and implementation tasks.

1.1 Introductory Information

VBWD was established on November 14, 1968 in response to a citizens' petition to the State of Minnesota to address water resource issues in the watershed.

Like all watershed districts, the VBWD is a special purpose unit of local government that manages water resources on a watershed basis (a watershed is an area of land that drains to a given lake, river, stream or wetland). Watershed district boundaries generally follow natural watershed divides, rather than political boundaries.

VBWD is located on the eastern edge of the Minneapolis-St. Paul Metropolitan area and covers approximately ~~65~~70 square miles. Approximately one square mile is in Ramsey County, the remainder of the VBWD lies in Washington County. Figure 2-1 shows the location of the VBWD and the communities that lie or partially lie within the VBWD. The following is a list of these communities:

Ramsey County Communities	Washington County Communities		
Maplewood	City of Afton	City of Mahtomedi	City of St. Mary's Point
North St. Paul	Baytown Township	City of Oak Park Heights	West Lakeland Township
White Bear Lake	City of Grant	City of Oakdale	City of Woodbury
	City of Lake Elmo	City of Pine Springs	

Watershed districts are governed by a local board of managers who are appointed by the boards of the counties with land in the watershed district. In the VBWD, the board of managers has five members; four managers are appointed by the Washington County Board and one manager is appointed by the Ramsey County Board. The appointments are for staggered three-year terms.

The regularly scheduled meetings of the VBWD board of managers are held twice a month, on the second and fourth Thursdays. The meetings are open to the public and are held at the Lake Elmo City Council Chambers, located at 3800 Laverne Avenue North.

VBWD has no central office and no full-time staff. All services, including engineering, legal, accounting, inspection, and secretarial services are provided by consultants. The VBWD has a

Section 5 of the VBWD Plan presents detailed issues pertaining to specific water bodies and how VBWD will address these issues. All of the actions identified in each of Sections 4.1 through 4.9, and Sections 5.1 through 5.3638, are included in the table of implementation tasks (Table 7-1).

The major issues, policies, and proposed actions in each of the nine subsections (Sections 4.1 – 4.9) are summarized in the following paragraphs.

Section 4.1 Public Involvement and Public Information

The VBWD recognizes the increasing importance of expanding the involvement of the public, local units of government, and other agencies, and expanding public information efforts to meet the challenges of managing VBWD's water resources. Through these efforts, the VBWD will increase the public's understanding of water resource management and issues in the watershed, and foster long-term public (and agency) commitment to protecting these resources.

The VBWD has used various methods to involve and inform the public, such as its website (www.vbwd.org) and citizen monitoring efforts. The VBWD will continue and expand these efforts to increase awareness of the VBWD, coordinate and cooperate with other groups to educate the public, recruit (and recognize) volunteers for monitoring efforts and involvement in VBWD programs, promote positive behaviors that have a positive impact on water resources, and to use its advisory committees in meaningful ways.

To assist with all of these watershed education-related efforts, the VBWD will hire a watershed educator.

Section 4.2 Surface Water Quality

Although surface water quality is commonly defined by its physical, chemical, biological, and aesthetic characteristics, good water quality is more than these few measurements. Water quality that is part of a healthy environment supports a rich and varied community of organisms and protects public health.

The lakes, ponds, streams, and wetlands in VBWD are important community assets that provide many benefits. The high quality of the watershed's natural resources makes it an attractive place for people to live. The VBWD recognizes that preserving the high quality of the watershed's natural resources is critical to the existence of a high quality of life among the citizens residing in the watershed and in the larger metropolitan region.

The VBWD Plan includes policies for a revised water body classification system, based on water quality, public access to the water body, whether or not the water body drains directly to an "outstanding resource value water" or a trout stream, and whether or not the water body is a stormwater pond. The VBWD will use the classification system to assist the VBWD in prioritizing and funding water quality improvement projects.

the highest potential for causing damages and property loss. The VBWD Managers will also seek to manage the stormwater and water resources in the watershed to maintain adequate streamflow, although they cannot control the main cause of deleterious low flows (drought).

The VBWD's past stream management actions have included floodplain management, stream monitoring (physical condition, water quality, quantity of flow, and biological), water quality data analysis, and streambank and gully erosion assessments.

The VBWD Plan groups streams as either perennial (i.e., Valley Creek [and Kelle's Coulee](#)) or intermittent (e.g., Raleigh Creek). The VBWD used the grouping system to determine frequency and type of monitoring, and will use the grouping to assist the managers in prioritizing and funding stream management and restoration projects.

The VBWD Plan calls for the regular monitoring of the water quality (including biological indicators) and streamflow of Valley Creek [and Kelle's Coulee](#), and the physical conditions of Valley Creek, [Kelle's Coulee](#) and Raleigh Creek.

This section of the VBWD Plan presents flood protection/water level control issues, policies, and actions that pertain to streams. Broader information on this topic is presented in Section 4.5. Flood protection/water level control issues and actions pertaining to specific water bodies are presented in the individual subsections of Section 5.

The VBWD Plan includes a policy for implementing projects to address identified streambank erosion, gully erosion, and other stream degradation problems. Proposed projects regarding these types of issues are discussed in more detail in Section 5 and include:

- Raleigh Creek stream management and stream restoration project
- Valley Creek dam inspection, analysis, and rehabilitation or dam removal project
- Valley Creek stabilization projects
- Silver Lake ditch erosion stabilization project
- Gully stabilization projects:
 - Ravine from Weber Pond to Long Lake
 - Goose Lake
 - Goetschel Pond

Erosion issues, policies, and actions are also discussed in Section 4.8 and the individual subsections of Section 5 of the VBWD Plan.

Section 5.0 Individual Watershed Management Plans

Section 5 presents information on the following 36 specific water bodies and watersheds within the VBWD in Sections 5.1 through 5.36:

5.1 Silver Lake	5.13 Lake Elmo	5.25 Sunfish Lake
5.2 Acorn (Mud) Lake	5.14 Downs Lake	5.26 Friedrich's Pond
5.3 Echo Lake	5.15 Horseshoe Lake	5.27 Legion Pond
5.4 Weber Pond	5.16 West Lakeland Storage Site	5.28 Bay Lake
5.5 Long Lake	5.17 Rest Area Pond	5.29 Goose Lake
5.6 Capaul's Pond	5.18 Fahlstrom Pond	5.30 Clear Lake
5.7 Lake DeMontreville	5.19 Lake Edith	5.31 Goetschel Pond
5.8 Lake Olson	5.20 Valley Creek	5.32 Mergens Pond
5.9 Lake Jane	5.21 Sunnybrook Lake	5.33 Rose Lake
5.10 Beutel Pond	5.22 Klawitter Pond	5.34 Kramer Pond
5.11 Raleigh Creek	5.23 Cloverdale Lake	5.35 Barton Pit
5.12 Eagle Point Lake	5.24 McDonald Lake	5.36 St. Croix River
		5.37 Kelle's Coulee
		5.38 Swede Hill Creek

The VBWD chose these [36-38](#) watersheds for inclusion in Section 5 of the VBWD Plan based on VBWD's knowledge of the following:

- Water quality issues and data
- Past or possible future flooding problems
- Intercommunity drainage problems
- Revisions to previously-published flood elevations
- Existing or possible future impacts to VBWD's Project 1007 drainage system
- Outstanding water resources

Each of the [36-38](#) individual watershed management plans includes the following:

- General information
- Water quality management plan, with supporting information summarizing:
 - Water chemistry data, and
 - Biological data, including information on fisheries, macrophytes (large aquatic plants), phytoplankton (non-rooted, floating plants – algae), and zooplankton (microscopic aquatic animals)
- Water quantity management plan, which typically includes supporting information on drainage patterns, flood levels, and flooding issues
- Other noteworthy information (e.g., groundwater pollution sites, groundwater-surface water interactions, etc.)

Section 5 is only available in CD format or on the VBWD website, due to its very large size. A CD containing Section 5 is included in a pocket in paper copies of the VBWD Plan. Although this Executive Summary does not summarize each of the ~~36~~³⁸ individual watershed plans, all of the implementation tasks are included in Table 7-1.

Section 6.0 VBWD Plan Review, Update and Revision

Section 6 provides information regarding the VBWD Plan review and approval process, updating the VBWD Plan, and the revision/amendment process for the VBWD Plan. The section includes clear guidelines for when general (major), minor, or no plan amendments are required, based on the type of VBWD Plan revision.

Section 7.0 Implementation Program

Section 7 presents the implementation program. Table 7-1 incorporates all of the implementation activities (studies, monitoring, rules, projects, etc.) called for in other sections of the VBWD Plan (especially Sections 4 and 5) into one table. The activities in Table 7-1 are grouped as follows:

1. Annual administrative activities
2. Annual operations and maintenance
3. Annual data collection and reporting activities
4. Non-annual administrative activities
5. Non-annual data collection and reporting activities
6. Non-annual studies
7. Capital projects

Table 7-1 includes a description of the activity, a VBWD Plan reference, VBWD's involvement in the activity, the estimated costs of the implementation activities, the potential funding source(s), and the proposed year of implementation.

Table 7-2 reorganizes all of the projects in Table 7-1 to show the year-by-year estimated costs of the implementation program and the total annual costs from 2005-2015.

This section also discusses the impact of the VBWD's implementation program on local governments.

Section 8.0 Local Watershed Management Plans

Section 8 discusses the VBWD and Minnesota requirements for local watershed management plans, the status of local planning, and the VBWD review process for local watershed management plans.

This section also discusses the steps necessary for a community to assume the permitting authority for all land alteration activities.

1.4 2011 VBWD Plan Amendment

In 2011 this Plan was amended to document the inclusion of two new subwatersheds that were formerly part of the Lower St. Croix Watershed Management Organization (LSCWMO): Kelle's Coulee and Swede Hill Creek. The Kelle's Coulee watershed is a 3.7 square mile watershed located along the former southern boundary of the VBWD. The Swede Hill Creek watershed is approximately 1.3 square miles in size and located adjacent to the Kelle's Coulee watershed and St. Croix River. The 5 square miles added by the additional watersheds increases the total VBWD area to 70 square miles.

This Plan has been amended to include critical changes resulting from the inclusion of these watersheds. The most significant revisions include the following:

- Revised jurisdictional boundary in Figures 2-1 and 3-1
- Revised watershed boundaries in Figure 3-2
- Updates to Section 4 – Overall Issues, Goals and Policies, including:
 - Section 4.3 – Stream Management and Restoration
 - Section 4.4 – Stormwater Management
 - Section 4.6 – Groundwater Management
- Additional individual watershed management plans, including
 - Kelle's Coulee (Section 5.37)
 - Swede Hill Creek (Section 5.38)
- Revised Implementation Tables (Tables 7-1 and 7-2)

Minor changes have been made throughout the Plan to reflect the new watershed areas. To limit the extent of plan revision, much of the water resource inventory information (and associated maps) for the Kelle's Coulee watershed and Swede Hill Creek watershed are not included in Section 3 of this Plan. Instead, the reader is directed to the most recent *LSCWMO Watershed Management Plan* (EOR, 2009) and/or the *Kelle's Coulee Stream Management Plan* (EOR, 2007) for a description of land and water resources, available data, and associated maps.

The VBWD is adjacent to the following watershed districts and joint powers watershed management organizations:

- Ramsey-Washington Metro Watershed District, along west-northwest boundary of VBWD
- Rice Creek Watershed District, along north-northwest boundary of VBWD
- Browns Creek Watershed District, along north-northeast boundary of VBWD
- Middle St. Croix Water Management Organization, along east boundary of VBWD
- ~~Lower St. Croix Water Management Organization, along southeast boundary of VBWD~~
- South Washington Watershed District, along south~~west~~ boundary of VBWD

The legal boundary of VBWD has been altered a number of times to more closely conform to actual drainage patterns. These alterations are listed below:

- 1974 – altered to exclude a portion of White Bear Lake
- 1984 – altered in the western portion of VBWD
- 1987 – altered boundary with Middle St. Croix Water Management Organization
- 2001 – altered boundary with Ramsey-Washington Metro Watershed District that affected one lot in Oakdale
- 2002 – altered entire common boundary with Browns Creek Watershed District
- 2003 – altered entire common boundary with South Washington Watershed District
- 2009 – altered to include additional watersheds in southern Afton (Kelle’s Coulee and Swede Hill Creek)
- 2009 – altered to include approximately 30 square miles transferred from the South Washington Watershed District
- 2010 – altered to exclude area transferred from the South Washington Watershed District in 2009

2.5 VBWD History

VBWD was established on November 14, 1968 to address existing flooding problems and prevent future flooding problems in the watershed.

Plan) is the fourth VBWD Plan approved by the Minnesota Board of Water and Soil Resources (BWSR) or its predecessor. The previous VBWD Plans were:

1. 1970 – *Overall Plan, Valley Branch Watershed District*
2. 1987 – *Valley Branch Watershed District Water Management Plan* (The Minnesota Water Resources Board (now BWSR) approved the Plan in March 1986, but the order formally approving the plan was not issued until September 1987; the Plan was printed in 1988).
3. 1995 – *Valley Branch Watershed District Water Management Plan*

Except for the ~~minor~~-boundary changes noted earlier in Section 2.4, VBWD has covered the same geographic area since its formation. In 2001, VBWD briefly became an enlarged watershed district with a different name – Lower St. Croix Valley Watershed District. It came about as the result of a 2000 Washington County petition to BWSR to eliminate all of the joint powers watershed management organizations within the County, which, among other changes, involved enlarging the size of VBWD to include the area currently covered by the Lower St. Croix Water Management Organization and the southern portion of the Middle St. Croix Water Management Organization. In November 2000, BWSR held a public hearing on the county’s petition, and in January 2001, BWSR issued an order to enlarge the VBWD and change its name to the Lower St. Croix Valley Watershed District. In March 2001, the Middle St. Croix Water Management Organization filed an appeal to BWSR’s order. In September 2001, the Minnesota Appeals Court reversed BWSR’s decision, finding that BWSR exceeded its statutory authority in granting Washington County’s petition to enlarge the VBWD to include territory already within a joint powers watershed management organization. Between January 2001 and September 2001, VBWD went by the name Lower St. Croix Valley Watershed District. After September 2001, the watershed district reverted back to its original name (Valley Branch Watershed District) and previous geographic size. [In 2009, two watersheds covering approximately 5 square miles \(Kelle’s Coulee and Swede Hill Creek\) were added to the VBWD from the Lower St. Croix Watershed Management Organization. An additional 30 square miles was transferred to the VBWD from the South Washington Watershed District in 2009 through a citizen’s boundary change petition. In 2010, the area added to the VBWD from the South Washington Watershed District in 2009 was returned to the South Washington Watershed District. The VBWD Plan was amended in 2011 to reflect these changes.](#)

VBWD has no central office and no full-time staff. All services, including engineering, legal, accounting, inspection and secretarial services are provided by consultants. The VBWD has a website (www.vbwd.org), which includes VBWD permitting information, manager and consultant information, agendas and minutes from managers’ meetings, annual reports, lake level and water quality data, and other information. The VBWD’s mailing address is:

Valley Branch Watershed District
P.O. Box 838
Lake Elmo, MN 55042-0538

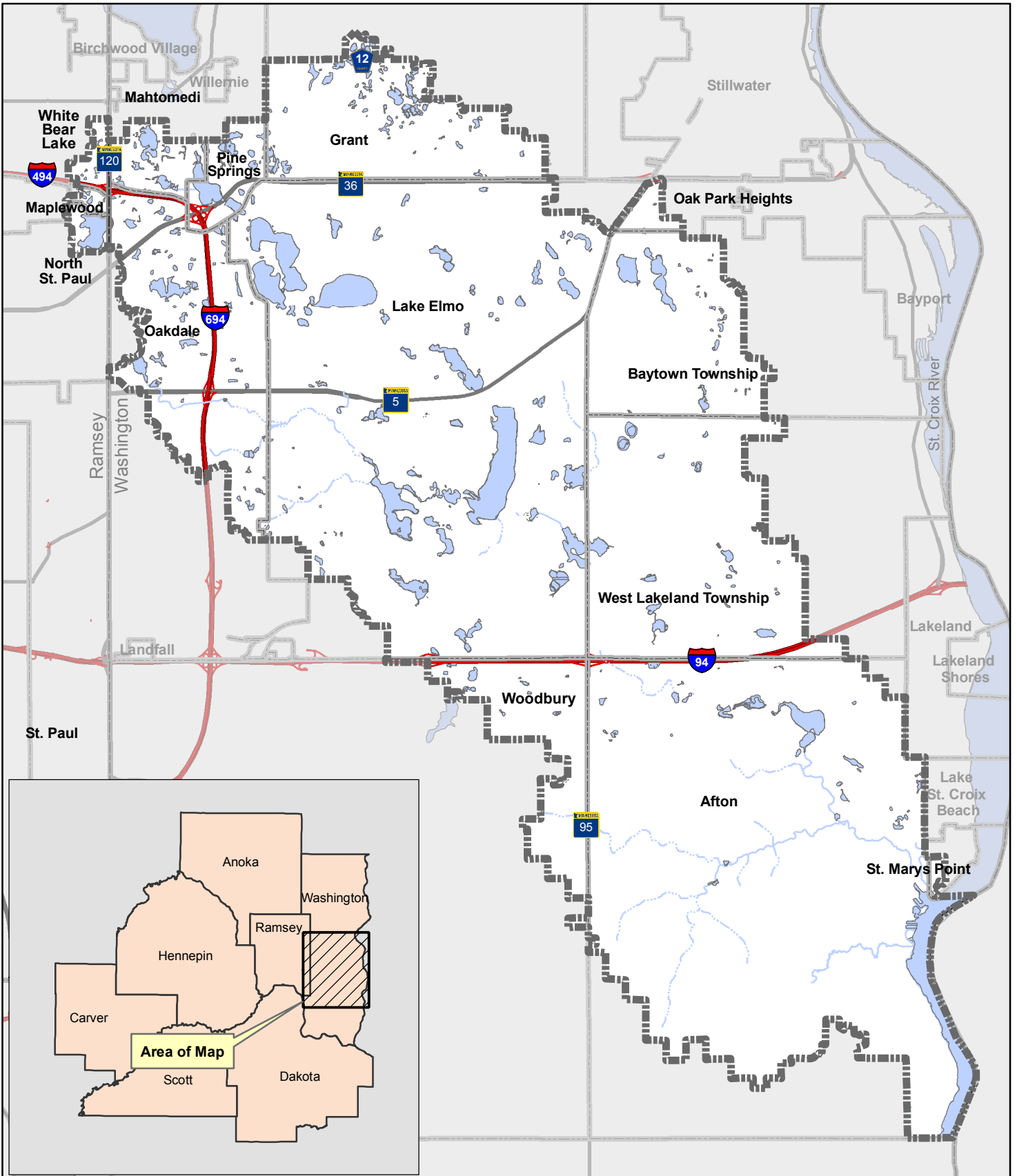


Figure 2-1

LOCATION AND COMMUNITIES
Valley Branch Watershed District



Scale in Miles

Table 3-1 (continued)
DRAINAGE AREAS
Valley Branch Watershed District

Subwatershed Name	Area, Acres
HRS-08	31.7
HRS-09	16.6
HRS-10	8.7
HRS-11	16.3
HRS-12	17.4
HRS-13	26.6
HRS-14	12.7
HRS-15	9.8
HRS-16	17.5
HRS-17	60.7
HRS-18	4.2
HRS-19	6.3
HRS-20	4.1
Subtotal – Horseshoe Lake Subwatershed	665.6
<u>Kelle's Coulee Major Subwatershed</u>	
<u>KCS-01</u>	<u>2348.6</u>
<u>Subtotal – Kelle's Coulee Subwatershed</u>	<u>2348.6</u>
Lake Jane Major Subwatershed	
JANE-01	342.5
JANE-02	112.0
JANE-03	23.2
JANE-04	10.0
JANE-05	22.0
JANE-06	43.1
JANE-07	23.5
JANE-08	11.2
JANE-09	58.0
JANE-10	96.2
JANE-11	8.6
JANE-12	41.6
JANE-13	38.4
JANE-14	10.7
JANE-15	20.8
JANE-16	13.1
JANE-17	21.0
JANE-18	15.6
JANE-19	29.6
JANE-20	3.9
JANE-21	71.8
JANE-22	11.1
JANE-23	52.0

