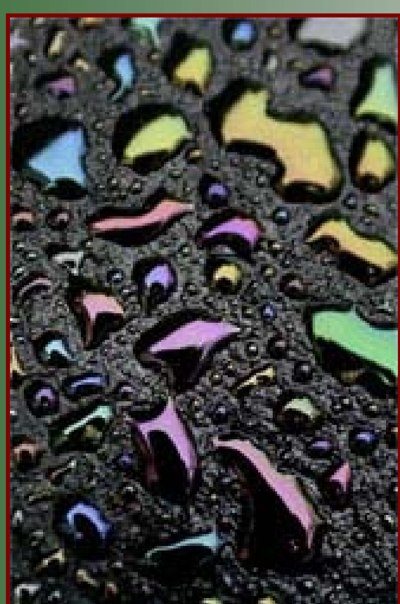
CITY OF LODI, WI

Spring Creek Watershed Study & Urban Stormwater Plan



Prepared by:

MSA PROFESSIONAL SERVICES

TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Prepared for:

Welcome To LODI

TABLE OF CONTENTS

City of Lodi, WI
Stormwater Quality Master Plan
Spring Creek Watershed Assessment

PART i – INTRODUCTION

PART A – URBAN STORMWATER QUALITY PLAN

TABLES

FIGURES

APPENDICES

PART B –SOIL LOSS IN RURAL AREAS

TABLES

FIGURES

APPENDIX

PART C – STREAM CORRIDOOR INVENTORY

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

1.0 INTRODUCTION

This report summarizes the results of a study of Spring Creek and its Spring Creek Watershed. Spring Creek is a Class II trout stream located in Dane and Columbia Counties, Wisconsin, that flows through the City of Lodi in its upstream reaches and discharges into Lake Wisconsin.

The report is divided into the following three sections:

1. Urban Stormwater Quality Plan—a modeling assessment of total suspended solids [TSS] load generation and attenuation in the City of Lodi;
2. Soil Loss in Rural Areas—a modeling assessment of soil loss rates from rural portions of the watershed areas; and
3. Stream Corridor Inventory—a field inspection of channel erosion, riparian buffers and the functional values of Lodi Marsh as they relate to stormwater and nonpoint source pollution.

This study and report was funded in part by a Wisconsin Department of Natural Resources (WDNR) Urban Nonpoint Source Planning (UNPS) grant, and in part by the City of Lodi, with technical support from the WDNR, Columbia County Land Conservation Department and UW-Extension.

2.0 PROJECT HISTORY

The scope of the UNPS grant funding this study originally included an Urban Stormwater Quality Plan for the City of Lodi, public stakeholder meetings, the creation of a stormwater utility, creation public education materials on stormwater issues, and creation of several stormwater related ordinances, including a construction site erosion control ordinance, a post-construction stormwater management ordinance and an illicit discharge ordinance.

The outcome of the stakeholder meetings held in fall of 2007, changed the direction of the work to be done under the City's UNPS grant. After four meetings, City stakeholders did not see a need for a stormwater utility. Consensus was the if there was a problem with water quality in Spring Creek that is was the result, at least in part, of activity in the upper watershed. In response to the strong consensus among City Stormwater Stakeholder Advisory Committee members, then-Mayor Paul Fisk worked with watershed stakeholders, MSA and the WDNR to revise the City's grant scope. The revised scope expanded project to include a study of the entire watershed and stream corridor, and eliminated the creation of a stormwater utility.

3.0 RESULTS

The common parameter that each section of the report quantified was sediment delivery to Spring Creek. The results each section are summarized in Table ES-1, and Sections 3.1-3.3, below.

Table ES-1.
Sources of TSS/Soil/Sediment in Runoff Discharged to Spring Creek

	Area (sq. miles)	Total Annual Load (tons/year)	Load Per Acre (tons/acre/year)
City of Lodi Runoff[1]	1.7	105	0.1
Rural Soil Loss[2]	44.4	4,385 – 56,790	0.1 – 2.0
Creek Channel Erosion[3]	46.6	<5216	<0.2

[1] TSS in runoff generated in the City of Lodi, flowing out of the City or directly to Spring Creek, after attenuation by existing City stormwater practices.
[2] Sediment delivered to creek from non-urban areas only
[3] Estimated erosion rate from 78 observation points prorated along the entire channel length. It is likely that the actual load is less, since observations were only made in locations with at least "slight" erosion.

3.1 URBAN STORMWATER MODEL

WinSLAMM and WinDETPOND modeling indicates that the City of Lodi generates 117 tons TSS in annually, and that the City's 14 existing ponds and existing sweeping program captures 12 tons (10.4%) of this load.

3.2 RURAL SOIL LOSS/SEDIMENT DELIVERY

The total watershed-wide soil loss calculated for the different crop rotations and conservation practices evaluated ranged from 0.3 to 4.3 tons/acre/year in cropped areas of the watershed, which is less than overall watershed-wide average tolerable soil loss rate "T", 4.6 tons/acre/yr. If the assumption that the soil loss rate from un-cropped rural areas of the watershed (near) zero, then the average soil loss rate from all rural areas of the watershed overall, ranges from 0.1 to 2.0 tons/acre/year.

3.3 STREAM CORRIOOR AND MARSH INVENTORY

The stream corridor and marsh inventory included an inspection of riparian buffers, channel erosion, and the functional values of Lodi Marsh as they relate to its ability to attenuate stormwater runoff. The channel erosion and riparian buffer inventory was conducted via field investigation at 48 road crossings and using aerial photos, and was used in support of the rural soil loss estimates described above. The marsh investigation was conducted in the field at eleven (11) observation points within the marsh.

3.3.1 RIPARIAN BUFFERS

The results of the riparian buffer inventory indicate that there is some type of vegetative buffer immediately adjacent to Spring Creek along 92.9% of the stream corridor. This percentage is slightly higher within the City of Lodi, (95.5%) and slightly lower in the rural areas of the watershed (92.8%). The width of buffer varies along the stream corridor; extending from 21-60 feet for 63.8% of the stream and out to over 100 feet along 54.2% of the stream.

Table ES-2. Creek Corridor Buffer Width

	Buffer Width	
	1-5 ft	**>100 ft**
Rural Areas	93%	53%
City of Lodi	96%	81%

3.2.2 CHANNEL EROSION

The field investigation included 48 crossing locations, and 78 observation points at these locations (including left and right banks) where there was at least slight channel bank erosion. Erosion was moderate and 21 sites and severe at 5.

The soils along the stream banks within and upstream of the City were found to be primarily silt loam with a few areas of sandy loam. Locations with moderate and severe erosion were generally found along stretches of channel with sandier soils

The average erosion rate per foot of channel length from the 78 data points was 0.01 tons/ft/year. If this is representative of the amount of erosion occurring along the entire channel length, this would be equivalent to 5,216 tons annually, or 0.2 tons per acre of watershed per year.

3.3 LODI MARSH

Field observations within Lodi Marsh were consistent with WDNR reports that it is a high quality wetland habitat and that the marsh effectively acts as a buffer and filter for stormwater runoff between the creek and upstream areas of the watershed.

4.0 DISCUSSION

Table ES-1 shows that both urban and rural areas of the watershed contribute sediment loads to Spring Creek. Note that the estimated average rate of soil loss from rural areas of Spring Creek Watershed is higher than the amount of sediment delivery by stream bank erosion and carried by stormwater runoff from the City of Lodi. However, pollutant loads associated with these discharges are unknown. Regardless, any effort to improve

Note this study only looked at one type of impact on Spring Creek—inputs of sediment and TSS. Other factors that significantly impact the Creek, and that have not been studied in this assessment, are likely to include temperature, manure, oil and grease, phosphorus, and metals.

4.1 URBAN STORMWATER MODEL

Since the City is not regulated by a municipal WPDES permit, it is under no obligation to improve its current TSS reduction rate. If the City wishes to voluntarily decrease the amount of TSS it discharges in runoff, it could increase the Citywide TSS removal to approximately 19.4% by implementing a weekly vacuum sweeping program, or to approximately 13% by installing pollutant separation devices the three potential locations.

Comparison studies show that an enhanced street sweeping program is significantly more cost effective than pollutant separation devices for increasing the City's overall TSS load attenuation. Furthermore, results of this study indicate little benefit in implementing an enhanced street sweeping program, *and* the separator device. However, it is important to note when comparing the per ton cost-efficiency of street sweeping verses construction of structural devices, that the street sweeping cost efficiency estimate of $6,400 ton/year, is an *ongoing annual* cost, whereas the BMP cost-efficiency estimates represent a one-time construction cost (there is a small annual maintenance cost). Also, important to note is that street sweeping does not reduce the amount of oil and grease discharged to the creek; if this is a significant issue of concern in any of these three these locations, then it could still make sense to install a structural device.

4.2 RURAL SOIL LOSS/SEDIMENT DELIVERY

The estimated watershed-wide average soil loss from rural areas is heavily dependent on assumptions made due to the lack of available data. For example, it was necessary to assume that data representative of large areas (ie Lake Wisconsin Watershed) is representative of smaller areas contained within it (Spring Creek Watershed) and that cropping and tillage practice data for Columbia County is also representative of Dane County. Therefore the results of this study should be used as an estimate of soil loss/sediment delivery rates for various crop rotation-conservation practice combinations, rather than as a definitive determination of soil loss watershed-wide value. In spite of the limitations described above, the modeling results are still useful for identifying locations within the watershed with a high soil loss, and understanding what crop rotation types and conservation practices could minimize the actual soil loss and/or sediment delivery to local waterways.

4.3 STREAM CORRIOOR AND MARSH INVENTORY

All of the data points for the erosion assessment were taken at locations where at least "slight" erosion was at was observed. Therefore, it is likely that the average erosion rate from these observation points prorated over the entire length of stream has over-estimated the amount of channel erosion watershed-wide, report in table ES-1.

5.0 RECOMMENDATIONS

1. Disseminate this report to watershed stakeholders.
2. Educate residents of the City of Lodi, and the counties, townships and landowners responsible for rural areas of the watershed in efforts to improve and protect Spring Creek.
3. Use Figures B1-B12 to identify areas with highly and moderately erodible soils. Limit cropping in the severely erodible areas; in moderately erodible areas plant crop rotations with a low soil loss potential and implement conservation practices such and low- or no- tillage farming, filter strips and contouring.
4. Conduct an inventory of animal operations in the watershed, and use this information to add nutrient application data to modeling. Use this modeling to identify area of the watershed with high pollutant load potential, and focus pollutant reduction efforts in these areas.
5. Maintain and enhance the current network of riparian buffers
6. Improve stream buffers to be consistent with minimum standards of Conservation Practice Standard 393, especially along areas of the creek draining highly erodible farm lands.
7. Maintain and enhance the buffering capacity of Lodi Marsh.
8. Conduct an erosion inventory along all navigable reaches of the Spring Creek.
9. Stabilize eroding channel banks.
10. Restrict land uses along the channel bank that may cause an increase in channel erosion.
11. The City of Lodi should implement a weekly vacuum sweeping program.
12. Continue to fund and encourage citizen monitoring programs, to better understand and characterize the sources and impacts of pollutants from the watershed.
13. Sample creek banks for nutrient content in eroded soils
14. Sample farm field runoff for nutrient content in sediment-laden runoff
15. Conduct additional studies of pollutants other than sediment and TSS that may be impacting the creek, such as temperature, manure, oil and grease, phosphorus, and metals.

1.0 INTRODUCTION

The City of Lodi is located in the downstream reaches of the Spring Creek Watershed. Spring Creek is a Class II trout stream; its east and west branches flow into the City from the south and east, and converge near the intersection of Main Street and Portage Street. After converging, the creek meanders through the downtown, flows north along Fair Street, and ultimately discharges into Lake Wisconsin approximately 3 miles downstream of the City. In addition to being a Class II trout stream, four miles if Spring Creek upstream of Lodi in Dane County are classified by the WDNR as an exceptional resource water (ERW).

2.0 SPRING CREEK BRANCHES & WATERSHED

Spring Creek's 46.6 square mile watershed, includes portions of Dane and Columbia Counties, and is predominantly comprised of agricultural lands. The exceptions being the City of Lodi (approximately 4%) in the downstream reaches of the watershed, and the northern half of the Village of Dane (approximately 1%), in the upstream reaches. Upstream of the City the stream is comprised of three main branches: east, west and middle, which converge into the main trunk just upstream and within the City.

Spring Creek's east branch drains 9.6 square miles of the overall watershed (approximately 20%), and is the branch with the coldest water[1]. The middle branch drains 9.8 square miles of the watershed (21%) and is an ephemeral waterway that joins the west branch upstream of the City and downstream of Lodi Marsh. The west branch of Spring Creek, drains 16 square miles of the watershed (approximately 34%) and originates in Lodi Marsh. The remaining 11.1 acres of the watershed drain to the creek's main branch. These branches and their respective subwatersheds are illustrated in Figure I-1 of this report.

Lodi Marsh is a 400 acre wetland complex on the Dane-Columbia County line that is owned by the DNR and designated as a state natural area. The marsh is dominated by cattails, bulrushes, and sedges, and home to a diversity of animal and insect species indicative of high quality prairie and wetland habitat. According to WDNR reports, the wetland helps buffer the stream from the impacts of agricultural activities in the upstream watershed. More information on Lodi Marsh can be found in Section C of this report.

3.0 ISSUES OF CONCERN

According to the WNDR, Spring Creek has, in recent times, experienced a decline in the natural reproduction of trout and in a number of macroinvertebrate species indicative of good water quality[2]. These effects are noticed downstream of the City of Lodi, which has been the cause of concern to some. Although some significant trout spawning does occur in the riffles within the city limits, the stream has been straightened and lacks suitable cover for fingerling fish. Furthermore, past fisheries surveys have found a few cold water and a few pollution intolerant indicator species in the creek, but more pollution tolerant species (white suckers and creek chubs) than coldwater special were found overall. The WDNR has made efforts to address the declining trout population by constructing about

---

[1] Schlimgen, Jason, 2003, *Spring Creek Watershed.*
[2]WDNR, July 2002, *Lower Wisconsin State of the Basin Report.*

one mile of stream habitat improvement work on some sections and by placing limits on the size fish that can be kept[3].

According to the WDNR, urban and rural land uses within the watershed have both contributed to the decline of the creek. Soil loss from farm fields, sedimentation due to bank erosion and inputs from nearby barnyards are among the top rural issues contributing to problems in the stream. Growth in housing and industrial developments in and around the City of Lodi are believed to be the main source of problems from urban areas, as these land uses contribute a large volume urban stormwater runoff to the creek.

One issue of concern related to urban area impacts is hot pavement heating up runoff and causing *thermal pollution*. Impervious surfaces also decrease infiltration, thereby decreasing *baseflow*, the flow of cool groundwater to a stream, thereby further accelerating the rise in stream temperature. This can have lethal effects on trout fish populations. It has been estimated by some at the WDNR that when the watershed exceeds 8% impervious cover, the water temperature will be too warm to support a trout fish population. Spring Creek Watershed is roughly estimated to be 6% - 7% percent impervious under current conditions, based on county land use mapping and the estimated percent impervious area of each land use type.

4.0 IMPETUS FOR CURRENT WORK

In September and October 2007, then-Lodi Mayor Paul Fisk convened a Stormwater Stakeholder Advisory committee comprised of residents, business owners, and representatives from the school district and a local environmental group to identify stormwater management priorities and explore the possible creation of a stormwater utility in the City of Lodi. The citizen committee met four times to learn about stormwater issues, existing and potential stormwater management activities in the City of Lodi, Spring Creek and its watershed, and a stormwater utility as a possible financing tool for future activities relating to stormwater management.

At the third meeting much of the discussion centered on participants' concerns about Spring Creek Watershed and the urban versus rural contribution to its current conditions. Although existing studies on Spring Creek do not reflect ecological crisis or severe degradation, participants generally agreed that it was very important to preserve the Creek as viable trout habitat and a treasured natural resource for area residents. Participants understood the importance of proactive planning for stormwater management, especially as urban development continues in the Lodi area. However, some participants were concerned that even if the City of Lodi increases funding for stormwater management activities, because of comparatively small size, it would have a minimal affect on the overall quality of Spring Creek. This sparked a lengthy discussion about shared responsibility among urban and rural residents of Spring Creek Watersheds.

When participants were asked to share their recommendations in writing at the conclusion of the fourth meeting, the most commonly expressed recommendation was the

[3] Larson, Tim, 2005, *Management of Trout Fishery of Lodi Creek.*

need for a comprehensive, watershed-wide study and plan to addresses stormwater and water quality concerns on both a citywide and watershedwide basis. Stakeholders felt that because the City of Lodi is less than 5% of the Spring Creek watershed, anything the City does to improve the quality of its runoff will have negligible impact if the surrounding townships don't do their part.

In response to the shared sentiment among City Stormwater Stakeholder Advisory Committee members, then-Mayor Paul Fisk called a meeting of watershed stakeholders, to discuss the need for a watershed-wide effort. The meeting was held on Tuesday, November 14, 2008 in City Hall, and was attended by representatives of each of the following entities:

- City of Lodi (Paul Fisk, Mayor; Ann Dansart & Eric Thompson, MSA Professional Services, City Consulting Engineer)
- Town of Lodi, (Roger Wetzel, Town Board Chair)
- Dane County (Susan Jones, Lakes and Watershed Commission Director)
- WDNR Fisheries Management Program (Tim Larson)
- WDNR Lower Wisconsin River Basin Team (James "Andy" Morton, Basin Supervisor & Jean Unmuth, Water Quality Specialist)
- Columbia County Conservationist Kurt Calkins planned to attend but was unable due to a work emergency. Mr. Calkins attended subsequent meetings.

The purpose of the meeting was to determine whether there was interest among group members in working on watershed-wide planning effort, and if so, how it could best be accomplished.

The group decided it was in favor of working together on a watershed plan, and all entities were willing to support and/or participate in the effort at some level. After several meetings, the group decided that the preliminary watershed planning effort (to be completed by MSA and paid for in part by the City's Urban Nonpoint Source (UNPS) grant) , at the sacrifice of other previously planned activities, including the creation of a stormwater utility. The plan was to use existing available data to characterize the current state and overall quality of Spring Creek and its tributaries, and identify current threats to the quality of the stream. Each entity represented at the meeting agreed to support the watershed planning and restoration process by undertaking specific tasks, including those listed below.

- Dane[4] and Columbia Counties agreed to compile and summarize all of its water quality, runoff and land use/cover information on Spring Creek watershed and provide this information to the City of Lodi and its consulting engineer for incorporation into the overall watershed-wide planning effort. Dane County also agreed to investigate and follow-up on rural or agricultural lands within Dane County found to be contributing excessively to water quality impairment of Spring Creek.

