Northeast Neighborhood
Conceptual Storm Water Management Plan

City of Fitchburg
Dane County, Wisconsin

MAY 2007
REVISED OCTOBER 2007

RUEKERT/MIELKE
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NORTHEAST NEIGHBORHOOD CONCEPTUAL STORM WATER MANAGEMENT PLAN

CITY OF FITCHBURG
DANE COUNTY, WISCONSIN

MAY 2007
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EXECUTIVE SUMMARY

This Conceptual Storm Water Management Plan provides a set of objectives and supporting criteria to guide the development of an effective storm water management system within the Northeast Neighborhood Planning Area. The plan recognizes that storm water management is essential to attaining an attractive, efficient, safe, and healthy urban environment. The study also prescribes the infiltration of storm water, and recommends storm water activities that mitigate the adverse impacts of development on water resources to the maximum extent practicable, including reduction of phosphorus input to Lake Waubesa.

INTRODUCTION

The City of Fitchburg engaged the firm of Ruekert-Mielke, Inc. to complete the Conceptual Storm Water Management Plan during their overall planning process for the Northeast Neighborhood area of the City, identified in the 1995 General Land Use Plan and June 2004 FUDA Study. Ruekert-Mielke, Inc. subcontracted with Natural Resources Consulting, Inc. (NRC) based in Cottage Grove Wisconsin to assist with the analysis and evaluation of wetlands and other significant natural resources. During the planning process the public along with several environmental groups expressed concern over the potential development of this area and its impact on area drainage and environmental resources such as wetlands, groundwater interception by municipal wells, and the quality of the ecosystems of which it is part. The intent of the Conceptual Storm Water Management Plan was to evaluate the potential effects of development within the plan area and the ecosystems of which it is part and to provide direction and standards to the City that are to be enforced once actual development commences.

WATERSHED STEWARDSHIP AND PLANNING FRAMEWORKS

Good engineering practice dictates that storm water management system planning, while properly conducted at the local level, also be conducted consistent with and supportive of plans and historical and environmental and legal actions within the broader framework of watersheds and subwatersheds, including plans of immediately adjoining areas located within the watershed, in broader and more comprehensive plans that contain the watershed, and in historical environmental and legal actions made to protect and restore the quality of the watershed and its ecosystem services.. Therefore, this planning necessarily includes an understanding of the watershed and the groundwater system of which it is part, the contributions of groundwater and surface flows to the watershed and its associated wetlands and lake, certain historic framework planning efforts, and historic environmental and legal actions related to the quality of the watershed and its ecosystem services. These framework plans are in addition to other local and regional ordinances and development requirements that would be applicable to development within the Northeast Neighborhood planning area.

The broader and more comprehensive framework of these plans and environmental and legal actions were used in the preparation of this conceptual storm water management system plan for the planning area, and are set forth in the referenced key documents. These documents served to make land use, flood control, water quality management and storm water facility development recommendations contained in adopted county and local plans consistent with each other, and with adopted regional plans.

EXISTING CONDITIONS

In any system planning effort, definitive knowledge is required of the existing condition of the system concerned and of the pertinent characteristics of the environment in which the system operates. With respect to storm water management system planning in particular, inventories and analyses are required of such factors as the health, biodiversity and intended use of existing water bodies within the planning area; of available topographic and cadastral mapping of the planning area; of existing land use conditions in the planning area; and of the drainage pattern, geology, climate and weather, water supply and natural resource base of the planning area. A review of the current water quality best management practices of the planning area was also completed. Maps and tables are included that show the existing land use types within the planning area.

FORECAST CONDITIONS

In conjunction with the City of Fitchburg, planned land use conditions are currently being developed for the Northeast Neighborhood planning area. A final map for planned land uses was not available at the time of this study. However, to analyze potential development in the plan area a mix of land uses gathered from both City supplied land uses and the draft land use plans created by the City and their consultant were utilized to account for future conditions which may be expected to exist in the planning area upon full build out. The most conservative or worst case land use scenario was utilized for this study.

DESIGN CRITERIA

The basic concepts underlying current urban storm water management planning practice have evolved from older practice which sought to remove excess surface water during and after a rainfall as quickly as possible by the provision of an efficient conveyance system generally consisting of urban street cross sections with curbs and gutters, catch basins or inlets, enclosed conduits, and sometimes hydraulically improved channels. The current practice emphasizes treatment as part of a treatment train, infiltration and storage as well as conveyance of runoff while integrating constructed drainage facilities with the existing natural drainage system. The objectives of the current practice include reducing the peak rate of runoff; reducing the transport of sediment and other water pollutants to downstream surface waters and wetlands; mitigating the adverse impacts of increased runoff and flow frequency on upstream, downstream and riparian flora and fauna; and protecting against increased downstream flooding. Special attention should be given to controlling phosphorus levels.

A summary table of the existing and recommended applicable storm water management rules and standards is included in Appendix A.

WATER RESOURCE ANALYSIS

The preparation of this conceptual storm water management system plan included a comparative evaluation of alternative means of meeting the identified drainage, water quality management and flood control system needs of the planning area. Several alternative concepts were developed to convey, store, infiltrate and treat storm water in the project area. The intent was to analyze the existing and potential planned land uses for the planning area to determine if the regulatory and recommended standards could be met. While the storm water quantity and quality analysis in this study focus primarily on regional control measures, it is anticipated that decentralized or source controls will be required to meet the goals and objectives.

The hydrology and water quality were modeled under forecast conditions for each major subbasin of the planning area using the Natural Resources Conservation Service TR-55 model and the Source Loading and Management Model (SLAMM) respectively. Summary tables of the results are included within the Water Resource Analysis chapter.

RECOMMENDATIONS

Peak runoff rates from potential development shall not exceed existing runoff rates. The existing City of Fitchburg Storm Water Ordinance requires restriction of peak flows from post development to pre-development levels for the 2-year, 10-year and 100-year recurrence 24-hour storm events. A "blue-green" storm water management system, which consists of a combination of constructed and natural conveyance and storage facilities, is recommended to the maximum extent possible. Additional infiltration requirements for areas developing within the Northeast Neighborhood Planning Area are recommended. For residential and non-residential developments, practices shall be designed to infiltrate sufficient runoff volume so that post-development infiltration volume is at least 100% of the pre-development infiltration volume, based upon average annual rainfall. The applicant shall also design infiltration systems and pervious surfaces to meet or exceed the estimated average annual recharge rate (7.6 inches per year), based on continuous simulation. These infiltration practices will be required unless the applicant can demonstrate that the NR 151 variance requirements are met.

The Wisconsin Department of Natural Resources as well as Dane County and the City of Fitchburg regulations require an 80 percent reduction in Total Suspended Solids (TSS) during construction and after development compared to no runoff management controls. Within the next year or so, the Department is expected to release a Total Maximum Daily Load (TMDL) limit for the entire watershed that will prescribe the maximum TSS and phosphorus loading allowed.

The Northeast Neighborhood planning area and surrounding properties have significant natural resource features that require protection. These environmental features include wetlands, woodlands, environmental corridors and waterways. We recommend categorizing the wetlands onsite or adjacent to the Northeast Neighborhood into one of three categories. Category 1 wetlands, which include the wetlands within Swan Creek and Nine Springs Creek, are proposed to have a 300-foot setback. Category 2 wetlands are proposed to have a 100-foot setback. Category 3 wetlands include significantly degraded wetlands that are dominated by invasive plant species, and are proposed to have a 75-foot setback. Thermal control measures are recommended, however, not required. During the review of any development plans within the Northeast Neighborhood the City and Regulatory agencies shall evaluate the need for thermal control on a case-by-case basis.

With the planning area containing or in the proximity of several highly regarded natural resource features, including the Nine Springs Creek and Swan Creek watersheds and Lake Waubesa into which both of these watersheds flow, additional study is recommended. This study would include a more detailed evaluation of how the proposed development would affect the groundwater system including storm water recharge, water quality, spring flow, and phosphorus loading.

Public education and involvement are the final but key components to a successful storm water management plan. To be effective, the selected options must use a mix of appropriate strategies to address viewpoints and concerns from a variety of audiences. To foster an active and involved community, which is crucial to the success of any storm water management program, a public involvement and participation program shall be implemented to notify the community of all storm water improvement activities, to engage citizens and schools in restoration of degraded wetlands, and encourage input and participation from local residents.

CHAPTER ONE

INTRODUCTION

NEED FOR STORM WATER MANAGEMENT SYSTEM PLANNING

Good storm water system planning, water quality management and flood control are among the most important requirements of urban development accomplished in harmony with the natural ecosystems of which they are part, including protection of public health and safety, private property and water resources. Inadequate storm water planning, water quality management and flood control can create costly problems that may include danger to human life; loss of the functional use of water resources; an increase in soil erosion, sedimentation and pollution of surface waters leading to a decline in the health of the local ecosystem; disruption of the movement of people and goods, and the delivery of services; compromise of the structural stability of buildings, pavements and utilities which may require costly maintenance and reconstruction; damage to real and personal property; and depreciation of real property values and attendant loss of tax base. Inadequate drainage and flood control may also create breeding grounds for noxious insects with attendant hazards to human and animal health and life. This Conceptual Storm Water Management Plan is intended to provide directions and standards for the development of the Northeast Neighborhood that will enable the area to achieve the various goals and objectives set forth in this plan.

IMPETUS FOR PLANNING EFFORT

The City of Fitchburg has engaged the firm of Ruekert-Mielke, Inc. to complete the Conceptual Storm Water Management Plan during their overall planning process for the Northeast Neighborhood area of the City, identified in the 1995 General Land Use Plan and June 2004 FUDA Study. Ruekert-Mielke, Inc. has subcontracted with Natural Resources Consulting, Inc. (NRC) out of Cottage Grove, Wisconsin to assist with the analysis and evaluation of wetlands and other significant natural resources. During the planning process the public along with several environmental groups expressed concern over the potential development of this area and its impact on area drainage problems and environmental resources such as wetlands, groundwater interception by municipal wells, the quality of ecosystems of which it is part, and its contribution to the potential eutrophication of Lake Waubesa. This Conceptual Storm Water Management Plan is intended to evaluate the potential effects of development within the plan area and the ecosystems of which it is part and to provide direction and standards to the City that are to be legislated prior to its development, as necessary, and enforced once actual development commences.

PLANNING AREA

The Northeast Neighborhood Storm Water Management Planning Area (plan area) considered in the planning effort is shown on Exhibit 1. The planning area had been identified in Appendix H of the 1995 General Land Use Plan, known as the Future Urban Development Areas (FUDA) study that was adopted by the City of Fitchburg in June of 2004. The planning area consists of approximately 870 acres. While entirely contained within the northeast corner of the City of Fitchburg in Dane County, the planning area borders the City of Madison to the north, and the Towns of Blooming Grove and Dunn to the east.

INSERT EXHIBIT 1

The planning area is largely agricultural along with wooded and open space areas. Existing residential development is spread out and accounts for less than ten percent of the total land use. The wooded areas include both oak and pine forests. In addition, it appears that at least one drumlin is located within the planning area.

Site topography subdivides the plan area between two subwatersheds. The northern portion of the planning area lies within the Nine Springs Creek subwatershed, while the southern portion lies within the Swan Creek subwatershed. Both the Nine Springs subwatershed and the Swan Creek watershed discharge their waters into Lake Waubesa. The Lake Waubesa Watershed of which these are part, in turn is part of the Yahara River/Lake Monona Watershed, which has been categorized by the Wisconsin Department of Natural Resources as a priority watershed since 1989. This watershed is a part of the Rock River Basin.

PLAN GOALS AND OBJECTIVES

The purpose of this conceptual storm water management plan is to provide the City of Fitchburg with a conceptual plan for a neighborhood wide, effective storm water management system that will adequately serve the existing and potential build out land use development conditions within the Northeast Neighborhood Plan area. The plan will identify measures needed to avoid the creation of future problems attendant to new land use development as well as identify measures for the reduction of nonpoint sources of surface pollution and protection of natural resources.

More specifically, the goals of the plan are:

- Provide a set of objectives and supporting standards to guide the development of an effective storm water management system.
- Preserve and reproduce existing hydrologic conditions including surface water and groundwater flows.
- Ensure treatment of storm water runoff prior to discharging to wetlands, groundwater or waters of the state.
- Protect public health and safety.
- Protect against storm water damage to private and public property.
- Protect existing wetlands, Lake Waubesa, and sensitive natural resources.
- Allow users flexibility for meeting storm water management goals.

It is important to note that this study is only a conceptual storm water management plan. While general recommendations are given, no specific details on how or where storm water management measures will be implemented are included as part of this report. Prior to land development within the plan area a site specific storm water management plan will need to be prepared by a registered engineer to address site-specific issues including actual onsite geotechnical and groundwater conditions, development layout and densities, further site and wetland delineations, and specific measures to meet the goals and objectives of this report as well as all state, county and local regulatory requirements.

CHAPTER TWO

FRAMEWORK PLANS

INTRODUCTION

Good engineering practice dictates that storm water management system planning, while properly conducted at the local level, also be conducted consistent with and supportive of plans and historical and environmental and legal actions within the broader framework of watersheds and subwatershed plans, including plans of immediately adjoining areas located within the watershed, in broader and more comprehensive plans that contain the watershed, and in environmental and legal actions made to protect and restore the quality of the watershed and its ecosystem services. Therefore, this planning necessarily includes an understanding of the watershed and groundwater system of which it is part, the contributions of groundwater and surface flows to the watershed and its associated wetlands and lake, certain historic framework planning efforts, and environmental and legal actions related to the quality of the watershed and its ecosystem services. These framework plans and actions are in addition to other local and regional ordinances, environmental and legal actions, and development requirements that would be applicable to development within the Northeast Neighborhood planning area.

PERTINENT FRAMEWORK PLANS

The broader and more comprehensive framework plans of importance to the preparation of a new storm water management system plan for the planning area are set forth in eleven key documents which reflect the findings and recommendations of iterative regional and local planning processes extending back to 1996. These documents serve to make land use, flood control, water quality management and storm water facility development recommendations contained in adopted county and local plans consistent with each other, and with adopted regional plans. Good planning and engineering practice requires such consistency. Such consistency is also important if certain proposed storm water management facility improvements are to receive necessary approvals under the State permitting process administered by the Wisconsin Department of Natural Resources.

We reviewed the following documents covering the subject area as listed below, and provided summaries of the salient, pertinent findings and recommendations contained in the documents.

1. City of Fitchburg General Land Use Plan
   (Prepared by Dane County Regional Planning Commission, March, 1995)

2. Dane County Environmental Corridors
   (Dane County Regional Planning Committee, 1996)

3. Nine Springs Watershed and Environmental Corridor – Summary Report
(1996 Water Resources Management Practicum, Ken Potter et al, 1996)

   The report evaluates the Nine Springs Watershed and identifies critical areas and management options. The protection of stream flow, as well as effective management of storm water runoff are the primary focal points. The three recommended strategies are: (1) to protect areas of high quality and functional value; (2) to correct or minimize adverse influences to the system; and (3) to restore and/or enhance areas of lesser quality with potential for improvement.

4. Dane County Land Use & Transportation Plan
(Dane County Regional Planning Committee, June 26, 1997)
http://www.co.dane.wi.us/vis2020/2020home.htm

5. Nine Springs Neighborhood Storm Water Management Plan, Final Report
(Vierbicher Associates, Inc. and Applied Ecological Services, Inc., June 23, 1998)

6. Nine Springs Neighborhood Plan
(Prepared by Fitchburg Planning and Zoning, Approved by City Council, December 8, 1998)
http://www.city.fitchburg.wi.us/761444.html

7. Nine Springs E-Way
(Prepared by Fitchburg Citizen's E-Way Advisory Committee, July 1, 1998)

8. Town of Dunn Land Use Plan
(Sept 1998 & Oct 2005 Amendment) http://town.dunn.wi.us/McFarlandDunn.aspx

9. Dane County Water Quality Plan Appendix G - Groundwater Protection Plan
(Dane County Regional Planning Commission, 1999)

   The plan was developed to address existing and potential ground water quality problems in Dane County, and to recommend groundwater protection strategies to improve existing management and prevent groundwater pollution. The plan emphasizes increased training and education, reduction of road salt usage by local governments, use of groundwater contamination maps and other available resources in land use decisions and the siting or approving of activities that could affect groundwater, and increased monitoring of existing and potential pollution sources in geologically sensitive areas.