Table 3-1 (continued)
DRAINAGE AREAS
Valley Branch Watershed District

Subwatershed Name	Area, Acres
SVB-07	135.2
SVB-08	32.3
SVB-09	62.7
SVB-10	83.5
SVB-11	100.7
SVB-12	31.6
SVB-13	10.6
SVB-14	639.8
SVB-15	51.8
SVB-16	294.1
SVB-17	91.0
SVB-18	92.3
SVB-19	174.7
SVB-20	33.9
SVB-21	114.8
SVB-22	485.3
SVB-23	25.1
SVB-24	234.0
SVB-25	85.2
SVB-26	174.0
SVB-27	163.2
SVB-28	23.5
SVB-29	107.3
SVB-30	179.9
SVB-31	145.4
SVB-32	262.0
SVB-33	174.2
SVB-34	98.7
SVB-35	43.5
Subtotal – South Fork Valley (Branch) Creek Subwatershed	4990.9
<u>Swede Hill Creek Major Subwatershed</u>	
<u>SHC-01</u>	<u>835.8</u>
<u>Subtotal – Swede Hill Creek Subwatershed</u>	<u>835.8</u>
Weber Pond Major Subwatershed	
WEB-01	28.0
WEB-02	11.8
WEB-03	19.3
WEB-04	15.2
WEB-05	8.2
WEB-06	1.5
WEB-07	5.1

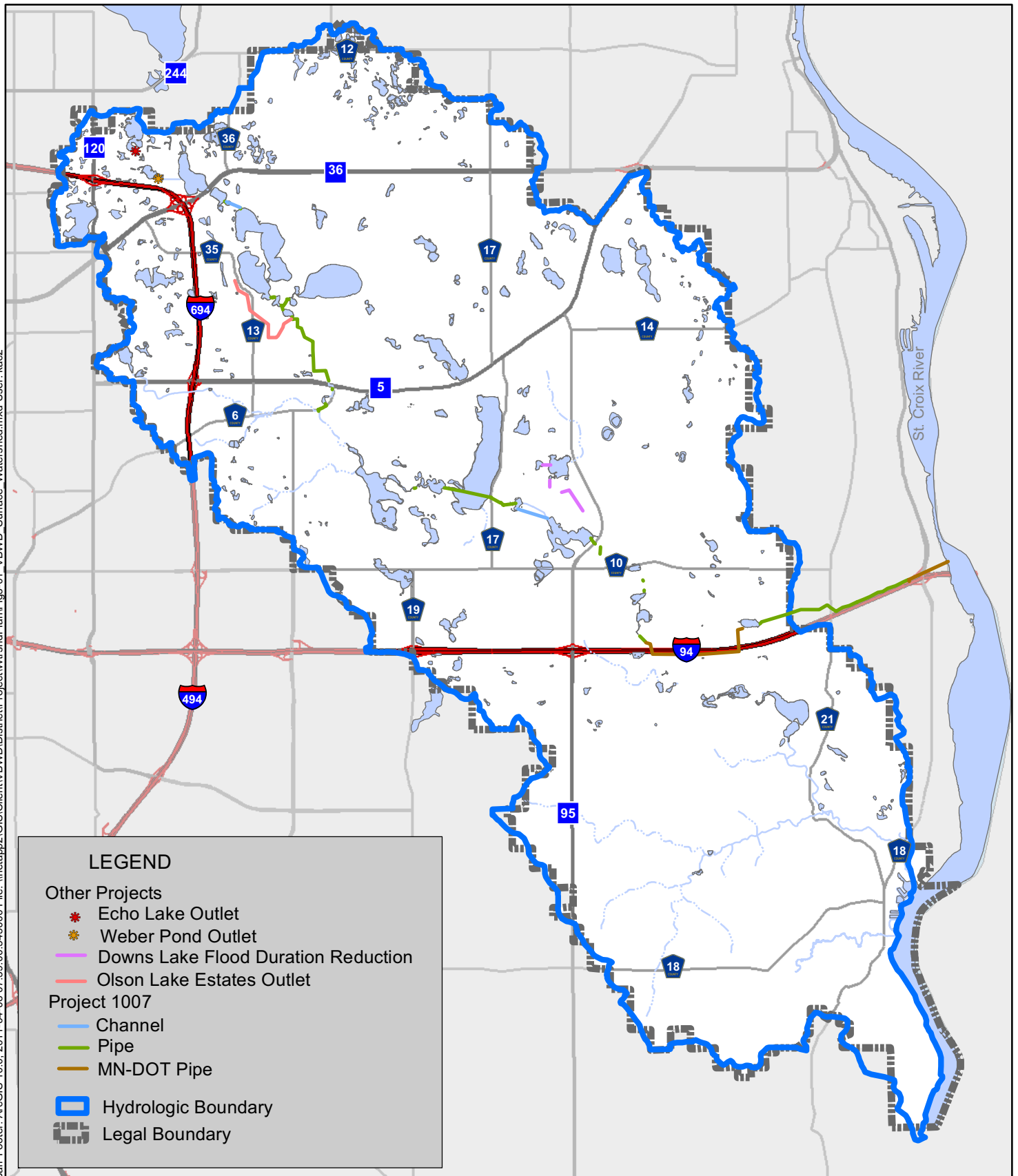
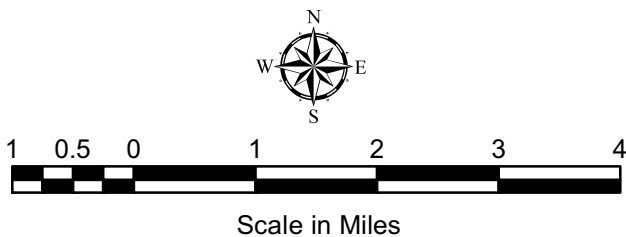


Figure 3-1

**VBWD FLOOD CONTROL PROJECTS
AND WATERSHED BOUNDARIES
Valley Branch Watershed District**



<p>4.3.4 Policies to Accomplish Mission</p>	<p>SM&R-A. 1. The water quality of VBWD’s perennial streams (Valley Creek, Kelle’s Coulee) will be regularly monitored. The water quality of intermittent streams may be monitored. 2. The physical condition of VBWD’s perennial streams (Valley Creek, Kelle’s Coulee) and major intermittent streams (Raleigh Creek) will be monitored on a regular basis. 3. Monitoring results will be reported.</p> <p>SM&R-B. Stream degradation problems will be prevented through administration of VBWD’s permit program, review of community plans, and education.</p> <p>SM&R-C. VBWD will implement stream management and stream restoration projects and actions to address identified streambank erosion, gully erosion and other stream degradation problems.</p> <p>SM&R-D VBWD will not allow new buildings to be constructed within the 100-year floodplain of a stream. The VBWD will consider solutions to existing flooding problems.</p>
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4.3.5 Background and History Related to Stream Management and Restoration

[At the time of Valley Branch Watershed District \(VBWD\) creation, there was](#) one perennial stream and several intermittent streams within the ~~Valley Branch Watershed District (VBWD)~~. [In 2010, a portion of the Lower St. Croix Watershed Management Organization \(LSCWMO\) was added to the VBWD, including a second perennial stream, Kelle’s Coulee.](#) A perennial stream is a stream that flows throughout the year. Valley Branch Creek (called Valley Creek by local residents, other agencies, and hereinafter in this Plan) [and Kelle’s Coulee are](#) the only perennial streams within the VBWD. Valley Creek and a number of [its](#) tributaries are Minnesota Department of Natural Resources (DNR)-designated trout streams and are DNR ~~P~~public ~~W~~waters. Groundwater supplies the baseflow of Valley Creek [and Kelle’s Coulee](#).

Intermittent streams are streams that flow during/after a snowmelt or rain event. Several intermittent streams lie within the VBWD. Some of the longer intermittent streams within the VBWD include:

- 1) Unnamed channel between Weber Pond and Long Lake
- 2) Unnamed channel between Long Lake and Lake DeMontreville
- 3) Raleigh Creek (formerly called Eagle Point Creek) – intermittent DNR-protected stream northwest of Eagle Point Lake, starting near I-694 and Highway 5 in the City of Lake Elmo
- 4) Farney Creek – intermittent stream west of Eagle Point Lake, starting north of the intersection of Inwood Avenue North (CSAH 13) and 15th Street North in the City of Lake Elmo

[Relatively little water quality data exists for Kelle's Coulee, which the LSCWMO started monitoring in 2006. Any future monitoring will be performed by the VBWD. \(See Section 5.37 for details of VBWD's monitoring program for Kelle's Coulee\).](#)

The VBWD has strived to prevent flooding and erosion within streams. After the VBWD formed in November 1968, it began reviewing development plans on a voluntary basis only. The first rules and regulations of the VBWD were adopted in 1972, and the VBWD has required the review of projects which could have an effect upon the streams within the VBWD ever since.

More recently, the VBWD has undertaken specific stream management and restoration activities, including:

- 1) Working with a large group of stakeholders to prepare the *Valley Creek Subwatershed Plan developed by the Valley Creek Subwatershed Advisory Committee, June 2002*. This document includes
 - a. Subwatershed Description,
 - b. Goals, Strategies, and Actions, and a
 - c. Recommended Implementation Program

This document also includes a 1999 Natural Resources Inventory (VBWD also provided financial support for this effort), an Alternative Stormwater Best Management Practices (BMP) Guidebook, and a proposed buffer plan.

- 2) Financially supporting a stream monitoring program where Stillwater Area High School students collect and identify aquatic insects (macroinvertebrates) from streams. The VBWD has supported this program for a number of years. Initially, the students collected the macroinvertebrates from a station on Valley Creek. More recently, they have collected samples from Valley Creek and Raleigh Creek. The students use the macroinvertebrate data to determine the health of the stream(s).
- 3) Restoring the channel and relieving flooding along Raleigh Creek. In 1998, the VBWD completed a channel modification project that removed old abutments on the creek south of 28th Street North.
- 4) Inspecting Valley Creek and Raleigh Creek for erosion, developing erosion monitoring programs, and proposing stabilization projects.
- 5) Contributing funding to the Department of Natural Resource's Neighborhood Wilds Program in 2003, which included improving the overbanks of the south branch of Valley Creek through removal of invasive species (e.g., buckthorn) and planting a diverse mix of native plants.

- 6) Computing 100-year flood levels for Valley Creek and Raleigh Creek. In 2003-2004, the VBWD computed these flood levels for Washington County to use in their efforts to re-map the FEMA (Federal Emergency Management Agency) Flood Insurance Rate Maps.

4.3.6 Identified Stream Management and Restoration Issues

Land use and land management influence the hydrologic cycle, and ultimately the health of the receiving stream. However, there are many opportunities to plan and manage land use and land practices to avoid negative impacts, and even create benefits for the watershed and its natural resources and inhabitants. Because streams (like all water resources) receive their water from the surrounding watershed, stream management needs to take place at the watershed level. In the case of Valley Creek, impacts to groundwater that might be outside of the watershed must also be taken into consideration.

Water Levels

As with lakes and wetlands, flooding of streams is a concern to VBWD residents, local units of government, and others. Flooding can be a threat to public health and safety, and can result in significant economic losses. For the perennial portions of Valley Creek, low water levels are also a concern. Lower water levels can significantly change the ecological value of the creek and could also result in lower property values of the adjacent lands. Several of the flooding issues discussed in Section 4.5.6 also apply to streams, and those issues are not repeated within this section.

Recent research by the St. Croix Watershed Research Station of the Science Museum of Minnesota determined that approximately 85% of the baseflow in the South Fork of Valley Creek is from groundwater, while the North Fork of Valley Creek receives nearly all of its baseflow from Lake Edith, which is assumed to be fed by groundwater. [Similarly, Kelle's Coulee is fed by groundwater sources via slow seep discharge \(see *Kelle's Coulee Stream Management Plan, 2007*\).](#) Since groundwater is such a critical factor in the flow and health of Valley Creek [and Kelle's Coulee](#), groundwater quality and quantity needs to be protected. See Section 4.6 for a discussion of groundwater management information, issues, and policies.

Floodplain Management

Floodplain management is the management of development and other activities in or near the floodplain to prevent flood damages. The DNR defines floodplain management as *“the full range of public policy and action for ensuring wise use of the floodplains. It includes everything from collection and dissemination of flood control information to actual acquisition of floodplain lands, construction of flood control measures, and enactment and administration of codes, ordinances, and statutes regarding floodplain land use.”*

Minnesota law defines the floodplain as the land adjoining lakes, water basins, rivers, and watercourses that has been or may be covered by the “100-year” or “regional” flood. See the discussion in Section 4.5.6 regarding the 100-year flood level and the 100-year flood event.

Floodplains of larger basins and streams are mapped by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps, which are included in community Flood Insurance Studies.

VBWD manages activities in the floodplains of VBWD. The VBWD rules and regulations require a VBWD permit for all work within the waters and floodplain of VBWD. The VBWD rules and regulations apply to all lakes, ponds, streams, marshes and other wetlands in VBWD, not just water bodies that have been mapped by the FEMA on Flood Insurance Rate Maps. VBWD floodplain management requirements for streams include:

1. VBWD determination or approval of flood levels,
2. VBWD setting of minimum building elevations at two feet above the “100-year flood level,”
3. Preservation of floodplains through easement dedication,
4. Restrictions on filling in the floodplain,
5. Restrictions on uses of the floodplain, and
6. Restrictions on alterations that impact floodplains

It is sometimes difficult for VBWD to set minimum building elevations for homes adjacent to streams because the 100-year flood level varies as you move along the stream. Often, VBWD will set a range of minimum building elevations to cover the entire property.

VBWD has determined 100-year flood levels for some streams that have not been mapped on FEMA Flood Insurance Rate Maps. Information about VBWD flood levels and FEMA flood levels is available from the VBWD engineer.

VBWD is aware of some homes within the floodplain of Valley Creek (see Section 5.20) and Raleigh Creek (see Section 5.11). [In the City of Afton, high waters elevations in the Lower St. Croix River and Kelle’s Coulee result in the flooding of homes; in addition, runoff from the bluffs adjacent to the St. Croix River floods basements and damages property \(see Sections 5.37 and 5.38\).](#) Additional homes may be within the floodplain of other intermittent streams. Many of these homes were constructed prior to establishment of flood levels and before VBWD began implementing its permit program. Establishment of flood levels and implementation of VBWD’s permit program have been very effective at preventing the construction of homes, businesses and other structures within the floodplain. A remaining issue is ensuring that buildings adjacent to floodplains are constructed to the correct elevation – if they are constructed too low, they may be within the floodplain. Another issue is that septic systems may be within the floodplain, even if homes are not within the floodplain.

See the Floodplain Management portion of Section 4.5.6 for more information about the authority of the DNR, counties and cities in floodplain management, including flood insurance requirements. As noted in Section 4.5.6, as more areas in VBWD are mapped by FEMA on Flood Insurance Rate Maps (e.g., through Washington County’s FEMA mapping effort), more properties could be shown as

located in the floodplain. This means more property owners will be required to obtain flood insurance or prove that they are not in the floodplain. In some cases, homes/structures that appear to be located within these FEMA-mapped floodplains may not actually be in the floodplain (e.g., lowest home elevation may be above the required elevation). To waive the mandatory flood insurance requirements, property owners must remove their homes/structures from the FEMA-mapped floodplains by obtaining a Letter of Map Amendment (LOMA) or a Letter of Map Revision (LOMR).

Stream Monitoring

Stream monitoring can be broken down into three categories:

- 1) Physical condition of the stream (including such factors as riffles, pools, bottom material, bank stability, bank vegetation)
- 2) Quality and quantity of the water supply (including water chemistry parameters such as pH, temperature, dissolved oxygen, fecal coliform bacteria, etc. and the fluctuation of water levels and flowrates)
- 3) Diversity of aquatic insects and other stream inhabitants

As urbanization and land use changes continue in VBWD, more information needs to be collected for VBWD to assess stream conditions, determine if there are physical (erosion), habitat, and/or water quality or quantity problems, track changes, detect trends, and better understand processes. While much data has been collected for Valley Creek and some data has been collected for Raleigh Creek, the VBWD has not collected much data for the shorter intermittent streams. [Limited data is available for Kelle's Coulee from 2006-2009.](#)

Water Quality Reporting

It has been requested that VBWD enter its water quality data into the STORET database. Water quality data collected as part of the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP) is already entered into the STORET database. As more water quality data is collected and entered into STORET, this data will be assessed and could result in the listing of VBWD streams on the MPCA's impaired waters (303(d)) list. The MPCA is required to include on its impaired waters list those water bodies that are not considered "fishable and swimmable," and to submit this list to the U.S. Environmental Protection Agency (EPA). VBWD is concerned that the MPCA standards presume swimming is the designated use for all streams, without consideration of the physical characteristics and locally intended use. All of the VBWD streams are too shallow to be suitable for swimming. Currently, no VBWD streams or sections of streams are on the MPCA's 2002 or (draft) 2004 impaired waters list. The 303(d) list is updated every two years. The State of Minnesota's Water Quality Standards (Minnesota Rules Chapter 7050) are the numeric and narrative conditions that are used to determine if the waters are impaired. A total maximum daily load (TMDL) analysis is conducted for waters included on the 303(d) list. The TMDL addresses the causes and source of the impairment and how to bring the water body back into compliance. Another issue for VBWD will be

the role of VBWD in determining the TMDL allocations and integrating the results of the TMDL analysis into VBWD management of water bodies.