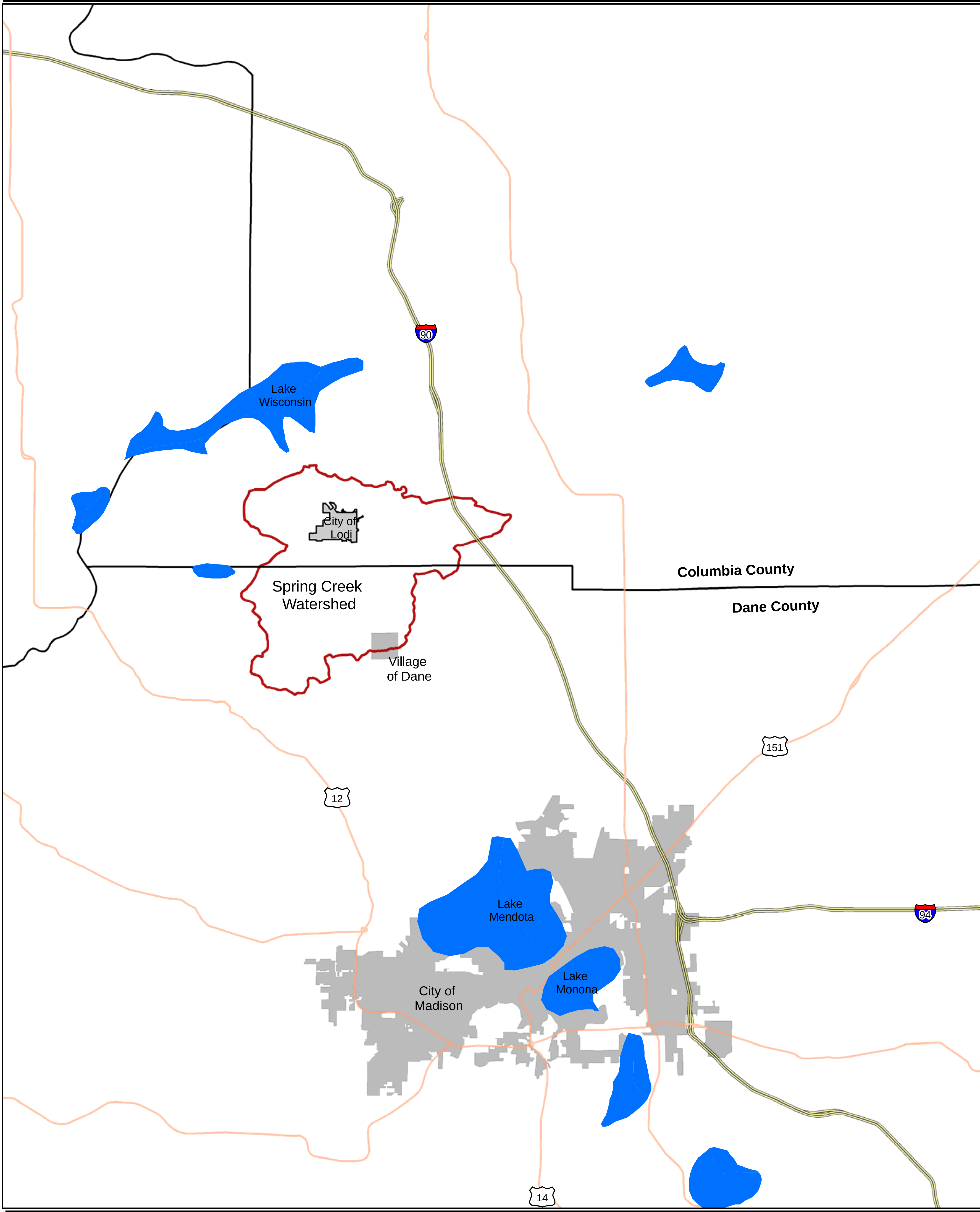
[4] Dane County subsequently decided to limit its involvement in the study and informed MSA that it could offer only limited support due to other higher priorities.

- WDNR Fisheries Management Program agree to compile, and summarize all information on Spring Creek fisheries and past habitat restoration efforts, and provide this information to the City of Lodi and its consulting engineer for incorporation into the overall watershed-wide planning effort.

- WDNR Lower Wisconsin River Basin Team agreed to compile, and summarize all of its water quality data and watershed information and provide this information to the City of Lodi and its consulting engineer for incorporation into the overall watershed-wide planning effort.

- City of Lodi agreed to working with its consulting engineer to compile the information provided by Dane County and WDNR, and refine the scope of its current stormwater analysis and planning efforts to include an analysis of the impact of Lodi runoff on Spring Creek within the context of the entire Spring Creek Watershed, including areas outside the City.

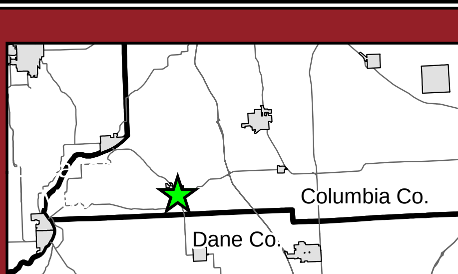
- Town of Lodi was supportive of the efforts, and agreed to have representative a representative serve on a possible future planned watershed consortium.



SPRING CREEK WATERSHED LOCATION

FIGURE i-1

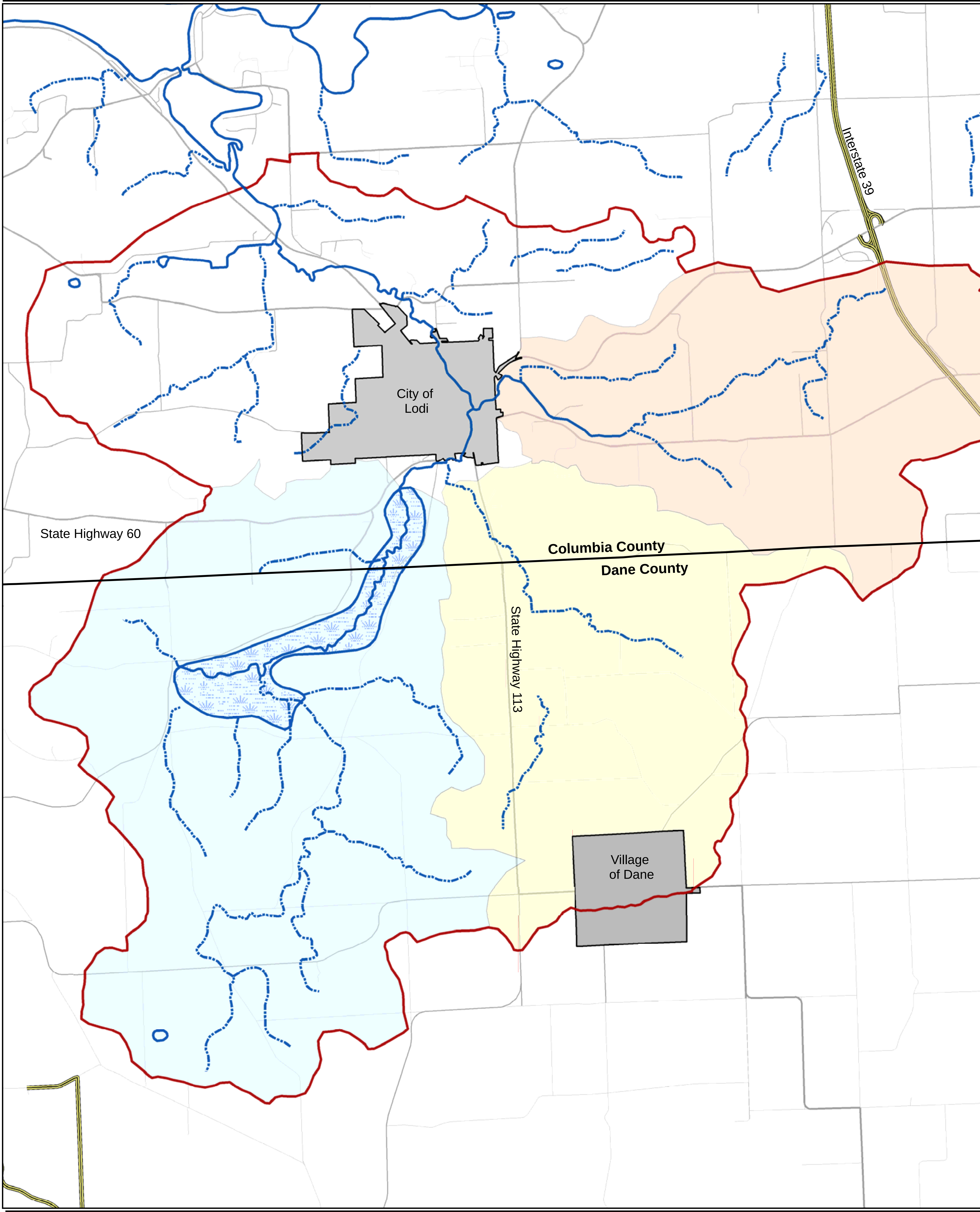
Spring Creek Watershed — *Dane and Columbia Counties, Wisconsin*



Feet

Spring CreekWatershed
Municipal Limits

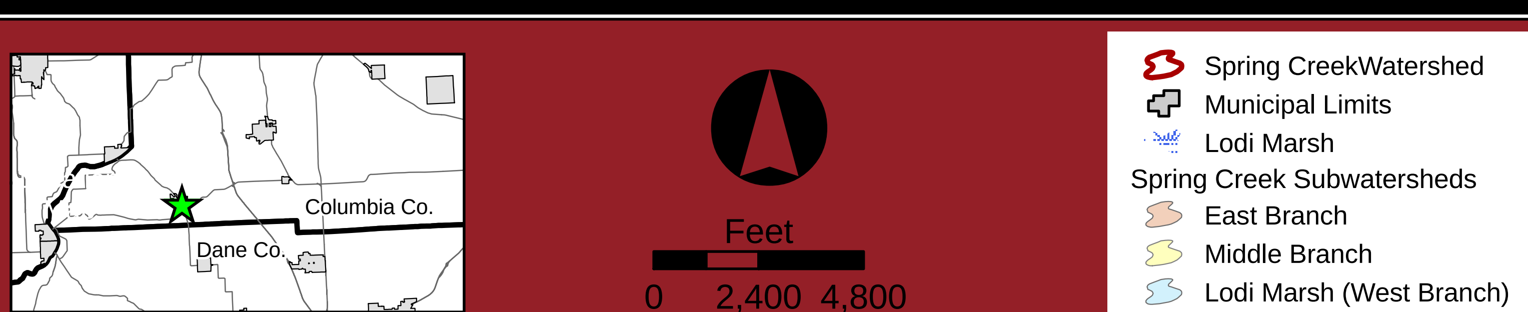
Drafted - LSR, Date - 06-04-08, File - g:/projects/...



SPRING CREEK WATERSHED OVERVIEW

FIGURE i-2

Spring Creek Watershed *Dane and Columbia Counties, Wisconsin*



Drafted - LSR, Date - 06-04-08, File - g:/projects/...

1.0 INTRODUCTION

This section of the report documents the findings of a study of the City of Lodi, conducted to determine the amount of total suspended solids (TSS) generated by stormwater runoff, captured by management practices and subsequently discharged from the City into Spring Creek. The study also identifies and evaluates two alternatives for improving TSS reduction.

The water quality modeling done for this report was performed to most accurately represent the *actual* amount of suspended solids generated within city limits and attenuated by Best Management Practices (BMPs). Under a municipal WPDES permit, some areas of a city are not allowed to be included in TSS generation calculations, and credit is not allowed for pollutant attenuation achieved by BMPs within these areas. Although the City of Lodi is not currently regulated by a Phase II WPDES municipal permit (under NR216.07(6)(b) and NR151.13), if it becomes regulated the future, the water quality calculations will need to be revised to conform to WDNR protocol for regulated WPDES communities. Note that as of the 2000 census, the City population was 2,882. If the its population exceeds 10,000 at some future time, it will require permit coverage, and be required to achieve a 40% reduction in total suspended solids in runoff, as compared to no controls.

The findings of this study are taken from a detailed water quality model of the City created using WinSLAMM and WinDETPOND software. The model was used to evaluate the TSS generated by existing land use with City and the reduction provided by 14 existing structural stormwater management structural BMPs within the City's stormwater drainage system and also the City's current street sweeping program. This study found the following:

TABLE A-1
City of Lodi
Current Total Suspended Solids Reduction Performance

Citywide Annual TSS Load	117.0 tons/yr
TSS Removed by Existing Street Sweeping Program (monthly, mechanical sweeping Citywide + weekly sweeping downtown, no parking controls)	2.7 tons/yr
Additional TSS Removed by existing structural BMPs	9.7 tons/yr
Total TSS Removed	12.4 tons/yr
TSS Reduction Rate	**10.6%**

The WinSLAMM model was also used to evaluate possible approaches for improving the City's TSS load reduction, including three enhanced street sweeping programs and installation of pollution separation devices in three potential locations. Results of these evaluations are summarized in Table A-2.

TABLE A-2
City of Lodi
Possible approaches for increasing Citywide TSS Reduction Performance

Option	BMP	Cumulative TSS Removal		Cumulative Additional *Annual* Cost (2009 dollars)
1	Existing Sweeping/BMPs	12.4 tons/yr	10.6%	$0
2	Install pre-fabricated manhole[1] devices (Vortechnics or similar device) in three locations	14.0 – 15.9 tons/yr	12.0% – 13.7%	$17,000[2]
3	Enhanced Street Sweeping Program (weekly, mechanical street sweeping, no parking controls)	15.6 tons/yr	13.3%	$11,000[3]
4	Enhanced Street Sweeping Program (weekly, high-efficiency street sweeping, no parking controls)	22.6 tons/yr	19.4%	$20,000[4]
5	Enhanced Sweeping Program #4 + Vortechnics Devices in three locations (options 2 + 4)	22.6 – 23.8 tons/yr	19.4% - 20.4%	$37,000

2.0 WATER QUALITY MODELING

The findings of this study are taken from a detailed WinSLAMM (Version 9.3.3) and WinDETPOND (Version 8.4.2) model of the City's stormwater management system. WinSLAMM is a Wisconsin Department of Natural Resources (WDNR) approved model recommended for use in determining TSS removal rates from stormwater management practices for assessment of compliance with WPDES requirements (see notation NR216.07(6)(b) – "The department believes that computer modeling is the most efficient and cost effective method for calculating pollutant loads. Pollutant loading models such as SLAMM, P8 or equivalent methodology may be used to evaluate the efficiency of the design in reducing total suspended solids.") 'WinSLAMM' abbreviates "Source Loading and Management Model [for Windows]"

WinSLAMM was originally developed to better understand the relationships between sources of urban runoff pollutants and runoff quality. It has been continually expanded since the late

[1] According to WDNR, properly size Vortechnics Devices can achieve up to 19% TSS removal. However, due to the large tributary watersheds, the devices may not always achieve this level of performance. The range of values shown in the table represents 10%-19% average annual TSS removal efficiency applied to loads generated in the area treated.
[2] Based on $60,000 per device cost estimate, from vendor. Assumes devices are financed over 15 years at an interest rate of 4.2%, plus $1,000 annually for cleaning.
[3] Includes the cost of additional labor associated with more frequent street sweeping, estimated with data provided by City staff to be $11,000 annually.
[4] Includes the cost of additional labor associated with more frequent street sweeping, estimated to be $11,000 annually, with data provided by City staff. Also includes the purchase of one high efficiency vacuum street sweeper, at a cost of $225,000 financed at 4.2% over a 15- year life-span, minus the estimated cost of the City's current street sweeping capital costs (replacing one mechanical sweeper [$129,000] every fifteen years).

1970s and has been revised to include a wide variety of source area (runoff and pollutant generators) and outfall control practices (runoff and pollutant management practices). WinSLAMM is based on actual field observations and has minimal reliance on theoretical processes.

Input data required by WinSLAMM for each model application includes a number of data files that describe local meteorological and hydrological conditions and pollutant loading characteristics. These files are prescribed for use in the WinSLAMM model by the USGS Wisconsin Water Science Center and include parameter files for rainfall, pollutant distribution, runoff coefficients, particulate solids concentrations, and pollutant delivery data.

2.1 RAINFALL DATA

The USGS has evaluated rainfall data collected across the state of Wisconsin for many years and has identified annual rainfall records for five locations in the state that are felt to be representative of a 'typical rainfall year'. For Lodi, the closest rainfall record recommended for use in water quality modeling is the Madison rainfall record for 1981. When simulations are executed for a typical rainfall year it is necessary to eliminate the winter season where precipitation falls as snow or ice. The SLAMM model cannot accommodate snowfall and runoff from snowmelt events. The range of winter dates applicable to the Madison rainfall data run from December 2 to March 12. Thus, the single-year simulation runs from March 12 to December 2.

It has been determined by the USGS and WDNR that a single year's simulation does not fairly represent the impact of street sweeping. Accordingly, a second rainfall record consisting of five consecutive years data must be used for street sweeping analyses. For Lodi, the rainfall gauge was again the Madison rainfall gauge.

2.2 WinSLAMM POLLUTANT LOADING FILES

Pollutant loading files required by the WinSLAMM model include a *Pollutant Probability Distribution File, Runoff Coefficient File, Particulate Solids Concentration File, Particulate Residue Reduction File, and a Street Delivery Parameter File.*

The *Pollutant Probability Distribution File* describes the pollutant loading from different source areas (land use types). This data is based upon actual pollutant loading collected from the study area or region.

The *Runoff Coefficient File* describes parameters specific to different source areas (land use types) that determine the runoff volumes resulting from rainfall events of different depth.

The *Particulate Solids Concentration File* contains parameters allowing the WinSLAMM model to determine the weight of particulate solids loadings resulting from runoff events of different volumes. The particulate solids concentration file includes data measured by the USGS from source areas including residential, commercial, and industrial rooftops; residential lawns; residential driveways; residential, commercial and industrial streets; commercial and industrial parking lots; freeways; and undeveloped areas.

The *Particulate Residue Reduction File* describes the fraction of total particulates that remains within the drainage system after rainfall events and so do not reach the system outfall.

The *Street Delivery Parameter File* contains data describing the fraction of total particulates that do not reach the outfall during a rain event, for different rain depths and street textures

2.3 MODEL PARAMETER FILES

The following model parameter files were entered into the WinSLAMM model(s) for evaluation of the City of Lodi's stormwater management system.

Rainfall Files -	***WisReg - Madison WI 1981.RAN***
	WisReg – Madison Five Year Rainfall.RAN
Pollutant Probability Distribution File -	***WI_GEO01.ppd***
Runoff Coefficient File -	***WI_SL06 Dec06.rsv***
Particulate Solids Concentration File -	***Wi_avg01.psc***
Particulate Residue Delivery File -	***Wi_dlv01.prr***
Street Delivery File:	
Residential/Other -	***WI_Res and Other Urban Dec06.std***
Institutional/Commercial/Industrial -	***WI_Com Inst Indust Dec06.std***
Freeway -	***Freeway Dec06.std***

2.4 WATERSHEDS, LAND USES, SOURCE AREAS, AND SOIL TYPES.

Watersheds are the sources of runoff and pollutants simulated by the program. WinSLAMM is capable of modeling only one watershed at a time containing up to six discrete categories of *land uses*: residential, institutional, commercial, industrial, freeway, and other urban areas. Each land use contains specific runoff and pollutant *source areas* including roofs, paved parking/storage areas, unpaved parking/storage areas, playground, driveways, sidewalks/walks, street areas, landscaped areas (small and large), undeveloped areas, isolated/water body area, other pervious areas and impervious areas (directly connected and indirectly connected. Each source area is further categorized by *soil type*, including sand, silt, and clay soil types. It is necessary to manually enter surface area (acres) for each source area within each land use within the watershed to be evaluated.

2.5 WATER QUALITY MANAGEMENT PRACTICES

WinSLAMM allows for assignation of water quality management practices for individual source areas within a land use type, land use types within a single watershed, the drainage system serving a watershed, or the point of discharge of the watershed (see WinSLAMM Modeling Flow Chart, Appendix A-1). Each structural management practice must be defined according to its specific geometry, including storage volume, outlet configuration, infiltration rate, etc. Non-structural management practices such as street sweeping must be defined according to the type and frequency of activity.