10. Dane County Water Quality – Conditions and Problems Report
(Dane County Regional Planning Commission, 1999)

11. Nine Springs Neighborhood Amendment to the Central Urban Service Area – Resolution RPC No. 882 (including Dane County RPC Staff Analysis, June, 1999)

12. Nine Springs Green-Tech Village Neighborhood Plan
(Prepared by Vandewalle & Associates, October 18, 2002)
http://www.city.fitchburg.wi.us/planning_zoning/GreenTechVillage.php

13. Yahara River/Lake Monona Watershed (LR08) – Lower Rock River Water Quality Management Plan, 2001 (WDNR)
http://www.dnr.state.wi.us/org/gmu/lowerrock/surfacewaterfiles/watersheds/lr08.pdf

    The Lower Rock River Basin Water Quality Report includes an evaluation of surface water resources, soil conditions, aquatic habitat conditions, land use, development concerns, existing urban areas and storm water runoff; identification of surface water pollution concerns and an explanation of the likely pollutant sources; recommendation of priority watershed projects under the Department's Nonpoint Source Pollution Abatement Program; and identification of implementation measures. The Yahara River/Lake Monona Watershed has been a nonpoint source priority watershed since 1989.

    Recommended nonpoint source pollution reduction measures are targeted at further assessment of impacts from human-altered hydro regimes throughout the basin. The three major goals of the priority watershed project are to reduce heavy metal loading to surface waters, reduce suspended solids to reduce sedimentation in streams and lakes and to reduce phosphorus loading to the waterways.

14. Chapter NR 151, Wisconsin Administrative Code, October 2002.

    Chapter NR 151 of the Wisconsin Administrative Code addresses nonpoint source pollution. It includes agricultural performance standards and prohibitions, non-agricultural performance standards, transportation performance standards, implementation and enforcement provisions, and a process to develop and disseminate non-agricultural technical standards.

    Requirements for non-agricultural areas include implementation of an erosion and sediment control plan for most transportation projects and all construction and post-construction sites which disturb more than one acre; control of sediment and peak discharge rates, minimum infiltration requirements, protective buffer areas and fueling and maintenance area limitations for new developments; implementation of a public education and yard waste management program for developed urban areas; and a total suspended solids reduction of 20 percent by 2008 and 40 percent by 2013 for all municipalities subject to an NR 216 municipal storm water permit.

15. The State of the Rock River Basin (WDNR, April 2002)
http://www.dnr.state.wi.us/org/gmu/lowerrock/rockreport_4_02.html

    The State of the Rock River Basin includes an evaluation of surface water resources, groundwater aquifers, aquatic habitat conditions, land use, development concerns, existing urban areas, storm water runoff and recreational uses; development of water use objectives; identification of nonpoint source water pollution control needs; and identification of implementation measures.

    The report recommends that nonpoint source pollution reduction measures target public participation and education, watershed preservation, land use planning, agricultural pollution control, streambank erosion, aquifer recharge, outdoor recreation and urban runoff.

The report also points out that the Rock River has been identified as an impaired water of the state and listed on the Environmental Protection Agency's 303(d) list. The river does not meet its functional use predominantly due to nonpoint source pollution, streambank erosion and hydrological modification. These sources cause significant habitat degradation, sediment embeddedness, nutrient enrichment and fish migration interference. Ultimately, this section of river will have a Total Maximum Daily Load (TMDL) calculated which outlines the maximum pollutant load it can receive and still meet its water quality standards.

16. Capital Springs Centennial State Park and Recreation Area Regional Analysis
    (WDNR Bureau of Parks and Recreation, August, 2003)
    http://dnr.wi.gov/master_planning/capsprings/

17. Dane County Water Quality Plan – Summary Plan 2004
    (Dane County Regional Planning Commission, 2004)
    http://www.danecorpc.org/publications.htm

    The report describes general status of surface water and groundwater conditions in Dane County. In general, despite significant growth and development that has occurred over the last 30 years, surface water quality in streams is not declining. However, over-fertilization and sedimentation of lakes from urban and rural nonpoint source storm water runoff continues to be a problem and groundwater quality indicates worsening trends.

    Priority Watershed Projects, local storm water management plans, and agricultural conservation practices should be pursued that implement strategies for reducing runoff pollution from these varied sources. Current monitoring programs should be continued and possibly expanded.

    Urban nonpoint source control recommendation U-1 states that storm water management plans should encourage infiltration of storm water, and attempt to mitigate the adverse impacts of development on water resources to the maximum extent practicable. Short range priority actions for the City of Fitchburg include: enforce infiltration maximization measures to protect Nine Springs Creek base flow; vigorously enforce and expand comprehensive erosion control and storm water management requirements beyond the minimum standards of the Dane County Ordinance to protect Nine Springs Creek from the adverse impacts of development; revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.

18. Chapter NR 216, Wisconsin Administrative Code, August 2004

    Chapter NR 216 of the Wisconsin Administrative Code implements Phases 1 and 2 of the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) program. It is intended to reduce, to the maximum extent practicable, the discharge of storm water pollutants into waters of the State from construction sites over one acre, designated municipalities and certain industrial facilities.

19. January 20, 2006 Memo from WDNR to Dane County & City of Madison Re: NR 151 Questions and Answers

20. Water Body Classification Study – Phase 1
(Dane County Regional Planning Commission, 2005)
http://www.danecorpc.org/media/WBC_web.pdf

Study discusses river and stream classifications based on their physical vulnerability to human impacts and the level of surrounding development. Buffer widths for river and stream protection are also discussed. Water quality benefits can generally by expected to increase with increasing buffer widths up to about 100 feet, beyond which a point of diminishing returns is reached. Increasing buffer widths beyond 100 feet will be primarily for shoreland wildlife. Under most circumstances, buffers necessary to protect streams, lakes, and wetlands should be a minimum of 75 to 100 feet in width.

21. Chapter 14, Manure Management, Erosion Control and Stormwater Management
(Dane County, October 31, 2006)
http://www.countyofdane.com/pdfdocs/ordinances/ord014.pdf

22. Report of the Stormwater Infiltration Task Force of the Dane County Lakes and Watershed Commission (July 6, 2006)
http://www.danewaters.com/pdf/2006StormwaterReport.pdf

Recommendations fall under five categories: Chapter 14 Infiltration Standards; Information and Enforcement; Monitoring Effectiveness of Infiltration Practices; Hydrologic Research and Management; and Resource Needs. One of the major items resulting from the task force was providing ordinance language to provide an option for developers to meet specific groundwater recharge goals (7.6 inches per year) in lieu of exceeding caps on the percentage of land required for infiltration devices.

23. Dane County Parks & Open Space Plan 2006 – 2011
(Dane County Parks, 2006)
http://www.co.dane.wi.us/lwrd/parks/plandev.asp - open_space_plans

24. Dane County Erosion Control and Stormwater Management Manual, 2nd Edition
(January 2007)
http://www.danewaters.com/pdf/manual/ecsm_manual.pdf

The manual is designed to help landowners, developers and consultants meet the requirements of Dane County's Erosion Control and Stormwater Management Ordinance and aid in the erosion control and stormwater management permit process. The manual also includes a list of management practices that will assist in meeting the performance standards set by the ordinance.

25. Capital Springs State Recreation Area Master Plan and Environmental Assessment (WDNR & Dane County Parks Commission, DRAFT January 2007)

The plan addresses goals related to historical, natural and recreational opportunities that the Capital Springs State Recreation Areas could provide. It is important to note that there are several parcels of land within the Northeast Neighborhood area plan north of Clayton Road that are already in or shown to be included in the proposed boundary expansion area of the Capital Springs Recreation Area. Additional goals include preservation, management and

enhancement of water resources, plant communities, wildlife, and threatened and endangered species on a regional basis. A highly important element in this plan is Lake Waubesa, whose water quality for recreation, fishing, boating, and swimming is vital to the park.

26. Fitchburg Chapter 27 – Erosion Control & Stormwater Management Ordinance, (Adopted by City Council January 23, 2007)

27. Town of Dunn Protected Lands Map
http://town.dunn.wi.us/maps/protected lands map.pdf

CHAPTER THREE

EXISTING CONDITIONS

INTRODUCTION

In any system planning effort, definitive knowledge is required of the existing condition of the system concerned and of the pertinent characteristics of the environment in which the system operates. With respect to storm water management system planning in particular, inventories and analyses are required of such factors as the health, biodiversity and intended use of existing water bodies within the planning area; of available topographic and cadastral mapping of the planning area; of existing land use conditions in the planning area; and of the drainage pattern, geology, climate and weather, water supply and natural resource base of the planning area. A review of the current water quality best management practices of the planning area is also required. While only a preliminary review of the existing conditions was conducted as part of this conceptual study, further planning and design work will require a much greater detailed analysis. The existing conditions of the planning area are shown with the 2005 aerial photography on Exhibit 2.

TOPOGRAPHY AND SURFACE DRAINAGE PATTERN

The drainage pattern of an area is a particularly important consideration in any storm water management system planning effort. As already noted, the planning area is located completely within the Rock River watershed and includes portions of the Nine Springs Creek and Swan Creek subwatersheds as shown on Exhibit 3. These subwatersheds drain into Lake Waubesa and subsequently into the Yahara River that drains to the Rock River. Once entering the Rock River, storm water runoff flows southwesterly before discharging into the Mississippi River at Rock Island Illinois, and ultimately to the Gulf of Mexico.

Drainage basins for the storm water management system planning effort were delineated based upon analyses of the large-scale topographic maps, and upon consideration of other pertinent data such as real property boundaries, existing storm water infrastructure and public street locations and configurations. For the purposes of this study, the planning area was divided into six drainage basins. These basins were broken down further for hydrologic analysis but those basins are not shown on the exhibit.

Runoff is generally by overland flow with culvert crossings under the roads. There are also several areas with depressions that are assumed to temporarily store water after larger rain events.

LAND USE

The existing land use pattern is another important consideration in the preparation of a storm water management system plan. The existing land use inventory within the Northeast Neighborhood plan area as of 2000 is shown on Exhibit 4. Table 1 presents the related existing land use information for the planning area.

INSERT EXHIBIT 2

INSERT EXHIBIT 3

INSERT EXHIBIT 4

TABLE 1

EXISTING LAND USE

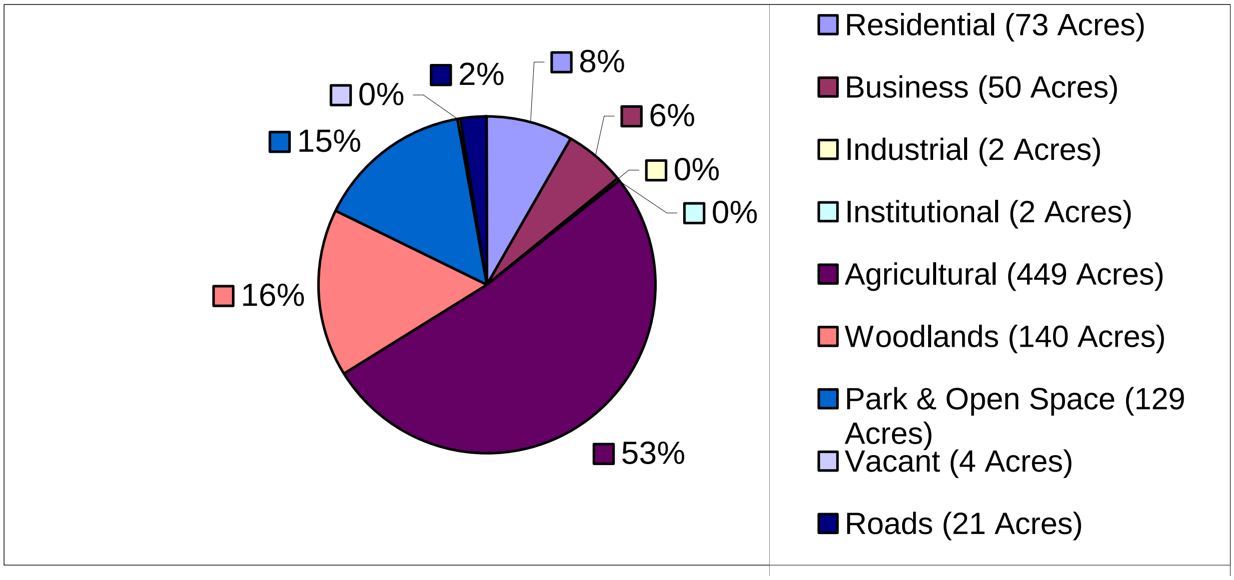


Table 1 indicates that the highest land use, about 53 percent of the planning area, was in agricultural uses in 2000. Residential uses comprised about 8 percent while the combined open space and woodlands accounted for 31 percent of the uses. Definitions for the various land uses are the same as the City's General Land Use Plan.

The further conversion of rural uses to urban uses within the City of Fitchburg may be expected to increase both the rate and volume of attendant storm water runoff. However, the City storm water management ordinance requires that the rate of runoff generated under proposed development conditions be restricted to the rate of runoff generated under existing land use conditions. To meet this requirement and the requirements of Chapters NR 151 and NR 216 of the Wisconsin Administrative Code necessitates the provision of detention storage, infiltration or other innovative storm water management techniques.

SOILS

The soil maps for the planning area have been condensed on Exhibit 5 to show the hydrologic soil groups as well as the hydric and hydric inclusive soils. The Natural Resource Conservation Service (NRCS), formerly USDA Soil Conservation Service classified soils into four groups: A, B, C and D. The soils within a group have similar runoff potential under similar storm, cover and saturation conditions. The hydrologic soil group is also an indicator of a soil's ability to infiltrate storm water. The influence of ground cover is treated independently.

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. At the other end, group D soils have high runoff potential and low infiltration rates when thoroughly wetted. The group B and C soils fall between them.

INSERT EXHIBIT 5

The NRCS definition of a hydric soil is a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part. These soils typically fall into the hydrologic group D, and tend to be located in wet areas such as drainage swales, depressions and floodplains. Hydric soils are also a key indicator for wetland delineation. There are also several areas within the Northeast Neighborhood planning area that are shown to have hydric inclusions. These somewhat poorly drained soils did not necessarily support wetlands historically, however these may be good locations for storm water management facilities.

GEOLOGY AND DEPTH TO BEDROCK

The geologic conditions of an area, including depth to bedrock and depth to the groundwater table, are important considerations in any storm water management system planning effort. The Northeast Neighborhood planning area is located on a rolling ground moraine of glacial origin. The groundwater reservoir provided by the glacial till deposits and underlying bedrock formations is the source of supply for many of the municipal and private on-site wells used within the planning area as a source of potable water.

WATER SUPPLY

Water supply within the City of Fitchburg storm water management system planning area is proposed to be provided by a well outside of the planning area. It is expected that the remaining private wells will be abandoned upon extension of municipal water service throughout much of the planning area.

NATURAL RESOURCE BASE

The natural resource base of an area is an important consideration in any storm water management planning effort. The natural resource base has great environmental, recreational and aesthetic value, and it is that base which makes an area pleasant in which to live and work, and attractive as a setting for high value residential, commercial, and industrial development. In order to preserve and protect the important community assets concerned, development (including storm water management system development) must be carefully adjusted to the ability of the natural resource base to support various types, densities and intensities of urban and rural development without deterioration or destruction of that base. Accordingly, careful consideration was given to the preservation and protection of the natural resource base within the Northeast Neighborhood planning area.