Stream Degradation

Increased rates and volumes of runoff, resulting from urbanization and other activities, can degrade a stream's physical condition and its water quality, change the flow in the stream, and can reduce the amount of groundwater flowing to a stream. This can lead to streams with warmer water, higher water levels, more frequent high water levels (including more frequent occurrences of bankfull flows – when water reaches the top of the stream's main channel banks), wider fluctuations in water levels, and longer durations of high (and low) flows. More frequent bankfull flows can cause stream bank erosion and other changes to the physical conditions of the stream.

The following paragraphs describe the effects of urbanization on streams, as quoted from the *Minnesota Urban Small Sites BMP Manual* (Barr, 2001):

Existing stream characteristics are a reflection of conditions in the watershed. Under natural conditions and at bank-full capacity, studies have shown that streams can handle a flow approximately equal to the 1½ to 2 year frequency peak discharge within their banks (Rosgen, 1994; Leopold et al., 1964). The frequency of bank-full events increases with urbanization, and might be expected to occur 2 to 8 times per year compared to less than once per year under natural conditions, causing the stream to enlarge its channel to reach a new equilibrium with the increased flows. In addition to regular flood damage, this condition causes previously stable channels to erode and widen. Much of the eroded material becomes bed load and can smother bottom-dwelling organisms. Sediment from streambank erosion eventually settles in stream, rivers and lakes, reducing their capacity and water quality. Base flow in streams is also affected by changes in hydrology from urbanization because a large part of base flow comes from shallow infiltration. Impervious cover reduces base flow, reducing the volume of water available for base flow in streams (MPCA, 2000). The problem may be further compounded by the installation of shallow ground water drainage systems to accommodate road or building construction. Lower recharge rates for groundwater in a watershed are generally reflected in lower stream base flows. Low rates of recharge also extend low flow durations; particularly during prolonged droughts.

Urbanization will increase the runoff volume from each storm event, thereby increasing the erosive force of the flows in the channel and can significantly upset the sediment load equilibrium that was established over many years. While the significance of large flood events should not be underestimated, the smaller flows with an approximately nine-month to two-year return period frequency can be very erosive. Often, these smaller flows have not been given sufficient consideration. Hydrologic studies need to look at flood, peak flow and total flow conditions, while keeping in mind that small-storm hydrology is a critical component for protection of property, water quality and habitat.

Valley Creek [and Kelle's Coulee](#) depends on groundwater for ~~its~~[their](#) baseflow, so any changes to the groundwater flow can reduce the baseflow of the stream and increase the stream's water temperature. In addition to urbanization, groundwater wells may divert water away from a stream, reducing its baseflow.

Stream water quality is closely linked to watershed conditions and internal processes (see Appendix A-4.2 for background information about water quality). As urbanization increases and other land use changes occur in VBWD, nutrient and sediment inputs (i.e., loadings) from stormwater runoff can far exceed the natural inputs to the stream. Stormwater runoff can carry significant amounts of phosphorus from the watershed into a stream. Land use changes resulting in increased imperviousness (e.g., urbanization) or land disturbance (e.g., urbanization, construction or agricultural practices) also result in increased amounts of phosphorus carried in stormwater runoff and stormwater runoff with higher temperatures. In addition to watershed sources, other possibly significant sources of phosphorus include atmospheric deposition, internal loading (e.g., release from anoxic sediments, algae die-off, aquatic plant die-back, and fish-disturbed sediment) and failing septic systems. The majority of VBWD properties adjacent to major water bodies are served by individual sewage treatment systems or community sewage treatment systems. Should these systems fail, they have the potential to add nutrients, bacteria and other pollutants to VBWD water bodies, including streams.

Watershed and in-stream changes can impact aquatic insects and the other stream inhabitants. Insects and other inhabitants are indicators of stream health. Some insects can only survive in high quality water, whereas others can survive in much poorer quality of water. A healthy stream has a good diversity of insects and stream inhabitants.

The VBWD has studied many of the water quality problems in the watershed and developed recommendations for improving water quality. Issues for VBWD include determining the role of VBWD in addressing the impact of septic systems on water quality, and the prioritization and implementation of water quality improvement projects. Another important issue is the prevention of water quality degradation in VBWD. Current VBWD rules require water quality treatment for projects, but the VBWD would like to achieve higher levels of water quality treatment than is currently required, and ensure that the water quality and quantity of the VBWD streams are protected or improved. (See Section 4.4 – Stormwater Runoff Management for more information about VBWD's water quality management policies.)

Another issue affecting stream water quality is the maintenance of stormwater management ponds – this issue is discussed and addressed in Section 4.4 – Stormwater Runoff Management.

Streambank and Gully Erosion

VBWD has conducted physical monitoring of its streams to determine if there are streambank and other erosion problems. In the past, VBWD usually conducted this type of monitoring only in response to problems. More recently, VBWD has conducted more intensive monitoring to identify problems.

In 2003, the VBWD began conducting a Phase I assessment to determine potential streambank restoration and gully stabilization projects along Valley Creek. Phase I involved visiting sites to determine the severity of erosion, determining if a project is warranted, and if so, determining what countermeasures should be installed. Phase I also prioritized the sites and developed cost estimates

for the countermeasures. Section 5.20 – Valley (Branch) Creek Watershed Management Plan discusses the Phase I results and proposed Phase II projects in more detail.

[The Kelle's Coulee Stream Management Plan \(EOR, 2007\) cites several localized streambank erosion issues near driveways and small ravines, but does not characterize erosion as a major problem throughout the system \(see Section 5.37\).](#)

Also in 2003, VBWD conducted physical monitoring of Raleigh Creek. Analysis of the results revealed that the creek has degraded since the last monitoring (1998) and improvement projects are warranted. Section 5.11 – Raleigh Creek Water Management Plan discusses the specific monitoring results and recommended projects. Erosion and sedimentation issues, policies, and actions are also discussed in Section 4.8 – Erosion Prevention and Sediment Control.

4.3.7 Policy Details, Strategies, and Actions Related to Stream Management and Restoration Issues

SM&R-A. Monitoring

VBWD will regularly monitor the water quality (including biological indicators) and streamflow of its perennial streams (Valley Creek [and Kelle's Coulee](#)). Section 5.20 – Valley (Branch) Creek Watershed Management Plan presents VBWD's monitoring policies specific to Valley Creek. VBWD may monitor the water quality of its intermittent streams, but only in response to an identified or suspected problem. The details of such a monitoring program will be determined at that time. [Section 5.37 – Kelle's Coulee Watershed Management Plan presents VBWD's monitoring policies specific to Kelle's Coulee.](#)

If VBWD can gain access, VBWD will regularly monitor the physical condition of the DNR [public waters watercourses](#) ~~protected streams~~ (Valley Creek, [Kelle's Coulee](#) and Raleigh Creek). The purpose of this monitoring is to assess stream degradation, including the identification of streambank and gully erosion sites. VBWD will monitor other intermittent streams only in response to problems.

VBWD will report the results of its stream monitoring in its annual report, which is posted on the website.

SM&R-B. Permit & Plan Review

VBWD will prevent stream degradation problems through its permit review program, review of community plans, and education efforts. Section 4.4 – Stormwater Runoff Management describes VBWD's stormwater management requirements. When reviewing projects, VBWD will consider the effect of in-stream structures on natural habitat and the needs of people/pedestrians.

SM&R-C. Stream Management and Restoration Actions

VBWD will implement stream management and stream restoration projects and actions to address identified streambank erosion, gully erosion and other stream degradation problems. VBWD will

prioritize projects according to the size of the affected area, the threat to public health, safety, or welfare, the damage/potential damage to the stream, and the downstream impacts of the problem. In general, VBWD will place a higher priority on addressing projects in and along its perennial streams (Valley Creek, [Kelle's Coulee](#)) and its intermittent streams with larger tributary watersheds (Raleigh Creek). Such projects could include streambank restoration, native plantings, sediment removal, and repair/ removal of structures. (See Section 4.9 for details on funding methods.)

The VBWD will assess the underlying mechanisms of hydrology, geomorphology, biology, connectivity, and water quality when evaluating stream restoration measures.

SM&R-D. Flood Protection

Through the implementation of the VBWD permit program, the VBWD will not permit new buildings to be constructed within the 100-year floodplain of a stream. The VBWD will consider solutions to existing flooding problems. The VBWD rules and regulations will continue to require a VBWD permit for all work within the waters and floodplain of VBWD. VBWD floodplain management requirements for streams will continue to include:

1. VBWD determination or approval of flood levels,
2. VBWD setting of minimum building elevations at two feet above the “100-year flood level,”
3. Preservation of floodplains through easement dedication,
4. Restrictions on filling in the floodplain,
5. Restrictions on uses of the floodplain, and
6. Restrictions on alterations that impact floodplains.

See Section 4.5.5 (Water Level and Floodplain Management) for more information regarding VBWD's issues and policies on this topic.

Stormwater quality treatment ponds are effective at removing significant amounts of sediment and some amounts of phosphorus from stormwater runoff. Stormwater quality treatment ponds are not the only stormwater quality treatment measures available. Additional stormwater quality treatment may be provided through other methods such as runoff pollution prevention and alternative stormwater treatment Best Management Practices (BMPs). Runoff pollution prevention methods include impervious surface reduction, good housekeeping, construction practices, soil erosion control, and sediment control. Alternative stormwater treatment BMPs include infiltration systems, filtration systems, constructed wetlands, etc. Impervious surface reduction and infiltration systems are especially effective since they reduce the volume of stormwater runoff produced. They also provide the added benefits of groundwater recharge. However, these alternative stormwater BMPs are not appropriate for all site conditions. For example, infiltration BMPs are not recommended for soils with very low permeability (i.e., clays), nor in situations where the bottom of the infiltration BMP would be less than three feet above the seasonally high water table (*Minnesota Urban Small Sites BMP Manual*, Barr, 2001).

The current VBWD rules require stormwater quality treatment ponds as the only form of stormwater treatment BMP. Although the VBWD's stormwater volume checklist is a move toward reducing stormwater volumes, the methods listed are not required. While the VBWD encourages developers to try new/innovative techniques, more incentives are likely needed.

4.4.7 Policy Details, Strategies, and Actions Related to Stormwater Runoff Management

SW-A. Stormwater Runoff Rates and Volumes

VBWD will continue to manage stormwater and snowmelt runoff rates on a regional or subwatershed basis throughout the VBWD. Specifically, VBWD will continue to require that future peak rates of runoff crossing community boundaries and/or leaving a development are below or equal to existing rates for critical duration events with return frequencies up to and including 100 years. In some cases it may be necessary for VBWD to allow a variance from this policy in order to relieve flooding problems. [The VBWD will require approval by the Board of Managers for projects that propose the diversion of surface water across established major watershed divides \(see Figure 3-2\).](#)

Generally, the VBWD requires that the rate of stormwater runoff from a site not increase as a result of development. This requirement applies to each development site in those communities that do not have an approved local water management plan. However, the VBWD could have problems enforcing this rule when communities wish to manage stormwater runoff on a regional basis. The use of regional detention basins commonly results in stormwater runoff rates from individual developments that could be higher or lower than pre-development runoff rates, depending on the site. Therefore, to allow for regional management of stormwater runoff in local watershed management plans, VBWD will continue to require that the rate of stormwater runoff be held to pre-development rates at community boundaries. The allowable runoff rates will be determined at the time local plans

are developed. For those communities without an approved local watershed management plan, the VBWD regulations will apply to individual development sites.

The VBWD will develop and adopt stormwater volume control requirements. The basis for the volume control requirements will be one of the following, or a combination of the following:

- water quality protection/stormwater quality treatment
- groundwater sustainability [and protection](#)
- streambank erosion protection
- wetland habitat protection

The VBWD will conduct a literature review and perform calculations to develop and justify the requirements. Once the literature and calculations are complete, the VBWD will draft changes to its rules and regulations, and follow the requirements of Minnesota Statutes to make the changes to the VBWD rules and regulations. The VBWD will involve local units of government and other agencies in the rule-making process.

SW-B. Stormwater Runoff Quality

Through its permit process, the VBWD will continue to require treatment of all stormwater runoff. VBWD will continue to require and encourage the implementation of stormwater management practices to achieve VBWD water quality goals for water bodies in the watershed. These practices include both structural and non-structural methods that reduce runoff rates and non-point nutrient and pollutant loadings. [The VBWD requires infiltration practices where such activities do not threaten the water quality of groundwater resources.](#)

VBWD will continue to encourage developers to try new and innovative stormwater management techniques and to encourage the retrofit of existing stormwater management features. The VBWD will develop a program to better encourage developers to implement these techniques. The VBWD will consider a number of incentive programs, including VBWD funding of the additional cost of constructing/implementing innovative stormwater management techniques versus traditional methods, VBWD funding of demonstration projects, and VBWD grant program for funding of projects associated with new development and retrofit projects.

The VBWD will work with local government units to adopt/revise their land use ordinances to allow for runoff pollution prevention methods (e.g., narrower streets, smaller parking lots).

The VBWD will apply the stormwater management standards/requirements in Section SW-E to ensure that stormwater quality treatment is provided at the time of development and to avoid future retrofitting of ponds to provide higher levels of treatment.

Through its permit program, the VBWD will continue to review proposed projects, developments and redevelopments to evaluate compliance with VBWD stormwater quality management standards. The

Sites Outside of the Valley Creek, Swede Hill Creek or Kelle's Coulee Watersheds

1. A permanent pool volume (“dead storage”) below the principal spillway (normal outlet) shall be provided that is greater than or equal to the runoff from a 2.5-inch 24-hour storm over the entire contributing drainage area, assuming full development. This is a change from the 1995 VBWD Water Management Plan, where the amount of dead storage varied depending on the water resource to which the development drained.
2. A permanent pool average depth (basin volume/basin area) shall be ≥ 4 feet, with a maximum depth of ≤ 10 feet.
3. An emergency spillway (emergency outlet) that is adequate to safely pass the 100-year frequency, critical-duration rainfall or runoff event.
4. Basin side slopes above the normal water level should be no steeper than three feet horizontal to one foot vertical (3H:1V) when possible, and preferably flatter. A basin shelf with a minimum width of 10 feet and 1 foot deep below the normal water level is needed to enhance wildlife habitat, reduce potential safety hazards, and improve access for long-term maintenance.
5. To prevent short-circuiting, the distance between the major inlets and normal outlet shall be maximized.
6. Effective energy dissipation devices shall be provided that reduce outlet velocities to 4 feet per second (fps) or less. These devices shall consist of stilling basins or other such measures to prevent erosion at all stormwater outfalls into the basin and at the detention basin outlet.
7. Trash and floatable debris skimming devices shall be placed on the outlet of all on-site detention basins to provide treatment up to the critical duration 5-year storm event. These devices can consist of baffled weirs, submerged outlets or other such measures. Velocities through baffled weir devices shall be less than 0.5 fps.
8. All inlets to detention basins, wetlands, etc., shall be placed at or below the normal water level.

Sites Within the Valley Creek, Swede Hill Creek and Kelle's Coulee Watersheds

Additional and/or different design considerations than those listed for Sites Outside of the Valley Creek, Swede Hill Creek, and Kelle's Coulee Watersheds ~~may be allowed and/or are~~ required for sites within the Valley Creek, Swede Hill Creek and Kelle's Coulee Watersheds.

C. Hydrologic/Hydraulic Design Requirements/Exhibits

The following design requirements must be followed and the listed exhibits must be submitted for all VBWD Permit Submittals.

determining whether or not they need flood insurance, the VBWD determined the flood elevations for the following water bodies:

- Metcalf Marsh – 1999
 - Unnamed creek upstream of Fahlstrom Pond – 2000
 - Unnamed basin near Lake DeMontreville – 2001
- c. In 2003, Washington County contracted with the VBWD to compute 100-year flood levels for several basins. Washington County was updating the FEMA Flood Insurance Rate Maps and requested that several basins be mapped, which had not been shown on the maps or were shown as “unnumbered A Zones” in the past. These basins included:
- Sunnybrook Lake and surrounding lowlands and DNR wetland 350W, which is located within the Sunnybrook Lake subwatershed
 - Cloverdale Lake and an adjacent wetland (DNR 312W)
 - Legion Pond
 - McDonald Lake and an upstream wetland (DNR 311W)
 - Kramer’s Pond
 - Friedrich’s Pond
 - Fahlstrom Pond and upstream lowlands
 - Bay Lake
 - Downs Lake and adjacent wetland (Eden Park Pond – DNR 463W)
3. Fahlstrom Pond study – In 2000, VBWD completed a study (*Draft Fahlstrom Pond Analysis*, June 2000) of a potential pumping station at Fahlstrom Pond. The study also reviewed the potential impacts of future development and the options for outlets on upstream landlocked ponds. The study was done at a conceptual level to collect enough information for the draft 2000 Plan amendment, discussed previously in this section.
4. Fahlstrom Pond Flood Level Analysis – In February 2003, the VBWD completed a draft report (*Draft Fahlstrom Pond Flood Level Analysis*, 2003) that computed the 1% probability flood levels for all of the basins within the Fahlstrom Pond subwatershed. The study looked at existing conditions and ultimate development conditions. The study was a cooperative project between the VBWD, the city of Woodbury, and the city of Afton.

Section 5 – Individual Watershed Plans discusses these activities in more detail.

[The Lower St. Croix Watershed Management Organization \(LSCWMO\) performed additional flood level analysis for areas now included in the VBWD \(i.e., Kelle’s Coulee\). FEMA-designated](#)

[floodplain areas in the Swede Hill Creek and Kelle's Coulee watersheds are not shown in this Plan. The reader is referred to the most recent LSCWMO Watershed Management Plan \(EOR, 2009\) for floodplain mapping of these watersheds. The LSCWMO developed an XP-SWMM hydrologic/hydraulic model was developed for the Kelle's Coulee watershed. The watershed was divided into nine subwatersheds and calibrated to streamflow data from 2004. The model was run for the 100-year 24-hour storm event and water surface elevations calculated for several cross sections. Revised FEMA floodplain maps were not created as part of this study \(i.e., a Letter of Map Revision, or LOMR, was not obtained\). The reader is directed to the LSCWMO's Kelle's Coulee Stream Management Plan \(EOR, 2007\) for documentation of the model and the resulting 100-year water surface elevations.](#)

4.5.6 Identified Water Level and Floodplain Management Issues

This section discusses the water level and floodplain management issues identified by the VBWD Managers, by individuals attending the July 31, 2003 issue identification workshop, and by other individuals (outside of the workshop). Water level and floodplain management issues that pertain to particular water bodies are discussed in Section 5 – Individual Plans.

Identified water level and floodplain management issues are organized into three topics: water levels (high water levels and low water levels), floodplain management, and a discussion of 100-year flood level and 100-year flood event.