The WinSLAMM modeling completed for this study included two types of management practices, street sweeping and structural management practices, including ponds, and outfall filtration devices. Street sweeping is a management practice applied at the *source area* level within the WinSLAMM model. Detention ponds and outfall filtration devices are management practices applied at the *outfall* level in WinSLAMM. However, for this study, structural management practices were modeled using the WinSLAMM expansion module called WinDETPOND. This was necessary because the WinSLAMM batch editor must be used to model a watershed containing more than one type of land use within a given land use category (for example, the land use types single-family residential and multi-family residential, within the residential category). However, the batch editor is not able to route the output from the model to an end-of-pipe treatment device. WinDETPOND can model these outputs provided a certain amount of manual data handling is completed. Additional discussion of the application of WinDETPOND is included in the following section.

3.0 APPLICATION OF WATER QUALITY MODELS

At this time, the City is not regulated by a Phase II WPDES permit, and regulation is not anticipated in the foreseeable future. Thus, the TSS reduction evaluation documented in this study includes the entire area within the corporate limits of the City of Lodi, rather than just the area that would be regulated under such a permit. However, if at some future time, the City is regulated, the SLAMM modeling should be re-run for the regulated area only. The WDNR has provided very specific guidance in the application of water quality models for the assessment of compliance with the TSS reductions required by NR151 and NR216. This guidance is documented in a June 16, 2005 memorandum from Russ Rassmussen (approved by Gordon Stevenson and Eric Rortvedt), titled, “Developed Urban Areas and the 20% and 40% TSS Reductions.” This memorandum is included in its entirety in Appendix A-2 of this report and documents several key issues regarding the determination of the regulated areas within the corporate limits of a municipality regulated by a Phase II WPDES under NR216.07(6)(b) and NR151.13. Additionally, other, “unofficial” WDNR guidance, which was not used in the study, such as awarding reduced or no credit for dry ponds, may be enforced by the WDNR if the City were regulated by a municipal WPDES permit.

3.1 MODEL STUDY LIMITS

The water quality modeling study area includes the entire city limits and those areas outside the city limits that drain to an existing or proposed structural water quality management practice within the City. Areas outside of city limits but draining to a city BMP were included in order to accurately assess the effectiveness of each BMP for its actual hydraulic load.   However, pollutant loads generated in areas located outside of Lodi were “turned off” in order to only include pollutant loads generated within City limits in our assessment. Watershed areas draining to existing or proposed management practices were delineated using the GIS program ArcMap. Delineation of watersheds was completed using four-foot contour topographic maps overlaid with storm sewer system maps. Figure A1 illustrates the project study area and city limits.

3.2 MODEL LAND USE

WinSLAMM can analyze an urban drainage area with up to six different land uses with 14 sources areas per land use. Each source area (such as turf, roofs, parking, playgrounds, and streets) is further classified according to their runoff behavior (for example, whether roofs are flat or pitched, and whether they drain directly to the drainage system or drain onto sandy or clayey soils).

Since data with this level of specificity is not typically available at a municipal or watershed scale, the WinSLAMM model comes with *Standard Land Use Files* (SLU files) which describe the distribution of source areas within a particular land use type. These files have been prepared by the authors of the WinSLAMM model based on studies of Wisconsin communities. The Standard land use files listed in the table below have been approved by the WDNR for use in Wisconsin with WinSLAMM version 9.3.3

TABLE A-3
WDNR APPROVED SLAMM STANDARD LAND USE FILES

Land Use Class	Standard Land Use File
Residential	• Duplex • High density residential with alleys • High density residential without alleys • High rise residential • Low density residential • Medium density residential • Mobile homes • Multi-family residential • Suburban residential
Commercial	• Downtown commercial • Strip commercial • Shopping Center • Office park
Industrial	• Light industrial • Medium industrial
Institutional	• Hospital • School • General institutional
Other Urban	• Cemetery • Airport • Open • Parks
Freeways	• Freeways

The land use classifications in the City of Lodi's assessor database do not correspond directly with the available WinSLAMM standard land use files. To accommodate this, each parcel was assigned a land use classification corresponding to the closest appropriate standard land use type. The first step in this process was to link the city parcel map, and assessor database. Each parcel was then assigned a general land use category based on its assessor database classification. Since the assessment categories are broader than what is needed for SLAMM modeling, and in some cases assessor parcel information was missing or inaccurate, each parcel was then individually reviewed, and refined/revised as appropriate based on the city zoning map, the land use discerned from aerial photos, and/or other additional information provided by the City. Refer to Table A-4 for general information on how parcel land use was assigned.

WinSLAMM standard land use files include adjacent roadway areas. However, since the City's land use files separate out roadway right-of-way, it was necessary to re-categorize right-of-way according to the land use of the adjacent parcels. Where the land use differed on either side of a roadway, the right-of-way was split down the middle and each side was assigned the land use of the adjacent parcel. *Freeway* land use is treated as a separate land use in the WinSLAMM model—and defined as limited access roadways, typically divided. These are assigned the SLU land use category "freeway," however, there are no freeways in the City of Lodi. Figure A-2 illustrates the WinSLAMM land use mapping.

TABLE A-4
City of Lodi
WinSLAMM Standard Land Uses

Assessor Category	Living Units	WinSLAMM Standard Land Use Type
Residential	1	• Medium-Density Residential, No Alley
Residential	2	• Duplex
Residential	>2	• Multi-Family Residential, No Alleys
Commercial	NA	• Strip Commercial
Exempt (Other)	NA	• Institutional, General • Park • Cemetery
Manufacturing	NA	• Light Industrial • Medium Industrial
Varied	NA	• Open

3.3 SOIL CLASSIFICATIONS

Each land use was further sub-categorized according to the underlying soil type. WinSLAMM requires that the soil for all land uses be classified as *sand, silt, or clay*. The table below identifies the soil texture that each soil series identified in the Columbia County Soil Atlas was assigned within the WinSLAMM model. A map of the distribution of soil textures within the study area is shown in Figure A3, 'Soil Texture Map.'

TABLE A-5
City of Lodi
WinSLAMM Soil Classifications

Soil Symbol	Soil Name	Soil Texture	Soil Symbol	Soil Name	Soil Texture
AtB	Atterberry silt loam	Silt	Mn	Military fine sandy loam	Silt
Ca	Channahon silt loam	Silt	Mt	Mt. Carroll silt loam	Silt
Do	Dodge silt loam	Silt	Os	Ossian silt loam	Silt
Dr	Dresden silt loam	Silt	Ot	Otter silt loam	Silt
Gr	Griswold silt loam	Silt	Pn	Plano silt loam	Silt
Ho	Houghton muck	Clay	Rd	Ringwood silt loam	Silt
Jo	Joy silt loam	Silt	Sa	St. Charles silt loam	Silt
Kn	Knowles silt loam	Silt	Sb	Salter fine sandy loam	Silt
La	LaPeer fine sandy loam	Silt	Sd	Sandy Land	Sand
Lo	Lorenzo loam	Silt	Se	Saybrook silt loam	Silt
Me	McHenry silt loam	Silt	Ts	Troxel silt loam	Silt

The size (area) and characteristics of each source area within each land use type was entered into the model according to the distribution within each standard land use file. Land use types were entered into the model according to the total area within each watershed corresponding to each land use and each soil texture. For instance, a watershed may include of medium-density residential land use built atop sandy and silty soils; in such an instance land use for *medium-density residential – sand* and *medium-density residential – silt* were separately entered into the model according to the total area of each land use and soil type within the watershed.

3.4 STREET SWEEPING

The WinSLAMM model is capable of modeling both mechanical and high-efficiency (vacuum) street sweeping. Sweeping intervals may be altered and sweeping may be evaluated with and without parking restrictions. Parking restrictions assume that cars are not allowed to park on streets on days when sweeping is to occur.

Street sweeping frequency data was provided by the City of Lodi Engineering Department. According to City staff, the entire City of Lodi is swept once every four weeks, and the downtown area is swept weekly. The City's current street sweeping program is completed using a mechanical sweeper. The area included in the downtown sweeping area is illustrated in Figure A-4.

The WNDR and USGS have provided the following guidance on their website regarding application of street sweeping to water quality models:

> *"For developed urban areas municipalities [should]......report [TSS load reductions] on an average annual basis. However…Since a single year [does]*

not fairly represent the impact of street cleaning, a series of rainfall files (5 consecutive years) must be used..."

The reason for this requirement is that it was found that identical street sweeping programs provided substantially different TSS reduction rates depending on the annual rainfall record selected for the simulation. It is speculated by the authors of the WinSLAMM model that this is the result of interactions between the randomness of rainfall events and the fixed schedule of sweeping. For example, if one rainfall record has comparatively more rainfall events on Mondays while street sweeping occurs consistently on Tuesdays then many of the pollutants that would be captured by the sweeper will have been washed off by the previous day's rainfall. On the other hand, if rainfalls occur more commonly at the end of the week, then the Tuesday sweeping schedule will capture comparatively more sediment, as there will be more 'dry' days of accumulation prior to the sweeping event. By running five years of rainfall data through the model it was felt that the impact of the randomness of rainfall occurrences would be minimized.

3.5 STRUCTURAL BMPs

3.5.1 Existing BMPs

There are currently 14 structural stormwater quality management devices within the City of Lodi's storm water management system. The City's consulting engineer and Director of Public Works provided construction plans for each device documenting necessary geometric data such as storage volume and outlet device configuration, when available. When not available, the storage volume was estimated using aerial photos and topographic maps. The location of each BMP was identified in GIS and the drainage area tributary to each device was delineated. The land use and soil characteristics of each BMP drainage area was determined by intersecting the land use-soil type and BMP drainage area shapefiles in GIS, and summing the area of each land use and soil type within each drainage area. This information was used to create a unique WinSLAMM model for each BMP drainage area. Output from the WinSLAMM model of each drainage area was consolidated and entered into a WinDETPOND model for the corresponding BMP. WinDETPOND results showed that the cumulative effect of existing structural BMPs and the improved street sweeping program described in the previous section achieved an overall Citywide TSS load reduction of 10.6%. As a result, additional approaches for increasing the City's TSS load reduction were evaluated.

3.5.2 Potential BMPs

City public works staff identified three locations at major storm sewer outfalls to Spring Creek as potential locations for installing of prefabricated pollutant separation or filtration devices; these locations are illustrated on Figure A-5.

Two types of pollutant separation devices were considered: multi-chambered treatment tanks (MCTT's) (filtration devices) and the Vortechs (hydrodyamanic separation device). Both types of devices are discussed in more detail in the following paragraphs.

3.5.2.1 MCTTs

According to the WDNR, properly sized MCTT's can achieve up to 80% TSS removal. Detailed information on these devices can be found in Appendix A-3. For the purpose of this study, MCTTs were not modeled, but instead were evaluated using pollutant removal efficiency and cost data developed by the WDNR and other sources. According these data, properly designed and installed MCTTs may achieve up to 80% TSS reduction, for an up-front cost of $38,000/acre and annual maintenance costs of $2,200/device/year (see Appendix A-3). Based on this information and watershed pollutant load generation rates calculated by WinSLAMM, the cost effectiveness of installing MCTTs on outfalls with the highest pollutant generation rates was evaluated.

3.5.2.2 Vortechs Treatment Unit

A Vortechs unit is a hydrodynamic separation device manufactured by Contech that removes sediment, oil and grease, and floating and sinking debris. Its swirl concentrator and flow controls work together to provide stable storage of captured pollutants. According to the manufacturer, precast models can treat peak design flows up to 25 cfs; cast-in-place models handle even greater flows. The effectiveness of Vortechs devices has been studied by the WDNR; according to their studies, these devices can achieve up to 19% TSS removal, when properly sized (Bannerman, Horwatich, and Bachuber, 2007, *A Preliminary Look at WinSLAMM as Method for Sizing Proprietary Single Chamber Settling Devices*).

3.6 WinDETPOND MODELING

When standard land use files are used to create a WinSLAMM model, the model drainage area may only be comprised of one land use type in each of the following broad land use classes: residential, institutional, commercial, industrial, open, and freeways. Furthermore, only one soil type per land use is allowed. Although the *WinSLAMM Planning File Editor* partially overcomes this limitation by allowing the user to simulate pollutant load and runoff volume from a watershed with any number of standard land use types and soil textures, the Planning File Editor output cannot be subsequently routed through an end-of-pipe treatment device such as a detention pond. It was therefore not possible to create a stand-alone WinSLAMM model that would accurately represent watershed pollutant loading and structural BMP pollutant reduction.

Structural management practices were modeled using the WinSLAMM companion module called WinDETPOND. To accomplish this, the separate WinSLAMM output ('.OPR') files from each standard land use type within the watershed of the BMP being evaluated were manually combined to form a single WinDETPOND input file. ORP files consist of three columns of information: the rainfall event number, the runoff volume at the outfall for that rainfall event, and the particulate loading at the outfall for that rainfall event. ORP data was combined manually by importing each ORP file into MSExcel and summing the runoff volume and particulate loading values for each rainfall event. The resulting output was saved as a comma delimited text file and was renamed to have the necessary ‘ORP’ extension.

A detailed, bullet list explanation of how WinSLAMM standard land use files were used, and how the WinSLAMM output was imported into WinDETPOND, is included in the Appendix A-1 of this report.

3.7 WinSLAMM MODELING

The Lodi rain garden was modeled in WinSLAMM as a biofiltration device, rather than in WinDETPOND, due to WinDETPOND’s limited suitability for modeling dry ponds and infiltration BMPs. It was possible to model this BMP directly in SLAMM, since the area draining to the rain garden only included three land use types, and therefore the process of using the planning file editor and manually combining .ORP files to create the pollutant load file (described in the previous section) was unnecessary.

The Lodi Community Rain Garden is located at the intersection of STH 113 and Pleasant Street and received runoff from a 20.1-acre drainage area. It consists of three adjacent infiltration cells, each with an underdrain and underlain by engineered soil to enhance infiltration of runoff. The amount of runoff that reaches the rain garden is regulated by a flow splitter. Specifically, the manhole upstream of the rain garden routes runoff via a12-inch pipe to the rain garden, until the capacity of the pipe is reached. In larger storms, overflow discharges via a 27-inch pipe.

Since WinSLAMM is not able to model a flow splitter, the amount of runoff and pollutant load in the rain garden’s drainage that actually reaches the rain garden, was estimated by creating a separate model of the flow splitter and its watershed in P8. According to P8 modeling results, approximately 60% of the flow and load that reaches the flow splitter is routed to the rain garden, while the remaining 40% bypasses the rain garden. The reduced flow and pollutant load was modeled in WinSLAMM by manually reducing the amount of these two quantities that reaches the rain garden to 60% of the actual load generated.

Since WinSLAMM’s biofiltration device module does not accommodate modeling rain gardens with multiple cells, the different cells within Lodi’s three-celled rain garden were modeled separately. Specifically, the first cell, referred to as “Cell A” in the construction plans, was modeled as a drainage system device; the areas of the second and third cells, referred to as “Cell B” and “Cell C” in the construction plans, were combined and modeled as a single outfall device. In WinSLAMM the model component titled “drainage system” describes options available to route runoff from source areas to an “outfall”, so by constructing the model in this way we were able to model two rain garden cells “in series”. A check on the validity of this method was done by creating a model of the rain garden and its watershed in P8, which showed similar results.

3.8 DETERMINING THE CITYWIDE ANNUAL TSS ATTENUATION RATE

Citywide cumulative TSS reduction estimates are the result of an algebraic exercise, whereby, the efficiency of successive downstream BMPs are compared to the efficiency of the BMP in question. Each BMP (structural and street sweeping) was modeled independently in WinSLAMM and WinDETPOND. That is, each BMP is modeled assuming that there are no other BMPs within its entire tributary area (ignoring upstream BMPs which discharge to the BMP being evaluated). This is due to WinSLAMM's inability to model BMPs in series.

The cumulative effectiveness of each BMP was determined algebraically by applying the highest efficiency of any downstream BMP in series with the BMP being considered. This is due to WinSLAMM's inability to track the particle distribution (and hydrograph attenuation) being discharged from any single BMP. If the downstream BMP's efficiency is greater than the BMP of concern, the higher efficiency is applied to the TSS loading for the watershed directly tributary to the BMP of concern. For example: BMP 1 is upstream of BMP 2. BMP 1 has a TSS removal efficiency of 60% and BMP 2 has an efficiency of 80%. In this case an efficiency of 80% is attributed to both watersheds (the downstream BMP receives all the flow and TSS from both watersheds). If the efficiency of BMP 1 was 90% then 90% would be attributed to its direct watershed while 80% would be attributed only to the watershed tributary to BMP 2.

Note that this approach introduces several unquantifiable errors in the modeling. The first is that the attenuation of an upstream BMP may reduce the hydraulic demand on a downstream BMP, effectively increasing its residence time and increasing the downstream BMP's TSS removal efficiency. This would tend to make the 'model' results conservative. However, what is more likely, is that the upstream pond will remove some of the more 'settleable' solids, that would then be unavailable for settling within the downstream BMP, reducing the TSS load to the downstream BMP, and subsequently reduce the BMP's TSS removal efficiency.

4.0 RESULTS

4.1 EXISTING CONDITIONS

The total annual TSS load produced by existing land use in the City of Lodi is estimate to be 117.0 tons/year. The following table summarizes the estimated performance of the City’s existing stormwater ponds and street sweeping at removing TSS from the regulated areas within the City.

TABLE A-6
City of Lodi
Existing Total Suspended Solids Reduction Performance

Citywide Annual TSS Load	117.0 tons/yr
TSS Removed by Existing Street Sweeping Program (monthly, mechanical sweeping Citywide + weekly sweeping downtown, no parking controls)	2.7 tons/yr
Additional TSS Removed by existing structural BMPs	9.7 tons/yr
Total TSS Removed	12.4 tons/yr
TSS Reduction Rate	**10.6%**

With its current management practices, the City of Lodi achieves 10.6% attenuation of the pollutant load generated within City limits

4.2 ENHANCED STREET SWEEPING PROGRAMS

Table A-7 compares the relative efficiencies of several alternative street sweeping scenarios for the City of Lodi.

TABLE A-7
City of Lodi
Alternative Street Sweeping Programs TSS Reduction Performance[5]

Description	Frequency	Street Sweeping Only	Street Sweeping + Existing BMPs	Net Increase in Citywide TSS removal[6] (tons/year)	Net Annual Cost Increase	Cost Effectives ($/ton/yr)
Mechanical	Current[7]	2.3%	10.4%	0	$0	NA
	Weekly Citywide	5.9%	13.3%	3.2	$11,000	$3,400
Vacuum	Current	5.1%	12.7%	2.4	$9,000	$3,800
	Weekly Citywide	13.5%	19.4%	10.2	$20,000	$2,000

Note that the cost effectiveness of an enhanced street sweeping program depends on the type of sweeper used and the cost of labor for more frequent sweeping. For example, if the City were to implement (the most rigorous sweeping program

[5] Per WDNR guidance the street sweeping modeling covered five years' of rainfall records. As a result the total TSS load (by weight) determined by the model for five years does not match that of single-year loads. Thus, the percent TSS reductions achieved by street sweeping were applied to single-year loads when for comparing the effectives of structural and sweeping practices and calculating the annual citywide reduction rate.
[6] As Compared to current conditions, with existing BMPs and sweeping program
[7] According to City staff, the entire City of Lodi is swept once every month, and downtown areas are swept weekly.

evaluated) weekly citywide vacuum sweeping, the cost of purchasing a vacuum sweeper would be approximately $225,000. Amortizing this over a lifespan of 15 years makes this an annual cost of $20,500. By comparison, the City estimates that it currently spends $11,500/yr in capital expenses for its current mechanical sweeping program. However, the City estimates that it currently spends $4,600/year in labor costs to sweep its downtown area weekly and the remainder of the city monthly. Under a weekly citywide sweeping program, the required labor would be nearly three times greater, raising the annual labor costs associated with street sweeping by $11,000. The total *additional* annual cost of this street sweeping program would be $20,000. A weekly citywide vacuum sweeping program would remove10.2 *additional* tons of TSS, or approximately $2,000/ton/year. This makes it by far the most cost-effective BMP.