The natural resource base of the planning area consists of seven elements: soils, streams and watercourses, groundwater, floodlands, wetlands, woodlands and wildlife habitat. The location, extent and characteristics of these seven elements have been inventoried, mapped and studied by Dane County and other local regulatory agencies and stakeholders. The studies indicated that the best remaining elements of the natural resource base of the area - the organic soils, the streams and watercourses, the areas of groundwater recharge and discharge, the floodlands, the major wetlands, the high quality woodlands, and the best wildlife habitat areas - occur in elongated areas in the landscape that are termed environmental corridors. Many of these same features are also located in areas within and adjacent to the planning area that have not been defined as environmental corridors. These corridors will need to be further defined prior to development. This would include, but is not limited to, environmental and open space corridors, wetland delineation, cultural archeological resources and endangered species identification.

The preservation of these corridors and environmental sensitive areas in essentially natural, open uses is considered essential to both the maintenance of the overall quality of the environment and to the avoidance of serious and costly developmental problems. The preservation of the corridors in essentially natural, open uses can assist in the attenuation of flood flows; the abatement of surface and groundwater pollution; favorable climate modification; reduction of air pollution and maintenance of atmospheric oxygen supplies; maintenance of biological diversity; and the maintenance of groundwater aquifers and stream flows. The intrusion of urban development into such corridors may result in the creation of costly problems, such as failing foundations for pavements and structures; wet basements; excessive operation of building foundation sump pumps; excessive clear water infiltration and inflow into sanitary sewerage systems; and poor surface drainage. To help achieve preservation of these environmental corridors, State regulations, as well as good planning and engineering practice, preclude the extension of sanitary sewer service into the environmental corridors.

The environmentally sensitive areas within the Northeast Neighborhood planning area are shown on Exhibit 6. The need to protect and preserve these environmentally sensitive areas was carefully considered in the conceptual storm water management planning. Outside of the planning area, but intimately connected with it are Nine Springs Creek and Swan Creek and Lake Waubesa into which both of these streams flow.

The Northeast Neighborhood planning area is impacted by the 100-year recurrence interval flood hazard area (100-year floodplain) from both Nine Springs Creek on the north side and Swan Creek on the south side. Any work or disturbance within these floodplains is regulated by local, state and federal regulations. Updated Flood Insurance Rate Maps (FIRM) have recently been released in Preliminary format as shown in Exhibits 7A and 7B, but final approval and adoption of this updated floodplain is not expected until 2008.

EXISTING WATER QUALITY BEST MANAGEMENT PRACTICES

The City of Fitchburg is acutely aware of the need to protect the valuable natural resource base located throughout the planning area. To reach this goal, the City is actively involved in numerous best management practices to protect water quality. The current activities include:

Wet Detention Basins – The City currently owns and maintains over 30 wet detention basins throughout the urbanized area. These basins collect and trap suspended solids and debris preventing them from being discharged into downstream drainageways, streams and lakes.

Street Cleaning – The City cleans over 100 street-miles of public streets and roads. All streets are cleaned a minimum of two times in early spring. Additional cleanings are performed through the summer and fall based on any accumulated solids identified by staff or the public.

De-Icing Management Program – The City blends de-icing material at a 60-40 salt to sand mixture to minimize salt usage while still working to accomplish a safe travel on public streets. Application of de-icing material is reduced on low volume and flatly graded streets.

INSERT EXHIBIT 6 (WETLAND LOCATIONS & OTHER ENVIR. FEATURES)

INSERT EXHIBIT 7A

INSERT EXHIBIT 7B

Yard Waste and Brush Collection – The City provides four weeks of curbside yard waste collection for residents per year. Curbside brush collections for residents are also provided. The City also manages a recycling drop-off site where residents can drop-off yard waste.

Hazardous Materials Collection – The City participates in the Dane County Clean Sweep program where residents can take household hazardous materials between May and October.

Public Education – The City sends out information on water quality in quarterly newsletters and maintains a web site to keep residents educated and informed about water quality issues. The City also participates in the Madison Area Municipal Storm Water Partnership (MAMSWAP) program that assists in providing regular public information and education via news articles, radio, and television advertising.

Chapter 27 – Erosion Control and Storm Water Management Ordinance Administration and Enforcement – The City keeps Chapter 27 current with all applicable county, state, and federal requirements related to water quality. City staff members review all new development and re-development projects to ensure compliance with Chapter 27 and enforce any violations of the ordinance.

Chapter 35 – Storm Water Utility Credits – The City maintains a credit and rebate program where property owner bills can be reduced or reimbursed for various water quality improvements being done on-site verses one of the City's regional facilities.

CHAPTER FOUR

FORECAST CONDITIONS

INTRODUCTION

In any planning effort, forecasts are required of those future events and conditions that may affect plan design and implementation. With respect to storm water management system planning in particular, the future needs that the plan must meet depend primarily upon future resident population and household levels within, and the attendant land use pattern of, the planning area. The flows to be accommodated by storm water management collection, conveyance, storage and treatment facilities are derived by application of facility design criteria and probable future land use patterns. The potential pollutant loadings from each basin are also largely dependant on the probable future land use.

PLANNED LAND USE CONDITIONS

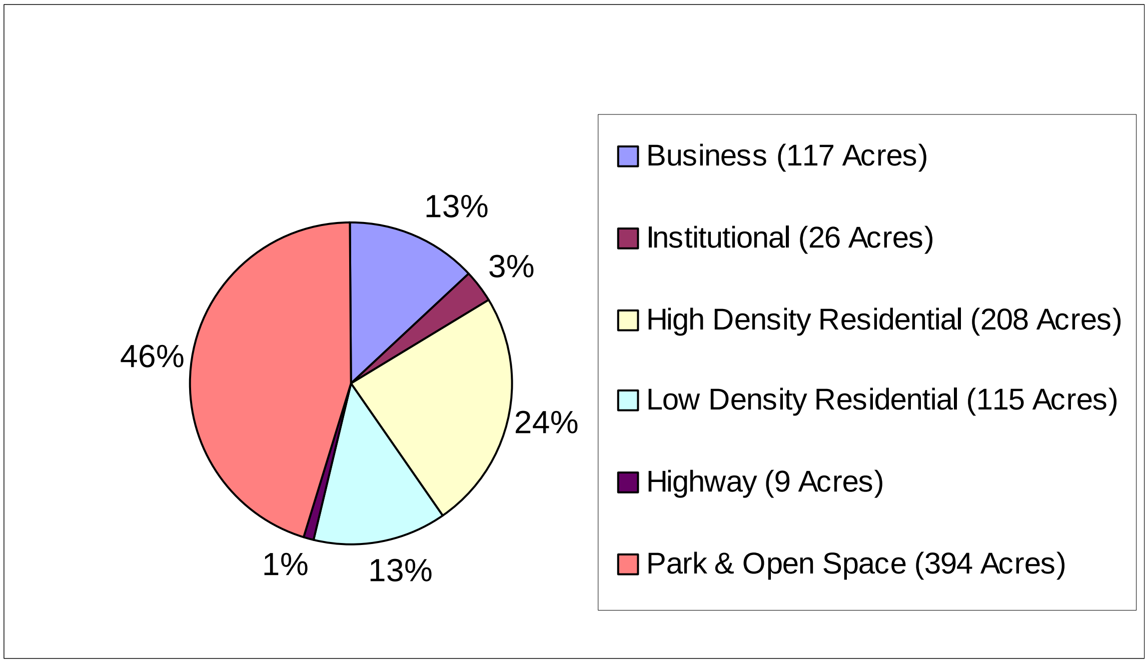
In conjunction with the City of Fitchburg, planned land use conditions are currently being developed for the Northeast Neighborhood planning area. A final map for planned land uses was not available at the time of this study. However, to analyze potential development in the plan area a mix of land uses gathered from both City supplied land uses and the draft land use plans created by the City and their consultant were utilized to account for future conditions which may be expected in the planning area upon full build out. The available information was compared and in case of conflict, the most conservative or worst case land use scenario was utilized for this study. Urban development was assumed to be excluded from environmental corridors and wetlands. Table 2 provides data on planned land use conditions for the planning area. While it appears the "roads" land use area decreases from existing to forecast conditions, this is due to the roads being included within the individual potential planned land use designations. Therefore, the roads within the residential land use designations are not broken out as a "roads" land use.

Anticipated changes in the land use pattern of the storm water planning area reflect the anticipated changes in resident population, household and employment levels. As indicated in Table 2, substantial change is anticipated in the land use following development within the Northeast Neighborhood planning area. The major changes are expected to be from agriculture to urban uses, with the largest increase occurring in the residential category. However open space area that includes the woodlands is expected to increase with the planned land use changes as a result of agricultural land uses being restored to open space. In the absence of sound planning, the further conversion of land from rural to urban use within the planning area may be expected to aggravate existing storm water management problems and create new problems. The need to resolve existing problems and to minimize the occurrence of new problems reinforces the need for this conceptual storm water management plan.

Because of the unknown drainage layout and land uses of the proposed development, drainage patterns and basins for planned land use conditions in this study were assumed to be the same as for existing conditions.

TABLE 2

POTENTIAL PLANNED LAND USE



Definitions of the individual land uses for forecast conditions are as defined in the City's General Land Use Plan.

CHAPTER FIVE

DESIGN CRITERIA

INTRODUCTION

The design of a storm water management system plan involves the application of the sciences of hydrology and hydraulics. Hydrology may be defined as the study of the physical behavior of the water cycle from its occurrence as precipitation, to its entry into streams, lakes, and the groundwater reservoir and its return to the atmosphere by evaporation and evapotranspiration. The application of hydrology to storm water management system planning focuses specifically on such factors as rainfall, soil conditions, ground cover, land uses, and on the volume and timing of surface runoff which reaches receiving surface water bodies. The location, extent and type of urban development greatly affects the variables concerned due to the changes in imperviousness, reduction in infiltration capacity, changes in natural storage, changes in flow paths and reduced flow times which accompany the conversion of land from rural to urban uses.

Hydraulics may be defined as the study of the physical behavior of water as it flows within natural stream channels, and associated floodlands; under and over bridges, culverts and dams; through lakes and impoundments; and through conduits such as artificial channels and sewers. The application of hydraulics to storm water management system planning focuses specifically on such factors as the length, slope and flow resistance of overland flow paths and receiving streams and watercourses, and on the configuration and capacity of natural and artificial storm water storage and conveyance facilities.

BASIC CONCEPTS

The basic concepts underlying current urban storm water management planning practice have evolved from older practices which sought to remove excess surface water during and after a rainfall as quickly as possible by the provision of an efficient conveyance system generally consisting of urban street cross sections with curbs and gutters, catch basins or inlets, enclosed conduits, and sometimes hydraulically improved channels. Current best management practices emphasize treatment as part of a treatment train, infiltration and storage, as well as conveyance of runoff while integrating constructed drainage facilities with the existing natural drainage system.

As noted earlier in Chapter One, the goals of the proposed storm water management systems are to:

1. Provide a set of objectives and supporting standards to guide the development of an effective storm water management system
2. Preserve and reproduce existing hydrologic conditions including surface water and groundwater flows
3. Ensure treatment of storm water runoff prior to discharging to wetlands, groundwater or waters of the state.
4. Protect public health and safety.
5. Protect against storm water damage to private and public property.
6. Protect existing wetlands, Lake Waubesa, and sensitive natural resources.
7. Allow users flexibility for meeting storm water management goals.

The systems should be cost effective, flexible and readily adaptable to changing needs.

The total storm water management system may be conceived as consisting of major, minor and water quality components. The major component should be designed to operate during infrequent, major rainfall events, the minor component should be designed to operate during frequent, relatively minor rainfall events and the water quality component should be designed to operate on the day to day rainfall events that comprise the majority of storms. The water quality component typically consists of swales, filter strips, infiltration basins and trenches, artificial wetlands, good housekeeping practices and storm water ponds with permanent pools. These devices used in combination or singularly, often seek to restore the infiltration of rainwater into the aquifer that typically is lost based on current development trends. In addition, these devices seek to trap and remove pollutants from the first flush of a rainfall event. This first flush of runoff typically contains the majority of pollutants known to cause degradation of receiving water bodies and the associated flora and fauna. In addition to the above structural and nonstructural measures, the success of any water quality component is dependant on the change of societal values resulting from a strong public education and outreach program. The water quality component, although functioning as a part of the minor and major systems, should be designed based on 2-year or more frequent recurrence interval rainfall events.

The benefits of incorporating storm water storage into urban storm water management systems may include reductions in the high kinetic energy of surface runoff; the entrapment of some level of pollutants; the protection of downstream aquatic biota; the reintroduction of infiltration into the urban drainage basin; the reduction in the peak rates of discharge; and the accommodation of uses for recreational and aesthetic purposes. The reduction in the volume of storm water runoff through infiltration comprises many of these same advantages but also includes the recharge of the ground water aquifer; the augmentation of low flows in streams; the preservation of stream base flows; and the cooling of urban runoff. However, the promotion of poorly designed infiltration in an urban area may also be problematic. Raising groundwater levels may contribute to excessive infiltration of clear water into sanitary sewerage systems, with the associated surcharging and backup of sewage into the basements of buildings. Infiltration may also contribute to groundwater pollution. Storm water storage facilities, if improperly designed, may also constitute attractive nuisances endangering the lives of children; may provide breeding grounds for noxious insects with hazards to human and animal life; and may be accompanied by unsightly algae and weed growths and unpleasant odors. Such storage facilities also create costly maintenance problems. If constructed on an unplanned basis with an improper relationship to the storm water management system as a whole, storage facilities by changing the times of concentration in a watershed may actually increase downstream flood flows and stages. Finally, storage facilities, while effective in reducing the peak rates of storm water discharge, extend the times of flow in receiving drainageways, and contribute to the warming of receiving water bodies.

Facilities designed solely to control storm water quantity, which include storm sewers and dry detention basins that drain completely between storms, provide little or no reduction in nonpoint source pollution control to receiving watercourses. When such facilities are integrated with nonpoint source pollution control facilities such as wet detention basins, infiltration trenches and basins, biofiltration basins, rain gardens, grass swales and waterways, regular street sweeping, catch basin cleaning, and other Best Management Practices, a significant reduction in nonpoint source water pollutant loadings may be achieved.

STORM WATER QUANTITY

Storm water runoff quantity includes a peak flow rate component and volume component. Both peak flow rates and volumes increase with increased imperviousness that accompanies new development. Therefore, storm water management practices are required to reduce peak flow rates and volumes to diminish any detrimental affects to the planning area and areas downstream of the planning area.

Overland flow patterns in urbanizing areas should be designed to maximize the inlet time of storm water runoff without adversely affecting urban structures or disrupting human activities. Thus, while providing adequate urban drainage, overland flow patterns should be designed to reduce the peak rate of discharge of storm water to the collection and conveyance facilities; and to reduce the velocity of overland flow, thereby reducing the energy level of flowing storm water and its ability to disturb sediment particles and surface pollutants. Similarly, as flow is maintained in its non-concentrated form over vegetated surfaces, sediment particles will be filtered out of the runoff and oils and greases will tend to adsorb to the vegetation. Flow in this diffuse state will also allow infiltration to occur to the maximum extent practicable. This is also referred to as unconnected impervious as compared to directly connected impervious.

Minimizing the amounts of paved surfaces can control the velocity of overland flow and, where possible, draining paved surfaces to pervious grassed areas rather than directly to paved gutters. Various detention and retention storage techniques and the use of flow spreaders and filter strips are also effective in reducing the velocity of overland flow.

Runoff from overland flow is typically collected and conveyed to a storage facility. Storm water storage can be defined as both the temporary detention and the long-term retention of storm water within the system. The primary purposes of storm water storage are to reduce the peak storm water drainage rates and the pollutant loadings both within the storm water management system itself and in the receiving waterways. Storm water storage reduces flow velocity and thus the potential for stream erosion; enhances the removal of sediment and other particulates suspended in storm water; and usually reduces the cost of downstream storm water conveyance and flood control facilities. Storm water storage facilities combined with infiltration facilities may also reduce the volume of storm water runoff.