Water Levels

High Water Levels

Both high water levels (flooding) and low water levels are of concern to VBWD residents, local units of government, and others. More concern and attention is usually paid to flooding because it is a greater threat to public health and safety, and can result in significant economic losses. Of special concern is flooding on landlocked water bodies, which prolongs the damages/impacts. Especially in the northern and eastern portions of VBWD, there are numerous landlocked basins (basins that have no surface water outlet). VBWD contains more than 50 landlocked basins greater than approximately five acres, and many of the more than 1,000 smaller wetlands and basins in VBWD are also landlocked. Landlocked basins are often located in kettle basins, which formed in glacial till and ice contact stratified drift. As glaciers retreated, large blocks of ice were left behind, which were then buried beneath glacial deposits. When the ice melted, depressions (kettle basins) were left behind, which typically have no natural outlet stream. These types of glacial deposits are characterized by rugged or “hummocky” relief. These materials, especially the glacial till, can have a relatively low permeability, which may retard seepage.

Because there is no surface outlet, runoff which collects in these depressions is removed only by seepage and evaporation. As a result, landlocked basins are subject to wide variations in water levels and their 100-year floodplains typically cover large areas. In addition, evaporation is likely to be low during periods of above-average precipitation since cooler air temperatures and cloudy days result in

less evaporation. As water tables rise during periods of above-average precipitation, seepage out of landlocked basins can also decrease.

The seepage from landlocked basins provides important groundwater recharge benefits. Also, landlocked basins do not discharge surface waters to downstream basins, which could otherwise be negatively impacted by the additional stormwater volume.

VBWD may be requested to provide outlets from landlocked basins to prevent damages that occur during periods of sustained high water levels, but it is not always feasible or reasonable for VBWD to do so. For example, it may not be feasible to provide outlets because of the long distances to the nearest outlet, the depth of the pipe, and the capacity of the nearest outlet. It may not be reasonable to provide outlets because of the downstream impacts on flood levels and/or water quality. It is also difficult to provide even temporary relief during flooding situations for the same reasons that it is difficult to provide permanent outlets.

Damages caused by flooding include:

- Damage to homes, businesses and other buildings
- Damage to infrastructure (e.g., roads, bridges)
- Flooding of individual septic systems, rendering them unusable
- Damage or destruction of recreational trails and bridges

Flooding may cause other damages that are harder to quantify, including the following:

- Flooding of roads so they are impassable to emergency vehicles, residents, and school buses
- Shoreline erosion
- Destruction of vegetation, such as grass, shrubs, trees, etc.
- Unavailability of recreational facilities for use by the public (e.g., inundation of beaches) and/or restricted recreational use of water bodies (e.g., no-wake zones)
- More strain on budgets and personnel for repairing flood-damaged facilities and controlling public use of facilities during flooding events
- Alterations to mix and diversity of wildlife species as a result of inundation of upland habitats

Related to high water level issues, a number of homes were built too low and are in the floodplain. This is discussed in more detail in the Floodplain Management Issues part of this section.

[The City of Afton's local water management plan identifies flooding issues in the Old Village. Flooding occurs from three sources, including Kelle's Coulee, the St. Croix River, and runoff from bluffs adjacent to the St. Croix River. Kelle's Coulee flooding may be exacerbated when St. Croix River water levels are high. The sources of flooding require a coordinated solution due to the](#)

[presence of a levee. The levee protects the city from high water levels in the St. Croix River, but also prevents upstream flows \(e.g., Kelle’s Coulee\) from discharging to the river. The City of Afton has proposed the following projects to address these flooding issues:](#)

- [St. Croix River Flooding – Levee reconstruction and accreditation \(pump station, seepage system and storage basins\) and associated work](#)
- [Kelle’s Coulee Flooding – Levee bypass system](#)
- [Bluff Runoff Flooding – Local system to collect runoff from the bluff and convey it safely to the levee pump station](#)

Low Water Levels

Although less likely to result in significant economic losses, VBWD recognizes low water levels can also have negative impacts. Possible negative impacts include interference with or diminished recreational use of the water resources, through reduced or lost access to the water resource by the public and shoreline residents, reduced aesthetic enjoyment of the water resources (e.g., from mud flats, smells), loss of wildlife habitat, and winterkill of fish. The VBWD cannot control drought, which is the main cause of deleterious low water levels.

Issues related to low streamflows are discussed in Section 4.3 – Stream Management & Restoration.

Floodplain Management

Floodplain management is the management of development and other activities in or near the floodplain to prevent flood damages. The DNR defines floodplain management as *“the full range of public policy and action for ensuring wise use of the floodplains. It includes everything from collection and dissemination of flood control information to actual acquisition of floodplain lands, construction of flood control measures, and enactment and administration of codes, ordinances, and statutes regarding floodplain land use.”*

Minnesota law defines the floodplain as the land adjoining lakes, water basins, rivers, and watercourses that has been or may be covered by the “100-year” or “regional” flood. See the discussion later in this section regarding the 100-year flood level and the 100-year flood event. Floodplains of larger basins and streams are mapped by the FEMA on Flood Insurance Rate Maps, which are included in community Flood Insurance Studies.

VBWD manages activities in the floodplains of VBWD. The VBWD rules and regulations require a VBWD permit for all work within the waters and floodplain of VBWD. The VBWD rules and regulations apply to all lakes, ponds, streams, marshes and other wetlands in VBWD, not just water bodies that have been mapped by the FEMA on Flood Insurance Rate Maps. VBWD floodplain management requirements include:

1. VBWD determination or approval of flood levels,
2. Use of a special method to determine flood levels on landlocked basins in lieu of a more detailed analysis (see Section 4.5.7 – WL&FM – E, Permit & Plan Review),
3. VBWD setting of minimum building elevations at two feet above the “100-year flood level” (see Discussion of 100-Year Flood Level and 100-Year Flood Event later in this section),
4. Preservation of floodplains through easement dedication,
5. Restrictions on filling in the floodplain,
6. Restrictions on uses of the floodplain, and
7. Restrictions on alterations that impact floodplains.

VBWD has determined 100-year flood levels for many water bodies that have not been mapped on FEMA Flood Insurance Rate Maps. [The LSCWMO has determined 100-year flood levels for Kelle’s Coulee \(see Section 5.37\)](#). Also, VBWD has determined 100-year flood levels for many water bodies that have been mapped by FEMA. There are discrepancies between the VBWD and FEMA 100-year flood levels in some situations. For example, the construction of Project 1007 resulted in changed 100-year flood levels on many lakes in VBWD. As a result, the 100-year flood levels shown on the FEMA Flood Insurance Rate Maps are different than the VBWD 100-year flood levels for Lake Olson, Lake DeMontreville, Lake Jane, Sunfish Lake, and Lake Elmo. The particular discrepancies are discussed in the appropriate portions of Section 5 – Individual Watershed Plans.

The landlocked water bodies in VBWD (and in Washington County) were either mapped on FEMA Flood Insurance Rate Maps as “unnumbered A Zones” or not mapped at all. In 2003, Washington County contracted with the VBWD to determine 100-year flood levels for several basins so that the flood levels could be mapped on FEMA Flood Insurance Rate Maps (these basins are listed in Section 4.5.5). There are a large number of landlocked basins remaining in VBWD for which the 100-year flood level has not been determined. It is more difficult to determine the 100-year flood level for landlocked basins than for basins with outlets. Because of this difficulty and the large number of landlocked basins in VBWD, VBWD developed a simplified method for estimating the 100-year flood level on landlocked basins (see Section 4.5.7 – WL&FM – E, Permit & Plan Review).

VBWD is aware of homes within the floodplains of Sunnybrook Lake, Eden Park Pond, Friedrich’s Pond, Fahlstrom Pond, Project 1007 lakes, and other major water bodies (see the appropriate parts of Section 5.0 – Individual Watershed Plans and Table 3-4). Additional homes may be within the floodplain of other lakes, ponds, and storage basins. Many of these homes were constructed prior to establishment of flood levels and before VBWD began implementing its permit program. Establishment of flood levels and implementation of VBWD’s permit program have been very effective at preventing the construction of homes, businesses and other structures within the floodplain. A remaining issue is ensuring that buildings adjacent to floodplains are constructed to the

4.6 Groundwater Management

<p>4.6.1 Importance</p>	<p>Most VBWD residents obtain their drinking water from groundwater. This makes it especially important to ensure that these aquifers are uncontaminated, protected from future contamination and provide adequate supplies. Several VBWD water bodies also are groundwater-dependent and need an adequate supply of clean groundwater.</p>
<p>4.6.2 General Issues</p>	<p>Groundwater quality and quantity is closely linked to the aboveground environment. Groundwater quality and quantity are dependent on the infiltration of surface water/rainfall through the soil, which is dependent on soil type, land cover, weather, and other factors. Changes to any of these factors will influence groundwater. While some of the factors are difficult to control, some activities and changes to land cover can be regulated and/or managed.</p> <p>Groundwater is a finite resource with inputs and outputs. The input is generally rainwater and snowmelt that seeps into the ground. The outputs can be groundwater that is pumped out for human use and groundwater that naturally discharges to lakes, wetlands, and streams.</p> <p>Maintaining clean, safe groundwater supplies is critical to human and environmental health and to the economic and social vitality of our communities. Groundwater can be contaminated by commercial and industrial waste disposal, landfills, leaking petroleum tanks, septic systems, mining operations, feedlots and fertilizer/pesticide applications. In Washington County, groundwater quality is good over the majority of the area; however, there are some locations in the County and the VBWD where contaminants have been found. In these areas, there are added financial and social costs to manage the affected water supply.</p>
<p>4.6.3 Mission</p>	<p>To manage and protect our water resources: lakes, ponds, creeks, streams, wetlands, drainages, and groundwater by:</p> <p style="padding-left: 40px;">Understanding the effects of community growth and other activities on <u>groundwater</u>, initially focusing on the groundwater–surface water interface.</p>
<p>4.6.4 Policies to Accomplish Mission</p>	<p>GM-A. 1. Groundwater level data will continue to be collected to assist in managing the water levels and floodplains of the VBWD’s water resources.</p> <p style="padding-left: 20px;">2. The VBWD will explore the development and implementation of a groundwater quality monitoring program to assist in managing the water quality of VBWD’s groundwater and surface water resources.</p> <p>GM-B. Groundwater level data will be reported.</p> <p>GM-C. 1. The VBWD will cooperate with Washington County to address groundwater quality issues (e.g., failing individual and community sewage systems).</p> <p style="padding-left: 20px;">2. The VBWD encourages the cities and other public water suppliers to adopt wellhead protection programs. These programs</p>

	<p>will include the identification and sealing of abandoned wells. The wellhead protection plans must be submitted to VBWD for review.</p> <p>3. The VBWD will cooperate with the cities and other public water suppliers to educate the general public concerning the use of best management practices to prevent contamination of groundwater supplies and the importance of these measures in protecting groundwater supplies.</p> <p>GM-D. Negative impacts (e.g., reduced flow to surface water bodies, lowering lake or wetland levels, well interference) to groundwater-dependent resources will be prevented through permit review, community plan review, and education efforts.</p> <p>GM-E. Negative impacts (e.g., flooding) to surface waters due to groundwater quality mitigation efforts (e.g., pump-out systems) will be prevented through permit review, community plan review, and education efforts.</p> <p><u>GM-F. Negative impacts to groundwater quality and quantity will be prevented through permit review, community plan review, and educational efforts.</u></p>
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4.6.5 Background and History Related to Groundwater Management

A discussion of the different aquifers and groundwater processes within the VBWD is given in Section 3.1. Groundwater issues are regulated by a number of agencies, including:

- Washington County (preparation and administration of county groundwater plan, individual sewage treatment systems (ISTS) for all Washington County communities of the VBWD, except for the City of Lake Elmo)
- Ramsey County (preparation and administration of county groundwater plan)
- City of Lake Elmo (ISTS, water supply for portions of the City)
- Cities of White Bear Lake, North St. Paul, Oakdale, Mahtomedi, Woodbury, Oak Park Heights, and the Cimarron Park community (water supplies)
- Minnesota Department of Health (MDH, drinking water) – The MDH is responsible for preventing pollution of water supplies to ensure safe drinking water sources and limit public exposure to contaminants. Through implementation of the federal Safe Drinking Water Act, the MDH administers the Public Water Supply Program, which allows the MDH to monitor groundwater quality and train water supply system operators. The 1996 amendments to the federal Safe Drinking Water Act require the MDH to prepare source water assessments for all of Minnesota’s public water systems and to make these assessments available to the public. These source water assessments are available at the following MDH website:
<http://www.health.state.mn.us/divs/eh/water/swp/swa/index.htm>.

Through its Well Management Program, the MDH administers and enforces the Minnesota Water Well Code, which regulates activities such as well abandonment and installation of new wells.

The MDH also administers the Wellhead Protection Program, which is aimed at preventing contaminants from entering the recharge zones of public well supplies. In 1997, the Wellhead Protection Program rules (Minnesota Rules 4720.5100 to 4720.5590) went into effect. These rules require all public water suppliers that obtain their water from wells to prepare, enact, and enforce wellhead protection plans. The MDH prepared a prioritized ranking of all such suppliers in Minnesota. Regardless of the ranking, Minnesota Rules 4720 require all public water suppliers to initiate wellhead protection measures for the inner wellhead management zone prior to June 1, 2003. If a city drills a new well and connects it to the distribution system, the city must begin development of a wellhead protection plan.

The Cities of North St. Paul, Oak Park Heights, and Woodbury are implementing their approved wellhead protection plans. The City of Lake Elmo, the City of Oakdale, the Cimarron Park community, and Oak-Land Junior High School are in the process of developing (or have recently completed) wellhead protection plans. The other cities that obtain their municipal water supplies from groundwater wells (Cities of White Bear Lake and Mahtomedi) are not currently in the process of preparing wellhead protection plans. Wellhead protection plans include: delineation of groundwater “capture” areas (wellhead protection areas), delineation of drinking water supply management areas (DWSMA), assessment of the water supply’s susceptibility to contamination from activities on the land surface, and management programs, such as identification and sealing of abandoned wells, and education/public awareness programs. Minnesota Rules 4720 require that wellhead protection plans be submitted to watershed management organizations for review.

- Minnesota Pollution Control Agency (MPCA, groundwater pollution) – The MPCA administers and enforces laws relating to pollution of the state’s groundwater. The MPCA monitors ambient groundwater quality, administers ISTS design and maintenance standards and regulates the use, registration and site cleanup of underground and above ground storage tanks. The MPCA is also responsible for administering the programs regulating construction and reconstruction of ISTS. The MPCA requires an inspection program for ISTS that meets MPCA standards. Minnesota Rules 7080 govern administration and enforcement of new and existing ISTS.
- Minnesota Department of Natural Resources (DNR, groundwater appropriations) – suppliers of domestic water to more than 25 people or groundwater appropriations that exceed 10,000 gallons per day or 1,000,000 gallons per year must obtain a water appropriation permit from the DNR. The DNR is also responsible for mapping sensitive groundwater areas, conducting groundwater investigations, addressing well interference problems, and maintaining the observation well network. (See Section 3.2.2.8 for more information about DNR water

appropriations permits, which apply to withdrawals from both surface water and groundwater.)

- Minnesota Department of Agriculture (agricultural pollution)
- Minnesota Geological Survey (MGS, mapping and investigation) – the MGS provides a complete account of the state’s groundwater resources through geological mapping and investigation projects. The MGS produces the county geologic atlases, interprets water well log information, and manages a database of county well information.
- Lower St. Croix Watershed Management Organization (LSCWMO) – the LSCWMO developed a *Karst Feature Inventory and Management Plan (EOR, 2007)* to guide management of water resources in karst areas. The LSCWMO report presents an inventory of karst areas in the LSCWMO and provides guidelines for projects located within karst areas. Karst features are present in the watersheds of Kelle’s Coulee and Swede Hill Creek, which are now part of the VBWD.

Under Minnesota Statutes (M.S. 103D.201 Subd. 2(14)), the VBWD has the authority to regulate groundwater, although it’s specific role in groundwater management is ill-defined. As with most watershed districts, the VBWD has not been very active in groundwater management in the past. However, early in its history, the VBWD recognized the significance of groundwater and its possible role in water levels of lakes and wetlands. In 1974, the VBWD began constructing its groundwater level monitoring network. All of the wells are located in the water table aquifer. Eleven wells were constructed. Four more wells were constructed in 1975. In 1978, three more wells were constructed and added to the monitoring network. Over the years, additional wells have been added and some have been destroyed. Figure 3-13 shows the locations of all the current and past VBWD groundwater monitoring wells. The VBWD read the water elevations at the groundwater monitoring wells approximately monthly until 1986. After 1986, the groundwater levels were read approximately quarterly for a few years. Since 1991, the groundwater levels have been read approximately every other month. The water levels at each groundwater well are shown on Figure 3-14.

The VBWD has used the groundwater level data to gain a better understanding of the groundwater flow patterns and the groundwater influence on lakes within the VBWD. In general, groundwater in the water table and upper aquifers flows east within the VBWD toward the St. Croix River. North of Highway 36, it flows northeast, between Highway 36 and Interstate 94, it generally flows southeast, and south of Interstate 94, it generally flows straight east.

Other activities that VBWD has undertaken in regards to groundwater management include:

- 1) Reviewing and commenting upon all DNR appropriation permits.
- 2) Working with the MPCA in its efforts to discharge treated contaminated water from the Washington County (Lake Jane) Landfill into the VBWD’s Project 1007 system.

- 3) Contributing to the Washington County Groundwater Plan 2003-2013 by actively participating on the Groundwater Advisory Committee.
- 4) Supporting Washington County in completing the Northern Washington County Groundwater-Surface Water Interaction Study, October 2003. This study included investigating the feasibility and impact on groundwater of using areas around Sunnybrook Lake for seepage of floodwaters.
- 5) Contributing and cooperating with Washington County, the Cities of Woodbury and Afton, and several other agencies and communities on the 2003 Legislative Commission on Minnesota Resources (LCMR) grant for determining the long-term sustainability of the groundwater in the Woodbury/Afton area.
- 6) Contributing to the 2004-2005 Southern Washington County Groundwater-Surface Water Interaction Study.

The VBWD will continue to collaborate with communities, counties and other agencies on the development of groundwater studies and management plans, and by review of relevant permits and wellhead protection plans. The VBWD will consider adopting new rules to support improved groundwater management and protection.

4.6.6 Identified Groundwater Management Issues

This section discusses the groundwater issues identified by the VBWD Managers, by individuals attending the July 31, 2003 issue identification workshop, and by other individuals (outside of the workshop). The VBWD is most concerned about the groundwater/surface water interface, i.e., VBWD surface water that becomes groundwater (groundwater recharge), groundwater that becomes surface water in VBWD (groundwater discharge/springs), or water that is extracted from groundwater in VBWD. Groundwater issues that pertain to particular water bodies are discussed in Section 5 – Individual Plans.