4.3 POLLUTANT FILTRATION/SEPARATION DEVICES

Applying WDNR suggested TSS attenuation rates for pollutant filtration/separate device to the SLAMM predicted TSS loads for areas tributary to each potential pollutant device location produced the results summarized in Table A-8. This table shows that although very effective at reducing TSS loads, the cost of installing MCTTs to treat large areas is comparatively cost prohibitive. By contrast, the Vortechs devices are much more affordable and cost effective. However, their percent removal is so low that if an enhanced sweeping program is implemented, the net benefit of the devices in terms of TSS load reduction is negligible.

TABLE A-8
City of Lodi
Pollutant Filtration/Separation Device
TSS Reduction and Estimated Cost Effectiveness

	MCTT Filtration Device			Vortechs Separation Device		
	TSS Reduction[8] (t/yr)	Annual 15- yr Cost[9]	Est. Cost Effectiveness ($/ton/yr)	TSS Reduction[10] (t/yr)	Annual 15- yr Cost[11]	Est. Cost Effectiveness ($/ton/yr)
OF 27	8.3	$491,000	$ 59,000	0.8	$ 6,400	$ 7,800
OF 45	5.6	$484,000	$ 86,000	0.6	$ 6,400	$ 12,000
OF 46	2.7	$131,000	$ 48,000	0.27	$ 6,400	$ 24,000

[8] Per WDNR MCTT's can achieve up to 80% TSS removal. Value in table represents additional removal after existing street sweeping program, 77.7%.

[9] Based on $38,000 per acre treated per year in capital costs, and $2,200 in annual maintenance. Assumes devices are financed over 15 years at an interest rate of 4.2%, plus $1,000 annually for cleaning.

[10] According to WDNR, properly sized Vortechnics Devices achieve 10%-19% TSS removal. However, due to the large tributary watersheds, the devices may not always achieve this level of performance. The value shown in the table represents 7.77% for the area treated (10% device efficiency minus the amount removed by existing street sweeping program).

[11] Based on $60,000 per device cost estimate, from vendor. Assumes devices are financed over 15 years at an interest rate of 4.2%, plus $1,000 annually for cleaning. Costs may be higher if more than one device is needed in a particular location.

5.0 DISCUSSION & RECOMMENDATIONS

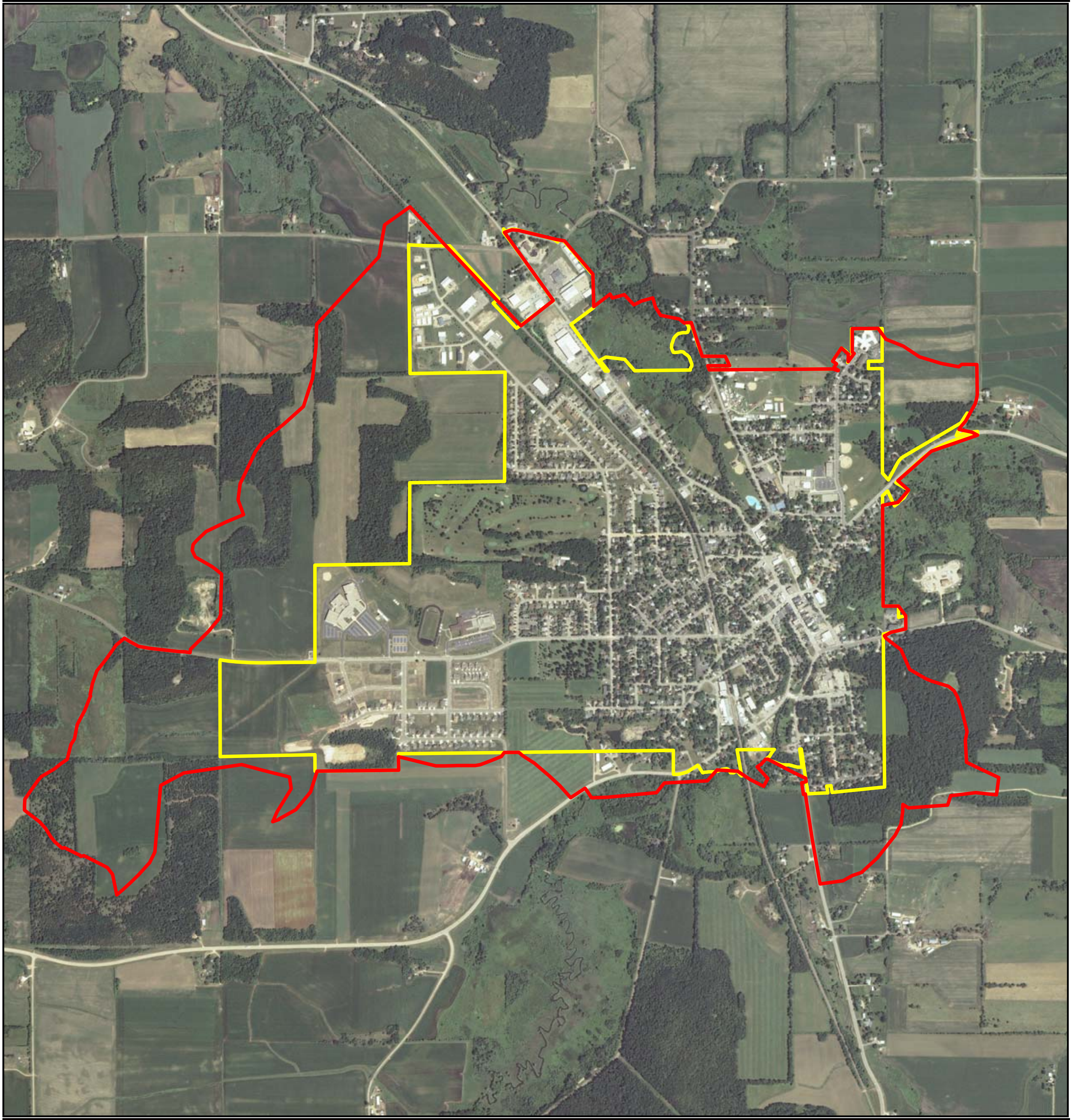
Modeling results of the 14 existing ponds, 3 proposed pre-fabricated separation devices and the most effective enhanced sweeping program could together remove 22.6%-23.8 % of the City's annual TSS load; these results summarized in Table A-9. However, since the City is not regulated by a municipal WPDES permit, it is under no obligation to increase this amount. If the City wishes to voluntarily increase the amount of TSS in runoff, it could increase the Citywide TSS removal to approximately 19.4% by implementing a weekly vacuum sweeping program or approximately 13% by installing pollutant separation devices in the three identified potential locations.

Cost effectiveness comparisons show that an enhanced street sweeping program is significantly more cost effective than pollutant separation devices for increasing the City's overall TSS load attention. Furthermore, results of this study indicate little benefit in implementing an enhanced street sweeping program, AND the Vortechs device (compare scenarios 4 and 5 in Table A-9). However, it is important to note when comparing the per ton cost-efficiency of street sweeping verses BMP construction, that the street sweeping cost efficiency estimate of $6,400 ton/year, is an *ongoing annual* cost, whereas the BMP cost-efficiency estimates represent a one-time construction cost. Also, important to note is that street sweeping does not reduce the amount of oil and grease discharged to the creek; if this is a significant issue of concern in any of these three these locations, then it could still make sense to install a Vortechs device.

TABLE A-9
City of Lodi
Possible approaches for increasing Citywide TSS Reduction Performance

Option	BMP	Cumulative TSS Removal		Cumulative Additional *Annual* Cost (2009 dollars)
1	Existing Sweeping/BMPs	12.4 tons/yr	10.6%	$0
2	Install pre-fabricated manhole[12] devices (Vortechnics or similar device) in three locations	14.0 – 15.9 tons/yr	12.0% – 13.7%	$17,000[13]
3	Enhanced Street Sweeping Program (weekly, mechanical street sweeping, no parking controls)	15.6 tons/yr	13.3%	$11,000[14]
4	Enhanced Street Sweeping Program (weekly, high-efficiency street sweeping, no parking controls)	22.6 tons/yr	19.4%	$20,000[15]
5	Enhanced Sweeping Program #4 + Vortechnics Devices in three locations (options 2 + 4)	22.6 – 23.8 tons/yr	19.4% - 20.4%	$37,000

[12] According to WDNR, properly size Vortechs Devices can achieve up to 19% TSS removal. However, due to the large tributary watersheds, the devices may not always achieve this level of performance. The range of values shown in the table represents 10%-19% average annual TSS removal efficiency applied to loads generated in the area treated.
[13] Based on $60,000 per device cost estimate, from vendor. Assumes devices are financed over 15 years at an interest rate of 4.2%, plus $1,000 annually for cleaning.
[14] Includes the cost of additional labor associated with more frequent street sweeping, estimated with data provided by City staff to be $11,000 annually.
[15] Includes the cost of additional labor associated with more frequent street sweeping, estimated to be $11,000 annually, with data provided by City staff. Also includes the purchase of one high efficiency vacuum street sweeper, at a cost of $225,000 financed at 4.2% over a 15- year life-span, minus the estimated cost of the City's current street sweeping capital costs (replacing one mechanical sweeper [$129,000] every fifteen years).



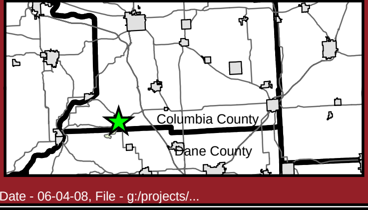
WinSlamm Modeling Area

FIGURE-A1

City of Lodi

Columbia County, Wisconsin

Location Map



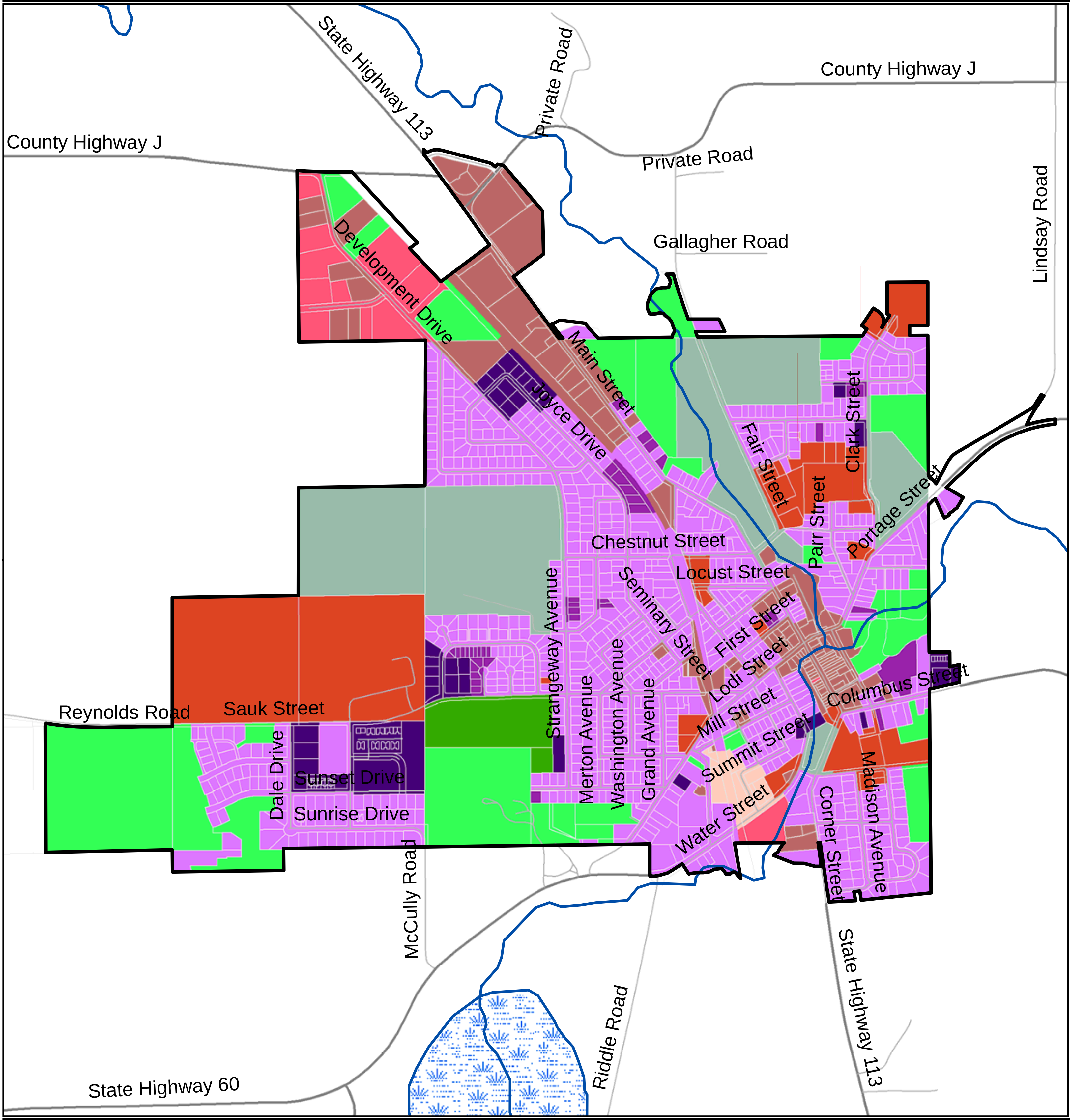
SLAMM Modeling Area

City Limits

Feet

0 2,400 4,800

Drafted - LSR, Date - 06-04-08, File - g:/projects/...



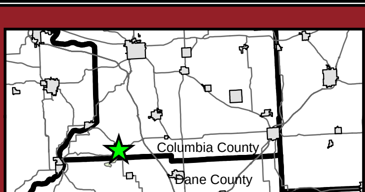
WinSLAMM Land Use

FIGURE A-2

City of Lodi

Columbia County, Wisconsin

Location Map



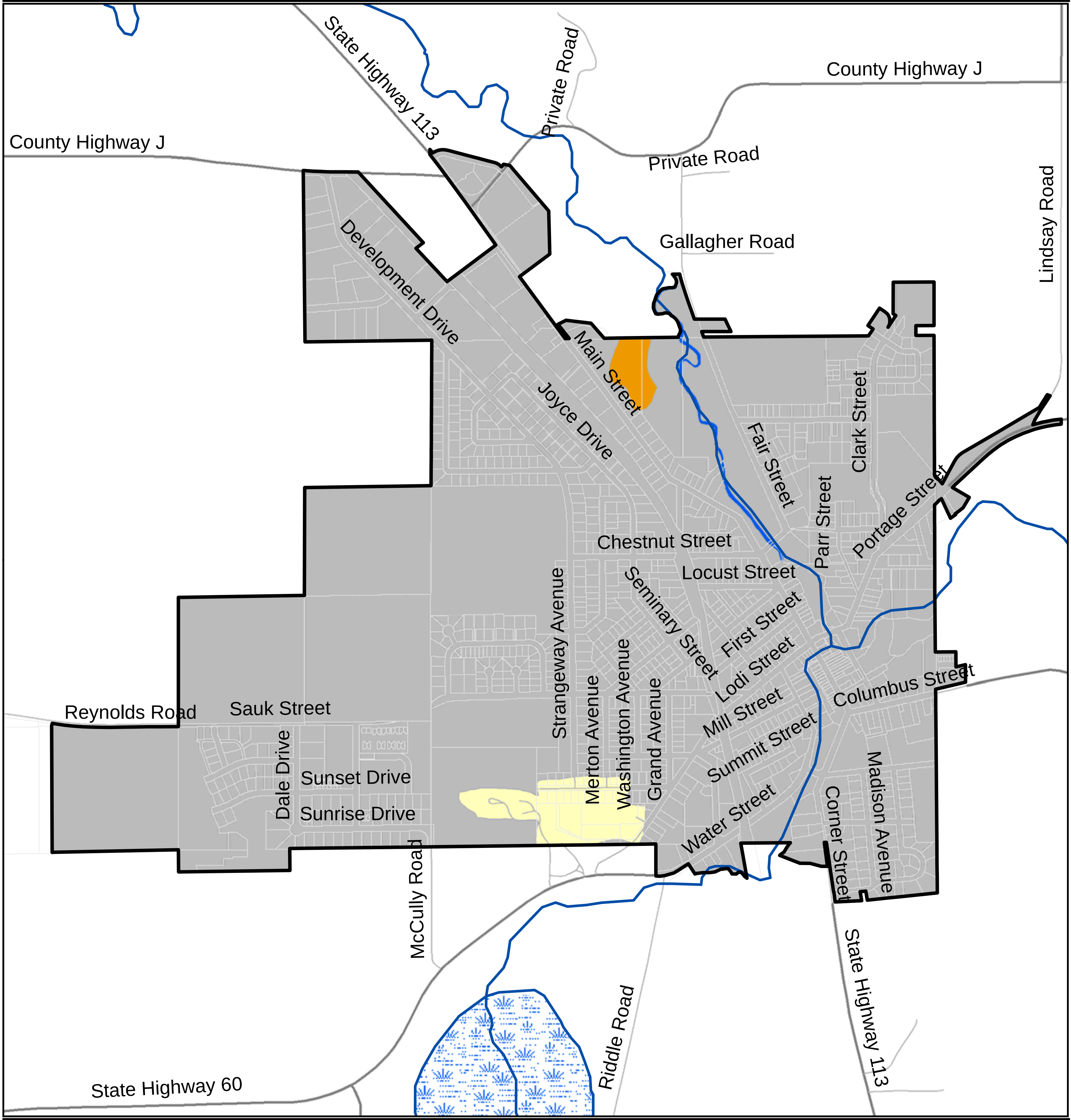
RESIDENTIAL	NON-RESIDENTIAL	OPEN/GREENSPACE
SINGLE FAMILY	LIGHT INDUSTRIAL	CEMETARY
DUPLEX	MEDIUM INDUSTRIAL	PARK
MULTI-FAMILY	INSTITUTIONAL	UNDEVELOPED
	COMMERCIAL	

Feet

0 2,400 4,800

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...