Storm water storage may be either natural or man-made. In an undisturbed setting, natural storm water storage areas normally exist. Storm water is stored in natural surface depressions, in wetlands, on floodplains, and in soils. These natural storage areas dispersed throughout a drainage area serve to significantly reduce the volume and rate of storm water runoff, and may increase the removal of storm water from the surface water system by evaporation, transpiration, and infiltration.

There are a wide variety of passive storm water detention measures that can be used in an urban setting. These measures consist of grassed storm water collection swales designed to flow at low velocities, thereby providing in line storage; and storm water conveyance swales designed to include check dams and berms to reduce flow velocities, thereby providing storage. Storm water storage can also be provided on parking lots, and in specially designed and constructed storm water storage facilities. These storage measures generally detain storm water for short periods of time, in some cases allowing increased infiltration, evaporation, and transpiration, and can significantly reduce downstream peak storm water discharges.

Peak Runoff Rate

The Wisconsin Department of Natural Resources requires control of the peak rate of runoff leaving a site after development to maintain pre-development peak runoff rates for a 2-year, 24-hour storm event (2.9 inches over 24 hours duration). Dane County has similar controls but requires additional reductions of the 10-year, 24-hour storm event (4.2 inches over 24 hours duration). Further, the City of Fitchburg requires maintaining peak flow rates for the 2-year, 10-year and 100-year (6.0 inches over 24 hours), 24-hour storm events to pre-development conditions, with pre-development referring to the extent and distribution of land cover types present before the initiation of the proposed land development activity, assuming that all land uses prior to land disturbing activity are in "good" condition as described in the NRCS Technical Release 55, "Urban Hydrology for Small Watersheds". A summary table of the applicable storm water management rules and standards is included in Appendix A.

Centralized Detention: A centralized detention approach utilizes major surface or subsurface detention facilities to provide temporary storage of storm water runoff for subsequent slow release to downstream channels or storm sewers. The centralized detention facilities are located on a limited number of carefully selected, strategically located sites to maximize benefits. Nonpoint source pollution control can be provided through the inclusion of permanent pools within the detention facilities and through measures such as selective plantings, construction site erosion control, pet waste control, and selection of building and construction materials to reduce the runoff of sediments, metals and other toxic pollutants.

The major advantages of a centralized detention approach are that, if properly applied, the facilities can limit the effects of urban development on downstream discharges, areas of inundation, stream bank erosion, streambed scour, and aquatic habitat; a substantial amount of nonpoint source pollutants can be removed; the size and resultant cost of downstream conveyance facilities can be reduced and the need for upgrading existing facilities can sometimes be avoided; the facilities can be combined with recreation and open space areas to provide multipurpose areas; and habitat can be provided for wildlife and waterfowl. Centralized detention facilities typically operate more effectively, require less land and have lower maintenance costs than a comparable number of individual onsite detention facilities.

The disadvantages of a centralized detention approach are that large, relatively level, open areas are usually required, thereby severely reducing the availability of potential sites in areas of existing development; the facility may not be cost-effective if the site and maintenance costs cannot be offset by the savings of providing smaller conveyance facilities downstream; for a permanent pool facility, the impounded water may present a public nuisance and health and safety hazard; odor and insect problems may be produced; and the hydraulic design and construction techniques required are more involved than for conveyance systems. The City generally constructs centralized storage facilities and the costs are charged back to the benefiting landowners and developers via special assessments or user charges.

Onsite Detention: Like centralized detention, onsite detention provides for the temporary storage of storm water runoff, but the storage sites are located close to, or at, the sources of runoff generation. Hence, these detention sites tend to be smaller than centralized detention facilities. Onsite detention measures include small detention basins, parking lot storage, swales, large channels with gentle slopes, and below grade chambers. The nonpoint source pollution control offered by detention can be improved through the inclusion of a permanent pool within the detention basin, along with measures such as selective plantings, construction site erosion control, pet waste control, and selection of building and construction materials which reduce the runoff contribution of sediments, metals and other toxic pollutants.

The advantages of the onsite detention approach are similar to those of centralized detention with regard to downstream water quantity and quality control and to the potential for reducing the size of downstream conveyance systems. Onsite facilities, however, have smaller unit site requirements than do centralized facilities, and therefore may be more readily applicable, although not totally without difficulty, in existing as well as newly developing urban areas. Onsite facilities may be less suitable for multipurpose uses such as recreation and open space, but more suitable for uses such as water quality, parking or open space in residential areas. The capital and maintenance costs of onsite facilities are typically borne by the landowners and developers concerned and not by the general public.

The disadvantages of the onsite detention approach are that maintenance requirements may be substantial; the impounded water in a detention pond may cause localized inconvenience and represent a health and safety hazard; odor and insect problems may be produced; and the costs may be high if not offset by smaller downstream conveyance systems. Onsite detention facilities typically operate less effectively, require more land and have higher maintenance costs than a comparable regional detention facility. Onsite detention may present a serious problem if the landowners concerned do not properly maintain the facilities. Therefore, legal and physical provisions should be made to permit the City to maintain the facilities if necessary and assess the landowners for the costs entailed.

Storm Water Storage Facilities

Natural storage of storm water is provided during overland flow in floodlands, wetlands, surface depressions, vegetated areas, and pervious soils. Preserving open areas, woodlands, wetlands, ponds, and areas with large infiltration capacities can enhance natural storage. These attributes can usually be incorporated into a storm water management system at less cost than would be required for the incorporation of artificial storage facilities.

Runoff Volume

There are no direct regulatory requirements related to the increase of volume from storm water runoff after development. However, the Wisconsin Department of Natural Resources as well as local regulatory authorities address volume increases resulting from development through an infiltration requirement. When discussing storm water infiltration, it is important to differentiate between infiltration and recharge. In this study, infiltration refers to any precipitation that does not leave the site as surface runoff. Recharge means the portion of the average annual rainfall that infiltrates the soil and becomes groundwater. Recharge does not include evapotranspiration, transpiration or runoff from the site. These definitions are consistent with the City's Storm Water Management ordinance. The summary table of rules for infiltration is included in Appendix A. Infiltration rate requirements typically differ for residential and nonresidential development.

With reference to the rules outlined in Appendix A, residential development requires infiltration of post-development runoff volume to 90 percent of pre-development runoff volume, while nonresidential development requires infiltration of post-development runoff volume to 60 percent of pre-development runoff volume. If a development would require more than 1% (residential) or 2%

(non-residential) of the site to meet NR151 Infiltration Standards, developers may choose to satisfy the standard by designing infiltration practices that meet a recharge rate of 7.6 inches per year, which is the estimated Dane County-wide pre-development groundwater annual recharge rate.

While these are minimum requirements, the presence of a highly regarded and potentially sensitive natural resource base within, adjacent to and downstream of the plan area should merit additional consideration. The Nine Springs Watershed and Environmental Corridor Summary Report states that, “much of the water within the Nine Springs Creek comes from a number of natural springs which occur throughout the watershed, especially within the delineated borders of the E-Way itself.” Recharge areas for these springs as well as for those in Swan Creek and the West Waubesa wetlands are uncertain.

Therefore, we recommend additional infiltration requirements for areas developing within the Northeast Neighborhood planning area. The storm water management plan shall include the following provisions and practices to increase the infiltration of runoff at sites unless the NR 151 variance requirements are met: For residential and non-residential developments, design practices to infiltrate sufficient runoff volume so that post-development infiltration volume shall be at least 100% of the pre-development infiltration volume, based upon average annual rainfall. The applicant shall also design infiltration systems and pervious surfaces to meet or exceed the estimated average annual recharge rate (7.6 inches per year), based on continuous simulation. At least one percent (1%) of the site must be used for infiltration.

100 percent infiltration of the pre-development volume of rainfall does not mean that no runoff will leave the site. For example, if 10,000 gallons of rainfall falls over a site and 1,000 gallons infiltrated during pre-development conditions 9,000 gallons of rainwater would still be allowed to leave the site as surface runoff under developed conditions.

While this method may limit standard development practices, alternative infiltration practices can be employed to help meet the infiltration requirements. Infiltration of roof runoff from commercial or industrial buildings within required onsite green areas and green roofs would reduce the costs of storm water conveyance facilities as well as downstream storage/treatment facilities. While green roofs attenuate runoff, they increase evapotranspiration, therefore, actually reducing recharge of groundwater. Treatment trains and/or blue-green systems could aid in infiltration over the entire drainage basin, rather than trying to infiltrate large quantities of runoff at the downstream water quality features where the soils are not usually conductive to infiltration. Onsite treatment for residential properties could be in the form of rain gardens, roof drains directed to lawn areas, and rain barrels.

The ability to utilize infiltration as a storm water management strategy is directly related to the type of soils, the depth to bedrock and the depth of groundwater. Dane County has prepared a series of maps called relative infiltration maps created from that data. There are three maps showing the relative infiltration as it occurs naturally, the relative engineered infiltration and the relative enhanced infiltration potential. A copy of the relative natural infiltration map for the City of Fitchburg is shown on Exhibit 8. The relative engineered infiltration and relative enhanced infiltration potential maps are available from Dane County. On site investigations will be required to provide ground truth to the information provided in the maps.

While local source or onsite infiltration is highly encouraged and possibly necessary for both commercial and residential properties, it is more difficult to implement effectively and dependably with small-scale, piecemeal development. A significant portion of the infiltration requirement should ideally be met through public or community facilities with any additional treatment considered an additional benefit. These public facilities are not necessarily centralized infiltration features at the downstream end of a watershed, but rather areas that are publicly owned or maintained. For storm water measures on private properties, easements along with legal authority should be in force to allow the City or other regulatory organization to provide necessary maintenance and bill back the property owners. The City could offer incentives for additional private storm water measures that go above and beyond the regulatory requirements. Homeowners with a rain garden for example could potentially receive a credit towards their storm water utility fee. In addition, any strategy for long-term storm water system success shall include a major educational component.

Centralized Infiltration: Infiltration facilities provide for the storage of storm water runoff for subsequent evaporation and/or infiltration. Strictly defined, such facilities differ from wet pond detention facilities in that the former are not intended to provide for any release of runoff, while the latter are intended to provide for release after temporary storage for treatment purposes. Nonpoint source pollution control can be achieved by various types of centralized infiltration, biofiltration and created wetland facilities, along with measures such as selective plantings, construction site erosion control, pet waste control, and selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants.

The major advantages of the centralized infiltration approach are that if properly applied, the facilities can limit the effects of urban development on downstream peak discharges, areas of inundation, stream bank erosion, streambed scour, and aquatic habitat; a substantial amount of nonpoint source pollutants are captured and held for subsequent removal by dredging; the size and resultant cost of downstream conveyance facilities can be reduced and the need for upgrading existing facilities can sometimes be avoided; the facilities can be combined with recreation and open space to provide multipurpose areas; habitat can be provided for wildlife and waterfowl; and the facilities can provide groundwater recharge. Centralized infiltration facilities typically require less land and have lower maintenance costs than a comparable number of individual onsite infiltration facilities.

The disadvantages of the centralized infiltration approach are that the facilities require large, relatively level, open areas; the facilities may be more expensive than detention facilities; less permeable soils require larger facilities; the facilities do not effectively infiltrate while the ground is frozen; maintenance requirements are substantial; larger facilities may cause significant groundwater mounding; and there is the potential for contamination of the ground water supply, particularly in critical land use areas such as commercial and industrial uses. The effects on groundwater levels may create problems such as wet basements, costly excessive operation of sump pumps, and excessive infiltration of clear water into sanitary sewers. The impounded water may present a public nuisance and health and safety hazard, and odor and insect problems may be produced. The site analysis, hydraulic design and construction techniques required are more involved than for conveyance systems.

INSERT EXHIBIT 8

Onsite Infiltration: Like centralized infiltration, onsite infiltration provides for the temporary storage and subsequent infiltration and/or evaporation of storm water runoff, but the storage sites are located close to, or at, the source of runoff generation. Hence, these sites tend to be smaller than centralized infiltration facilities. Nonpoint source control measures appropriate under the onsite infiltration approach may include various types of infiltration, biofiltration and constructed wetland devices, selective plantings, construction site erosion control, pet waste control, and selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants.

The advantages of the onsite infiltration approach are similar to those of the centralized infiltration approach with regard to water quantity and quality control downstream, and to the potential for reducing the size of downstream conveyance systems. Additionally, since they are located near the source of runoff generation, cleaner runoff from roofs can be separated from the runoff stream and diverted directly to infiltration facilities negating the need for costly pretreatment facilities. Areas of intense industrial use may still require pretreatment of roof discharge but most other areas will not. Onsite facilities have smaller unit site requirements, thereby being more readily applicable, although not totally without difficulty, in existing as well as newly developing urban areas. Onsite facilities typically result in less groundwater mounding than centralized facilities and failure of a single onsite facility does not equate to failure of the overall infiltration system. Onsite facilities may be less suitable for multipurpose uses such as recreation and open space, but more suitable for uses such as open space in residential areas. The capital and maintenance costs of onsite facilities are borne by the landowners concerned and not by the general public.

The disadvantages of the onsite infiltration approach are that maintenance requirements may be substantial. The impounded water may cause localized inconveniences and represent a health and safety hazard; odor and insect problems may be produced; improperly designed or constructed facilities may contaminate the ground water supply; the facilities do not effectively infiltrate while the ground is frozen; and the costs may be high if not offset by smaller downstream conveyance systems. Onsite infiltration facilities typically require more land and have higher maintenance costs than a comparable regional infiltration facility. The effects on ground water levels may create severe problems such as wet basements, costly excessive operation of sump pumps, and excessive infiltration of clear water into sanitary sewers. Onsite infiltration may present a serious problem if the landowners concerned do not properly maintain the facilities. Therefore, legal and physical provisions should be made to permit the City to maintain the facilities if necessary and assess the landowners for the costs entailed. While readily applicable as an integral part of large-scale urban development proposals, the concept is more difficult to implement effectively and dependably with small-scale, piecemeal development.

The Wisconsin Department of Natural Resources is promoting infiltration as a means to recharge groundwater reservoirs, maintain stream base flows and promote proper continuation of the hydrologic cycle. Chapter NR 151 of the Wisconsin Administrative Code contains specific infiltration requirements for new development and redevelopment projects throughout the State, including the City of Fitchburg. As individual site conditions allow, centralized and onsite infiltration facilities will become significantly more prevalent as effective storm water management facilities throughout the State of Wisconsin. With their lower potential for groundwater mounding and since failure of one onsite infiltration facility does not equate failure of the entire infiltration system, the Wisconsin Department of Natural Resources currently prefers onsite infiltration facilities over centralized facilities.

"Blue-Green" System: A "blue-green" storm water management system consists of a combination of constructed and natural conveyance and storage facilities. Conveyance channels are vegetation-lined preferably "free-form", as opposed to geometrically shaped and are interconnected with natural surface depressions and wetlands. Such a system provides for the temporary storage and conveyance of storm water runoff in the vegetation-lined channels and associated depression and wetland areas, which slow the runoff and allow ponding and infiltration. The drainage system of an area may consist almost entirely of "blue-green" channels, or it may be supplemented by other management measures including storm sewers. Nonpoint source pollution control measures appropriate under the "blue-green" approach may include certain types of storm water detention, retention and infiltration facilities, constructed wetlands, turf-lined open channels, selective plantings, construction site erosion control, pet waste control, and selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants.

The advantages of the "blue-green" approach are that downstream peak flows may be reduced; pollutants in storm water runoff may be removed by filtration through the soil and vegetation, by biological uptake, and by sedimentation; the "free-form" open channels and related drainage areas can serve as part of park and open space sites following the multi-use concept; habitat areas for wildlife and waterfowl can be maintained or enhanced; construction costs may be lower than those of systems relying more heavily on constructed facilities; and the aesthetic qualities of a "natural" drainage system may be particularly attractive to some citizens.

The disadvantages of the "blue-green" approach are that it may make it difficult to develop an open channel system which can effectively accommodate the high peak flows generated from medium to high density urban areas served by storm sewers; the channels are difficult to properly clean and maintain; the flowing channels may be perceived as a safety hazard; and some citizens and local public officials may oppose open channel flow in urban areas.