Washington County Groundwater Plan 2003-2013

The *Washington County Groundwater Plan 2003-2013* presents information, issues, policies, and suggested implementation activities for groundwater management. The county's plan identifies watershed districts (WD) and joint powers watershed management organizations (WMO) as the lead implementing agency to address the following issues:

- Reduced groundwater recharge resulting from urbanization
- Degraded quality of groundwater as a result of increased non-point source pollution
- Reduced groundwater flows to surface waters, lowered lake levels, and well interference resulting from overuse of groundwater

- Need for citizens and public officials to understand groundwater-related issues

The county's plan calls for WDs and WMOs to implement the following activities:

1. Provide education to citizens and public officials on:
 - The interaction of surface and groundwater quality and quantity
 - The value of and need to protect groundwater recharge areas and wetlands
 - Implementing best management practices and low-impact development strategies to protect groundwater resources

Section 4.6.7 of this Plan includes groundwater-related education efforts, while Section 4.1 describes VBWD's overall education efforts.

2. Adopt rules for all new developments to control stormwater runoff volume and establish performance standards. *Section 4.6.7 and Section 4.4.7 of this Plan call for the development of infiltration/volume control requirements.*
3. Develop and adopt rules or policies on the quantity of water used in areas where existing wells and/or groundwater dependent natural resources could be negatively impacted by overuse of groundwater. *Section 4.6.7 of this Plan calls for the possible development of a VBWD groundwater appropriations permitting program.*

Karst Features

The presence of karst features within the Swede Hill Creek and Kelle's Coulee watersheds in the VBWD may have impacts on groundwater quality and the protection of groundwater resources. Karst regions are areas with soluble bedrock that is slowly dissolved by infiltrating water. In these regions, surface water features are typically well connected to groundwater resources, creating increased potential for groundwater contamination. Karst features may include sinkholes, springs, and sinking streams (areas where surface streams disappear through percolation or sinkholes). The MGS, University of Minnesota, and DNR have developed inventories of karst features. See the LSCWMO's *Karst Feature Inventory and Management Plan* (EOR, 2007) for maps of karst regions within portions of the VBWD.

It may be desirable to limit groundwater infiltration of stormwater to protect groundwater quality in these areas. The concentration of stormwater runoff collected over a wide area into a detention basin could create hydraulic heads that promote excessive infiltration and may create stability issues (e.g., sinkholes). In karst regions, the LSCWMO's *Karst Feature Inventory and Management Plan* recommends small-scale on-site best management practices (BMPs). The *Minnesota Stormwater Manual* (2005) includes stormwater management guidance related to karst areas.

[The VBWD will protect karst areas through its project review and permitting program and the continued implementation of its BMP Grant Program.](#)

Groundwater Quantity

Groundwater is a finite resource with inputs and outputs. The input is generally rainwater and snowmelt that seeps into the ground (recharge). The outputs can be groundwater that is pumped out for human use and groundwater that naturally discharges to lakes, wetlands, and streams. The inputs and outputs need to be managed to ensure a sustainable groundwater supply. A specific example of a groundwater quantity issue is the possible impact of proposed high-capacity municipal groundwater wells in Woodbury on Valley Creek and on existing individual wells in the area. Another example is the possible impact of future increased pumping from the City of Lake Elmo's municipal wells on Lake Elmo water levels (see Section 5.13 – Lake Elmo Watershed Plan – for more information).

Groundwater Quality

Maintaining clean, safe groundwater supplies is critical to human and environmental health and to the economic and social vitality of our communities. Groundwater can be contaminated by commercial and industrial waste disposal, landfills, leaking petroleum tanks, septic systems, mining operations, feedlots and fertilizer/pesticide applications. Public water suppliers (e.g., cities) may not have jurisdiction (or complete jurisdiction) to control land uses within their Drinking Water Supply Management Areas (DWSMA). Public water suppliers need cooperative partners in this instance. Surface water management infrastructure and land use decisions could impact susceptible/vulnerable water supplies. [The presence of karst features in portions of the VBWD must also be considered in surface water management and land use decisions.](#)

It is also important that the public be aware of the importance of drinking water protection on the public's general health and well being.

In Washington County, groundwater quality is good over the majority of the area; however, there are some locations in Washington County and the VBWD where contamination has been found. In these areas, there are added financial and social costs to manage the affected water supply. The following paragraphs discuss Special Well Construction Areas in VBWD.

Special Well Construction Areas (Well Advisories)/Groundwater Contamination Sites

There are currently three MDH-designated Special Well Construction Areas (formerly known as “well advisory areas”) located within the VBWD. Figure 4.6-1 shows the three Special Well Construction Areas. These three areas are:

1. [Lakeland/Lakeland Shores Special Well Construction Area](#)

In VBWD, this area covers small portions of Afton, near Stagecoach Trail (CSAH 21) and West Lakeland Township, south of Interstate 94 (it also includes portions of Lakeland and Lakeland Shores, which are not within VBWD).

A remedial system, consisting of gradient control wells and spray irrigation of effluent began operating in late 1983. The system effectively removed organic compounds from the water and reversed the spread of contamination. In May of 1986, Lake Elmo received a grant to construct a public water supply to serve the homes adversely affected by the landfill. A program was also initiated to seal the wells once the homes were connected to the public water supply. The remedial system was discontinued and the site was capped.

Recently, the MPCA and the MDH sampled groundwater in the areas south and southeast of the landfill. Based on the sampling results, the MPCA concluded that some of the waste disposed at the landfill contained perfluorooctanoic acid (PFOA), a persistent, widely-distributed contaminant. Appendix A-4.6 contains an August 2004 fact sheet produced by the MPCA and the MDH on the topic.

4.6.7 Policy Details, Strategies, and Actions Related to Groundwater Management Issues

GM-A & GM-B Data Collection and Reporting

The VBWD will continue to collect groundwater level data to assist in managing the water levels and floodplains of the VBWD's water resources. This data will be reported [in the VBWD annual report](#). [The VBWD will also explore the development and implementation of a groundwater quality monitoring plan to assist in management of VBWD resources and provide baseline data for further understanding of surface water-groundwater interactions.](#)

To protect the quality and quantity of groundwater, it must first be understood. The conclusions of the Southern Washington County Groundwater-Surface Water Interaction Study and the Woodbury-Afton LCMR study, along with the VBWD's continued groundwater level readings, will help the VBWD to better understand groundwater and its relationship to surface water and land cover. Reports on these studies are expected to be complete in the summer of 2005. The VBWD will use the information to categorize surface waters as:

1. Groundwater discharge water bodies
2. Groundwater recharge water bodies
3. Flow-through water bodies

Groundwater level readings collected by the VBWD will continue to be published in the VBWD's annual reports, which are also posted to the VBWD's website.

GM-C Cooperation

The VBWD will cooperate with Washington County to address groundwater quality issues (e.g., failing individual and community sewage systems).

Because the County and other entities have adequate ISTS permitting and maintenance programs, the VBWD does not plan to adopt any rules regarding ISTS. However, the VBWD will continue to work with Washington County and other entities to protect natural resources.

The VBWD encourages the cities and other public water suppliers to adopt wellhead protection programs. These programs will include the identification and sealing of abandoned wells. In accordance with Minnesota Rules 4720, the wellhead protection plans must be submitted to VBWD for review.

The VBWD will continue to collaborate with communities, counties and other agencies on the development of groundwater studies and management plans, and by review of relevant permits and wellhead protection plans. The VBWD will cooperate with the cities and other public water suppliers to educate the general public concerning the use of best management practices to prevent contamination of groundwater supplies and the importance of these measures in protecting groundwater supplies.

GM-D, GM-E & GM-E-F Prevention of Negative Impacts

VBWD will prevent negative quality and quantity impacts (e.g., reduced flow to surface water bodies, lowering lake or wetland levels, well interference, aquifer contamination) to groundwater dependent resources through permit review, community plan review, and education efforts.

Upon completion of the studies discussed in GM-A in mid-2005, the VBWD will develop rules and regulations to protect the quality and quantity of groundwater. The VBWD will involve local units of government and other agencies in the rule-making process. These rules might involve the following:

- An infiltration requirement with the intent to maintain groundwater recharge or at least minimize reductions in the quantity of groundwater recharge. The requirement will also need to incorporate assurances that the water being infiltrated will not contaminate the groundwater.
- A groundwater appropriations permitting program that is more stringent than the DNR's program and/or covers appropriations smaller than those regulated by the DNR. The intent of the VBWD permit program would be to minimize groundwater depletion by wells, well interference, and reduced flows to groundwater-dependent resources.

After the studies are complete, the VBWD will also be able to offer more specific comments to communities when reviewing their plans. The VBWD will also be able to provide the public with more specific groundwater information. This information will be useful in the VBWD's education program. Section 4.1 contains the VBWD education policies.

The VBWD will seek to protect groundwater resources from contamination from stormwater runoff in sensitive areas. Sensitive areas may include, but are not limited to, areas where karst features are present, groundwater levels are close to the surface, or soil conditions may allow contaminated water

to infiltrate without adequate filtering, or a combination of these situations. The VBWD will consider the presence of sensitive areas and stormwater “hotspots” (i.e., land uses that may produce high levels of contaminants) and how they may impact groundwater resources when reviewing projects and plans. VBWD will prevent negative impacts (e.g., flooding) to surface waters due to groundwater quality mitigation efforts (e.g., pump-out systems) through permit review, community plan review, and education efforts.

The VBWD will seek to protect groundwater quantities where feasible. The VBWD will consider developing rules regarding the use of once-through groundwater pumping systems (e.g., open-ended geothermal systems and other systems that waste groundwater). Any future rule implemented by the VBWD will comply with the *Washington County Groundwater Plan* (Washington County, 2003) and other applicable groundwater regulations.

As discussed previously within this Section, some contamination areas currently exist within the VBWD. It is unclear what, if any, additional remedial measures will be proposed. Some remedial measures could impact surface waters. For example, if groundwater is pumped and discharged to the surface in order to contain the Baytown Township Groundwater Contamination Site, the discharged water could flow into Bay Lake or Downs Lake. Bay Lake is landlocked and Downs Lake has experienced high water problems in the past. Increasing the volumes of water entering either of these lakes could cause or exacerbate flooding problems.

	<p>E. Continuing to administer the Wetland Conservation Act requirements as the responsible local government unit.</p> <p>F. Educating our constituents and the local government units within the VBWD on water quality and quantity issues, management, and means of improvement.</p> <p>Further, the method with which natural resources policies will be implemented will directly reflect the mission of promoting open communication with our constituents, both our citizen base and pertinent governmental units.</p>
<p>4.7.4 Policies and Actions to Accomplish Mission</p>	<p>WL-A. Revise VBWD rules and regulations to incorporate wetland management standards and a wetland management classification system.</p> <p>WL-B. Complete wetland inventories and assessments in targeted areas of the VBWD. The VBWD will meet with agencies, local government units, technical evaluation panel members, and other groups to share the results of the inventories, assessments, and classifications, gather feedback, and explore partnerships and potential projects related to wetland management.</p> <p>WL-C. Wetland activities will be managed through VBWD administration of the Wetland Conservation Act and the VBWD rules and regulations.</p> <p>WL-D. Develop invasive species control program.</p> <p><u>WL-E. Consider impacts and benefits to fish and wildlife habitat when designing VBWD projects and reviewing projects proposed by others that impact land and water resources within the VBWD.</u></p>

4.7.5 History Related to Wetlands

The VBWD was one of the first watershed districts to recognize the multiple benefits of wetlands by implementing wetland protection rules. From the formation of the VBWD in 1968 until the completion of Project 1007 in 1987, the VBWD primarily focused on solving flooding problems. During this time, storage volumes in wetlands were protected so that flooding would not be exacerbated. On December 13, 1990, the VBWD adopted revised Rules and Regulations, which specifically included provisions for wetland protection. The rules required that permits be obtained for dredging, ditching, excavating, or placing of fill in wetlands. Where alterations could not be avoided, lost wetland acreage was required to be replaced at a rate not less than 1.5 times the area of the alteration.

In 1991, reacting to public concern about Minnesota’s disappearing wetlands, the Minnesota Legislature approved, and Governor Arne Carlson later signed into law, the Wetland Conservation

4.7.6.3 Connectivity

In assessing the value of wetland communities for their benefit to water and wildlife, large wetland complexes composed of numerous wetland types are typically more valuable than small, monotype wetlands, and wetlands that are connected by other natural communities are more valuable than isolated units. When resources are either contiguous, or functionally connected by native vegetation or water or both, plant and animal species are better able to move, which can increase opportunities for reproduction and survival in general.

Connectivity can be accomplished by ensuring the protection of wetlands and connecting corridors in undeveloped areas (the protection of non-wetlands involves land planning and acquisition that may be beyond the scope of the VBWD) and by expanding and improving smaller patches of natural resources in developed areas, such as parks and residential properties. [The VBWD will consider the connectivity of wetlands and other natural areas in the design of VBWD projects and in its review of projects proposed by others. For example, the VBWD may consider existing and proposed greenway corridor plans, local comprehensive plans, and natural resource inventories.](#)

The identification, protection, and preservation of wetlands in the VBWD can be accomplished with an overall vision of connecting natural communities to maximize the benefits of protection. Shoreline buffers can also be a way of establishing connectivity in resources; providing an important attribute for wildlife as well as providing protection to the shoreline wetlands.

4.7.6.4 Water Quality

Wetlands are important for protecting and maintaining downstream water quality. Water quality within wetlands is also important for maintaining the integrity of the wetlands. Water quality is an integral part of water management within the VBWD.

Wetlands naturally provide water quality benefits to downstream waters by:

1. Preventing erosion by slowing flow velocities and intercepting wave action,
2. Allowing for sediment deposition by slowing flow velocities and,
3. Removing nutrients from runoff in some wetlands and at certain times of the year.

However, unnaturally overloading wetlands with sediment or nutrients can diminish their effectiveness in providing water quality benefits.

Most natural wetland systems have developed with relatively low levels of sediment and nutrient inputs (floodplain wetlands are an exception). When land use and hydrologic systems become altered, the natural sediment and nutrient loads can (and often do) increase in magnitude and frequency. These changes typically result in tipping the ecological balance to benefit non-native and invasive plant species thereby minimizing the benefits to wildlife, fisheries, amphibians, and humans. Degraded water quality in wetlands can get passed on to downstream waters, resulting in a chain reaction of degradation.

techniques, and restoration techniques, the VBWD can effectively initiate good land stewardship throughout the VBWD. To facilitate distribution of appropriate information, the VBWD will consider establishing a “library” of invasive species control materials (brochures, flyers, websites, etc.) to accompany requests for information from residents/developers, to facilitate a clear, consistent message.

WL-E. Consideration of Fish and Wildlife Habitat

Wetlands and other natural areas provide valuable habitat for many types of wildlife, including waterfowl, songbirds, raptors, mammals, fish, and amphibians. The quality of wildlife habitat is dependent on many of the issues discussed in previous sections. For example, increased connectivity between wetlands and natural areas generally results in natural communities that are more valuable than those in isolated areas.

The VBWD will consider the positive and negative impacts to wildlife habitat when designing projects and in its review of projects proposed by others. By doing so, the VBWD will improve the ecological quality of its water resources and surrounding areas. The VBWD will consider the impacts of projects on the connectivity of wetlands and other natural areas. The VBWD’s buffer requirements and wetland protection standards help protect habitat connectivity.

4.8 Erosion Prevention and Sediment Control

<p>4.8.1 Importance</p>	<p>Erosion prevention and sediment control is a major responsibility of the VBWD. Addressing erosion and sedimentation issues is a high priority because erosion and sedimentation have a high potential to cause damages, property loss, and adverse impacts on water quality. Erosion prevention and sediment control will remain a high priority as the watershed continues to urbanize, which increases the potential for erosion and sedimentation problems.</p>
<p>4.8.2 General Issues</p>	<p>Although erosion and sedimentation are natural processes, they are often accelerated as a result of human activities (especially construction and the removal of deep-rooted vegetation). Erosion and sedimentation issues are dependent on hydrology and the physical condition of the watershed. Hydrology is dependent on the weather, the topography of the landscape, the soils, the land cover, and other factors. Changes to any of these factors will influence the rate of erosion and sedimentation. While some of the factors are difficult to control, changes to land cover can be regulated and/or managed.</p>
<p>4.8.3 Mission</p>	<p>To manage and protect our water resources: lakes, ponds, creeks, streams, wetlands, drainages, and groundwater by:</p> <ul style="list-style-type: none"> B. Improving and protecting the <u>quality</u> of water for all water bodies within the District; and C. Managing the <u>quantity</u> of water and minimizing the negative impact on the District from floods, high flows, and droughts by providing public works projects and other prudent measures. <p>Addressing existing erosion and sedimentation problems and preventing future problems are integral to VBWD achieving this mission.</p>
<p>4.8.4 Policies to Accomplish Mission</p>	<p>EP & SC-A.</p> <ol style="list-style-type: none"> 1. Erosion prevention and sedimentation control measures will be implemented on all VBWD projects. 2. Soil erosion and sedimentation problems will be identified, inventoried and monitored. 3. Soil protection, sedimentation controls and/or other measures will be implemented to correct erosion and sedimentation problems that threaten VBWD water resources or the public’s health, safety, and welfare. 4. Local watershed management plans will be reviewed for compliance with this Plan. <p><u>5. The VBWD will collaborate with other units of government to identify and protect areas that are highly sensitive to erosion.</u></p>

Regardless of its source, sediment deposition decreases water depth, degrades water quality, smothers fish and wildlife habitat, and degrades aesthetics. Sediment deposition can also wholly or partially block culverts, manholes, storm sewers, etc., causing flooding. Sediment deposition in detention ponds and wetlands also reduces the storage volume capacity, resulting in higher flood levels and reducing the amount of water quality treatment provided. Suspended sediment, carried in water, clouds lakes and streams and disturbs aquatic habitats. Sediment also reduces the oxygen content of water and is a major source of phosphorus, which is frequently bound to the fine particles. Erosion also results in channelization of stormwater flow, increasing the rate of stormwater runoff, and further accelerating erosion.

As erosion and sedimentation increase, stormwater management systems (e.g., ponds, pipes) require more frequent maintenance, repair, and/or modification so they will function as designed.

Key areas of existing erosion and sedimentation problems in VBWD include Valley Creek, [Kelle's Coulee](#) and Raleigh Creek. See Section 4.3 for more information about stream management and Sections 5.11, ~~and~~ 5.20 [and 5.37](#) for more information about erosion and sedimentation problems along Raleigh Creek, ~~and~~ Valley Creek [and Kelle's Coulee](#), respectively. [Gully erosion is apparently prevalent along the bluffs adjacent to the St. Croix River in the Swede Hill Creek watershed \(see Section 5.38\).](#)

Continued urbanization in VBWD will result in increased erosion and sedimentation, unless effective erosion prevention and sediment control measures are implemented before, during, and after construction.

In recognition of these issues, the VBWD rules and regulations address erosion prevention and sediment control at construction sites.

Although VBWD conducts inspections of VBWD-permitted projects, the VBWD may not be aware of problems at these sites until some time has passed. In addition, VBWD may not be aware of erosion and sedimentation problems at locations where a VBWD permit is not required. In both situations, it would be helpful if residents and/or city/township staff in VBWD notified VBWD of such problems in the watershed.