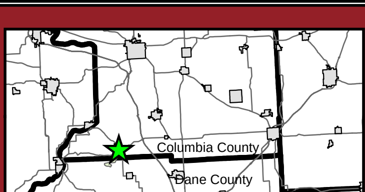
SOIL TEXTURE

FIGURE A-3

City of Lodi

Columbia County, Wisconsin

Location Map



Feet

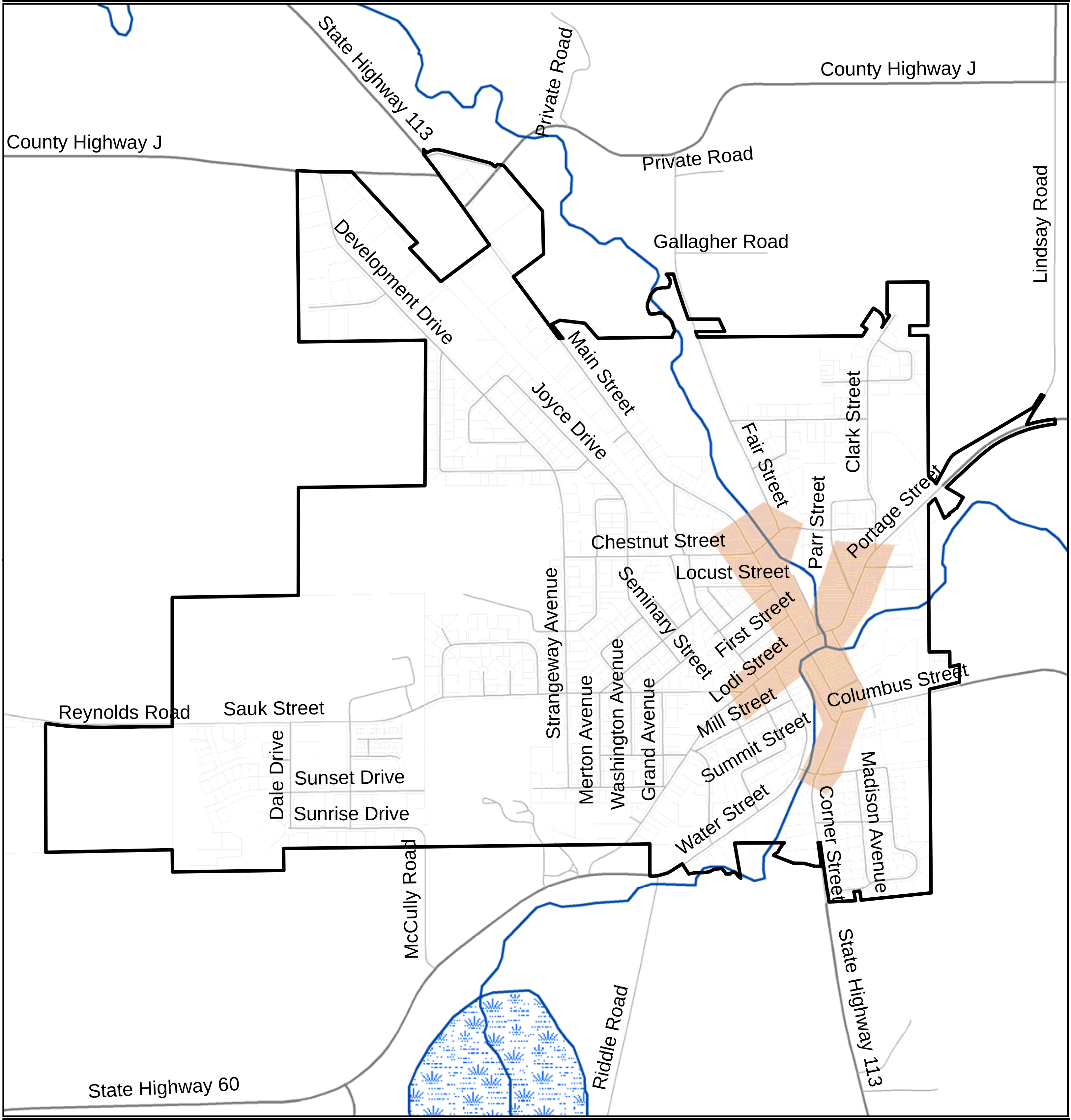
0 2,400

Soil Texture

SAND CLAY
SILT WATER

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

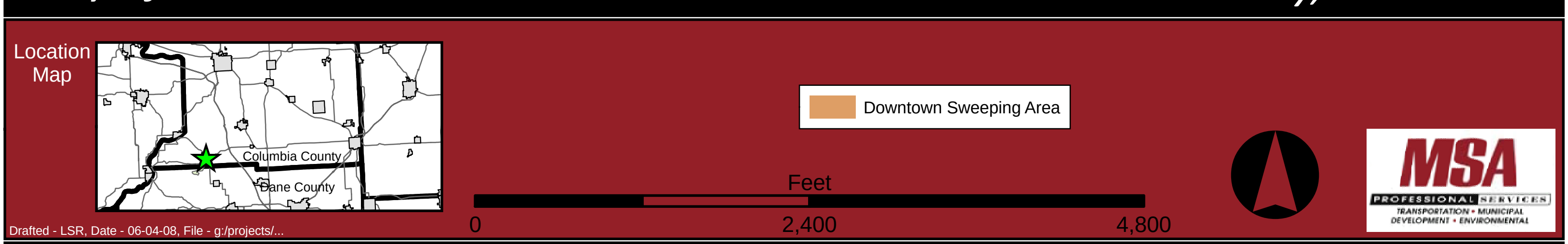


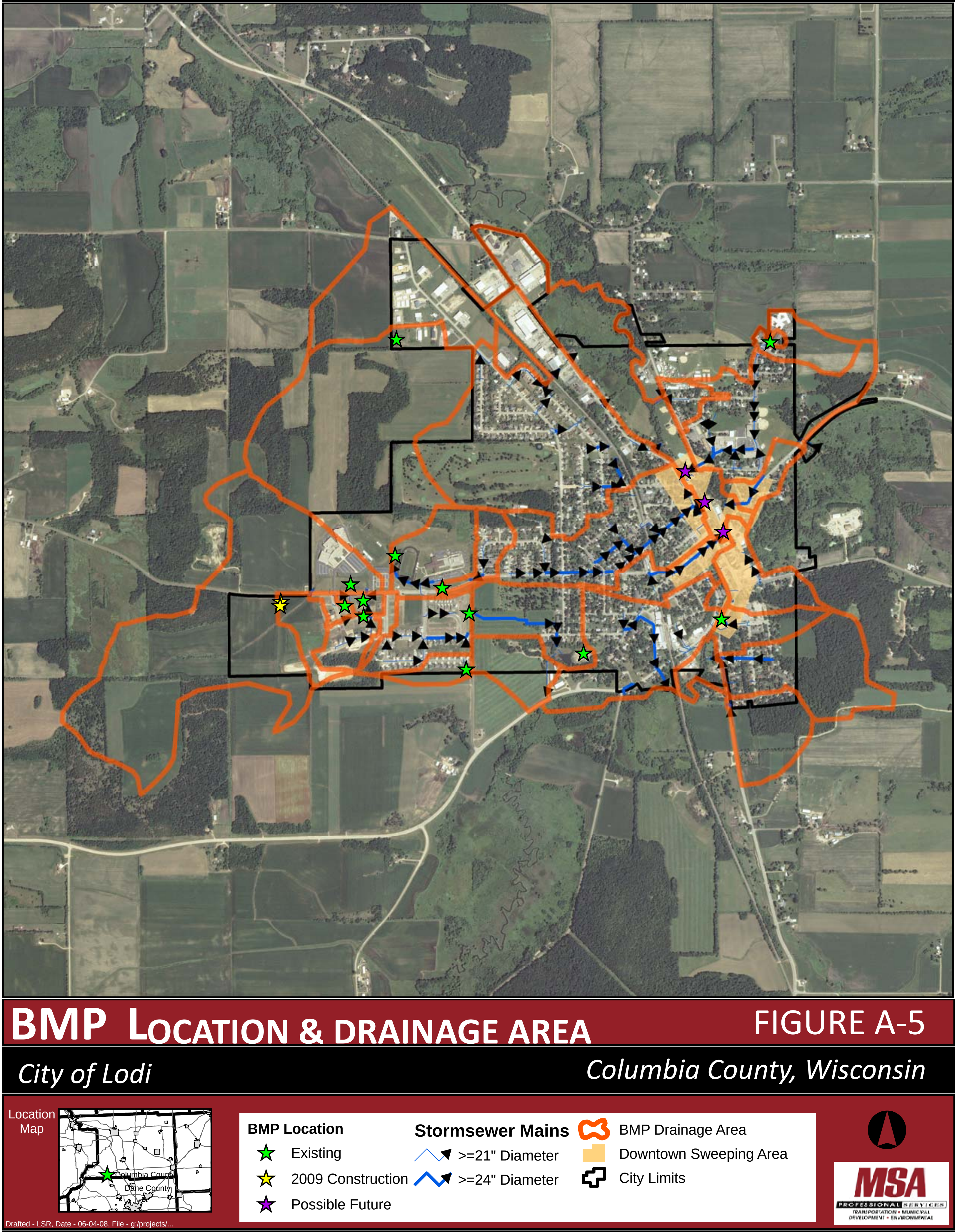
DOWNTOWN SWEEPING AREA

FIGURE A-4

City of Lodi

Columbia County, Wisconsin





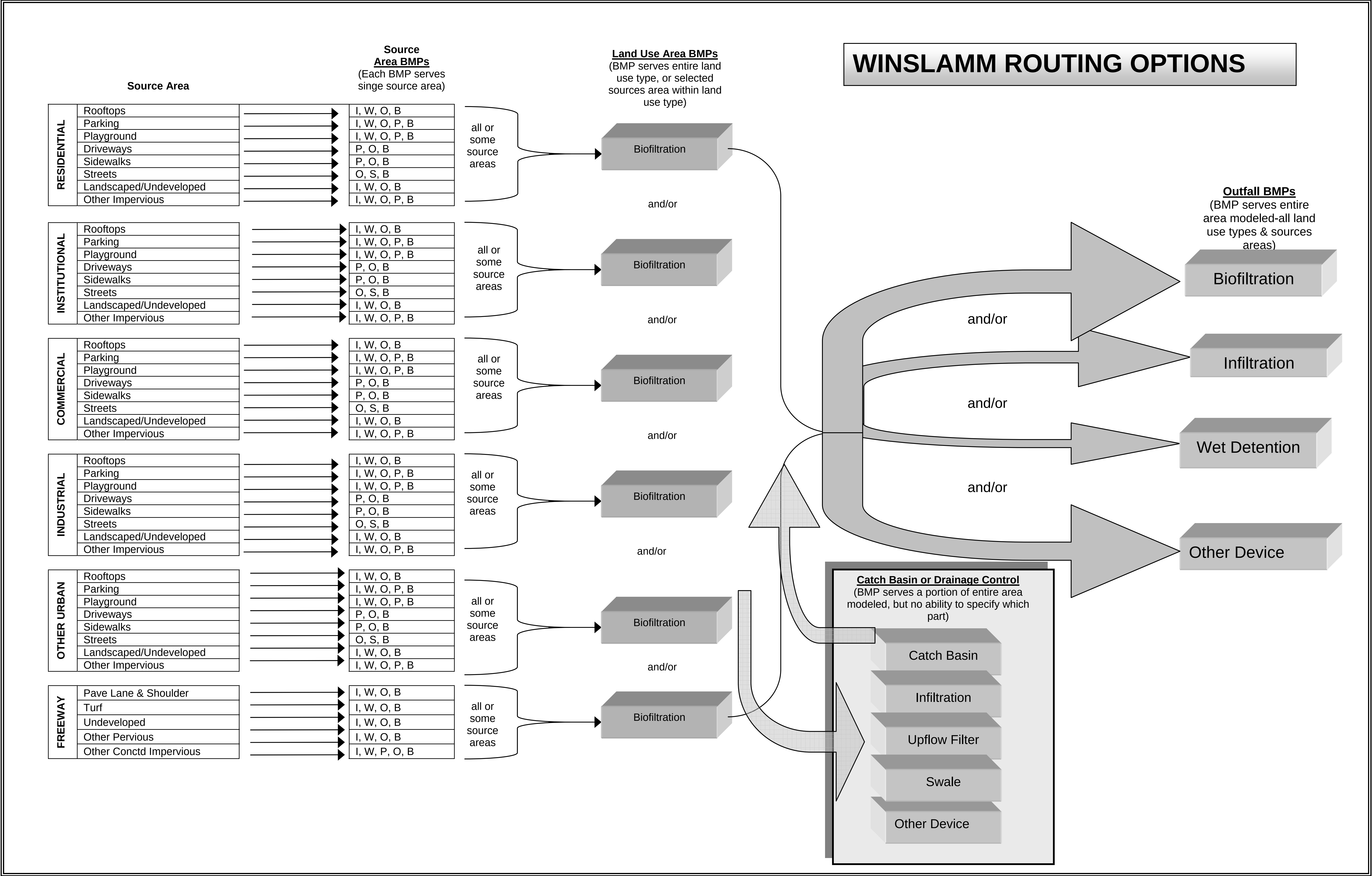
BMP LOCATION & DRAINAGE AREA

FIGURE A-5

City of Lodi

Columbia County, Wisconsin

Drafted - LSR, Date - 06-04-08, File - g:/projects/...


WINSLAMM ROUTING OPTIONS
Source Area
Source Area BMPs
(Each BMP serves singe source area)
Land Use Area BMPs
(BMP serves entire land use type, or selected sources area within land use type)
RESIDENTIAL
Rooftops
Parking
Playground
Driveways
Sidewalks
Streets
Landscaped/Undeveloped
Other Impervious
I, W, O, B
I, W, O, P, B
I, W, O, P, B
P, O, B
P, O, B
O, S, B
I, W, O, B
I, W, O, P, B
all or some source areas
Biofiltration
and/or
INSTITUTIONAL
Rooftops
Parking
Playground
Driveways
Sidewalks
Streets
Landscaped/Undeveloped
Other Impervious
I, W, O, B
I, W, O, P, B
I, W, O, P, B
P, O, B
P, O, B
O, S, B
I, W, O, B
I, W, O, P, B
all or some source areas
Biofiltration
and/or
COMMERCIAL
Rooftops
Parking
Playground
Driveways
Sidewalks
Streets
Landscaped/Undeveloped
Other Impervious
I, W, O, B
I, W, O, P, B
I, W, O, P, B
P, O, B
P, O, B
O, S, B
I, W, O, B
I, W, O, P, B
all or some source areas
Biofiltration
and/or
INDUSTRIAL
Rooftops
Parking
Playground
Driveways
Sidewalks
Streets
Landscaped/Undeveloped
Other Impervious
I, W, O, B
I, W, O, P, B
I, W, O, P, B
P, O, B
P, O, B
O, S, B
I, W, O, B
I, W, O, P, B
all or some source areas
Biofiltration
and/or
OTHER URBAN
Rooftops
Parking
Playground
Driveways
Sidewalks
Streets
Landscaped/Undeveloped
Other Impervious
I, W, O, B
I, W, O, P, B
I, W, O, P, B
P, O, B
P, O, B
O, S, B
I, W, O, B
I, W, O, P, B
all or some source areas
Biofiltration
and/or
FREEWAY
Pave Lane & Shoulder
Turf
Undeveloped
Other Pervious
Other Conctd Impervious
I, W, O, B
I, W, O, B
I, W, O, B
I, W, O, B
I, W, P, O, B
all or some source areas
Biofiltration
Outfall BMPs
(BMP serves entire area modeled-all land use types & sources areas)
Biofiltration
and/or
Infiltration
and/or
Wet Detention
and/or
Other Device
Catch Basin or Drainage Control
(BMP serves a portion of entire area modeled, but no ability to specify which part)
Catch Basin
Infiltration
Upflow Filter
Swale
Other Device

SLAMM – Batch Processing Work Flow

1. Open up WinSLAMM
2. Click on "File", "Output Format Options"
   - Click on "Save Outfall Runoff and Particulate Loading for WinDETPOND Analysis".
3. Click on "Run"
   - "Run Batch Editor" A warning will pop up about deleting any data that was in the input module, click on yes to continue.
4. The WinSlamm Batch Editor will open up
   - Click on "Options"
     i. "Select Path for Standard Land Use Files"
        Browse through directory to the location of the Standard Land Use files specific to the site.
        - Standard land use file must begin with "SLU/" in their site description
        - Verify the input files are appropriate using the http://wi.water.usgs.gov/slamm/readme9.2.html website. (This website has parameter files to use for Version 9.2 of SLAMM.)

     ii. "Select Destination Path for Creating Files"
        Browse through directory to the location of where you would like the files to be saved.

     iii. "Planning File Editor"
        An editing screen will open up.
        a. Enter Outfall Label
        b. Enter Soil Type
        c. Enter Land Use Type
        d. Enter Area
        * Note: Cannot have the same soil type and land use type entered twice and must have more than 1 entry. If you have only 1 entry, enter in a dummy soil, landuse and area and delete the dummy entry in the output after you have run the model.
        e. Click on "File", "Save As". This creates a PLA file.
        f. Click on "File", "Exit".

     iv. Click on "Create and Run a Series of DAT files from a Drainage Basin Land Use Database"
        a. Find and select the PLA file want to run.
        b. Running the file will create an individual DAT and ORP file for each soil and land use combination. ORP files are data files that display the TSS generated for each landuse. When multiple landuses are in a watershed, WinSLAMM creates multiple ORP files, one for each soil and landuse combination.

5. In order to enter in the drainage basin runoff procedure in WinDETPOND, the ORP files generated from WinSLAMM are needed. WinDETPOND can only have one ORP file entered; therefore, a combined ORP file needs to be created. ORP files consist of 3 columns of information: the rainfall event number, the runoff volume at the outfall for that rainfall event and the particulate loading at the outfall for that rainfall event. To create a combined ORP file, follow the following steps:
    - Open, copy and paste all of the ORP files flowing to the BMP into excel.
    - Make a "Combined" column, adding up the runoff volume and particulate loading values (the two last columns) for each rainfall event. Save this file as an excel file.
    - Copy and paste special (values) the combined data in a separate excel file. Data should include the rainfall event, runoff volume and particulate loading. Remove column labels. Add a row at the top of the file with the location and dates of the rain file. (This can be copied from the individual ORP files). Save this file as a CSV file.
    - Open the CSV file in notepad and saved as an ORP file. This file can be used in WinDETPOND.
6. Other information that needs to be entered into WinDETPOND include:
    - The stage-area information
    - The outlet parameters
    - The rainfall information (which must be the same as used in WinSLAMM).

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 6, 2005

TO: Regional Water Leaders, Basin Leader & Experts
Storm Water Permit Staff (via Email)

FROM: Russ Rasmussen, Director
Bureau of Watershed Management

SUBJECT: Developed Urban Areas and the 20% and 40% TSS Reductions
Sections NR 151.13(2) and NR 216.07(6), Wis. Adm. Code

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Issue

Under s. NR 151.13 (2), Wis. Adm. Code, a municipality subject to the municipal storm water permit requirements of subch. I of ch. NR 216, Wis. Adm. Code, must, to the maximum extent practicable, implement a 20% and a 40% reduction in total suspended solids in runoff that enters waters of the state as compared to no controls, by March 10, 2008 and March 10, 2013, respectively. Staff who work with affected municipalities need guidance on what areas under the municipalities' jurisdictions will be included in this requirement. They also need to know what is meant by "no controls" and "with controls", and what methods are acceptable for making these calculations.

Discussion

Chapter NR 216, Wis. Adm. Code, is the implementation code for the developed urban area performance standard. Applicability for permit coverage purposes is dictated by s. NR 216.02, Wis. Adm. Code. Under this provision, owners or operators of the following municipal separate storm sewer systems (MS4s) are required to obtain coverage under a WPDES municipal storm water permit:

- MS4s serving populations of 100,000 or more.
- Previously notified owners or operators of municipal separate storm sewer systems.
- MS4s within urbanized areas as identified by EPA.
- MS4s serving populations over 10,000 unless exempted by DNR.

"MS4" means a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all the following criteria:

- Owned or operated by a municipality.
- Designed or used for collecting or conveying storm water.
- Not a combined sewer conveying both sanitary and storm water.
- Not part of a publicly owned wastewater treatment works that provides secondary or more stringent treatment.