"Blue-green" system components currently exist within the planning area, including channels and wetlands. Although these systems should not be used as the sole source of storm water treatment for new developments, they can be expanded or enhanced to provide additional functional value and abate storm water runoff problems. Because of the potential benefits, enhancement of existing “blue-green” systems and creation of new "blue-green" system features were considered in the development of the conceptual storm water management plan.

NONPOINT SOURCE POLLUTION CONTROL MEASURES

Nonpoint source water pollution control may be defined as the management of urban and rural land uses to reduce the loadings of pollutants discharged to surface waters. For the purposes of this Conceptual Storm Water Management Plan, such control measures will be considered only with respect to urban nonpoint sources of pollution. Various nonpoint source pollution control measures are described in detail in the Dane County Erosion Control and Stormwater Management Manual, 2007 (http://www.danewaters.com/pdf/manual/ecsm_manual.pdf), and the Wisconsin Department of Natural Resources Storm Water Management Technical Standards (http://www.dnr.state.wi.us/org/water/wm/nps/stormwater/techstds.htm).

Erosion Control

There are two major categories of urban nonpoint sources of pollution. The first category is the erosion of soil from disturbed land areas, especially construction sites. The primary pollutants transported in this manner are suspended sediments and sediment-attached pollutants such as phosphorus. Residential, commercial, industrial, highway, and public utility construction sites all have the potential to produce large amounts of sediment which will reach receiving streams if not controlled. Because of the transitory nature of construction projects, measures to control construction site erosion and runoff are inherently of a short-term nature. Such control measures include mulching and seeding or polymer application of disturbed areas, construction of filter fabric and straw bale fences to intercept eroding soil prior to discharge to a receiving stream, channel stabilization, construction of sediment traps, temporary diversions, stone check dams and wet detention basins, stabilization of stream banks through the provision of sod, geosynthetics, natural armoring or riprap, protection of storm water inlets and proper construction scheduling.

Best management practice designs for these structural and non-structural erosion control practices are available in the Dane County Erosion Control and Stormwater Management Manual (available at http://www.danewaters.com/business/stormwater.aspx).

Special consideration should be given to the sequencing of individual construction sites as they relate to any planned regional detention basins in their subwatershed. For example, consideration should be given to constructing regional wet detention basins prior to individual construction of sites upstream as a secondary measure of erosion control to enhance the overall erosion control efficiency. Continuous monitoring of the effectiveness of the overall system should be conducted until final stabilization of the individual sites.

Storm Water Runoff Pollutants

The second major category of urban nonpoint sources of pollution is the storm water runoff and associated pollutants contributed from developed urban areas. As land is converted from rural to urban uses, the impervious area is increased, different types of pollutants accumulate on and are washed off of the land surface, and the overall amount of water pollutants contained in the storm water runoff is increased. The control of urban nonpoint source pollution requires long-term solutions which effectively reduce the loadings of those pollutants that are causing water quality problems, and which are flexible enough to be adapted to planned development patterns and densities.

Nonpoint source pollution control measures appropriate for developed urban areas can be classified either as source area controls or as outfall controls. Source area controls are Best Management Practices carried out in upland areas near the pollution source. Outfall controls are applied at or near the storm water outlet prior to discharge to the receiving stream. Source area controls may include infiltration devices, pervious pavement, biofiltration cells, decentralized storage facilities or constructed wetlands, vegetated filter strips, street cleaning, increased leaf and clippings collection and disposal, and reduced use of road deicing salt. Outfall controls may include centralized storage facilities or constructed wetlands, proprietary storm water treatment devices and physical or chemical treatment processes.

The control of road deicing salt is a common problem throughout the State of Wisconsin. While protecting safety and maintaining access to homes and businesses is necessary, handling snow should be done with care to prevent environmental damage. Alternative deicers to road salt such as calcium chloride are available, but pollution potential, working temperatures and costs of all alternatives must be evaluated. While control of road salting and sanding may be addressed on a development-by-development basis, it would be more beneficial to have a citywide snow treatment policy in place. The City currently blends deicing material at a 60-40 salt to sand mixture to minimize salt usage while still working to accomplish safe travel on public streets. Application of deicing material is reduced on low volume and flatly graded streets. For private development maintenance plans should address how snow will be handled prior to approval of any building plans.

Infiltration systems can achieve a high level of loading reduction in both dissolved and particulate pollutants from the drainage area served, with the pollutant loading reductions being proportional to the resulting reduction in storm water volume. Some systems, including infiltration basins and trenches, constructed wetlands, vegetated filter strips, porous pavements, grass swales and waterways, and perforated drainage systems also filter additional pollutants from the remaining runoff. Vegetation-lined infiltration basins, biofiltration areas and gravel-filled infiltration trenches often collect the storm water runoff from frequent storm events from small impervious areas such as parking lots or roofs. Infiltration trenches are generally lined with filter cloth. Trenches may be entirely below grade, or they may be adapted to the existing topography with one side being a low berm constructed of pervious material and covered with filter cloth and small riprap. Such an installation would collect and store runoff, which would gradually be released by infiltration through the berm. Vegetated filter strips, which are generally placed between the pollution source and the collector system, remove pollutants in overland flow through both filtering and infiltration. Porous pavements are generally the most applicable in parking areas that do not handle heavy traffic loads. Such pavements may consist of specially constructed concrete or paving-block grids with openings for the establishment of grass cover. Grass waterways and perforated drainage systems can be effectively incorporated into the conveyance system for transport of runoff to receiving waters. Grass swales, usually placed along roadways, may also reduce pollutant loadings through both filtering and infiltration.

While properly located and sized infiltration devices can substantially reduce the loadings of pollutants from nonpoint sources to receiving waters, care must be taken to avoid contamination of the groundwater. Studies have shown that particulates are effectively filtered out in the top layers of soil surrounding infiltration devices. However, dissolved pollutants may reach the groundwater when infiltration devices are improperly located in areas with unsuitable topography and soils, or with a shallow depth to bedrock or to the groundwater table. Other potential adverse impacts of infiltration devices include wet basements, sump pump overloading, groundwater mounding, building and foundation failures, and excessive infiltration of clear water into sanitary sewers. Because of these potential problems, infiltration devices should be carefully planned in areas with a high potential for groundwater contamination and areas of intensive urban development. It should also be noted that long-term maintenance problems might be attendant to the use of infiltration devices. Such maintenance may be required to remove and dispose of resulting contaminated soils thereby restricting the effectiveness of the devices. Construction of these facilities should be planned to minimize sedimentation and compaction of soils.

Proprietary storm water treatment devices are designed to remove sediment and hydrocarbon loadings from runoff before they are conveyed to the storm drain network or to an infiltration device. The effectiveness of such devices in removing pollutants has not been adequately monitored in the field. Because of the relatively small storage volumes and resultant brief retention times involved, such devices are not expected to provide a high degree of pollutant removal. Maintenance is required to clean out the material collected in the devices on an ongoing basis. Such devices also require careful siting and permitting to meet the attendant regulatory issues.

Street cleaning can be an effective method of urban nonpoint source pollution control under certain circumstances. Approximately 5 to 30 percent reductions in pollutant loadings from industrial, commercial, institutional, governmental and high density residential areas can be achieved if parking and storage areas are included in the cleaning operation. Wisconsin Department of Natural Resources does not allow credit for street cleaning for new or redevelopment projects. Although credit for street cleaning is given for managing existing developed areas, it should be clear that new or redevelopment projects can not take credit for street cleaning to meet their Total Suspended Solids performance standard.

Man-made detention storage facilities and wetlands can be utilized to reduce storm water runoff rates and volumes. Such storage facilities and areas can also produce significant reductions in nonpoint source pollutant loadings.

Along with infiltration basins that are designed to completely store all tributary runoff, the wet detention basin is highly effective in reducing pollutant loadings. In wet detention basins, pollutants are removed through both sedimentation of particulates and biological assimilation of dissolved nutrients. Wet detention basins require considerable maintenance in order to function properly as nonpoint source control measures. Maintenance requirements for wet basins include weed and algae control, inspection, litter removal, and periodic dredging of accumulated sediments. The cost of periodic dredging is the largest maintenance cost. That cost can be reduced by confining the accumulation of most of the inflowing sediment to a settlement forebay located at the inlet of a wet detention basin. Means of disposal of dredged sediment vary, depending on the level of contamination of the sediment. Sediments with high concentrations of toxic chemicals or metals must be disposed of in specially designed containment areas or landfills. Sediment to be dredged should be tested to determine the appropriate means of disposal.

Wetlands can serve to remove pollutants from storm water runoff by sedimentation, biological assimilation, and filtration. The long flow-through times and low flow velocities in wetlands allow suspended sediments and particulate pollutants to settle. Wetland plants assimilate nutrients, and metals and hydrocarbons are deposited in wetland sediments. While wetlands may be effective in controlling nonpoint source pollutant loadings to downstream waters under certain conditions, the accumulation of pollutants may be harmful to the wetland ecosystem. The effects of certain nonpoint pollutants on wetlands are known. An abundance of nutrients in a wetland can lead to dominance of less desirable, non-native plant species. Pesticides are taken up by certain plant species and are then released to the water column following plant decay. Due to the relatively long water retention times in wetlands, road de-icing salt concentrations may exceed acceptable levels, leading to density stratification, in the lower layers of the wetland water column. Depending on the hydrologic and hydraulic characteristics of a particular wetland, accumulated pollutants may be flushed to downstream waters during large storm events. The capacity of wetlands to remove pollutants and the long-term effects of such removal on wetlands has not been definitively established. It is desirable to provide facilities to reduce nonpoint source pollutant loadings prior to discharge to wetlands.

Therefore, water quality treatment is required to occur prior to entering any existing wetland. However constructed wetland complexes may be introduced to assist in the water quality treatment. In addition, small isolated wetlands within the planning area that have been disturbed or farmed or are comprised of non-native species may be candidates for wetland restoration.

Total suspended solids (TSS) are typically used as an indicator constituent within the Wisconsin Department of Natural Resources regulations because most other pollutants, particularly metals, often attach to suspended solids. The Department reasons that when total suspended solids are removed, a similar percentage reduction in other pollutants is also achieved. The Wisconsin Department of Natural Resources as well as Dane County and the City of Fitchburg regulations require an 80 percent reduction in TSS during construction and after development compared to no runoff management controls. The Wisconsin Department of Natural Resources bases this reduction on the average annual rainfall while the County and City base this reduction on the 1-year, 24-hour storm event. The Wisconsin Department of Natural Resources and Dane County are in the process of creating new models to measure pollution reduction from specific best management practices.

While TSS are the typical indicator used, pollutants of concern in storm water include volatile organic compounds and toxic organics such as herbicides and pesticides as well as biological contaminants (usually pet waste) prevalent in residential land uses. Wet detention ponds with appropriate outlet designs are typically the most effective treatment measures for such pollutants.

Nonstructural Measures for Storm Water Drainage and Nonpoint Source Pollution Control: The nonstructural approach to storm water drainage primarily involves reducing damages from unusually high storm water runoff and pollution rather than controlling the runoff rates or pollution levels themselves. Nonstructural measures include land use and storm water regulations, open space and floodland preservation, public education and participation and structure floodproofing.

Oil & Grease Control

Best management practices to reduce petroleum in runoff for fueling and vehicle maintenance areas are included in NR 151. Dane County and the City of Fitchburg also require treating the first 0.5 inches of runoff for oil and grease in commercial and industrial areas.

Phosphorus And Eutrophication

The Wisconsin Department of Natural Resources is currently undergoing a Total Maximum Daily Load (TMDL) study of the Rock River Basin that will set specific limits on the release of phosphorus from urban development. This study and subsequent limits are anticipated to be released in 2008.

PROTECTION OF NATURAL RESOURCES

While infiltration, best management practices and runoff control measures aid in protecting natural resources, additional measures can be added to increase the safety factor for protection. These additional protections include buffer zones and thermal control.

Wetland Buffer Zones

Wetland buffers or protective area requirements are currently regulated by Wisconsin Department of Natural Resources Code 151 and Dane County ordinances. The Wisconsin Department of Natural Resources requires a 75-foot setback from all wetland characterized by the Wisconsin Department of Natural Resources as being an Outstanding Resource Water, Exceptional Resource Water and wetlands in Areas of Special or Natural Resource Interest. For perennial and intermittent streams, lakes, and highly susceptible wetlands a 50-foot setback is required. Highly susceptible wetlands include the following types: fens, sedge meadows, bogs, low prairies, conifer swamps, shrub swamps, other forested wetlands, fresh wet meadows, shallow marshes, deep marshes and seasonally flooded basins. For less susceptible wetlands the recommended setback is 10 percent of the average width, but no less than 10 feet and no more than 30 feet. Less susceptible wetlands include degraded wetlands dominated by invasive species such as reed canary grass. The Wisconsin Department of Natural Resources code requires that impervious surfaces be kept out of the protective area to the maximum extent possible. Dane County also has a wetland setback requirement of 75 feet for all structures in their ordinance.

When referring to setbacks Dane County looks more at habitat protection versus water quality protection. The Dane County Water Body Classification Study - Phase One discusses river and stream classifications based on their physical vulnerability to human impacts and the level of surrounding development. Buffer widths for river and stream protection are also discussed. Water quality benefits can generally by expected to increase with increasing buffer widths up to about 100 feet, beyond which a point of diminishing returns is reached. Increasing buffer widths beyond 100 feet will be primarily for shoreland wildlife. Under most circumstances, buffers necessary to protect streams, lakes, and wetlands should be a minimum of 75 to 100 feet in width. However, wildlife and plant species setback recommendations can range from 30 feet to upwards of 700 feet typical according to the Conservation Thresholds for Land Use Planners by the Environmental Law Institute, 2003. Dane County Parks recommends a setback of 300 feet. This allows them to provide grants to people or organizations to protect the areas between a smaller setback and the 300-foot distance.

Working with Natural Resource Consultants, we have come up with a recommendation for applying wetland buffers based on individual wetland size, location, type, and condition. The recommendation is closely modeled after Wis. Adm. Code NR 151.12 “Protective areas” and NR 103.04 “Wetlands in areas of special natural resource interest”. Both the Nine Springs and Swan Creek wetlands will meet the criteria set forth below for a 300-foot wetland buffer.

I) WETLAND BUFFERS

A) Definition

1) The wetland buffer is the area of land that commences at the field delineated boundary of wetlands as measured horizontally to the nearest impervious surface. Wetland boundaries shall be identified following the procedures set forth in the 1987 Corps of Engineers Wetland Delineation Manual and subsequent guidance documents. Identified wetlands shall contain wetland buffers as determined by the following wetland categories:

B) <u>Category 1 Wetlands – 300 foot buffer</u>

1) Category 1 wetlands are wetlands in areas of special natural resource interest as defined in Wis. Adm. Code NR 103.04.

2) Category 1 wetlands include wetlands within the boundary of designated areas of special natural resource interest and those wetlands which are in proximity to or have a direct hydrologic connection to designated areas of special natural resource interest.

3) Exceptions:

(a) Wetland swales or ditches that extend or protrude from a Category 1 wetland and meet all of the following criteria shall contain a 75-foot wetland buffer. Wetland swales or ditches that do not meet all of the following criteria shall maintain a 300 feet buffer unless otherwise specified.

(i) The wetland swale or ditch extends for a distance greater than 225 feet from the Category 1 wetland;

(ii) The wetland swale or ditch maintains a width no greater than 50 feet for a distance no less than 1000 feet from the Category 1 wetland or to the point of termination which ever occurs first;

(iii) The wetland swale or ditch does not meet the definition of a Category 2 wetland. If the criteria of Category 2 are met then the wetland buffers identified for a Category 2 wetland shall apply however; conditions (i), (ii), and (iv) of this paragraph must be met;

(iv) The wetland swale or ditch is not a navigable body of water as determined by the Wisconsin Department of Natural Resources.