Another issue for VBWD is determining the appropriate time to return remaining escrows and cash sureties to the permit applicant (e.g., after every lot is developed/restored). In some situations, a different local unit of government will return its escrow to a developer, while VBWD holds onto its escrow because VBWD still has issues with a site.

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- Heiskary, S.A. and C.B. Wilson. 1990. *Minnesota Lake Water Quality Assessment Report, Second Edition. A Practical Guide for Lake Managers*. Minnesota Pollution Control Agency.

[WSB and Associates, Inc. 2011. *Surfacewater Management Plan*. Prepared for the City of Afton.](#)

5.0 Individual Watershed Management Plans

This section of the VBWD Plan presents information on specific water bodies and watersheds within the VBWD. VBWD chose ~~36-38~~ water bodies for inclusion in Section 5 of the VBWD Plan based on VBWD's knowledge of the following:

- Water quality issues and data
- Past or possible future flooding problems
- Intercommunity drainage problems
- Revisions to previously-published flood elevations
- Existing or possible future impacts to VBWD's Project 1007 drainage system
- Outstanding water resources

The ~~36-38~~ individual watershed management plans are organized into ~~three~~-four general groups:

1. water bodies which are part of VBWD's Project 1007 drainage system,
2. water bodies tributary to Valley Creek, and
3. landlocked water bodies.
- ~~3-4.~~ watersheds formerly included in the LSCWMO

Within the Project 1007 system, the individual watershed management plans begin at the upstream end (Silver Lake) and proceed downstream, to Rest Area Pond. For the landlocked water bodies, the individual water management plans begin generally in the north and proceed to the south and east.

Each individual watershed management plan includes the following:

- General information
- Water quality management plan, with supporting information that includes a summary of
 - Water chemistry data, and
 - Biological data, including information on fisheries, macrophytes (large aquatic plants), phytoplankton (non-rooted, floating plants – algae), and zooplankton (microscopic aquatic animals)
- Water quantity management plan, with supporting information that typically includes information on drainage patterns, flood levels, and flooding issues

Table 5.0-1
Numerical Listing of Section 5 Subsections

Section Number	Water Body/Watershed
5.1	Silver Lake
5.2	Acorn (Mud) Lake
5.3	Echo Lake
5.4	Weber Pond
5.5	Long Lake
5.6	Capaul's Pond
5.7	Lake DeMontreville
5.8	Lake Olson
5.9	Lake Jane
5.10	Beutel Pond
5.11	Raleigh Creek
5.12	Eagle Point Lake
5.13	Lake Elmo
5.14	Downs Lake
5.15	Horseshoe Lake
5.16	West Lakeland Storage Site
5.17	Rest Area Pond
5.18	Fahlstrom Pond
5.19	Lake Edith
5.20	Valley Creek
5.21	Sunnybrook Lake
5.22	Cloverdale Lake
5.23	Klawitter Pond
5.24	McDonald Lake
5.25	Sunfish Lake
5.26	Friedrich's Pond
5.27	Legion Pond
5.28	Bay Lake
5.29	Goose Lake
5.30	Clear Lake
5.31	Goetschel Pond
5.32	Mergens Pond
5.33	Rose Lake
5.34	Kramer Pond
5.35	Barton Pit
5.36	St. Croix River
5.37	Kelle's Coulee
5.38	Swede Hill Creek

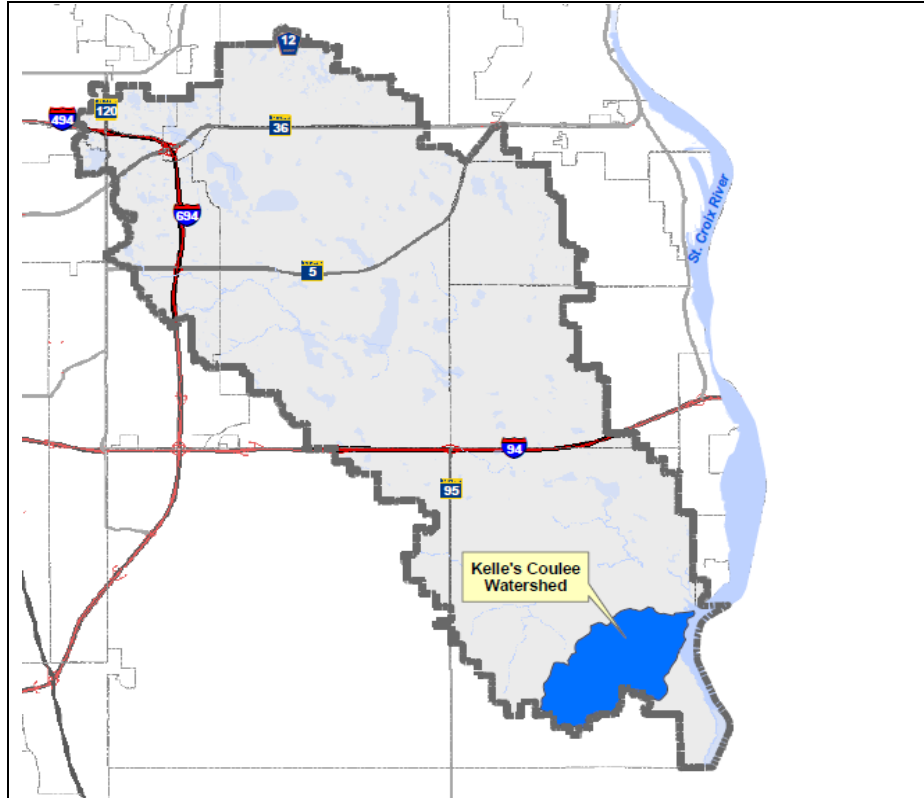
Table 5.0-2
Alphabetical Listing of Section 5 Subsections

Section Number	Water Body/Watershed
5.2	Acorn (Mud) Lake
5.35	Barton Pit
5.28	Bay Lake
5.10	Beutel Pond
5.6	Capaul's Pond
5.30	Clear Lake
5.22	Cloverdale Lake
5.7	Lake DeMontreville
5.14	Downs Lake
5.12	Eagle Point Lake
5.3	Echo Lake
5.19	Lake Edith
5.13	Lake Elmo
5.18	Fahlstrom Pond
5.26	Friedrich's Pond
5.31	Goetschel Pond
5.29	Goose Lake
5.15	Horseshoe Lake
5.9	Lake Jane
5.37	Kelle's Coulee
5.23	Klawitter Pond
5.34	Kramer Pond
5.27	Legion Pond
5.5	Long Lake
5.24	McDonald Lake
5.32	Mergens Pond
5.8	Lake Olson
5.11	Raleigh Creek
5.17	Rest Area Pond
5.33	Rose Lake
5.36	St. Croix River
5.1	Silver Lake
5.25	Sunfish Lake
5.21	Sunnybrook Lake
5.38	Swede Hill Creek
5.20	Valley Creek
5.4	Weber Pond
5.16	West Lakeland Storage Site

5.37	Kelle’s Coulee Watershed Management Plan (New Section)	1
5.37.1	General Information.....	1
5.37.2	Water Quality Management Plan.....	2
5.37.2.1	Water Quality Implementation Plan.....	2
5.37.2.2	Water Quality Issues	3
5.37.2.3	Water Chemistry Data.....	3
5.37.2.4	Biological Data.....	4
5.37.3	Water Quantity Management Plan.....	4
5.37.4	References.....	5

5.37 Kelle's Coulee Watershed Management Plan (New Section)

5.37.1 General Information



Kelle's Coulee is a steep-sided ravine located in the southern portion of the City of Afton. A spring-fed perennial creek flows from the coulee to the St. Croix River, discharging into the river downstream (south) of downtown Afton.

Kelle's Coulee flows approximately 2.8 miles from the point the creek becomes perennial-flowing (water flowing year-round) to the mouth of the creek at the St. Croix River. Kelle's Coulee becomes perennial-flowing about 0.45 miles northeast of the intersection of Trading Post Trail and Afton Boulevard (CSAH 18). Upstream of this area, Kelle's Coulee is

Kelle's Coulee Watershed Information	
Tributary Area (acres)	2,348
Downstream Watershed	St. Croix River
Kelle's Coulee Information*	
Estimated 2-year flowrate at St. Croix Tr. (cubic feet per second, cfs)	5.4
Modeled 100-year flowrate at St. Croix Tr. (cfs)	93
Perennial Channel Length from Headwaters to Confluence with St. Croix River (miles)	2.8

* Source: *Kelle's Coulee Stream Management Plan* (EOR 2007b)

an intermittent stream. (Intermittent streams are dry most of the time, but flow during rain or snowmelt events.)

The Kelle's Coulee watershed has a drainage area of 2,348 acres, or approximately 3.7 square miles. Most of the watershed is undeveloped. Existing and proposed land use is primarily rural residential in the lower portions of the watershed and agricultural uses in the uplands to the southwest. Upstream of St. Croix Trail (CSAH 21) the riparian areas of the creek are primarily classified as forested wetlands, with upland forests on the ravine sides (EOR 2007b).

5.37.2 Water Quality Management Plan

Kelle's Coulee represents a unique and high quality resource within the VBWD. It is similar to Valley Creek (see Section 5.20) as a perennial, groundwater-fed stream. Because of this, the VBWD rules applicable to the Valley Creek watershed (and described in Section 4.4) will also be applied to the Kelle's Coulee watershed. Kelle's Coulee it is not a DNR-designated trout stream.

5.37.2.1 Water Quality Implementation Plan

In December 2007, the Lower St. Croix Watershed Management Organization (LSCWMO) completed the *Kelle's Coulee Stream Management Plan* (EOR 2007b). The plan provides technical background and recommends strategies for watershed protection.

Specific water quality implementation tasks that the VBWD plans to undertake for Kelle's Coulee include the following:

1. The VBWD will monitor the water quality of Kelle's Coulee and perform the actions discussed in Section 4.3. The VBWD will continue to collect water chemistry and flow data through a continuous water monitoring station. In addition, if VBWD can gain access, VBWD will regularly monitor the physical condition of Kelle's Coulee. The purpose of this monitoring is to assess stream degradation, including the identification of streambank and gully erosion sites. VBWD will monitor the intermittent portions of Kelle's Coulee only in response to problems. VBWD will report the results of its stream monitoring in its annual report, which is posted on the website.
2. The VBWD will attempt to develop and implement a volunteer stream monitoring program conducted by local students or residents, similar to the volunteer stream monitoring program in place for Valley Creek.
3. In 2007, the LSCWMO began to develop a prioritized list of potential stabilization projects. The VBWD will:
 - a. Use the 2007 data to perform a spring and erosion inventory to identify areas of special concern related to karst geology and potential locations for streambank and gully stabilization.
 - b. Use the 2007 data and inventory described above to identify and prioritize areas for habitat improvement and streambank stabilization projects and to determine the most appropriate project methods
 - c. Implement projects as funding is available.
4. The VBWD will work with its educator to develop educational information to educate residents on the sensitivity of Kelle's Coulee and to publicize the VBWD BMP cost-share grant program.

The geologic and topographic features within the Kelle's Coulee watershed merit additional management considerations when the VBWD designs or reviews projects in this watershed. The VBWD will apply the following management standards, which are adapted from the *LSCWMO Watershed Management Plan* (EOR 2009) and *Kelle's Coulee Stream Management Plan* (EOR 2007b).

1. For projects disturbing steep slopes, erosion control measures must be installed at 75-foot intervals along steep slopes. Such slopes must be protected with temporary or permanent erosion control within seven days of disturbance.
2. Projects proposing stormwater facilities in karst sensitive areas should follow the management guidelines included in the *LSCWMO Karst Feature Inventory and Management Plan* (EOR 2007a), the Minnesota Stormwater Manual (MPCA 2008) or other more-recent documents such as those developed through the Minnesota Pollution Control Agency's Minimum Impact Design Standards (MIDS) project.

5.37.2.2 Water Quality Issues

Although there is little available surface water quality data from Kelle's Coulee, the available data suggests that surface water quality in the Kelle's Coulee watershed is good. This is largely due to the undeveloped nature of the watershed. Land use is mainly agricultural and low-density residential, resulting in low levels of imperviousness. There are also some unfragmented tracts of forest and grassland that provide valuable habitat in the watershed. Some streambank and ravine erosion have been reported in the Kelle's Coulee watershed, as shown in Figure 9 of the *Kelle's Coulee Stream Management Plan* (EOR 2007b).

The largest threats to surface water quality in the watershed are development and poor vegetation management. Increased runoff from development has the potential to carry excessive nutrients and contaminants to the stream, as well as increase erosion into and within the stream. Appropriate stormwater management practices and maintenance of vegetated buffers between developed areas and the stream will reduce these risks.

5.37.2.3 Water Chemistry Data

Limited water chemistry data for Kelle's Coulee is available from sampling performed from 2006 through 2009. Two grab samples from the creek and one sample of a headwaters spring collected in 2006 had nitrate levels ranging from 2.9 ppm to 3.8 ppm (EOR 2007b). Additional biweekly water quality samples collected from 2007 to 2009 had average nitrate levels of 2.2 ppm (MPCA 2011). These measured nitrate levels are lower than levels found in nearby areas of Washington County, and are well below the drinking water maximum contaminant level of 10 ppm.

Water quality monitoring in 2007, 2008, and 2009 revealed high levels of *E. coli* in Kelle's Coulee in 2007, 2008 and 2009. It is likely that Kelle's Coulee will be listed by the MPCA as impaired due to *E. coli* in the draft 2012 impaired waters 303(d) list.

5.37.2.4 Biological Data

While water samples provide an assessment of stream water quality at the time of sample collection, benthic invertebrates provide a long-term assessment of water quality. They live on the bottom and in the vegetation of a stream as long as water quality conditions permit. As attached organisms, benthic aquatic invertebrates are exposed to all the temporal variations in stream quality and “integrate” the quality of passing water. Each type of benthic invertebrate has a different tolerance for pollution; studying the numbers and types of benthic invertebrates can indicate pollution in a stream. When sufficient pollutants enter the stream to prevent their survival, they are eliminated from the stream. Monitoring the presence or absence of biological indicator organisms provides indirect evidence of the effects of transitory changes in stream water quality related to stormwater runoff.

The LSCWMO collected benthic invertebrate samples from Kelle’s Coulee in 2006 (EOR 2007b), near the beginning of the perennial-flowing portion of the creek. Samples were collected from a riffle location with a D-frame aquatic net. The substrate was disturbed with the sampler’s feet, allowing dislodged invertebrates to drift into the net downstream. Additional samples were collected by randomly sampling the stream substrate at a location just upstream of the St. Croix Trail crossing.

A total of 2,614 specimens representing 38 taxa (different macroinvertebrate species) were collected from Kelle’s Coulee. Sites with greater than 25 taxa are considered to have very high quality macroinvertebrate community structure; this is especially true given the small stream size and sand and sand/silt substrates in Kelle’s Coulee.

5.37.3 Water Quantity Management Plan

The Washington Conservation District collected streamflow data for Kelle’s Coulee between 2004 and 2006 near the St. Croix Trail. In summer 2006, the LSCWMO measured baseflow at two locations during conditions with low antecedent moisture; the baseflow measurements indicated the stream was gaining groundwater inflow between the two locations evaluated (EOR, 2007b). The LSCWMO also performed a spring inventory along Kelle’s Coulee in June, 2006. Areas of significant groundwater discharge are presented in the *Kelle’s Coulee Stream Management Plan* (EOR 2007b).

The LSCWMO developed an XP-SWMM hydrologic and hydraulic model in order to evaluate the impact of future development on streamflow and flood stages. The *Kelle’s Coulee Stream Management Plan* (EOR 2007b) details the model development and calibration. The model indicates that some crossings along Kelle’s Coulee may be susceptible to erosion, including the St. Croix Trail crossing. The XP-SWMM model estimated water levels due to the 100-year storm event, as well as estimated the increased flows and velocities under future developed conditions. Results of the modeling are presented in the *Kelle’s Coulee Stream Management Plan* (EOR, 2007b). Modeled 100-year flood elevations are presented in the *Kelle’s Coulee Stream Management Plan* (EOR, 2007b), although the plan does not discuss existing flooding issues within the watershed.

Some flooding issues are present within the Kelle's Coulee watershed. The Old Village of Afton floods from three sources, including Kelle's Coulee, the St. Croix River (which can back up into Kelle's Coulee), and runoff from the bluffs adjacent to the St. Croix River (WSB, 2011). Damages from flooding along Kelle's Coulee are increased during years when the St. Croix River floods. The sources of flooding necessitate a coordinated solution, as levees inhibit flow between the watershed and the St. Croix River. The City of Afton has proposed the following measures to address these flooding issues:

- St. Croix River Flooding – Levee reconstruction and accreditation (pump station, seepage system and storage basins) and associated work
- Kelle's Coulee Flooding – Levee bypass system
- Bluff Runoff Flooding – Local system to collect runoff from the bluff and convey it safely to the levee pump station

The VBWD Managers will continue to determine the appropriate level of VBWD involvement in local and regional flooding issues on a case by case basis. If requested by the City of Afton, the VBWD may support the city's efforts to address these flooding issues. VBWD support could include assisting the city in evaluating solutions, obtaining funding, or other means in accordance with the policies of the VBWD (see Section 4.5).