Under s. NR 216.07(6)(a), Wis. Adm. Code, a municipality must develop a stormwater management program to achieve compliance with the developed urban area performance standard (s. NR 151.12(2), Wis. Adm. Code). Developed areas are generally those that were not subject to the post-construction performance standards (s. NR 151.12 or NR 151.24, Wis. Adm. Code). The total suspended solids control requirements of s. NR 151.13(2)(b)1.b. and 2., Wis. Adm. Code, may be achieved on an individual municipal basis. Control does not have to apply uniformly across the municipality. The control may also be applied on a regional basis by involving several municipalities.

A municipality is required under s. NR 216.07(6)(b), Wis. Adm. Code, to provide an assessment of the actions taken to comply with the performance standards. This assessment may take the form of an annual progress report. The initial assessment must include a pollutant-loading analysis using a model such as SLAMM, P8 or equivalent methodology that is approved by the department. At a minimum, a pollutant-loading analysis must be conducted for total suspended solids and phosphorus. A model would not be run again after the initial assessment unless significant management changes occurred that should be accounted for, or the progress report indicates a re-run is necessary.

DNR Guidance

To comply with the code, the developed urban area must be modeled under a “no control” condition and a “with controls” condition. The 20% and 40% TSS reductions are assessed against the “no control” condition for the entire area served by the MS4 as defined below. They are not applied uniformly across the municipality, nor are they applied drainage area by drainage area within the municipal boundary. In most cases however, a calculation drainage basin by drainage basin will be used to determine the total loading and the achieved reductions.

Areas Required to be Included in the Calculations

A municipality must include the following areas when calculating compliance with the developed urban area standard (s. NR 151.13, Wis. Adm. Code):

1. Any developed area that was not subject to the post-construction performance standards of s. NR 151.12 or 151.24, Wis. Adm. Code, that went into effect October 1, 2004 and that drains to the MS4 owned or operated by the municipality.
2. Any area covered by an NOI submitted prior to October 1, 2004 where development is still underway. The pollutant load shall be based on full build out. If it is known that the future development of some parcels may require compliance with s. NR 151.12 or NR 151.24, Wis. Adm. Code, then these areas may be excluded from the calculation.
3. Any undeveloped (in-fill) areas under 5 acres. These areas must be modeled as fully developed, with a land use similar to the properties around them.
4. For municipalities with large areas of agricultural lands separating areas of development, only the areas within the urbanized area as defined by the U.S. Census Bureau.

5. Non-manufacturing areas of industrial facilities such as customer or employee parking lots. (The manufacturing, outside storage and vehicle maintenance areas of these industrial facilities are covered under a subch. II of ch. NR 216, Wis. Adm. Code, industrial permit.)
6. Any industry that has certified a condition of "no exposure" in accordance with s. NR 216.21(3), Wis. Adm. Code.
7. Any developed urban area where it is already established that the area will be annexed by the municipality prior to March 10, 2008. There must be an agreement with the municipality that will be losing the area, to prevent double counting.

Areas Prohibited from Inclusion in the Calculations

Areas and loadings that shall not be included:

1. Lands zoned for agricultural use and operating as such.
2. Pollutant loadings from an upstream MS4 (independent of whether it is regulated under a ch. NR 216, Wis. Adm. Code, permit)
3. Any internally drained area with natural infiltration. (This does not included engineered or constructed infiltration areas.) However, an internally drained area that discharges to a karst feature is not likely to be receiving adequate treatment prior to any contact with the groundwater. The municipality is encouraged to look at this area for possible treatment options.
4. Undeveloped land parcels over 5 acres within the municipality. These areas will be subject to s. NR 151.12 or 151.24, Wis. Adm. Code, when developed.

Optional Areas to Include in the Calculations

Areas a municipality may, but is not required to, include in the developed urban area load calculation:

1. Property that drains to *waters of the state* without passing through the permittee's MS4. Waters of the state include surface water, wetlands and groundwater and has the meaning given in s. 283.01(20), Stats. Waters of the state may overlap with the definition of MS4. For this purpose, if a waterway meets the definition of an MS4 it will be regulated as an MS4. The definition for MS4 is given in s. NR 216.002(17), Wis. Adm. Code. The significant language in that definition is whether or not the municipality owns or operates the drainage way (i.e., maintains, has easement access for work, etc.). For example, when a "stream" is designed or used for collecting or conveying storm water such as flowing through a municipally owned or operated culvert or bridge restriction, that "stream" is part of the MS4.
2. Any area that discharges to an adjacent municipality's MS4 (Municipality B) without passing through the jurisdictional municipality's MS4 (Municipality A). Municipality B that receives the discharge into their MS4 may choose to be responsible for this area from Municipality A. If Municipality B has a treatment device that serves a portion of A as well as a portion of B, then the practice must be modeled as receiving loads from both areas, independent of who carries the responsibility for the area.
3. Industrial facilities subject to a permit under subch. II of ch. NR 216, Wis. Adm. Code. This exclusion covers the facilities that are required to have permit coverage. Contact the regional stormwater specialist or central office to get a list of permitted facilities within a municipality.
    - The industrial NR 216 permit covers areas with industrial materials and activities, specifically areas with manufacturing, vehicle maintenance, storage of materials, etc.

A municipality may include any of the areas identified above in their developed urban area as part of their load calculation provided the areas are not prohibited from inclusion in the calculation. If they choose to include an area, it must be included in both the "no controls" and "with controls" condition. Inclusion of areas they choose to be responsible for will allow them to take credit for any of those areas that may have controls in place. For example, if an industrial park would have been excluded because all the industries in the industrial park have an NR 216 industrial permit, but the municipality chooses to keep this area in their “no controls” area, then any best management practices existing or built to serve the industrial park can be included in the “with controls” scenario.

Model Inputs

Model Version:

To model the TSS load in the area served by the MS4 the municipality must select a model that can track particle distribution. Such models include SLAMM and P8. In general, a municipality must use the most current version of a model that is available at the time of the analysis. However, a municipality may use an earlier version of a model if it was previously used to calculate loads in the municipality and these loads were documented in a stormwater management plan, database, or other report. The most current versions of SLAMM and P8 will be accessible through the DNR website with links to the authors. A summary of past versions and the changes made with each SLAMM update will also be posted. The DNR has recently received a grant to help upgrade P8 to a Windows format.

As part of the reporting process, the municipality must identify which version it is using. It must use the same version for both the “no controls” scenario and the “with controls” scenario. If an older version of the model is used, this may mean that as the model is updated a municipality cannot take credit for some practices that are only available in the most recent models. In order to take credit for practices that are in recent versions of the models, both the “no controls” and “with controls” scenario must be run with the latest model. A municipality must run all drainage basins in the developed urban area with the same model and model version.

“No control”

The “no controls” condition can be based on the standard land use files for different land uses in SLAMM. This assumes certain default parameter files, an assumed level of disconnection and an assumed distribution of road smoothness. For the drainage system, the default will be curb and gutter (even if the drainage system is currently swale drainage), in fair condition. For “no controls” there will be no recognition of street sweeping, catch basin cleaning, swale drainage, or the existence of any engineered best management practices. These practices and facilities will be accounted for under the “with controls” condition. A municipality is not required to use the standard land use files if it has surveyed the land uses in its developed urban area and has “real” source area data on which to base the input files.

“With controls”

The “with controls” condition is applied to the developed urban area with the inclusion of the practices and facilities (existing and proposed). Modeling is a means to confirm a device’s efficiency for the conditions found in Wisconsin. If the model cannot predict efficiencies for certain practices that the municipality identifies as water quality practices, then a literature review must be conducted to estimate the reduction value. However, proprietary devices that utilize settling as their means of solids reduction should be modeled as catch basins with sumps. The efficiency of proprietary devices that utilize filtration as a means of solids reduction cannot currently be modeled using SLAMM.

Practices on private property that drain to an MS4 can be included in the “with controls” scenario for a municipality, if the municipality is able to ensure that the practice will continue to be maintained. The efficiency of the practice on private property must be modeled using the best information the municipality can obtain on the design of the practice. For example, permanent pool area is not sufficient information to know the pollutant reduction efficiency of a wet detention basin even if it matches the area requirements identified in Technical Standard 1001 Wet Detention Basin for an 80% reduction. Information on the depth of the sediment storage layer and the outlet design are critical features that determine whether a detention pond is providing 80% TSS reduction.

As information on proprietary practices or new stormwater designs becomes available through monitoring, the model will be adjusted to reflect changes in efficiency.

Again, future versions of the model can be used to evaluate the “with controls” condition, but only if the “no controls” scenario is also run with the new version.

Further clarifications

- If a portion of a municipality’s MS4 drains to a stormwater treatment facility in an adjacent municipality, the municipality generating the load will not receive any treatment credit unless there is an inter-municipal agreement for maintenance of the BMP. This contract must be in writing with signatures from both municipalities at the time of the evaluation.
- The model results will be the basis for determining compliance with the permit for “no controls” and “with controls” TSS load. No credit will be given for implementation of ordinances or information and education programs.
- For reporting purposes, the pollutant load must be summarized as the cumulative total for the developed urban area served by the MS4. Additionally pollutant loads for grouped drainage areas as modeled shall also be reported. Drainage areas may be grouped at the discretion of the modeler for such reasons as to emphasize higher priority areas, balance model development with targeting or for cost-effectiveness.

Approved By:

Gordon Stevenson, Chief
Runoff Management Section

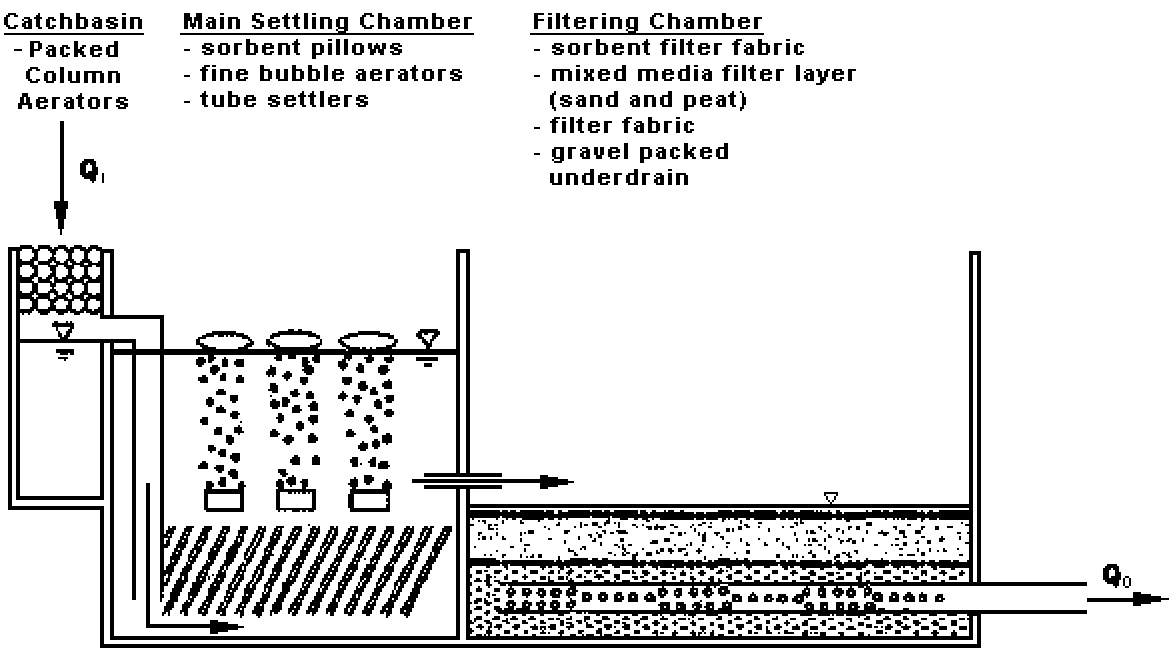
Eric S. Rortvedt
Storm Water Program Coordinator

(From USFHA Website http://www.fhwa.dot.gov/environment/ultraurb/uubmp3p9.htm)

3.10.3 MCTT System

The multi-chamber treatment train (MCTT) consists of a series of treatment units that mimic those found in a conventional wastewater treatment plant (Figure 33). The first chamber aerates the stormwater as it enters the treatment train and permits preliminary settling of larger diameter sediment. Stormwater is then conveyed to an inclined tray settler, where the majority of the settleable particulates are captured. Dissolved air flotation is then provided to help lift floatables and oil to absorbent media. The last step entails passing stormwater through a sand/peat filter.

Figure 33. General schematic of MCTT (Pitt, 1996)



The MCTT is applicable to small and isolated paved critical source areas from about 0.1 to 1 ha (0.25 to 2.5 ac). Gas stations, high traffic areas, and car washes are examples of land uses that could warrant this practice. As a relatively expensive BMP, the MCTT is reserved for those locations equipped with electric power and where regular maintenance is feasible. A recent retrofit installation cost $95,000 to tie an MCTT into an existing storm drain system for a 1 ha (2.5 ac) drainage area (Pitt, 1996). The cost to install would be lower if the installations were in new, developing areas and if prefabricated units became available.

During 13 storms monitored at a parking lot, the MCTT was found to remove 83 percent of total suspended solids, 100 percent of lead, and 91 percent of zinc (Pitt, 1996). In addition, the MCTT was found to be effective at removing toxicants: a 96 percent reduction was found in total toxicity as measured by the Microtox® screening test. As a result of its processes, ammonia nitrogen was found to increase by several times and the water gained a color due to staining from the peat medium.

In another study, 15 storms were monitored at a municipal maintenance yard where an MCTT had been installed to measure the pollutant reduction achieved by this device. The actual quantity of water passing through the MCTT consistently was found to be approximately 87 percent of rainfall volume. High pollutant reduction efficiencies were found for all particle-associated constituents, such as total suspended solids (98 percent) and total phosphorus (88 percent), and some dissolved constituents, such as dissolved zinc (68 percent). This municipal maintenance garage and parking facility is used primarily by garbage trucks, plows, and other heavy equipment (Greb et al., 1998).

The design of the MCTT is very site-specific and depends highly on local meteorology (e.g., mean inter-event periods, local rainfall intensity/duration relationships). The design challenge is to provide sufficient equalization capacity to ensure even inflow into the filter bed. As a result, there can be a 300 percent difference in the size of the MCTT depending on the facility location. The size of components is dependent on the depth of the facility and whether the facility will drain by gravity or be pumped dry. For most applications, the commitment of surface area will probably fall between 0.5 percent and 1.5 percent of land area (Pitt, 1996).

MULTI-CHAMBERED TREATMENT TRAIN (MCTT)
Milwaukee, Wisconsin

THE ROUGE RIVER PROJECT
A WORLD CLASS EFFORT

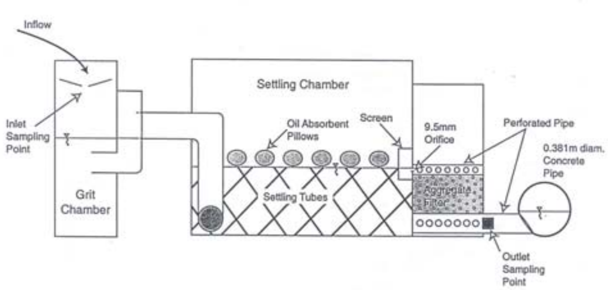
BRINGING OUR RIVER BACK TO LIFE

A publication of the Wayne County Rouge River National Wet Weather Demonstration Project
Information Date: May 2003

Objective

The objective of the Multi-Chambered Treatment Train (MCTT) was to evaluate the water quality benefits of a stormwater treatment system for stormwater runoff from a municipal maintenance yard.

The MCTT was not funded as part of the Rouge River National Wet Weather Demonstration Project. This project profile summarizes work completed by others and is provided for information to Rouge River watershed communities and others.



Schematic of Milwaukee MCTT

Owner
City of Milwaukee, Wisconsin

Location
Milwaukee, Wisconsin municipal maintenance garage and parking facility.

Total Cost
Not Provided

Dates
The project study took place between April 1996 and September 1997.

Demonstration Aspects

The use of a MCTT demonstrated that treatment of stormwater could be accomplished in an area with little open space by constructing the MCTT underground.

Project Highlights

The MCTT treated all the stormwater from 15 storms. High reduction efficiencies were achieved for total suspended solids, total phosphorous, total zinc, dissolved phosphorous, and dissolved zinc.

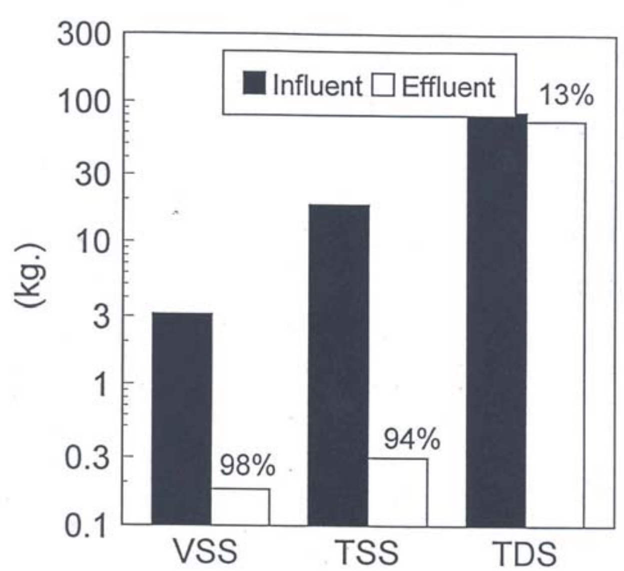
Major Elements

- The MCTT consists of a grit chamber, settling chamber and a filter bed. The grit chamber also has a mesh bag of column packing balls that aid in aeration. The settling chamber has absorbent pads to remove hydrocarbons. The filter is a mixed media filter consisting of sand, peat and activated carbon.
- The MCTT is designed to treat the first half-inch of rain from an area of 0.164 acres. The designed detention time is 72 hours.

- The runoff being treated is from a parking lot for municipal vehicles like garbage trucks, dump trucks, and backhoes.
- Influent and effluent samples were collected from 15 storm events. Samples were tested for 68 constituents.

Project Results

- 15 storms were monitored between April 1996 and September 1997.
- Influent samples had detectable concentrations of most of the constituents sampled for. In the effluent samples all of the dissolved constituents sampled for were below detection limits. In addition suspended solids, volatile suspended solids, lead, and zinc were generally below detection.
- Influent BOD ranged from 8.8-51 mg/l while a majority of the effluent BOD was below the detection limit.
- A high reduction in total suspended solids (98%), total phosphorous (88%), total zinc (91%) was achieved with the MCTT. High removal rates were also achieved for dissolved phosphorous (78%) and dissolved zinc (68%).



Additional Information

The MCTT project is described in the paper by Seven R. Greb, Seven R. Corsi, and Roger Bannerman, titled "Evaluation of the Multi-Chambered Treatment Train, a Retrofit Water Quality Management Practice". This paper is available in on the USGS website at http://www.usgs.gov/http://www.usgs.gov/.

Another project that evaluated a MCTT was in Birmingham Alabama. This study reported preliminary results that the treatment unit was providing substantial reductions in stormwater toxicants, organics, and suspended solids. The author's conclusions are that "The MCTT is seen to be capable of reducing a broad range or stormwater pollutants that have been shown to cause substantial receiving water problems (Pitt 1994b)." This study is summarized in the paper titled, "A Multi-chambered Stormwater Treatment Train", by Brian Robertson, Robert Pitt, Ali Ayyoubi and Richard Field. This paper is available in the *Stormwater NPDES Related Monitoring Needs*, which consists of papers presented at the Engineering Foundation Conference held in Colorado, August 7-12, 1994.