C) <u>Category 2 Wetlands – 100 foot buffer</u>

1) Category II wetlands include the following wetland community types:

(a) Fens;

(b) Sedge meadows;

(c) Bogs;

(d) Low prairies;

(e) Conifer swamps;

(f) Shrub swamps;

(g) Forested wetlands;

(h) Wet meadows;

(i) Shallow marshes

(j) Deep marshes

(k) Seasonally flooded basins

2) Wetland plant community types shall be determined based on "Wetland Plants and Plant Communities of Minnesota & Wisconsin", 1997, U.S. Army Corps of Engineers, Eggers and Reed.

3) Wetlands containing intact native plant communities but are located within a monotypic stand of invasive plant species shall by identified as Category 2 wetlands.

D) Category 3 Wetlands – 75 foot buffer

1) Category 3 wetlands include significantly degraded wetlands that are dominated by invasive plant species such as reed canary grass and box elder.

2) Category 3 wetlands must be comprised of more than 90% invasive species as measured by percent cover.

3) Invasive species can include both native and non-native plant species and must be identified on the Wisconsin Department of Natural Resources list of invasive plant species which can be found online at http://dnr.wi.gov/invasives/plants.htm

II) Wetland Buffer Restrictions

A) Impervious surfaces shall be kept out of the wetland buffer area to the maximum extent practicable and must comply with all applicable Dane County shoreland, wetland and inland wetland ordinances and area-wide protection plans. The storm water management plan shall contain a written site-specific explanation for any parts of the wetland buffer area that are disturbed during construction.

B) Where land disturbing construction activity occurs within a protective area, and where no impervious surface is present, adequate sod or self-sustaining vegetative cover of 70% or greater shall be established and maintained. Nonvegetative materials, such as rock riprap, may be employed as necessary to prevent erosion such as on steep slopes or where high velocity flows occur.

C) A minimum of 50% of the distance of the wetland buffer measured horizontally from the delineated wetland boundary shall be established to a native plant community following the standards set forth in the City of Fitchburg's "Standard Specifications for Native Landscaping" (Appendix B).

D) Best management practices such as filter strips, swales or wet detention basins, that are designed to control pollutants from nonpoint sources may be located in the wetland buffer area. However, all storm water management devices located within the wetland buffer area shall establish a native plant community following the standards set forth in the City of Fitchburg's "Standard Specifications for Native Landscaping".

The proposed City of Fitchburg's Standard Specifications for Native Landscaping" document is included in Appendix B.

Thermal Control

The Northeast Neighborhood planning area is not located within a Dane County Thermally Sensitive Area. The County considers areas to be thermally sensitive if they are within a watershed that drains to an existing or proposed Cold Water Community or Class I, II or III Trout Stream as designated by the Wisconsin Department of Natural Resources. However the temperature from runoff from pervious surfaces can increase significantly on warm summer days. Infiltration will significantly reduce temperatures as the ground cools the water that infiltrates. Other thermal control measures include disconnected impervious surfaces, stone crib outlets and submerged outlets for wet ponds.

Thermal control measures are recommended, however, not required. During the review of any development plans within the Northeast Neighborhood the City and regulatory agencies shall evaluate the need for thermal control on a case-by-case basis.

CHAPTER SIX

WATER RESOURCE ANALYSIS

INTRODUCTION

The preparation of a storm water management system plan requires the comparative evaluation of alternative means of meeting the identified drainage, water quality management and flood control system needs of the planning area. Several alternative concepts were developed to convey, store, infiltrate and treat storm water in the project area. The intent was to analyze the existing and potential planned land uses for the planning area to determine if the regulatory and recommended standards could be met. While the storm water quantity and quality analysis in this study focus primarily on regional control measures, it is anticipated that decentralized or source controls will also be required to meet the goals and objectives.

WATER QUANTITY

Hydrology

The Natural Resources Conservation Service's Technical Release 55, "Urban Hydrology for Small Watersheds" (TR-55) methodology was utilized to determine peak flow rates and storm water runoff volumes for the planning area. Input data included land uses, drainage areas, soils and time of concentrations. Runoff Curve Numbers (RCN) were based on values provided in TR-55 as well as the City's Erosion Control and Storm Water Management ordinance. Rainfall depths were obtained from the City of Fitchburg's Erosion Control and Storm Water Management Ordinance and are as shown on Table 3.

TABLE 3

24-HOUR STORM EVENT RAINFALL DEPTHS

Recurrence Interval	Rainfall Depth
2-Year	2.9 inches
10-Year	4.2 inches
100-Year	6.0 inches

This development area was divided into six separate basins based on topography and drainage patterns to outlet structures. Drainage basins for existing and potential land use conditions were assumed to be the same for this study. It is likely that once final plans are created that the actual drainage basins for proposed conditions will alter somewhat. Land use, soils and topography were based on the assumptions in Chapter 3, Existing Conditions, and Chapter 4, Forecast Conditions. Areas of natural storage were modeled when identified within the six basins and were based upon the topography and drainage patterns. These areas include natural low areas within the existing farm fields. A summary of the major basins with existing peak flows and runoff volumes is shown in Table 4. Table 5 shows the peak flows and volumes created from potential land use conditions without any storm water management water quality or quantity controls. There are no peak flows or runoff volumes shown for drainage basins 2 and 5 in Table 4 and 6 because they are internally drained. Because of the large amount of land set aside as open space and the reduction of agricultural lands under forecast conditions, composite runoff curve numbers are not substantially increased over existing land use conditions.

TABLE 4

EXISTING CONDITIONS HYDROLOGY

Drainage Basin	Area (Acres)	Composite RCN	Peak Runoff Rate (cfs)			Runoff Volume (ac-ft)		
			2-Yr	10-Yr	100-Yr	2-Yr	10-Yr	100-Yr
1	274	70	30	78	168	10	26	53
2	56	68	0	0	0	0	0	0
3	182	68	1	2	20	2	5	22
4	205	67	40	120	357	7	18	38
5	15	70	0	0	0	0	0	0
6	136	73	63	159	346	7	16	31

TABLE 5

POTENTIAL LAND USE CONDITIONS HYDROLOGY WITH NO CONTROLS

Drainage Basin	Area (Acres)	Composite RCN	Peak Runoff Rate (cfs)			Runoff Volume (ac-ft)		
			2-Yr	10-Yr	100-Yr	2-Yr	10-Yr	100-Yr
1	274	75	189	411	769	18	37	68
2	56	68	39	105	218	2	5	11
3	182	73	144	333	645	10	22	42
4	205	73	133	313	610	12	25	47
5	15	71	17	39	76	1	2	5
6	136	73	104	246	482	8	16	31

Table 6 shows the peak flows and volumes created from potential land use conditions with storm water management measures included. These management measures included centralized wet detention pond facilities to reduce peak flows as well as treat the runoff. The forecast peak flows and volumes in Table 6 do not account for reductions associated with infiltration.

TABLE 6

POTENTIAL LAND USE CONDITIONS HYDROLOGY WITH CONTROLS

Drainage Basin	Area (Acres)	Composite RCN	Peak Runoff Rate (cfs) *			Runoff Volume (ac-ft) *		
			2-Yr	10-Yr	100-Yr	2-Yr	10-Yr	100-Yr
1	274	75	18	45	147	17	36	67
2	56	68	0	0	0	0	0	0
3	182	73	0	2	25	0	4	22
4	205	73	36	97	324	12	25	47
5	15	71	0	0	0	0	0	0
6	136	73	58	107	304	8	16	31

* Infiltration measures not included in peak runoff rate or volumes

Summary

Approximate sizes of water quality and quantity ponds necessary to achieve the water quantity requirements are shown on Exhibit 9. The exhibit also shows the approximate areas estimated to achieve the infiltration requirements. The infiltration basin acreage was based on the Wisconsin Department of Natural Resources NR 151 code requirement by the maximum surface area required method. Depending on actual development layouts, densities and field conditions, the infiltration areas will need to be adjusted to meet the proposed infiltration requirements.

WATER QUALITY

Urban Nonpoint Source Pollution Control Measures

As stated earlier, a great deal of concern has been placed on reducing the nonpoint source pollutants that are carried by storm water runoff to the waters of the State, in this case the Rock River. It is important to understand that nonpoint pollution is difficult to quantify and difficult to locate as there are no well defined sources. Nonpoint pollutants may be generated in all areas of land use, and include soil erosion from open farm fields and construction sites; decomposing materials such as leaves deposited in the gutters and storm sewers, fertilizers and pesticides, heavy metals from automobiles, rooftops, and buildings; and pet litter and animal waste from farms and barnyards. These pollutants create water quality problems that not only affect the look, feel and smell of the surface waters, but also the health and safety of plants, animals and people that come in contact with the polluted waters.

In an effort to reduce nonpoint source pollutants, selected waterways within the United States were monitored and tested for certain pollutants. It was determined that the majority of polluted waters contain high levels of total solids, total phosphorus, copper, lead, zinc, and cadmium. A summary of the pollutant elements evaluated in this study is presented on Table 7.

INSERT EXHIBIT 9

TABLE 7

STORM WATER POLLUTANT ELEMENTS

Pollutant	Typical Sources	Water Quality Impacts
Sediment	Soil, atmospheric deposition (dust), litter and debris, particles from automobiles and tires, deteriorated pavement	Decreases water clarity, covers valuable plants and bottom dwelling organisms, destroys breeding sites, reduces aquatic plant photosynthesis
Phosphorus	Fertilizer, organic matter (leaves, grass clippings), soil	Excessive algae growth, dissolved oxygen reduction, odors
Cadmium	Batteries, pigments, coatings and platings and stabilizers for plastics	Interferes with biological processes of other elements such as zinc in biological systems
Lead	Atmospheric deposition, automobiles, paint, medical equipment	Toxic to aquatic life
Copper	Automobile brake pads, wire, roof materials	Toxic to aquatic life
Zinc	Galvanized steel roof drains and downspouts, coatings, rubber products	Toxic to aquatic life

The Source Loading and Management Model is a widely accepted computer program for evaluating and quantifying nonpoint source pollutants. Each major subbasin of the planning area was evaluated using this model. As recommended by the Department of Natural Resources, the 1981 rain file was used within SLAMM. This file contains actual precipitation data from 1981 and is considered to represent a typical year for the greater Madison area. Other parameter files used were the Pollutant Probability Distribution, Runoff Coefficient, Particulate Solids Concentration, Particulate Residue Reduction, Street Delivery Parameter and the Particulate Size Distribution file. SLAMM combines this data with other historical data files to determine the probable amount of pollutants, particle sizes and distributions. The land use within each basin was input along with the types of drainage controls and outfall controls that are found in each particular basin. Outfall controls were input if a wet detention pond was located within a basin. Outfall controls include weir structures, orifices or pipes, and infiltration trenches. The model was then run and the probable pollutant loadings determined for each basin. The pollutant loadings for each basin were then analyzed to identify alternatives for reducing those loadings.

The model calculates a loading for each specified pollutant. The pollutant loadings are given in pounds and are equal to the amount of that pollutant that may be expected to runoff from the basin concerned over the course of a year. Generally, pollutant loadings increase when the amount of critical land use (industrial, commercial, high density residential, governmental, institutional, and interstate highways) increases; the length of curb increases; the length of grass swales decreases; the number of times catch basins are cleaned decreases; and the number of times streets are swept decreases. With the introduction of best management practices including the introduction of grass swales in place of curb and gutter or with the introduction of a wet detention pond, infiltration basin or biofiltration device, particulate solids loadings may be expected to decrease for the drainage areas that are tributary to the control measures.

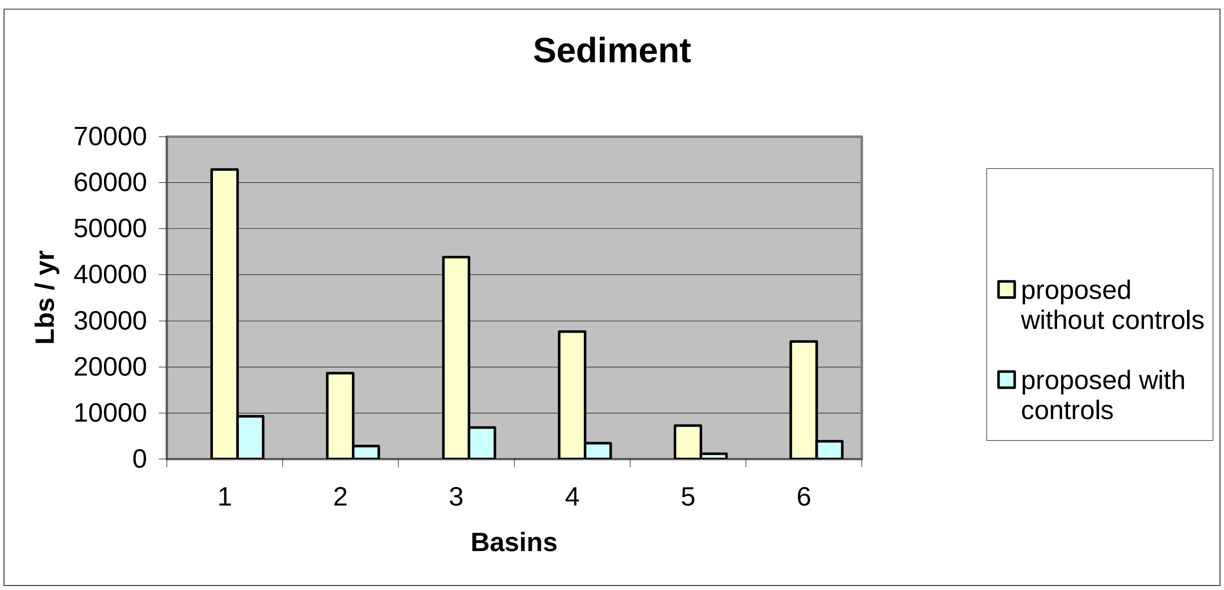
The purpose of this analysis was to evaluate the pollutant loadings under developed conditions. In addition, NR216 and NR151 require that all new development achieve an 80% total suspended solids (TSS) reduction when comparing the developed condition with no controls versus the developed condition with all of the proposed controls in place. The reduction goals are largely based on the TSS loadings. If the reduction goals are met for TSS, many of the other pollutants loadings, including those for phosphorus will also be substantially reduced. Ultimately, this section of the Rock River will have a Total Maximum Daily Load (TMDL) calculated which outlines the maximum pollutant load it can receive and still meet its water quality standards.

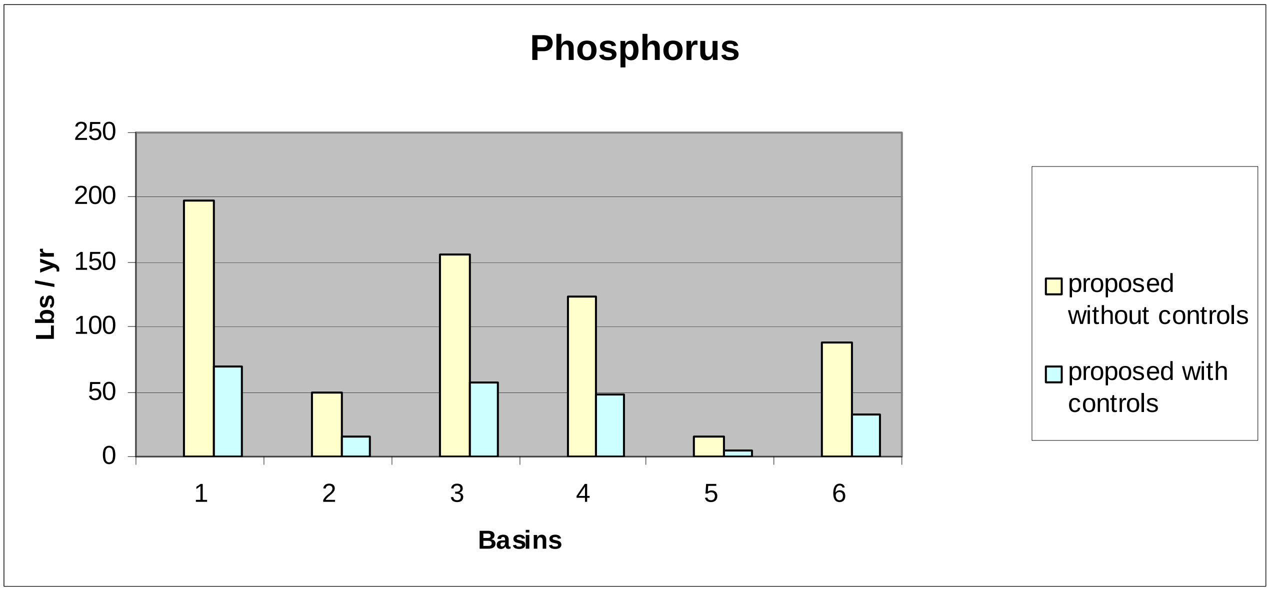
Water quality ponds were sized in order to achieve a reduction of 80% of the Total Suspended Solids as required by NR151. The proposed pond acreage that achieves the 80% reduction requirement is outlined in Exhibit 9. The water quality ponds were modeled with five feet of depth below the outlet structure invert elevation. Outlet structures were sized to match the peak flow rates from the existing conditions 2-year, 10-year and 100-year peak flow rates.