5.37.4 References

Emmons & Olivier Resources (EOR). June 2007. *Karst Feature Inventory & Management Plan, Lower St. Croix Watershed Management Organization.*

Emmons & Olivier Resources (EOR). December 2007. *Kelle's Coulee Stream Management Plan, Lower St. Croix Watershed Management Organization.*

Emmons & Olivier Resources (EOR). February 2009. *LSCWMO Watershed Management Plan, Lower St. Croix Watershed Management Organization.*

Minnesota Pollution Control Agency (MPCA). January 2008. *Minnesota Stormwater Manual, Version 2.*

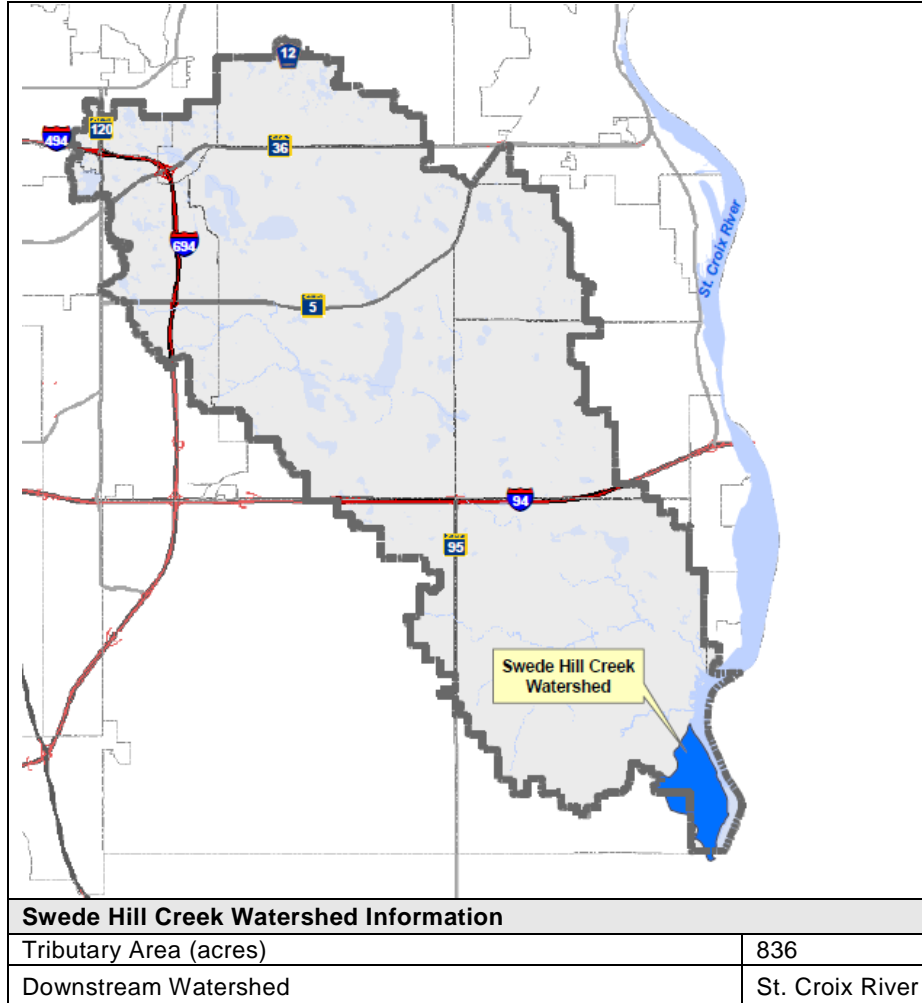
Minnesota Pollution Control Agency (MPCA). April 2011. *Environmental Data Access: Surface water data.* Available online at <http://www.pca.state.mn.us/index.php/topics/environmental-data/eda-environmental-data-access/eda-environmental-data-access-home.html>. Station ID S004-462.

WSB and Associates, Inc. 2011. *Surfacewater Management Plan.* Prepared for the City of Afton.

5.38	Swede Hill Creek Watershed Management Plan (New Section).....	1
5.38.1	General Information.....	1
5.38.2	Water Quality Management Plan.....	1
	5.38.2.1 Water Quality Implementation Plan.....	2
	5.38.2.2 Water Quality Issues	2
5.38.3	Water Quantity Management Plan.....	2
5.38.4	References.....	3

5.38 Swede Hill Creek Watershed Management Plan (New Section)

5.38.1 General Information



The Swede Hill Creek watershed contains several steep-sided ravines and bluffs that drain directly to the St. Croix River. There are no perennial streams or other water bodies in the watershed.

The Swede Hill Creek watershed has a drainage area of 836 acres, or approximately 1.3 square miles. Most of the watershed is undeveloped and heavily forested. Existing and proposed land use is primarily rural residential in the northeast portions of the watershed, agricultural uses in the uplands along the western edge of the watershed, and parkland

(Afton State Park) in the southern third of the watershed.

5.38.2 Water Quality Management Plan

Although there are no surface water bodies within the Swede Hill Creek watershed, its location along the banks of the St. Croix River adds to the importance of maintaining high water quality. Being directly tributary to the St. Croix River, stormwater runoff from this watershed will directly impact river water quality, and there may be limited opportunities for treatment prior to discharge. Because of this, the VBWD rules applicable to the Valley Creek watershed (and described in Section 4.4) will also be applied to the Swede Hill Creek watershed.

5.38.2.1 Water Quality Implementation Plan

The VBWD plans to undertake the following specific water quality implementation tasks for the Swede Hill Creek watershed:

1. The VBWD will perform a spring and erosion inventory to identify areas of special concern with regards to karst geology and potential locations for streambank and gully stabilization.

The geologic and topographic features within the Swede Hill Creek watershed merit additional management considerations when the VBWD designs or reviews projects in this watershed. The VBWD will apply the following management standards, which are adapted from the *LSCWMO Watershed Management Plan* (EOR 2009) and *Kelle's Coulee Stream Management Plan* (EOR 2007b).

1. For projects disturbing steep slopes, erosion control measures must be installed at 75-foot intervals along steep slopes. Such slopes must be protected with temporary or permanent erosion control within seven days of disturbance.
2. Projects proposing stormwater facilities in karst sensitive areas should follow the management guidelines included in the *LSCWMO Karst Feature Inventory and Management Plan* (EOR 2007a), the Minnesota Stormwater Manual (MPCA 2008) or other more-recent documents such as those developed through the Minnesota Pollution Control Agency's Minimum Impact Design Standards (MIDS) project.

5.38.2.2 Water Quality Issues

There is no available surface water quality or groundwater quality data for the Swede Hill Creek watershed. The undeveloped nature of the watershed and large areas of forest and grassland result in low levels of imperviousness and valuable wildlife habitat. Streambank and ravine erosion has been reported in the Swede Hill Creek watershed, as discussed in the *LSCWMO Watershed Management Plan* (EOR 2009).

The largest threats to surface water quality in the watershed are development and poor vegetation management. Increased runoff from development has the potential to carry excessive nutrients and contaminants to the stream, as well as increase erosion into and within the stream. Appropriate stormwater management practices and maintenance of vegetated buffers between developed areas and the stream will reduce these risks.

5.38.3 Water Quantity Management Plan

The City of Afton's local water management plan (WSB, 2011) identifies runoff from the bluffs adjacent to the St. Croix River as a source of flooding present in the Swede Hill Creek watershed. Runoff from the bluffs has caused damage to city infrastructure and has seeped into residents basements, causing property damage. The City of Afton held a public task force meeting to address flooding issues including bluff runoff. To address this flooding issue, the City of Afton has proposed

a local stormwater system to collect runoff from the bluff and convey it safely to the levee pump station.

The VBWD Managers will continue to determine the appropriate level of VBWD involvement in local and regional flooding issues on a case by case basis. If requested by the City of Afton, the VBWD may support the city's efforts to address these flooding issues. VBWD support could include assisting the city in evaluating solutions, obtaining funding, or other means in accordance with the policies of the VBWD (see Section 4.5).

5.38.4 References

Emmons & Olivier Resources (EOR). June 2007. *Karst Feature Inventory & Management Plan, Lower St. Croix Watershed Management Organization.*

Emmons & Olivier Resources (EOR). December 2007. *Kelle's Coulee Stream Management Plan, Lower St. Croix Watershed Management Organization.*

Emmons & Olivier Resources (EOR). February 2009. *LSCWMO Watershed Management Plan, Lower St. Croix Watershed Management Organization.*

Minnesota Pollution Control Agency (MPCA). January 2008. *Minnesota Stormwater Manual. Version 2.*

WSB and Associates, Inc. 2011. *Surfacewater Management Plan.* Prepared for the City of Afton.

7.0	Implementation Program	1
7.1	Implementation Program	1
7.2	Impact on Local Governments.....	3

capital improvement projects listed in Table 7-1, the VBWD will hold a public hearing on the proposed change to the funding method before ordering the project.

The structural and non-structural activities listed in Table 7-1 will be financed in accordance with the policies in Section 4.9, as guided by Tables 4.9-2 and 4.9-3, and as shown in Table 7-1. Most non-structural activities will be funded through the VBWD administrative budget (called “general fund” in Minnesota statutes) fund. In accordance with laws and county requirements, the VBWD must adopt a budget for the following year and forward its budget to the counties by September 15 (see Section 4.9 for more details regarding specific county budgeting deadlines for capital projects). The VBWD holds an annual hearing on the budget prior to forwarding it to the counties.

The capital improvement project costs in Table 7-1, expressed in 2004 dollars, will be adjusted annually in accordance with an inflation index (i.e., the Engineering News Record’s Construction Cost Index). As stated in Section 6.3, the VBWD will consider the following increases in estimated project costs to be consistent with the VBWD Plan and not require a minor or general plan amendment:

- The updated cost estimate is \$500,000 or less, and the increase is less than \$200,000 higher than the estimated costs shown in Table 7-1 (as annually adjusted);

OR

- The updated cost estimate is more than \$500,000, and the increase is up to 60% higher than the estimated costs shown in Table 7-1 (as annually adjusted).

If the cost of a capital improvement project in Table 7-1 increases by more than these amounts, the VBWD will follow the minor plan amendment process before implementing the project (see Section 6.3 for more information regarding plan amendments).

Similarly, the VBWD may implement the activities and projects listed in Table 7-1 at a different time than shown in the table (e.g. year 2007 rather than 2009), as circumstances dictate. For example, the availability of grants and partnerships could result in either acceleration or delay of projects. The VBWD will consider such shifts in the time schedule to also be consistent with the Plan and not require a minor or general plan amendment (see Section 6.3 for more information regarding plan amendments).

The VBWD will consider any changes to estimated costs for annual activities, studies and other non-structural projects to be consistent with the VBWD Plan and not require a minor or general plan amendment (see Section 6.3 for more information regarding plan amendments).

[In 2011 this Plan was amended to document the inclusion of two new subwatersheds formerly part of the Lower St. Croix Watershed Management Organization \(LSCWMO\) into the VBWD: Kelle’s Coulee and Swede Hill Creek. The additional watershed area represented by these subwatersheds \(5 square miles\) represents a 7.7% increase in the watershed area of the VBWD. Kelle’s Coulee adds](#)

3.1 miles of perennial and intermittent stream channel to the VBWD, increasing the stream channel length in the VBWD by 27%. The additional area and resources the VBWD now manages may increase the cost of VBWD-wide implementation items presented in Table 7-1. The costs for revised or new implementation items, including those in the Swede Hill Creek watershed and Kelle's Coulee watershed, are presented in 2011 dollars. Other items are presented in 2005 dollars.

7.2 Impact on Local Governments

This section discusses how the VBWD's implementation program will affect local government in terms of cost and administrative issues.

The VBWD's intention is to limit additional requirements imposed upon local units of government as much as possible while still accomplishing the VBWD's purposes and implementing the Plan. The VBWD's implementation program will be funded through tax levies. These taxes would not affect the local unit of government's finances directly since the VBWD tax levies do not apply towards the local unit of government's levy limits. However, there would be a financial impact to the residents of the cities and townships that reside in the VBWD watershed.

Some of the implementation program elements reflect the goals, policies and requirements of state and regional units of government that local units of government would need to address in any case.

Some of the cities already have ordinances in place that address many of the VBWD requirements. Applicable ordinances address shorelands, floodplains, wetland protection, stormwater management, erosion control, and stormwater system maintenance. Local governments must adopt the DNR's shoreland management regulations, if required by the DNR.

The VBWD is not changing the wetland regulation burden for the member cities since VBWD is willing to continue to act as the local government unit responsible for administering the Wetland Conservation Act.

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
AA-9	Review and comment on MPCA's draft impaired waters (303(d)) list	Section 4.2.7	VBWD performs	\$2,000	VBWD Ad Valorem	Every other year
AA-10	Buffers: require 16.5-foot wide <u>or wider</u> buffers and encourage/ support wider buffers for new VBWD-permitted projects; encourage/support buffers at existing homes/ businesses and park areas	Section 4.2.7	VBWD performs, possible cooperation with other units of government	\$0 (included in permit administration or education items)	VBWD Ad Valorem	Annually
AA-11	Develop and implement incentive program to encourage developers to try new and innovative stormwater management techniques. Incentive program could include VBWD funding of additional cost for implementing innovative measures, VBWD construction of demonstration project (see Capital Projects section of Table 7-1), and VBWD grant program.	Section 4.4.7	VBWD performs, possible cooperation with other units of government	Develop program: \$5,000 Administer/ Implement program: \$50,000	VBWD Ad Valorem	2005 – Develop program 2006 – Begin implementing Annually thereafter
AA-12	Conform to NPDES Phase II MS4 requirements, implement VBWD's Stormwater Pollution Prevention Plan (SWPPP)	Section 4.4.7	VBWD performs	\$3,000	VBWD Ad Valorem	Annually
AA-13	Administer VBWD permit program	Section 4.4.7	VBWD performs	\$25,000	VBWD Ad Valorem (for non-escrow projects or projects with waived fee)	Annually
AA-14	Review and comment on all DNR public waters work permit applications	Section 4.5.7	VBWD performs	\$500 per permit	VBWD Ad Valorem	Annually

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
ADC-4b	Stream water quality and streamflow monitoring of Kelle's Coulee and annual reporting	Sections 4.3.7 and 5.37.2.1, Item 1	Biological monitoring: VBWD performs, Water quality & streamflow monitoring: VBWD performs or contracts for performance	Biological monitoring: \$1,000 (beginning in 2012) Water quality and streamflow: \$7,000 (VBWD portion of cost), beginning in 2011	VBWD Ad Valorem Remaining costs paid by grant funds	Annually, beginning in 2011
ADC-5	Valley Creek – Continue volunteer stream monitoring program <ul style="list-style-type: none"> Valley Creek 	Section 5.20.2.1, Item 2 Section 5.37.2.1, Item 2	VBWD funds	\$6,000 (Valley Creek) beginning in 2012	VBWD Ad Valorem	Annually
ADC-6	Physical monitoring of DNR- protected streams public waters watercourses and report results <ul style="list-style-type: none"> Valley Creek Raleigh Creek Kelle's Coulee (i.e. Valley Creek and Raleigh Creek) and report results 	Sections 4.3.7, 5.11.2, 5.37.2	VBWD performs	\$8,000 12,000	VBWD Ad Valorem	Annually
ADC-7	Raleigh Creek – Fund volunteer stream monitoring program	Section 5.11.2	VBWD funds	\$4,000	VBWD Ad Valorem	Annually
ADC-8	Monthly basin water level monitoring and reporting. Expand to include: Echo Lake, Weber Pond, Capaul's Pond, Legion Pond, Bay Lake, Goose Lake, Clear Lake, Mergens Pond, Rose Lake and Kramer Pond	Sections 4.5.7, 5.3.3, 5.4.3, 5.6.3, 5.27.3, 5.28.3, 5.29.3, 5.30.3, 5.32.3, 5.33.3, and 5.34.3	VBWD performs, through volunteers (assumed)	\$2,000	VBWD Ad Valorem	Annually
ADC-9	Daily precipitation monitoring and monthly reporting	Section 4.5.7	VBWD performs through volunteer(s)	\$100	VBWD Ad Valorem	Annually
ADC-10	Snowpack monitoring	Section 4.5.7	VBWD performs	\$3,000	VBWD Ad Valorem	When needed

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
ADC-11	Groundwater level monitoring & reporting	Section 4.5.7 and 4.6.7	VBWD performs	\$3,500	VBWD Ad Valorem	At least quarterly monitoring, annual reporting
ADC-12	Groundwater quality monitoring	Section 4.6.7	VBWD Performs	\$10,000 - \$20,000, pending plan development (see A-27)	VBWD Ad Valorem	Annually, pending monitoring plan (see A-27)
Non-Annual Administrative Activities						
A-1	Hold tours, events, and/or orientation meetings for interested citizens	Section 4.1.7	VBWD performs	\$5,000-\$10,000 per event	VBWD Ad Valorem	As needed or in response to requests
A-2	Seek input from Technical Advisory Committee	Section 4.1.7	VBWD performs	\$1,000 per meeting	VBWD Ad Valorem	As needed
A-3	Revise individual water body classifications	Section 4.2.7	VBWD performs	Variable, less than \$5,000	VBWD Ad Valorem	As warranted
A-4 (See also P-4 in this table)	Implement recommended actions resulting from habitat monitoring program	Section 4.2.7	VBWD performs, possibly partner with others	Variable, less than \$20,000	VBWD Ad Valorem	As recommended
A-5	Cooperate with the DNR and other groups on fisheries issues	Section 4.2.7	DNR and other groups perform, VBWD assists	Variable, less than \$2,500	VBWD Ad Valorem	As requested
A-6	Review local watershed management plans	Section 4.4.7, Section 4.5.7, Section 4.8.7, Section 8.3	VBWD performs	Variable, costs could range from \$5,000 to \$15,000 per plan	VBWD Ad Valorem	2005, 2007, 2009
A-7	Work with local government units to adopt/revise land use ordinances to allow for runoff prevention methods (narrower streets smaller parking lots, etc.)	Section 4.4.7	VBWD performs	\$5,000/year	VBWD Ad Valorem	2006-2008

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
A-17	Begin updating VBWD Watershed Management Plan	Section 6.2	VBWD performs	\$100,000 - \$400,000 Dependent on Minnesota Statute and Rule Changes	VBWD Ad Valorem	2013
A-18	Silver Lake – Encourage buffers	Section 5.1.2.1, Item 2d and Section 4.2.7	VBWD performs and works with North St. Paul and Maplewood	\$1,000	VBWD Ad Valorem	2006
A-19	Acorn Lake – Require Oakdale to install outlet restriction or provide information that shows not needed	Section 5.2.3	City of Oakdale performs	\$500	VBWD Ad Valorem	2007
A-20	Long Lake Outlet operation– Communication with property owners	Section 5.5.3.3, Item 3	VBWD performs	\$500	VBWD Ad Valorem	As needed, assume every other year
A-21	Eagle Point Lake watershed – Work with WCP to protect oak forest areas and upland buffers	Section 5.12.2.1, Item 3	Washington County Parks performs with help from VBWD	\$1,000	VBWD Ad Valorem	2007
A-22	Valley Creek – provide incentives and technical assistance for removing or modifying flood control structures	Section 5.20.2.1, Item 5	VBWD performs	\$10,000	VBWD Ad Valorem	2007
A-23	Valley Creek – work with agencies on reduction of thermal impacts	Section 5.20.2.1, Item 6	VBWD coordinates with other agencies	\$2,000	VBWD Ad Valorem	2006
A-24	Sunnybrook Lake – Work with Grant on raising low roads	Section 5.21.3.4, Item 4	VBWD works with the City of Grant	\$10,000	VBWD Ad Valorem	2005
A-265	Obtain additional Washington County Two-foot contour data for added subwatersheds	Section 5.37	VBWD performs	\$2,500	VBWD Ad Valorem	2011
A-276	Develop groundwater quality monitoring plan	Section 4.6.7	VBWD performs	\$7,000	VBWD Ad Valorem	2012