To obtain further information on the Rouge Project, including documents, maps and general information, visit us at:

http://www.rougeriver.com

ACKNOWLEDGEMENT

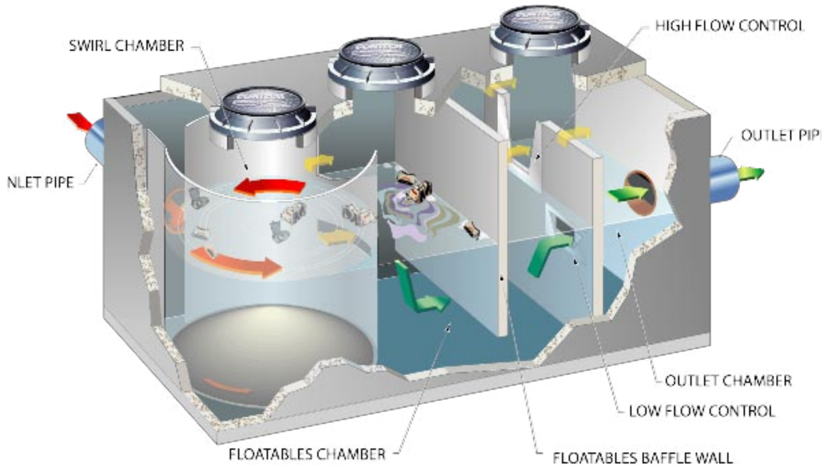
The Rouge River National Wet Weather Demonstration Project is funded, in part, by the United States Environmental Protection Agency (EPA) Grant #XP995743-01, -02, -03, -04, -05, -06, -07, -08 and #C264000-01.

Vortechs®

High performance hydrodynamic separation

The Vortechs system is a high-performance hydrodynamic separator that effectively removes finer sediment, oil and grease, and floating and sinking debris. Its swirl concentrator and flow controls work together to minimize turbulence and provide stable storage of captured pollutants. The design also allows for easy inspection and unobstructed maintenance access. With comprehensive lab and field testing, the system delivers proven results and site-specific solutions.

Precast models can treat peak design flows up to 25 cfs; cast-in-place models handle even greater flows. A typical system is sized to provide an 80% load reduction based on laboratory-verified removal efficiencies for varying particle size distributions such as 50-micron sediment particles.



How does it work?

Water enters the swirl chamber at a tangent, inducing a gentle swirling flow pattern and enhancing gravitational separation. Sinking pollutants stay in the swirl chamber while floating pollutants are stopped at the baffle wall. Typically Vortechs systems are sized such that 80% or more of runoff through the system will be controlled exclusively by the low flow control. This orifice effectively reduces inflow velocity and turbulence by inducing a slight backwater appropriate to the site.

During larger storms, the water level rises above the low flow control and begins to flow through the high flow control. The layer of floating pollutants is elevated above the influent pipe, preventing re-entrainment. Swirling action increases in relation to the storm intensity, which helps prevent re-suspension. When the storm drain is flowing at peak capacity, the water surface in the system approaches the top of the high flow control. The Vortechs system will be sized large enough so that previously captured pollutants are retained in the system even during these infrequent events.

As a storm subsides, treated runoff decants out of the Vortechs system at a controlled rate, restoring the water level to a dry-weather level equal to the invert of the inlet and outlet pipes. The low water level facilitates easier inspection and cleaning, and significantly reduces maintenance costs by reducing pump-out volume.

Vortechs

- Proven performance speeds approval process
- Treats peak flows without bypassing
- Flow controls reduce inflow velocity and increase residence time
- Unobstructed access simplifies maintenance
- Shallow system profile makes installation easier and less expensive
- Very low headloss
- Flexible design fits multiple site constraints

Vortechs®

1.0 INTRODUCTION

This section of the report summarizes the results and findings of SNAP-Plus modeling of agricultural areas of Spring Creek Watershed. The purpose of modeling was to estimate the annual soil loss and sediment delivery from rural areas of the Spring Creek watershed to Spring Creek, for the purpose of developing data for comparison to other watershed sources.

2.0 SNAP-PLUS MODELING

2.1 SNAP PLUS MODEL BACKGROUNG INFORMATION

SNAP-Plus is a nutrient management planning software program designed for the preparation of nutrient management plans. The program is available free for download from the internet, courtesy of UW-Extension, WNDR, WDATCP, NRCS and the UW Soil Science Department. The program's primary purpose is to serve as a site-scale tool for individual farms to: calculate nutrient application rates for farm fields, predict soil loss, determine whether fields are meeting tolerable soil loss, commonly referred to as "T" requirements, and as a tool for phosphorus management. In this case, however, it was used on a watershed-scale to estimate the soil loss and sediment delivery to the Spring Creek using land cover, crop rotation and tillage data for the watershed.

2.2 DATA INPUT SCREENS

The Snap-Plus model includes the following five data input screens: farm, field, soil tests, nutrient sources, and cropping. For the watershed-scale soil loss and sediment delivery modeling conducted in this study, data input were required for all except the "nutrient sources" screen[1].

2.1.1 FARM DATA ENTRY SCREEN

The "Farm" screen allows users to enter basic information about the farm being modeled, such as producer name and address, a description of farm operations and crop types, and the county in which the farm is located in. The only data entry required in the farm screen for the Spring Creek watershed modeling was county and crop types. Since the SNAP-Plus "farm" screen only allows farms to be modeled in a single county, two separate models were created, one for fields located in Dane County and one for fields located in Columbia County. The crop types for each farm were also selected in this screen. Additional information on how crop types were selected is included in the "Cropping" paragraph (ss. 2.1.4) of this section.

2.1.2 FIELD DATA ENTRY SCREEN

The "Field" screen allows users to input the following information for each field modeled: name, size (ac), soil map symbol, soil series name,

[1] *An attempt was made early on in the study to model nutrient applications and phosphorus loadings, however, privacy laws prevented obtaining the data necessary for reliable nutrient modeling.*

nitrogen restrictions, field slope (%), below field slope to water (%), and distance to perennial water (ft). All of the required data fields except the latter are auto-filled with default values based on the county soil atlas mapped soil-map-unit (smu) entered for that field. It is important to verify these default values when using SNAP-Plus as a site-scale tool for farm field management, however, for the purpose of estimating soil loss on a watershed scale, the default values were assumed to be sufficient.

"Distance to perennial water" refers to the overland distance between a surface water body and farm field location. The data entry field requires users to select from among the following six ranges: 0-300 feet, 301-1000 feet, 1001-5000 feet, 5001-10,000 feet, 10,001-20,000 feet and greater than 20,000 feet. In this study, the area of land falling within each range was determined using ArcGIS, by creating buffers corresponding to the maximum of each of these ranges around waterways. No location in the Spring Creek Watershed was found to be more than 10,000 feet from a waterway.

The location and magnitude of each unique combination of the following three variables:

- Soil map unit (SMU)
- Distance to water
- County

was determined by "unioning" the three spatial data layers in ArcGIS. Through this process, 522 unique combinations were found to exist in the watershed. In this report, each unique combination of the three listed variables will henceforth be referred as a "*SMUDC*" (soil map unit-distance-county).

To simplify the modeling effort, *SMUDC* categories covering less than 1% of the total watershed area in each county were eliminated. The remaining "dominant" *SMUDC* types were increased proportionally to their overall percent area so that the total watershed area remained the same. This reduced the total number of *SMUDC* categories modeled by almost half (from 522 to 257) even though the *SMUDC* categories eliminated collectively covered less than 8% of the total watershed area. Additionally, *SMUDC*'s only found in areas of the watershed clearly not used for crops (such as Lodi Marsh) were eliminated. Each of the remaining *SMUDC*s were entered as a separate field in the SNAP-Plus "field" screen.

2.1.3 SOIL TEST DATA ENTRY SCREEN

The "Soil Tests" screen requires that users enter one or more soil test results for each modeled field. At a minimum, data for the following fields must be filled for the program to calculate nutrient application recommendations: test date, pH, organic matter(%), phosphorus (ppm) and potassium (ppm). For the purposes of this study, average soil test values for Dane and Columbia County were used, as reported by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP).

2.1.4 CROPPING DATA ENTRY SCREEN

Crop rotations are entered in the “Cropping” screen by entering the crop type for each year of the rotation being modeled. Rotations may be from one to eight years. For each crop in each year of the rotation, yield goal and tillage type must be specified. For each rotation, users must also indicate whether contouring practices are utilized and whether filter strips exists. Crop rotations may be hand-entered for individual fields, or applied automatically to one or more fields using the program’s “rotation wizard”.

In this study, four different crop rotations were modeled for each *SMUDC* type. The four rotations were developed using information provided by the Columbia County Land Conservation Department (LCD). LCD staff provided a description of the four most common crop rotation cycles in the watershed, typical yield goals for each crop, and the percentage of different crop types and tillage practices in the watershed. The four crop rotations are summarized in Table B-1. Each rotation was modeled separately, and results calculated on an average annual basis, so it was not necessary for all rotations to be the same length.

Table B-1. Crop Rotations Modeled in SNAP-Plus

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Rotation 1	**Crop**	Corn Silage	Soybeans	Corn Silage	Soybeans	Corn Silage	Soybeans
	Yield Goal	16-20	46-55	16-20	46-55	16-20	46-55
	Tillage	MB Plow	No till	MB Plow	No till	MB Plow	No till
Rotation 2	**Crop**	Corn Grain	Corn Grain	Soybeans	Corn Grain	Corn Grain	Soybeans
	Yield Goal	151-170	171-190	46-55	151-170	171-190	46-55
	Tillage	Chisel	No till	No till	Chisel	No till	No till
Rotation 3	**Crop**	Corn Grain	Seeding Alfalfa	Alfalfa	Alfalfa	Corn Grain	Soybeans
	Yield	151-170	3.6-4.5	3.6-4.5	3.6-4.5	171-190	46-55
	Tillage	Chisel	Chisel	Chisel	Chisel	Chisel	Chisel
Rotation 4	**Crop**	Corn Grain	Winter Wheat	Corn Grain	Soybeans		
	Yield Goal	151-170	61-80	171-190	46-55		
	Tillage	Chisel	Chisel	Chisel	No till		

Each of the four rotations was modeled under the following three conditions:

- No contouring or filter strips
- On-contour, without filter strips[2]
- On contour with filter strips

For this application "no contouring" represents a field that is not consistently worked across the slope. "On-contour" represents a field that field is consistently planted and tilled on the contour across the slope. Furthermore, per SNAP-Plus modeling guidance, only field-edge filter strips designed according to Wisconsin NRCS Conservation Practice Standard 393 were treated as a "filter strip" in SNAP-Plus modeling.

3.0 WATERSHED-WIDE SOIL LOSS ESTIMATION

The average annual soil loss rate from cropped areas watershed-wide was estimated by first determining the area-weighted average soil loss for each crop rotation, and then weighting each crop rotation based on its percent dominance in the watershed.

The area-weighted soil loss for each crop rotation was determined by weighting the soil loss rate of each *SMUDC*. Each *SMUDC*s weight was calculated by multiplying its total area by the estimated percent of its total area that is cropped, summing the total cropped area of all *SMUDC*s, and then weighting each according to its percent of the total cropped area of the watershed.

The estimated cropped percent of each *SMUDC* was based on its distance to water category. The distance to water shapefile was intersected with Columbia County's 2001 and 2002 Crop Cover layers in ArcGIS. This process showed, not surprisingly, that watershed areas within 300 feet of a waterway have the lowest percent cropped area (35%), whereas the areas furthest from water (5001-10,000 in this case) had the highest percent (72%) cropped area. These percentages were used as the basis for determining the percent cropped area of individual *SMUDC*s.

The dominance of each crop rotation in the watershed was calculated by using its percent dominance in the watershed. The percent dominance of each rotation was determined using data provided Columbia County Land Conservation Staff on the relative amount of each crop type and tillage practice within the Lake Wisconsin Watershed. The assumed estimated dominance of each crop rotation is summarized in Table B-2, below.

Table B-2
Crop Rotation Dominance

Rotation No.	Dominance
1	5%
2	42%
3	30%
4	23%

Note that in the processes described in the preceding paragraphs of this section, Columbia County data was assumed to also be representative for Dane County areas of the watershed. This was necessary since similar data from Dane County was not made available to the authors of this study.

4.0 RESULTS

The total watershed-wide soil loss for each crop rotation, with and without contouring practices, and with and without contouring and filter strips, ranged from 0.3 to 4.3 tons/acre/year in cropped areas of the watershed. Thus, even though some rotations exceeded "T" under some conditions, the overall watershed-wide average soil loss for each rotation was less than the average weighted "T" value for the cropped areas of the watershed[3], 4.6 tons/acre/yr. Modeling results by rotation, and conservation practice type are summarized in Table B-3. Modeling results by location for each crop rotation, with and without contours and filter strips, are illustrated in Figures B1 through B12.

[3] Weighted average "T" value for cropped areas of Spring Creek modeled in SNAP-Plus

Recall that the soil loss rates referenced in the preceding paragraph are soil loss rates from *cropped* areas only. If one were to make the assumption that the soil loss rates from un-cropped rural areas of the watershed is zero or near zero, then the average soil loss rate from the rural areas of the watershed overall, would range from 0.1 to 2.0 tons/acre/year.

Table B-3. SNAP-Plus Estimated Soil Loss/Sediment Delivery[4] (t/cropped acre/year)

	Rotation 1	Rotation 2	Rotation 3	Rotation 4	Weighted Average
No Practices	13.8	3.9	4.1	3.3	4.3
With Countouring	10.9	2.4	2.8	2.0	2.8
Contours + Filter Strips	0.7	0.2	0.4	0.3	0.3

At this time, Columbia County Land Conservation Staff believe that at least 20% of the cropped areas in the watershed have contouring practices and have filter strips[5]. (The actual amount may be significantly more; the county is currently working on an inventory of conservation practices in the watershed, however, this data is not yet complete or available). If this estimate were accurate, then the actual soil loss rate from cropped areas would be 3.5 tons/acre/year or less, and from rural areas overall would be 1.6 tons/acres/year.

5.0 DISCUSSION & RECOMMENDATIONS

5.1 DISCUSION OF LIMITATIONS

The estimated watershed-wide average soil loss is heavily dependent on assumptions that were necessary to make due to the lack of available data. For example, it was necessary to assume that data representative of large areas (ie Lake Wisconsin Watershed) is representative of smaller areas contained within it (Spring Creek Watershed) and that cropping and tillage practice data for one County in the watershed (Columbia) is representative of all areas of the watershed (Dane and Columbia County). Therefore the results of this study should be used as an estimate of soil loss/sediment delivery rates for each *SMUDC*-crop rotation-conservation practice combination, rather than as a definitive determination of soil loss watershed-wide value.

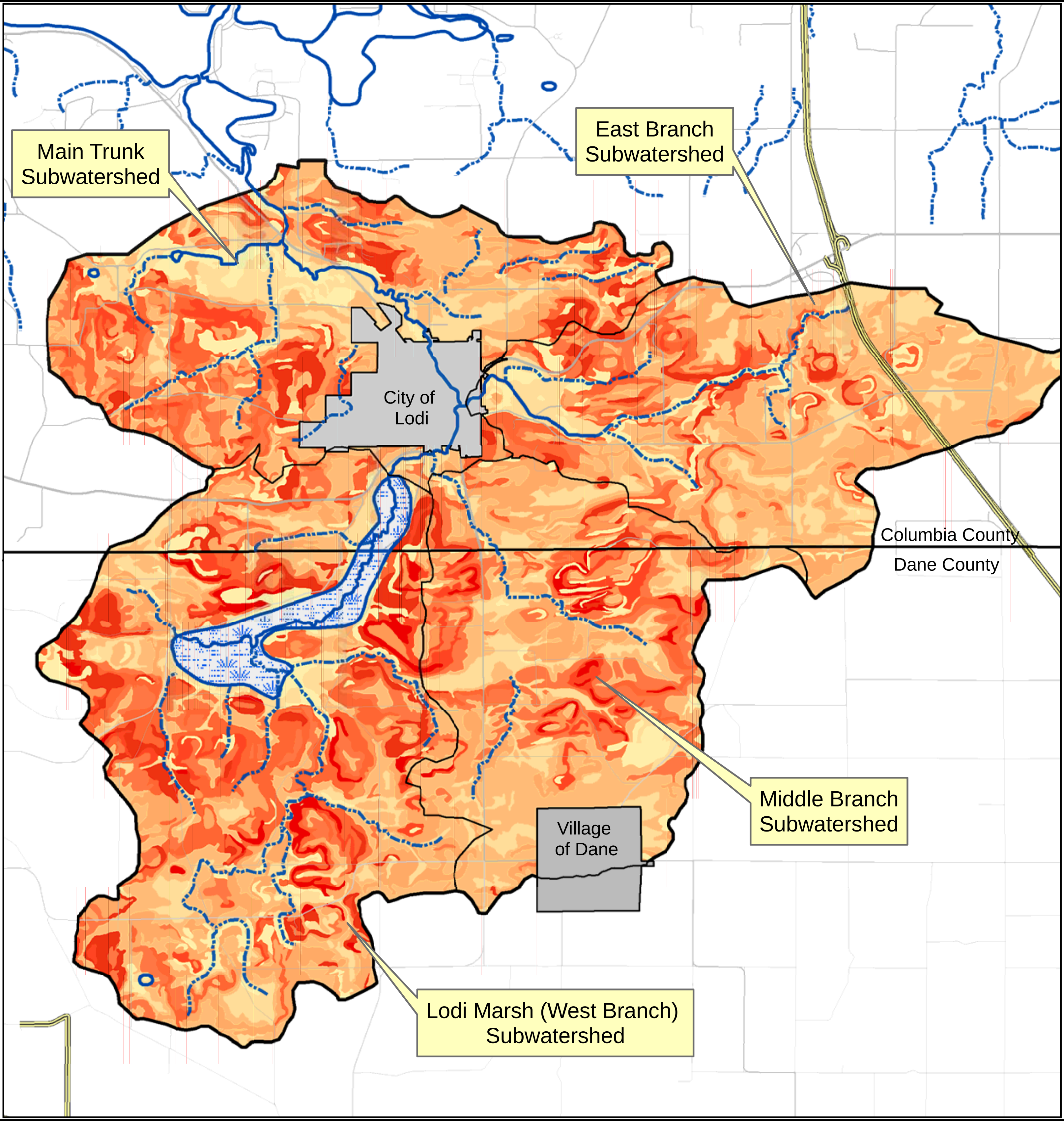
[4] Table B-3 shows the soil lost rate for the "without practices", and "with contouring only" scenarios, and the sediment delivery rate for the contouring + filter strip scenario. Sediment delivery is the amount of eroded sediment from the field that will be transported in runoff through the filter strip area to water.

[5] Although section C reports that upwards of 90% of the riparian corridor has some type of buffer, SNAP-Plus only allows credit for field-edge filter strips designed according to Wisconsin NRCS Conservation Practice Standard 393. A copy of this standard can be found in Appendix B-1. It is not known at this time how much of the existing riparian buffers meet the Conservation Practice Standard.

5.2 RECOMMENDATIONS

In spite of the limitations described above, the modeling results may still be useful for identifying locations within the watershed with a high soil loss, and understanding what crop rotation types and conservation practices could minimize the actual soil loss and/or sediment delivery to local waterways. For example, use Figures B1-B2 to identify areas with highly and moderately erodible soils. Limit cropping in the severely erodible areas; in moderately erodible areas plant crop rotations with a low soil loss potential and implement conservation practices such and low- or no- tillage farming, filter strips and contouring.