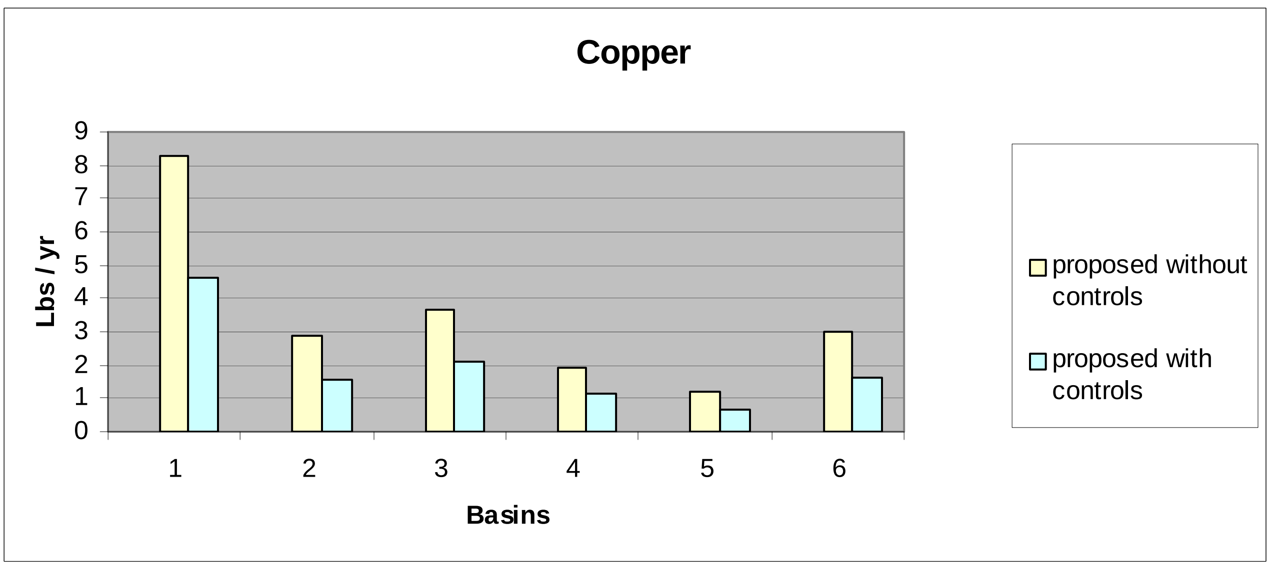
SLAMM modeling results are as shown in Figures 1-6.

FIGURES 1-6

SLAMM MODELING POLLUTANT LOADINGS




Phosphorus
250
200
150
100
50
0
Lbs / yr
1
2
3
4
5
6
Basins
proposed without controls
proposed with controls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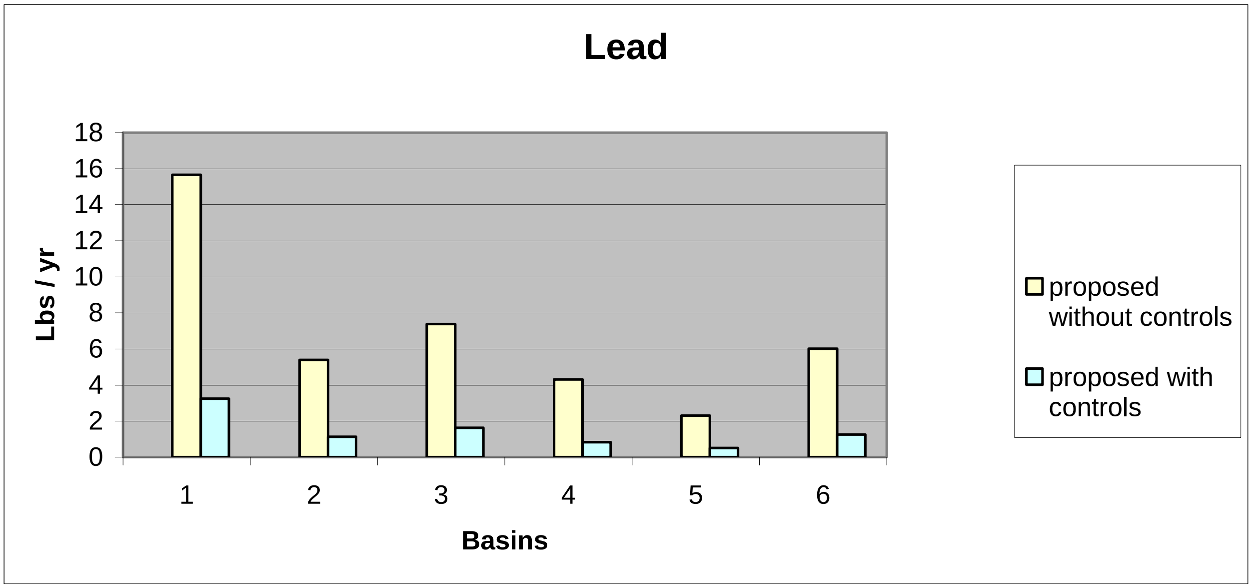
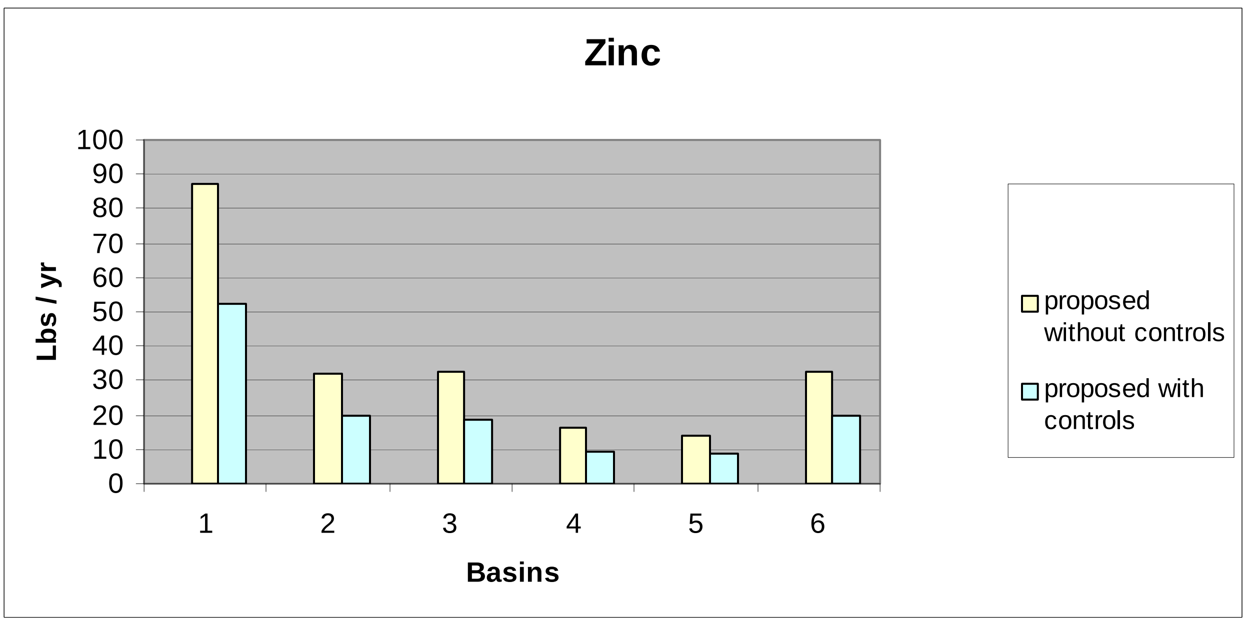
8
7
6
5
4
3
2
1
0
Lbs / yr
1
2
3
4
5
6
Basins
proposed without controls
proposed with controls


Lead
18
16
14
12
10
8
6
4
2
0
Lbs / yr
1
2
3
4
5
6
Basins
proposed without controls
proposed with controls


Zinc
100
90
80
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Lbs / yr
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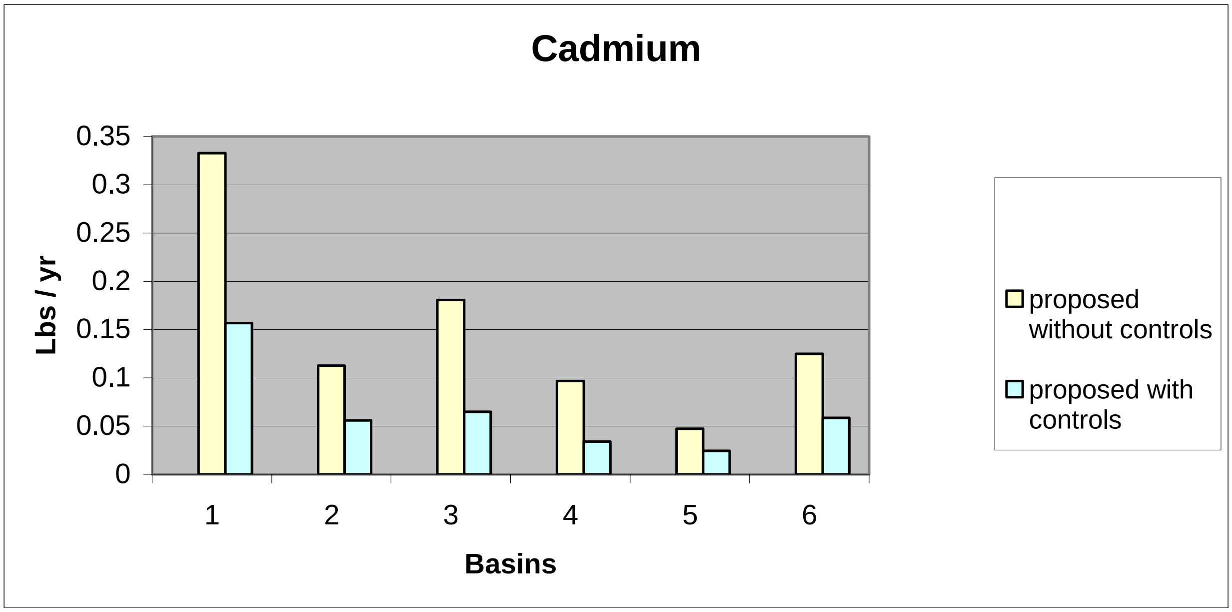
Basins
proposed without controls
proposed with controls



Summary

The SLAMM model has many different tools available for analyzing pollutants within an area. The 80% pollutant reduction achieved through the use of water quality ponds and infiltration areas in this study could be accomplished by using any combination of parameters available through the WINSLAMM modeling program. Exhibit 9 shows the Conceptual Storm Water Management planning area along with approximate sizing recommendations in order to achieve the storm water quality and quantity requirements for each basin.

CHAPTER SEVEN

RECOMMENDATIONS

INTRODUCTION

This Conceptual Storm Water Management Plan provides a set of objectives and supporting criteria to guide the development of an effective storm water management system within the Northeast Neighborhood Planning Area. The plan recognizes that storm water management is essential to attaining an attractive, efficient, safe, and healthy urban environment. The recommended storm water management plan thus incorporates compatible multi-use planning concepts and recognizes the opportunities provided as well as the constraints imposed by other community needs, such as park and open space, transportation, and water supply. The study also prescribes the infiltration of storm water, and recommends storm water activities that mitigate the adverse impacts of development on water resources to the maximum extent practicable.

STORM WATER RUNOFF QUANTITY

Peak runoff rates from potential development shall not exceed existing runoff rates. The existing City of Fitchburg Storm Water Ordinance requires restriction of peak flows from post development to pre-development levels for the 2-year, 10-year and 100-year recurrence 24-hour storm events. Disconnected impervious areas are recommended to increase infiltration and reduce peak runoff rates. Detention facilities can be a combination of centralized or onsite to meet the regulatory requirements. While peak flow rates will be reduced to pre-development rates, consideration shall be taken to not completely eliminate runoff directed towards any particular outlet so as to not disturb the natural waterway flows necessary to maintain environmental features such as wetlands or other ecological systems.

A "blue-green" storm water management system, which consists of a combination of constructed and natural conveyance and storage facilities, is recommended to the maximum extent possible. Conveyance channels are vegetation-lined preferably "free-form", as opposed to geometrically shaped and are interconnected with natural surface depressions and wetlands, provided that pre-treatment measures are in place. Such a system provides for the temporary storage and conveyance of storm water runoff in the vegetation-lined channels and associated depression and wetland areas, which slow the runoff and allow ponding and infiltration. These systems can also be designed to be beautiful and diverse and can incorporate other associated activities such as walking trails and educational components.

Infiltration

Additional infiltration requirements for areas developing within the Northeast Neighborhood Planning Area are recommended. For residential and non-residential developments, practices shall be designed to infiltrate sufficient runoff volume so that post-development infiltration volume shall be at least 100% of the pre-development infiltration volume, based upon average annual rainfall. The applicant shall also design infiltration systems and pervious surfaces to meet or exceed the estimated average annual recharge rate (7.6 inches per year), based on continuous simulation. These infiltration practices will be required unless the applicant can demonstrate that the NR 151 variance requirements are met. Source control should be the goal of infiltration and natural infiltration and recharge areas shall be protected and maintained to the maximum extent possible. Alternative infiltration measures such as rain gardens, biofiltration, pervious parking lots, and bioswales are strongly encouraged but maintenance and effective implementation are key components that must be addressed.

STORM WATER RUNOFF QUALITY

Total suspended solids (TSS) are typically used as an indicator constituent within the Wisconsin Department of Natural Resources regulations because most other pollutants, particularly metals, often attach to suspended solids. The Department reasons that when total suspended solids are removed, a similar percentage reduction in other pollutants is also achieved. The Wisconsin Department of Natural Resources as well as Dane County and the City of Fitchburg regulations require an 80 percent reduction in TSS during construction and after development compared to no runoff management controls. Within the next year or so, the Department is expected to release a Total Maximum Daily Load (TMDL) limit for the entire watershed that will list the maximum pollutant load it can receive and still meet its water quality standards.

With the introduction of best management practices including the introduction of grass swales in place of curb and gutter or with the introduction of a wet detention pond, restored wetland, infiltration basin or biofiltration device, particulate solids loadings may be expected to decrease for the drainage areas that are tributary to the control measures. TSS loadings for future development is expected to be lower than for existing conditions because of the large amount of agricultural land uses currently in the planning area.

Oil and Grease Control

Best management practices to reduce petroleum in runoff for fueling and vehicle maintenance areas is included in NR 151. Dane County and the City of Fitchburg also require treating the first 0.5 inches of runoff for oil and grease in commercial and industrial areas.

Phosphorus and Eutrophication

As noted earlier in this document, the Wisconsin Department of Natural Resources is currently undergoing a process to implement a Total Maximum Daily Load (TMDL) for phosphorus coming from urban development. Site-specific best management practices designs shall be required that incorporate phosphorus reduction to the most current phosphorus limits at the time of development.