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
Non-Annual Data Collection and Reporting Activities						
DC-1	Monitor water quality of Raleigh Creek and other VBWD intermittent streams	Sections 4.3.7 and 5.11.2	VBWD performs	Raleigh Creek: \$5,000	VBWD Ad Valorem	As required/ requested, in response to identified or suspected problem
DC-2	Monitor physical condition of streams other than Valley Creek, and Raleigh Creek and Kelle's Coulee	Section 4.3.7	VBWD performs	\$5,000	VBWD Ad Valorem	As needed, in response to problems
DC-3	Stormwater pond inventory – locate ponds and determine if ponds meet criteria	Section 4.4.7	VBWD performs	\$50,000	VBWD Ad Valorem	2006-2010
DC-4	Identify, inventory, prioritize, and monitor erosion and sedimentation problems that arise outside of VBWD permit program	Section 4.8.7	VBWD performs	\$15,000	VBWD Ad Valorem	As identified
DC-5	Silver Lake Intensive Water Quality Monitoring	Section 5.1.2.1, Item 2a	VBWD performs	\$10,000	VBWD Ad Valorem	2006
DC-6	Silver Lake ditch erosion stabilization evaluation	Section 5.1.2.1, Item 4	VBWD performs	\$5,000	VBWD Ad Valorem	2007
DC-7	Long Lake – Evaluate ravine erosion from Weber Pond	Section 5.5.2.1, Item 3a	VBWD performs	\$5,000	VBWD Ad Valorem	2006
DC-8	Long Lake – Evaluate sedimentation source from Highway 36	Section 5.5.2.1, Item 3b	VBWD performs	\$2,000	VBWD Ad Valorem	2006
DC-9	Goose Lake – Investigate gully erosion	Section 5.29.2, Item 2	VBWD performs	\$3,000	VBWD Ad Valorem	2008
DC-10	Goose Lake – complete aquatic plant surveys to determine if curlyleaf pondweed is kept in check	Section 5.29.2, Item 4	VBWD performs	\$5,000	VBWD Ad Valorem	Every 3 years
DC-11	Goetschel Pond – Investigate gully erosion	Section 5.31.2, Item 3	VBWD performs	\$2,000	VBWD Ad Valorem	2005

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
DC-12	Mergens Pond - develop bathymetric map	Section 5.32.2	VBWD performs	\$1,000	VBWD Ad Valorem	2005
DC-13	Spring and erosion inventory – locate springs in areas of karst geology and identify erosion problem areas in Kelle’s Coulee and Swede Hill Creek watersheds	Section 4.6.6, Section 5.37.2.1, Item 4, Section 5.38.2.1	VBWD performs	\$10,000	VBWD Ad Valorem	2013
Non-Annual Studies						
S-1	Complete diagnostic-feasibility studies, when recommended, to determine needed water quality improvement projects	Section 4.2.7	VBWD performs	\$100,000 - \$300,000	VBWD Ad Valorem	As recommended
S-2	TMDL studies: cooperate with MPCA to determine responsible party for developing TMDL study, actively participate in TMDL process	Section 4.2.7	VBWD performs TMDL study (if found to be responsible party), VBWD performs implementation, other agencies/groups likely involved	\$100,000 - \$300,000	VBWD Ad Valorem	As required
S-3	Develop stormwater pond maintenance/repair/ retrofit plan	Section 4.4.7	VBWD performs	\$10,000	VBWD Ad Valorem	2006
S-4	Update VBWD Stormwater Management Rules and Regulations, including stormwater volume control requirement	Section 4.4.7, Section 5.20.2.1, Item 2	VBWD performs	\$35,000 (with A-13 & S-14)	VBWD Ad Valorem	2005
S-5	Assist property owners in FEMA unnumbered A zones in obtaining Letters of Map Amendment or Letters of Map Revision	Section 4.5.7	VBWD performs	\$5,000 per instance	VBWD Ad Valorem	As needed

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Item Number	Item Description	Plan Reference	VBWD and other Government Involvement	Total Estimated Cost	Potential Funding Sources/Authority	Proposed Implementation Year
S-6	Complete wetland inventories and functional assessments in targeted areas of the VBWD, and meet with stakeholders to share results, gather feedback, and explore partnerships/projects.	Section 4.7.7	VBWD performs	\$25,000 per year	VBWD Ad Valorem	Inventories: 2006-2015 Meetings: 2007-2015
S-7	Develop invasive species education and control program	Section 4.7.7	VBWD performs	\$5,000	VBWD Ad Valorem	2008
S-8	Silver Lake – Study (i.e. literature review) of curlyleaf pondweed and Eurasian water milfoil transport to downstream waters	Section 5.1.2.1, Item 3	VBWD performs	\$2,000	VBWD Ad Valorem	2008
S-9	Echo Lake Addition – Flood Relief Study	Section 5.3.3.1	VBWD and/or Mahtomedi performs study, Mahtomedi implements project (See P-13)	\$20,000	VBWD Ad Valorem	2005
S-10	Lake DeMontreville – Prepare feasibility study for sedimentation control project	Section 5.7.2.1	VBWD performs	\$20,000	VBWD Ad Valorem	2007
S-11	Rest Area Pond – Study (i.e. literature review) possible downstream impact of curlyleaf pondweed infestation	Section 5.17.2, Item 2	VBWD performs	\$2,000	VBWD Ad Valorem	2008
S-12	Rest Area Pond – Investigate feasibility of restricting outlet	Section 5.17.3	VBWD performs study, working with Mn/DOT	\$10,000	VBWD Ad Valorem	2008
S-13	Valley Creek – Identify critical areas of concern for protection	Section 5.20.2.1, Item 1	VBWD performs	\$5,000	VBWD Ad Valorem	2005
S-14	Valley Creek – Modify buffer rules	Section 5.20.2.1, Item 3	VBWD performs	With S-4	VBWD Ad Valorem	2005
S-15	Kelle's Coulee – Streambank stabilization feasibility study	Section 5.37.2.1, Item 3	VBWD performs	\$20,000	VBWD Ad Valorem	Pending survey results (see DC-13)
S-16	Swede Hill Creek – Slope/bluff stabilization feasibility study	Section 5.38.2.2	VBWD performs	\$15,000	VBWD Ad Valorem	Pending survey results (see DC-13)

Table 7-1

**IMPLEMENTATION PROGRAM
Valley Branch Watershed District**

Capital Projects						
P-1	Install information signs at current and future VBWD projects	Section 4.1.7	VBWD performs	\$5,000 per sign	VBWD Ad Valorem	As needed. Assumed 2008 for current projects.
P-2	Implement stream management and stream restoration projects and actions to address identified stream degradation problems Identified projects:	Section 4.3.7	VBWD performs, possibly partnering with other organizations	Variable, up to \$1,000,000	VBWD Ad Valorem if under \$500,000	To be determined
	<ul style="list-style-type: none"> Raleigh Creek – Stream management and stream restoration project implementation 	Section 5.11.2	VBWD performs	\$50,000	If over \$500,000: Streams with public access: 50% watershed-wide ad valorem, 50% subwatershed ad valorem	2005
	<ul style="list-style-type: none"> Raleigh Creek – Detention basin(s) flow reduction & water quality treatment project 	Section 5.11.3	VBWD performs with financial support from Lake Elmo, Oakdale, and Washington County	Up to \$1,000,000	Streams without public access: 25% watershed-wide ad valorem, 50% subwatershed ad valorem, 25% special assessment	2006
	Kelle's Coulee – implement stream stabilization projects	Section 5.37.2.1, Item 6	VBWD performs	Up to approx. \$100,000/project	VBWD Ad Valorem	As identified
	Swede Hill Creek – implement slope/bluff stabilizaion projects	Section 5.38.2.1	VBWD performs	Up to approx. \$100,000/project	VBWD Ad Valorem	As identified
P-3	Implement TMDL studies in VBWD	Section 4.2.7	VBWD performs TMDL study (if found to be responsible party), VBWD performs implementation, other agencies/groups likely involved	\$500,000 to \$1,000,000	VBWD Ad Valorem	As required
P-4	Implement recommended projects resulting from habitat monitoring program, i.e. lakescaping demonstration project, sediment excavation, aquatic plant management	Section 4.2.7	VBWD performs	\$10,000 to \$100,000	VBWD Ad Valorem	As needed

**Table 7-2
IMPLEMENTATION PROGRAM SUMMARIZED BY YEAR
Valley Branch Watershed District**

	Item Number	Year											
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Annual Administration	AA-1	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
	AA-2	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
	AA-3	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000	\$21,000
	AA-4	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	AA-5	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
	AA-6	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	AA-7	\$0	\$5,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
	AA-8	\$0	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
	AA-9	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	AA-10	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	AA-11	\$5,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
	AA-12	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
	AA-13	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
	AA-14	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500
	AA-15	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	AA-16	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
	AA-17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	AA-18	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
	TOTAL AA	\$95,500	\$170,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500	\$215,500
Annual Operation & Maintenance	AOM-1	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	
	AOM-2	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	
	AOM-3	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500	
	TOTAL AOM	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	\$31,500	
Annual Data Collection	ADC-1	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	
	ADC-2	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	\$63,000	
	ADC-3	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	
	ADC-4	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000	
	ADC-4b	\$0	\$0	\$0	\$0	\$0	\$0	\$7,000	\$8,000	\$8,000	\$8,000	\$8,000	
	ADC-5	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	
	ADC-6	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	\$12,000	\$12,000	\$12,000	\$12,000	
	ADC-7	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	
	ADC-8	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	
	ADC-9	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100	
	ADC-10	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	
	ADC-11	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500	
	ADC-12												
TOTAL ADC	\$120,600	\$120,600	\$120,600	\$120,600	\$120,600	\$120,600	\$127,600	\$132,600	\$132,600	\$132,600	\$132,600		

As determined. See "Additional" items below.

**Table 7-2
IMPLEMENTATION PROGRAM SUMMARIZED BY YEAR
Valley Branch Watershed District**

	Item Number	Year											
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Non-Annual Administrative	A-1	As needed or in response to requests. See "Additional" items section below.											
	A-2	As needed. See "Additional" items section below.											
	A-3	As warranted. See "Additional" items section below.											
	A-4	As recommended. See also P-4. See "Additional" items section below.											
	A-5	As requested. See "Additional" items section below.											
	A-6	\$15,000	\$0	\$30,000	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-7	\$0	\$5,000	\$5,000	\$5,000	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0
	A-8	\$0	\$0	\$0	\$18,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-9	As needed. See "Additional" items section below.											
	A-10	\$0	\$0	\$0	\$4,500	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-11	As needed. See "Additional" items section below.											
	A-12	As needed. See "Additional" items section below.											
	A-13	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4	See S-4
	A-14	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-15	As needed. See "Additional" items section below.											
	A-16	As needed. See "Additional" items section below.											
	A-17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$80,000	\$80,000	\$80,000	\$80,000
	A-18	\$0	\$1,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-19	\$0	\$0	\$500	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-20	\$500	\$0	\$500	\$0	\$500	\$0	\$500	\$0	\$500	\$0	\$500	\$500
	A-21	\$0	\$0	\$1,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-22	\$0	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-23	\$0	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-24	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	A-25	\$0	\$0	\$0	\$0	\$0	\$0	\$2,500	\$0	\$0	\$0	\$0	\$0
	A-26	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$7,000	\$0	\$0	\$0	\$0
TOTAL A	\$25,500	\$18,000	\$47,000	\$27,500	\$5,500	\$0	\$3,000	\$12,000	\$80,500	\$80,000	\$80,500	\$80,500	
Non-Annual Data Collection and Reporting	DC-1	As required/requested, in response to identified or suspected problem. See "Additional" items below.											
	DC-2	As needed. See "Additional" items below.											
	DC-3	\$0	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$500	\$500	\$500	\$500	\$500	
	DC-4	As identified. See "Additional" items below.											
	DC-5	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-6	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-7	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-8	\$0	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-9	\$0	\$0	\$0	\$3,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-10	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000	
	DC-11	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-12	\$1,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	DC-13	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$0	
	TOTAL DC	\$3,000	\$72,000	\$55,000	\$53,000	\$55,000	\$50,000	\$500	\$5,500	\$10,500	\$500	\$5,500	\$5,500

**Table 7-2
IMPLEMENTATION PROGRAM SUMMARIZED BY YEAR
Valley Branch Watershed District**

	Item Number	Year											
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Studies	S-1	As recommended. See "Additional" items below.											
	S-2	As required. See "Additional" items below.											
	S-3	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-4	\$35,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-5	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-6	\$0	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
	S-7	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-8	\$0	\$0	\$0	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-9	\$20,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-10	\$0	\$0	\$20,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-11	\$0	\$0	\$0	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-12	\$0	\$0	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-13	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	S-14	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4	with S-4
	S-15	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$20,000	\$0
	S-16	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$15,000
TOTAL S	\$60,000	\$35,000	\$45,000	\$44,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$45,000	\$40,000	

**Table 7-2
IMPLEMENTATION PROGRAM SUMMARIZED BY YEAR
Valley Branch Watershed District**

Item Number	Year										
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
P-1	\$0	\$0	\$0	\$15,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-2 (See "Additional" items, too.)	\$50,000	\$1,000,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-3	As required. See "Additional" items below.										
P-4	As needed. See "Additional" items below.										
P-5	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	\$200,000	\$200,000	\$200,000
P-6 (See "Additional" items, too.)	\$0	\$0	\$100,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-7 (See "Additional" items, too.)	\$0	\$0	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-8	As needed. See "Additional" items below.										
P-9	\$0	\$0	\$0	\$0	\$35,000	\$0	\$0	\$0	\$0	\$0	\$0
P-10	\$0	\$0	\$0	\$0	\$190,000	\$0	\$0	\$0	\$0	\$0	\$0
P-11	\$0	\$0	\$0	\$50,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-12	\$0	\$0	\$0	\$0	\$0	\$20,000	\$0	\$0	\$0	\$0	\$0
P-13	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-14	\$0	\$0	\$0	\$0	\$0	\$1,000,000	\$0	\$0	\$0	\$0	\$0
P-15	\$0	\$0	\$0	\$0	\$0	\$195,000	\$0	\$0	\$0	\$0	\$0
P-16	\$0	\$0	\$0	\$100,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-17	\$0	\$0	\$0	\$200,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-18	As needed. See "Additional" items below.										
P-19	\$0	\$0	\$0	\$0	\$0	\$0	\$75,000	\$0	\$0	\$0	\$0
P-20	\$0	\$0	\$0	\$0	\$0	\$0	\$400,000	\$0	\$0	\$0	\$0
P-21	\$0	\$0	\$0	\$200,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-22	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$60,000	\$0	\$0	\$0
P-23	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$223,000	\$0	\$0	\$0
P-24	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0
P-25	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$388,000	\$0	\$0
P-26	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$300,000	\$0
P-27	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$25,000	\$0
P-28	\$0	\$10,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-29	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$190,000
P-30	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$30,000	\$0
P-31	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$203,000
P-32	\$150,000	\$250,000	\$250,000	\$250,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-33	\$0	\$250,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-34	\$3,800,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-35	\$0	\$0	\$0	\$25,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-36	\$0	\$0	\$80,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
P-37	As needed. See "Additional" items below.										
TOTAL P	\$4,000,000	\$1,510,000	\$430,000	\$850,000	\$225,000	\$1,215,000	\$475,000	\$488,000	\$588,000	\$555,000	\$593,000
YEARLY TOTAL	\$4,672,200	\$2,405,200	\$1,459,200	\$1,834,200	\$1,131,200	\$2,100,200	\$1,281,200	\$1,332,200	\$1,579,200	\$1,565,200	\$1,604,200

**Table 7-2
IMPLEMENTATION PROGRAM SUMMARIZED BY YEAR
Valley Branch Watershed District**

Item Number	Year										
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Possible Additional Items - Implementation years and costs are estimated. The Managers will review the need for these items during their annual budget setting process.											
ADC-12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$15,000	\$15,000	\$15,000	\$15,000
Total ADC Additional	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$15,000	\$15,000	\$15,000	\$15,000
A-1	\$0	\$5,000	\$0	\$5,000	\$0	\$5,000	\$0	\$5,000	\$0	\$5,000	\$0
A-2	\$1,000	\$0	\$1,000	\$0	\$1,000	\$0	\$1,000	\$0	\$1,000	\$0	\$1,000
A-3	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0	\$5,000	\$0
A-4	\$0	\$0	\$0	\$20,000	\$0	\$0	\$0	\$0	\$0	\$20,000	\$0
A-5	\$0	\$2,500	\$0	\$2,500	\$0	\$2,500	\$0	\$2,500	\$0	\$2,500	\$0
A-9	\$0	\$2,000	\$0	\$2,000	\$0	\$2,000	\$0	\$2,000	\$0	\$2,000	\$0
A-11	\$0	\$1,000	\$0	\$0	\$0	\$1,000	\$0	\$0	\$0	\$1,000	\$0
A-12	\$1,000	\$0	\$0	\$1,000	\$0	\$0	\$1,000	\$0	\$0	\$1,000	\$0
A-15	\$0	\$500	\$0	\$500	\$0	\$500	\$0	\$500	\$0	\$500	\$0
A-16	\$0	\$5,000	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0
Total A Additional	\$2,000	\$16,000	\$1,000	\$31,000	\$6,000	\$11,000	\$7,000	\$10,000	\$1,000	\$37,000	\$1,000
DC-1	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000
DC-2	\$0	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0	\$5,000	\$0	\$0
DC-4	\$0	\$0	\$0	\$15,000	\$0	\$0	\$0	\$0	\$0	\$0	\$15,000
Total DC Additional	\$0	\$5,000	\$5,000	\$15,000	\$5,000	\$5,000	\$0	\$5,000	\$5,000	\$0	\$20,000
S-1	\$0	\$0	\$0	\$100,000	\$0	\$0	\$0	\$0	\$100,000	\$0	\$0
S-2	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	\$0	\$0	\$0	\$0
S-5	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$0
Total S Additional	\$0	\$0	\$0	\$100,000	\$5,000	\$0	\$200,000	\$0	\$100,000	\$0	\$0
P-2	\$0	\$0	\$1,000,000	\$0	\$0	\$0	\$0	\$50,000	\$100,000	\$100,000	\$100,000
P-3	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$750,000	\$0	\$0
P-4	\$0	\$0	\$0	\$0	\$50,000	\$0	\$0	\$0	\$0	\$0	\$50,000
P-6	\$0	\$0	\$0	\$0	\$0	\$100,000	\$0	\$0	\$100,000	\$0	\$0
P-7	\$0	\$0	\$0	\$0	\$0	\$10,000	\$0	\$0	\$0	\$0	\$10,000
P-8	\$0	\$0	\$100,000	\$0	\$0	\$0	\$100,000	\$0	\$0	\$0	\$100,000
P-18	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0
P-37	\$0	\$0	\$0	\$0	\$750,000	\$0	\$0	\$750,000	\$0	\$0	\$750,000
Total P Additional	\$0	\$0	\$1,105,000	\$0	\$800,000	\$110,000	\$100,000	\$800,000	\$955,000	\$100,000	\$1,010,000
TOTAL ADDITIONAL	\$2,000	\$21,000	\$1,111,000	\$146,000	\$816,000	\$126,000	\$307,000	\$830,000	\$1,076,000	\$152,000	\$1,046,000
TOTAL + TOTAL ADDITIONAL	\$4,674,200	\$2,426,200	\$2,570,200	\$1,980,200	\$1,947,200	\$2,226,200	\$1,588,200	\$2,162,200	\$2,655,200	\$1,717,200	\$2,650,200