PROTECTION OF NATURAL RESOURCES

The Northeast Neighborhood planning area and surrounding properties have significant natural resource features that require protection. These environmental features include wetlands, woodlands, environmental corridors and waterways. Potential land uses should be designed to protect existing environmentally sensitive areas and to minimize the disruption of normal runoff flows and infiltration recharge areas. Development planning will need to be designed around the natural site constraints. Special consideration should be given to protection of Nine Springs Creek, Swan Creek, and Lake Waubesa that are the receiving waters for this planning area.

Wetland Buffers

We recommend categorizing the wetlands onsite and adjacent to the Northeast Neighborhood into one of three categories. Category 1 wetlands, which include the wetlands within Swan Creek and Nine Springs Creek, are proposed to have a 300-foot setback. Category 2 wetlands are proposed to have a 100-foot setback. Category 3 wetlands include significantly degraded wetlands that are dominated by invasive plant species, and are proposed to have a 75-foot setback. Impervious surfaces shall be kept out of the wetland buffer area to the maximum extent practicable in addition to meeting existing state and county requirements. A minimum of 50% of the distance of the wetland buffer measured horizontally from the delineated wetland boundary shall be established with a native plant community. Best management practices such as filter strips, swales or wet detention basins, that are designed to control pollutants from nonpoint sources may be located in the wetland buffer area. However, all storm water management devices located within the wetland buffer area shall establish a native plant community. Further wetland identification and delineation may be necessary to determine the condition and rating category of wetlands within the planning area. The proposed buffer setbacks are more restrictive than any of the existing regulatory setbacks adopted for this area.

Thermal Controls

Thermal control measures are recommended, however, not required. During the review of any development plans within the Northeast Neighborhood the City and Regulatory agencies shall evaluate the need for thermal control on a case-by-case basis. Thermal control measures could include infiltration, disconnected impervious surfaces, stone crib outlets and submerged outlets for wet ponds.

Additional Groundwater Study Recommendations

While this conceptual storm water management plan discusses general storm water management goals and concepts, the study scope did not evaluate groundwater conditions within the planning area. With the planning area containing or in the proximity of several highly regarded natural resource features, including the Nine Springs Creek and Swan Creek watersheds, additional study is recommended prior to development. This would include a more detailed evaluation of how the proposed development would affect the groundwater system including storm water recharge, water quality and spring flow protection. This could include further evaluation and model updating of the existing Dane County groundwater model or the Nine Mile Spring Inset Model. The models could be updated to simulate the drawdown that a proposed well in or adjacent to the planning area would create in the different vertical layers of the aquifer system at the location of the springs. This will provide an estimate of the maximum and minimum impact a well may cause. The Dane County model could be updated and used to simulate the flow path and travel time of storm water from the proposed storm water infiltration ponds to the point of discharge to surface water. This will provide a more concise description of the fate of the infiltrated storm water, which is necessary to determine if any water quality issues associated with the storm water could impact other users in the aquifer or critical surface water bodies.

We recommend that the City of Fitchburg continue to work with Dane County and other municipalities within Dane County in coordinating a regional update to this Dane County groundwater model. Additional water quantity and quality information for Nine Springs Creek and Swan Creek would be beneficial for calibrating inset models for each of these subwatersheds.

Public Education and Involvement

Public education and involvement are the final but key components to a successful storm water management plan. Existing public education materials published by the Wisconsin Department of Natural Resources and the University of Wisconsin Extension cover topics such as general water quality education; illicit discharge detection and elimination; onsite reuse of leaves and grass clippings; pet waste collection; fertilizer and pesticide usage; disposal of waste oil and other hazardous materials; riparian landowner shoreline management; environmentally sensitive land development; and infiltration of residential storm water runoff. The program must target businesses and activities that may pose a storm water contamination concern and must include education of designers and contractors. The educational materials may be distributed at the City Hall, the public library, citizen centers or through mailings with utility bills. Interpretive signage can also be employed throughout the development, particularly in park and trail spaces, to educate the public on storm water management issues. To be effective, the selected options must use a mix of appropriate strategies to address viewpoints and concerns from a variety of audiences.

To foster an active and involved community, which is crucial to the success of any storm water management program, a public involvement and participation program shall be implemented to notify the community of all storm water improvement activities and encourage input and participation from local residents. Examples include: storm drain stenciling; public meetings and citizen panels; citizen water quality monitoring; storm water workshops; community cleanups; citizen watch groups; "Adopt a Stream" groups; or "Give Water a Hand" programs as promoted by the University of Wisconsin Extension. In general, each of these activities will include citizen volunteers but will require impetus, oversight and supervision from the City.

APPENDIX A

APPENDIX A

STORM WATER MANAGEMENT STANDARDS

Northeast Neighborhood Planning Area
Conceptual Storm Water Management Plan

Parameter	DNR Code 151	Dane County	City of Fitchburg	Northeast Neighborhood
Peak Runoff Rate	Maintain pre-development peak rate for 2-yr 24-hr storm.	Maintain pre-development peak rates for 2-yr and 10-yr 24-hr storms. Safely pass 100-yr 24-hr storm.	Maintain pre-development peak rates for 2-yr, 10-yr, and 100-yr 24-hr storms.	City of Fitchburg Standard
Infiltration (Residential)	Post-development 90% of pre-development; or infiltrate 25% post-development runoff volume from 2-yr 24-hr storm. Max. 1% site required for infiltration area.	Post-development 90% of pre-development. If > 1% infiltration area, can meet estimated ave. annual recharge.	Same as Dane County	Post-development 100% of pre-development & meet estimated average annual recharge.
Infiltration (Non-residential)	Post-development 60% of pre-development; or infiltrate 10% post-development runoff volume from 2-yr 24-hr storm. Max. 2% of site required for infiltration area.	Post-development 60% of pre-development. If > 2% infiltration area, meet estimated ave. annual recharge.	Same as Dane County	Post-development 100% of pre-development & meet estimated average annual recharge.
Wetland Protection	75 ft. ORW & ERW & wetlands in ASNRI. 50 ft. highly susceptible wetlands. 10% of ave. wetland width (10 ft. - 30 ft.) less susceptible wetlands.	75 ft. setback for all structures.		300 ft. Category 1 Wetlands 100 ft. Category 2 Wetlands 75 ft. Category 3 Wetlands
Total Suspended Solids (TSS)	Reduce 80% based on ave. annual rainfall as compared to no runoff management controls	Reduce 80% based on 1-yr 24-hr storm event.	Same as Dane County	City of Fitchburg Standard
Thermal Control		Reduce temp. runoff within watershed of waterway identified as a Cold Water Community by the DNR.	Same as Dane County	Thermal control treatment recommended at all outets

APPENDIX A

STORM WATER MANAGEMENT STANDARDS

Northeast Neighborhood Planning Area
Conceptual Storm Water Management Plan

Parameter	DNR Code 151	Dane County	City of Fitchburg	Northeast Neighborhood
Soil Erosion	80% of TSS to Maximum Extent Possible	Off-site soil loss limited to 7.5 tons per acre annually	Same as Dane County	City of Fitchburg Standard
Oil and Grease Control	BMPs to reduce petroleum in runoff for fueling & vehicle maintenance areas.	Potential for oil or grease, first 0.5 in. runoff treated (Commercial/Industrial)	Same as Dane County	City of Fitchburg Standard

Definitions:
ORW = Outstanding Resource Water as determined by the Wisconsin Department of Natural Resources
ERW = Exceptional Resource Water as determined by the Wisconsin Department of Natural Resources
ASNRI = Area of Special Natural Resources as determined by the Wisconsin Department of Natural Resources
TSS = Total Suspended Solids
BMP = Best Management Practice

APPENDIX B

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February 22, 2007

Mr. Kevin Contardi
Ruekert-Mielke
W233 N2080 Ridgeview Parkway
Waukesha, WI 53188

Re: Native Landscape Standard Installation, Management, and Performance Standards, Fitchburg Northeast Neighborhood Plan, Dane County, Wisconsin

Dear Kevin:

In conjunction with the City of Fitchburg's NE Neighborhood Plan, Natural Resources Consulting, Inc., is please to provide you with the following "Standard Specifications for Native Landscaping" within the wetland buffers, stormwater management devices (basins, swales, rain gardens, etc.), and other open space areas where native landscaping may be required. These following standard specifications include sections presenting the 1) Site preparation requirements; 2) Seed and plant installation requirements; 3) Management requirements; and 4) Site performance standards. These specifications are intended to be somewhat general in nature to allow for flexibility to accommodate site specific designs. NRC recommends that a site-specific Native Landscape Plan is provided to the City of Fitchburg for review and approval which will address and specify all components of this standard specification document.

1. Site Preparation

<u>Soil Preparation</u>

All areas designated for native landscaping where soil disturbance occurs shall be deeply tilled to loosen the soils to a depth of at least 12 inches following all final land disturbing activities. Following deep tillage, the areas shall be lightly tilled to loosen the surface soils and prepare a seeding bed. Planting areas shall be graded/tilled to a smooth, uniform surface plane with loose, uniformly fine texture soils, and all stones shall be removed in excess of 4 inch diameter. At least 6 inches of topsoil shall overly the subsoil upon final tillage. No further soil disturbing activities shall be implemented following light tillage. Fertilizer shall not be applied to the native landscaping areas unless soil tests indicate a significant lack of nutrients.

Best management practices shall be implemented as necessary for prevention of erosion with the following limitations:

1. Cover crop seeding shall consist of either seed oats or annual rye grass and must be certified free of noxious weed and perennial seed material. In some circumstances such as wet areas these cover crops may be substituted with an annual barnyard grass with prior approval from the City of Fitchburg.

2. Mulch material and erosion control blankets must be free of noxious weed seeds. If a non-synthetic straw mulch is desired the plant material shall be derived from native plants such as little bluestem.

Herbicide Treatment

All native landscape areas shall be treated with a generalized post emergent herbicide, such as Glyphosate ("Round-up" or "Rodeo") according to the herbicide label directions for at least one complete growing season following the final tillage prior to installing seed and/or plant material. Herbicide shall be applied after vegetation emerges but prior to seed production. Typically, 3 to 4 herbicide applications will be necessary through one growing season (e.g. May, June, July, and Sept.). However, if the weed-seed bank does not diminish within one growing season, prolonged treatment may be necessary prior to seeding/planting. Exceptions to a full growing season of herbicide treatment may apply with prior approval from the City of Fitchburg such as but not limited to: 1) the presence of steep, highly erodable slopes; or 2) the presence of constructed soils that do not contain a weed-seed bank. However, in such a circumstance at least one generalized herbicide treatment shall be conducted at least 30-growing-season-days following final tillage prior to seed/plant installation.

2a. Native Seed Installation

Native Seeds

A Native Landscape Plan shall be provided identifying the seed mix proposed for any given planting area. In most cases, seed alone will be adequate for native landscape development especially at a larger scale. However, some site specific circumstances may require live plant installation (see follow sections). All native seed shall be purchased and provided PLS (pure live seed) complying with the AOSA (Association of Official Seed Analysts) rules. **Native seed shall be applied at a minimum rate of 200 PLS per square foot.** All seed mixes shall be comprised of at least 15 native species and no single species shall comprise more than 20% of the seed mix (in terms of seeds/sq.ft.). Selected seed mixes must be appropriate for the site conditions accounting for hydrology, moisture, light, slope, and soil type. All proposed seed mixes shall be subject to approval from the City of Fitchburg.

Seeding Methods

The contractor shall plant the native seeds using one or a combination of both of the methods outlined below as appropriate to site conditions. When ever feasible the former of the two shall be implemented.

No-till Drilling
There are drills specifically designed for native seeds. The drills typically have disk openers, multiple boxes for different sized seeds with agitators, and individually springed row units. Generally these implements must be used on firm, dry, level to rolling landscapes greater than one acre in size.

Broadcast
These methods include everything from hand spreading out of buckets to larger tractor mounted spreaders. The broadcast method can be used in variable conditions from wet to dry, level to sloped, but generally on areas less than two acres in size.

Seeding Schedule

The contractor shall plant the native seeds within one of the two recommended seasons. The spring season starts as early as possible on snow-free soils and continues until May 15th. The dormant fall season starts on November 1st and continues until snow cover. Installations of seed done in the summer months can be successful but may require specialized seed mixes and irrigation. For planting schedules proposed outside of what is described above, the contractor shall consult the City of Fitchburg.

2b. Native Live Plant Installation

Native Plants

Installation of live herbaceous plants may be necessary within areas difficult to establish native plants from seed (such as inundated soils) or areas where rapid establishment is necessary (such as steep slopes/highly erodable soils). Live plants shall only be utilized to compliment a native seed mix and does not eliminate the need for applying seed. However, seeding rates may be reduced by up to 50% in areas where live plants are installed. It is recommended that live plant plugs are utilized within the base of wet detention basins, rain gardens, and along the banks of steeply sloped basins.

A Native Landscape Plan shall identify the selected plant species for each planting area. Plants shall be selected that are suitable for the site conditions accounting for hydrology, moisture, light, slope, and soil type. All proposed live plants shall be subject to approval from the City of Fitchburg. Live plants shall be installed at a minimum of one plant per two square feet. All non-dormant plants shall be healthy and vigorous with well-developed leaf, stem and root systems. The minimum stem height of the plant stock shall be 3 inches for most species.

Planting Schedule

Dormant plants shall be planted before May 15 or between September 15 and October 30. Non-dormant plants shall be installed from May 15 or until August 15 assuming there is no risk of frost. Installing after August 15 may cause a risk of plants not "rooting in" before winter and subsequent heaving and death. Installation of plants shall not occur outside of the specified windows, except as approved by the City of Fitchburg.

3. Native Landscape Management

Management of the native landscape areas shall commence for at least 4 years from initial installation of seed and plant material. The following management specifications are intended to be general in nature to allow for flexibility to accommodate site specific management issues. A short and long term management plan shall be outlined within the Native Landscape Plan and is subject to approval by the City of Fitchburg.

Mowing

The native landscape areas shall be mowed at a height between 8 and 12 inches and shall occur prior to annual weeds producing seed. Mowing shall be repeated as often as necessary and typically requires mowing every three to five weeks throughout the growing season during the first two years. Mowing too often or too low can be hard on the native plants and should not occur more than 5 times within a single growing season. Mowing shall not be conducted when conditions are too wet resulting in significant soil disturbance. When annual weed growth begins to diminish mowing can be reduced to a single annual event (typically by the 3rd year) or substituted with prescribed burning if practical.

Herbicide Treatment

Periodic spot spraying shall be utilized to kill individual invasive weeds within the native planting areas. Spot spraying shall occur on at least 3 separate occasions (spring, early summer, late summer) annually for at least the first 3 years following seeding. Herbicide spot spraying beyond 3 years will require an evaluation on a case-by-case basis. Portions of the native landscape areas with heavy invasive weed infestation may require additional seed application if native plant cover is void.

Prescribed Burning

Prescribed burning is used to reduce the standing dead biomass, kill young emerging weeds, set back perennial weeds, kill young woody plants, and provide conditions for native species recruitment and dominance within the native plant community. Although prescribed burns are a very effective management tool, burning may not be feasible depending on various factors including proximity to homes. Prescribed burning shall be evaluated on a case-by-case basis and implemented when and where feasible.

4. Performance Standards

The following performance standards shall be achieved after **four** growing seasons following initial seed and plant installation.

1. Invasive Species: The total cover within each native landscape area by invasive species shall not add up to more than 20% at the end of the forth growing season. Invasive species include all species (non-native and native) identified by the WDNR which can be found at http://dnr.wi.gov/invasives/plants.htm

2. Plant Community Establishment: Average vegetation cover shall exceed 80% after the end of the forth growing season.

A summary vegetation survey report shall be provided to the City of Fitchburg following the forth growing season identifying whether or not the performance standards have been achieved. An action plan for meeting these performance standards shall be provided if they are not obtained by the end of the forth growing season.