A second recommendation is to conduct an inventory of animal operations in the watershed, and use this information to add nutrient application data to modeling. Use this modeling to identify area of the watershed with high pollutant load potential, and focus efforts pollutant reductions efforts in these areas.

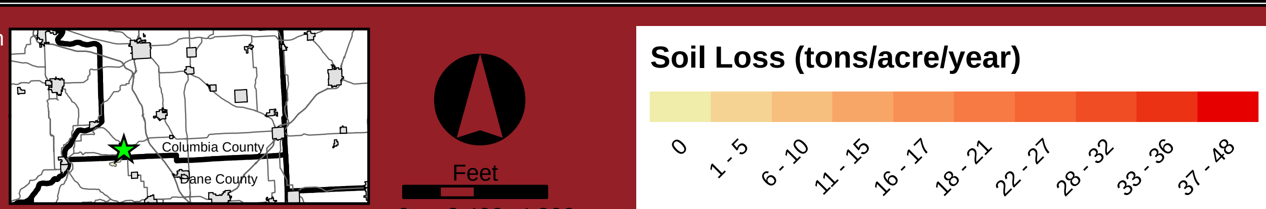


SNAP+ PREDICTED SOIL LOSS RATES

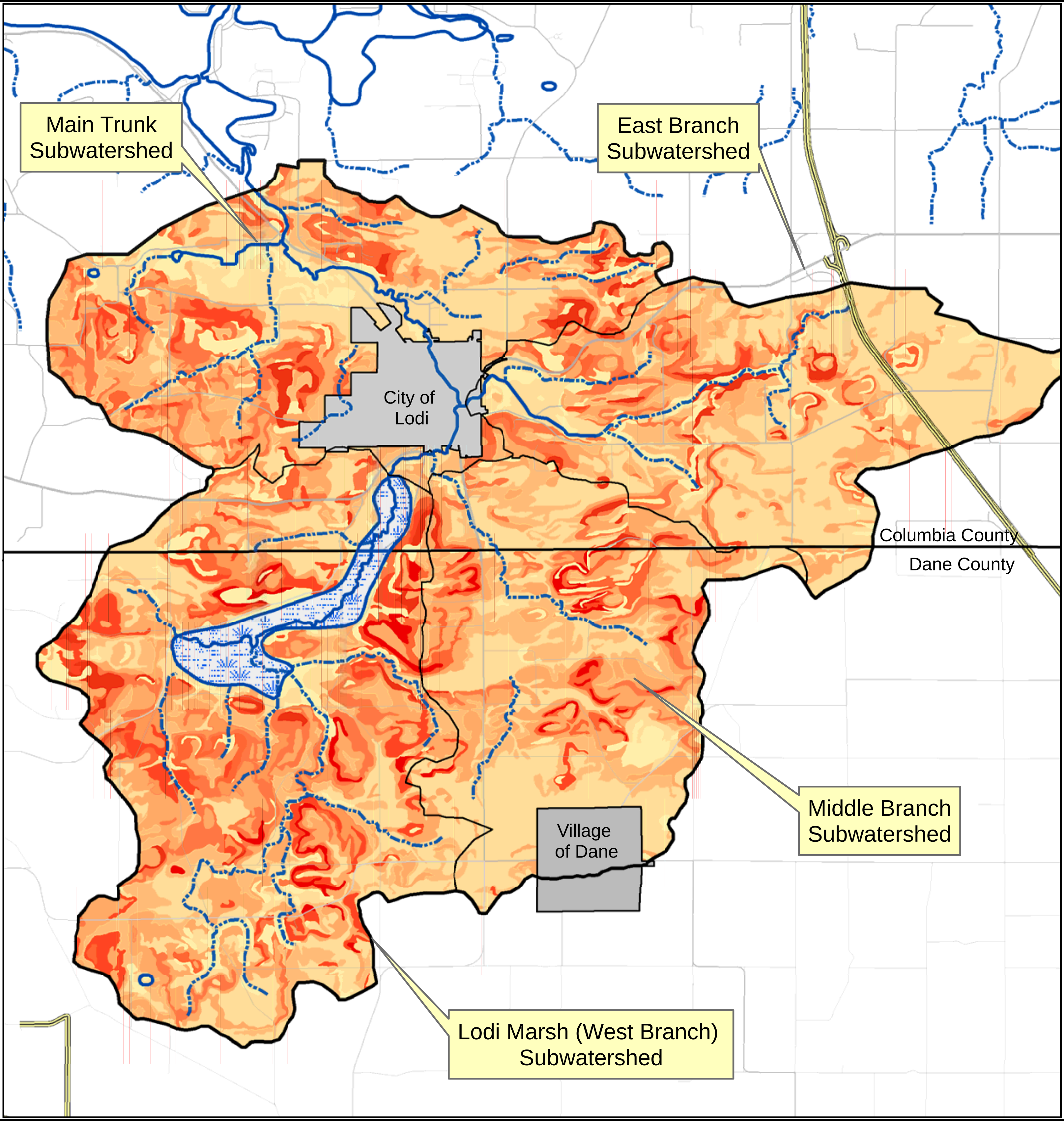
FIGURE B-1

Rotation 1

Spring Creek Watershed, WI



Drafted - LSR, Date - 06-04-08, File - g:/projects/...



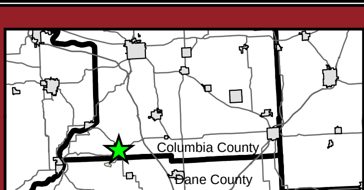
SNAP+ PREDICTED SOIL LOSS RATES

FIGURE B-2

Rotation 1, With Contouring

Spring Creek Watershed, WI

Location Map



Feet

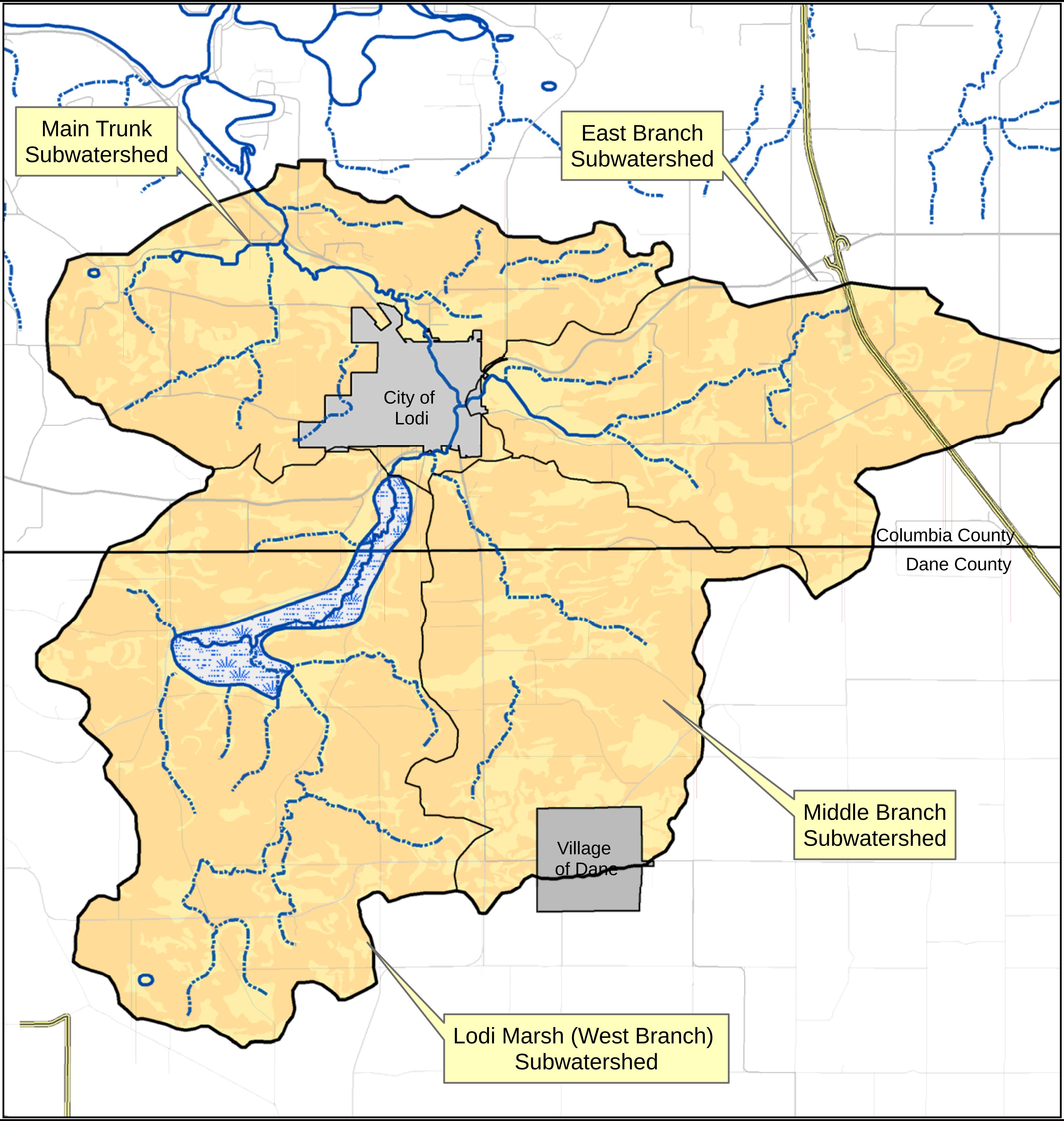
0 2,400 4,800

Soil Loss (tons/acre/year)

0, 1 - 5, 6 - 10, 11 - 15, 16 - 17, 18 - 21, 22 - 27, 28 - 32, 33 - 36, 37 - 48

MSA PROFESSIONAL SERVICES TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

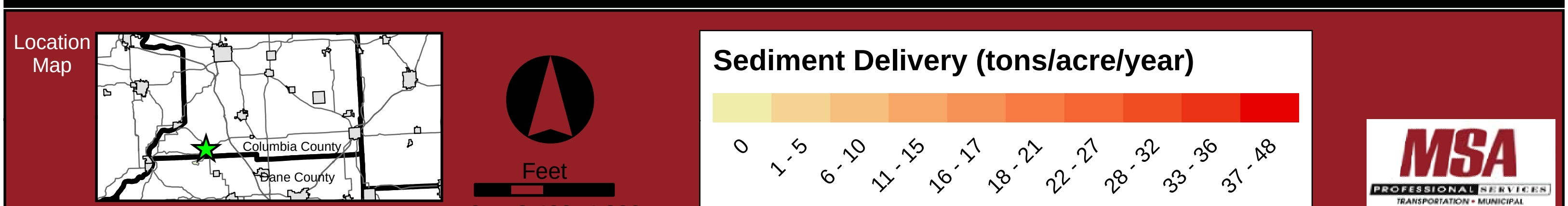


SNAP+ PREDICTED SEDIMENT DELIVERY RATES

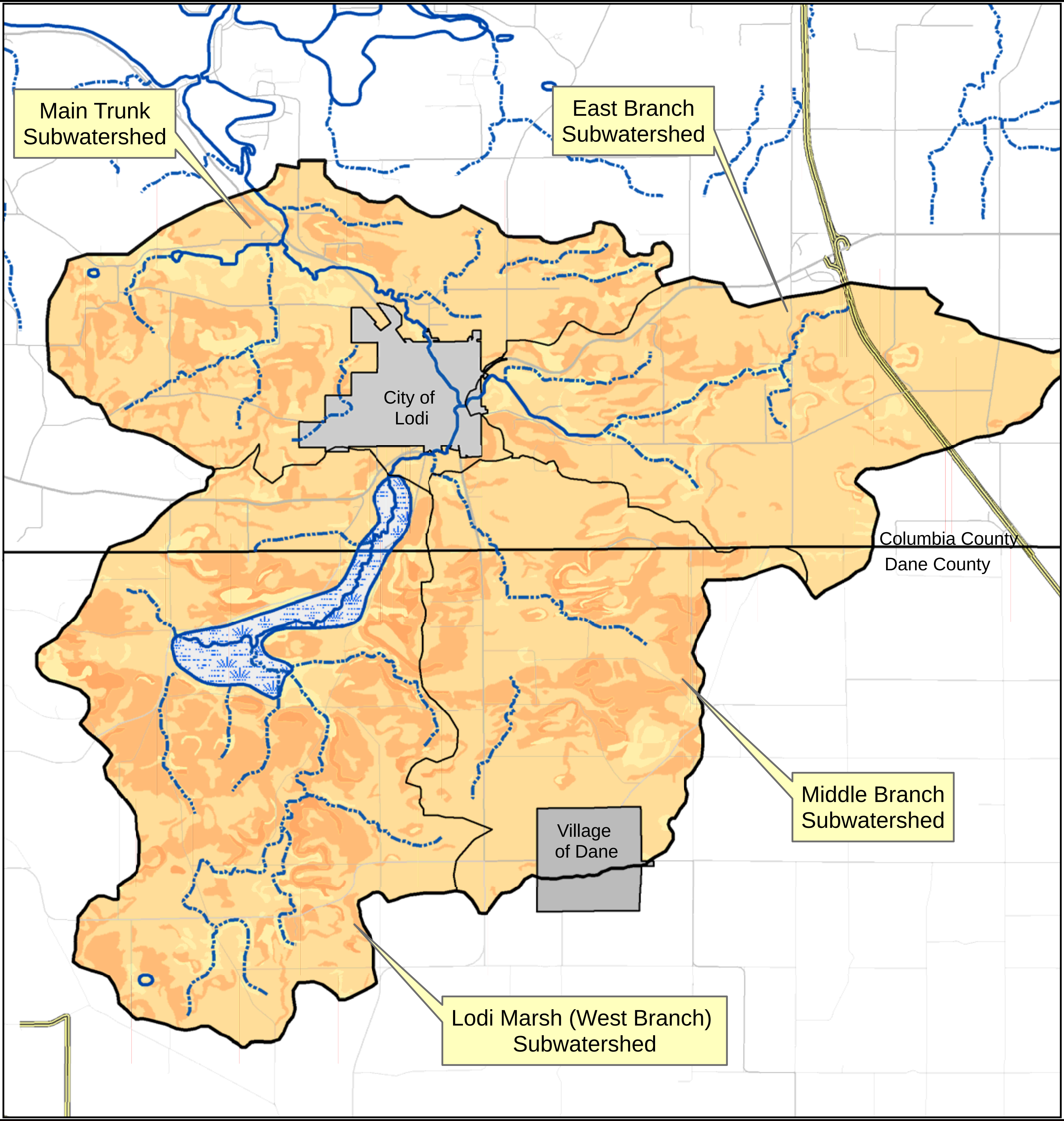
FIGURE B-3

Rotation 1, with Contouring & Filter Strip

Spring Creek Watershed, WI



Drafted - LSR, Date - 06-04-08, File - g:/projects/...



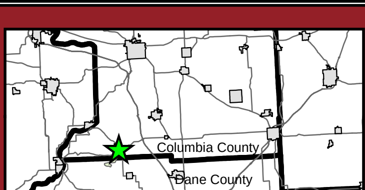
SNAP+ PREDICTED SOIL LOSS RATES

FIGURE B-4

Rotation 2

Spring Creek Watershed, WI

Location Map



Feet

0 2,400 4,800

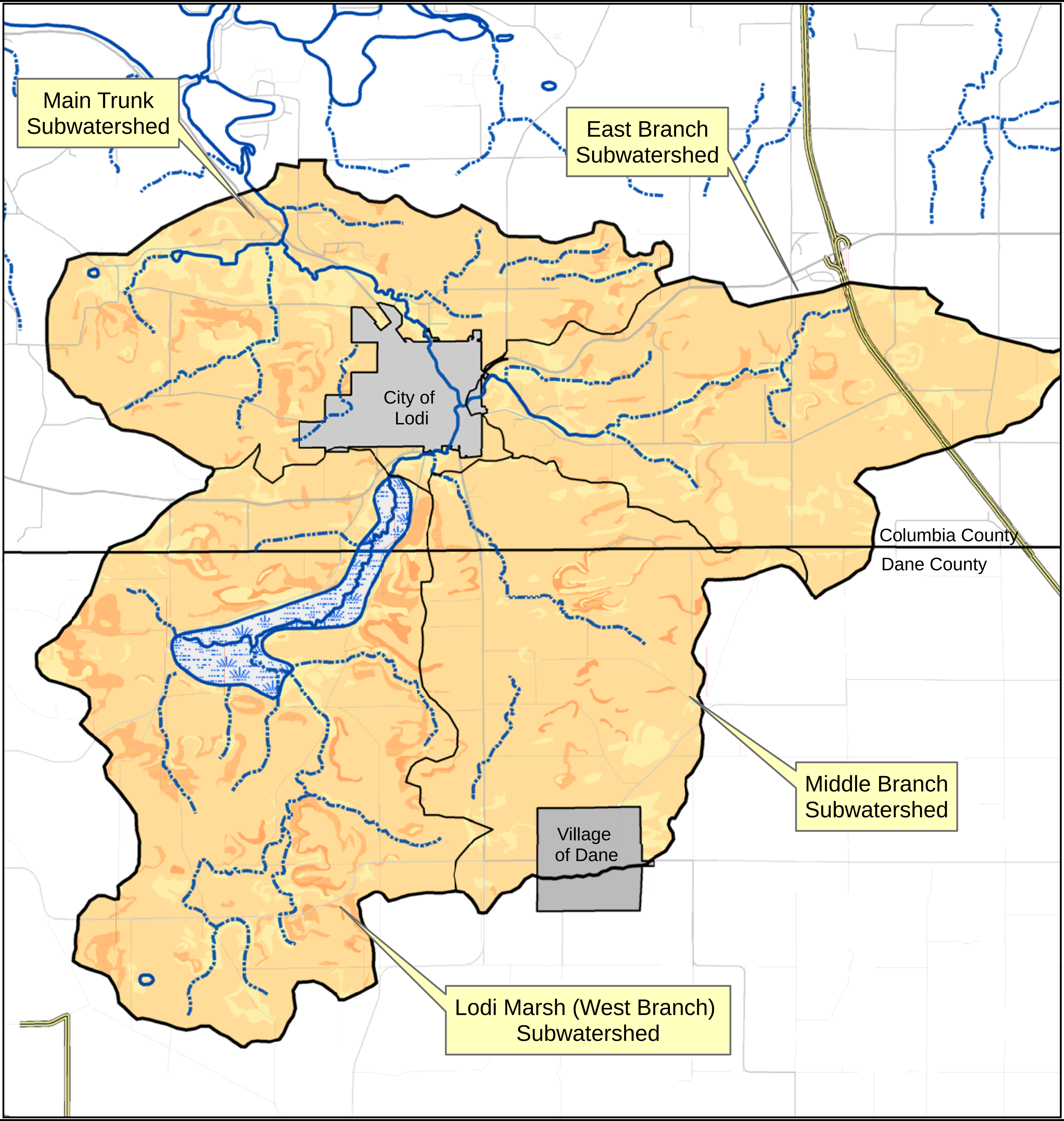
Soil Loss (tons/acre/year)

0, 1 - 5, 6 - 10, 11 - 15, 16 - 17, 18 - 21, 22 - 27, 28 - 32, 33 - 36, 37 - 48

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

MSA PROFESSIONAL SERVICES

TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL



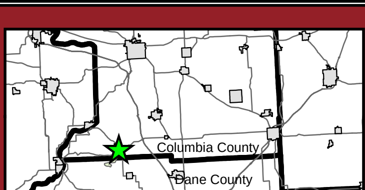
SNAP+ PREDICTED SOIL LOSS RATES

FIGURE B-5

Rotation 2, With Contouring

Spring Creek Watershed, WI

Location Map

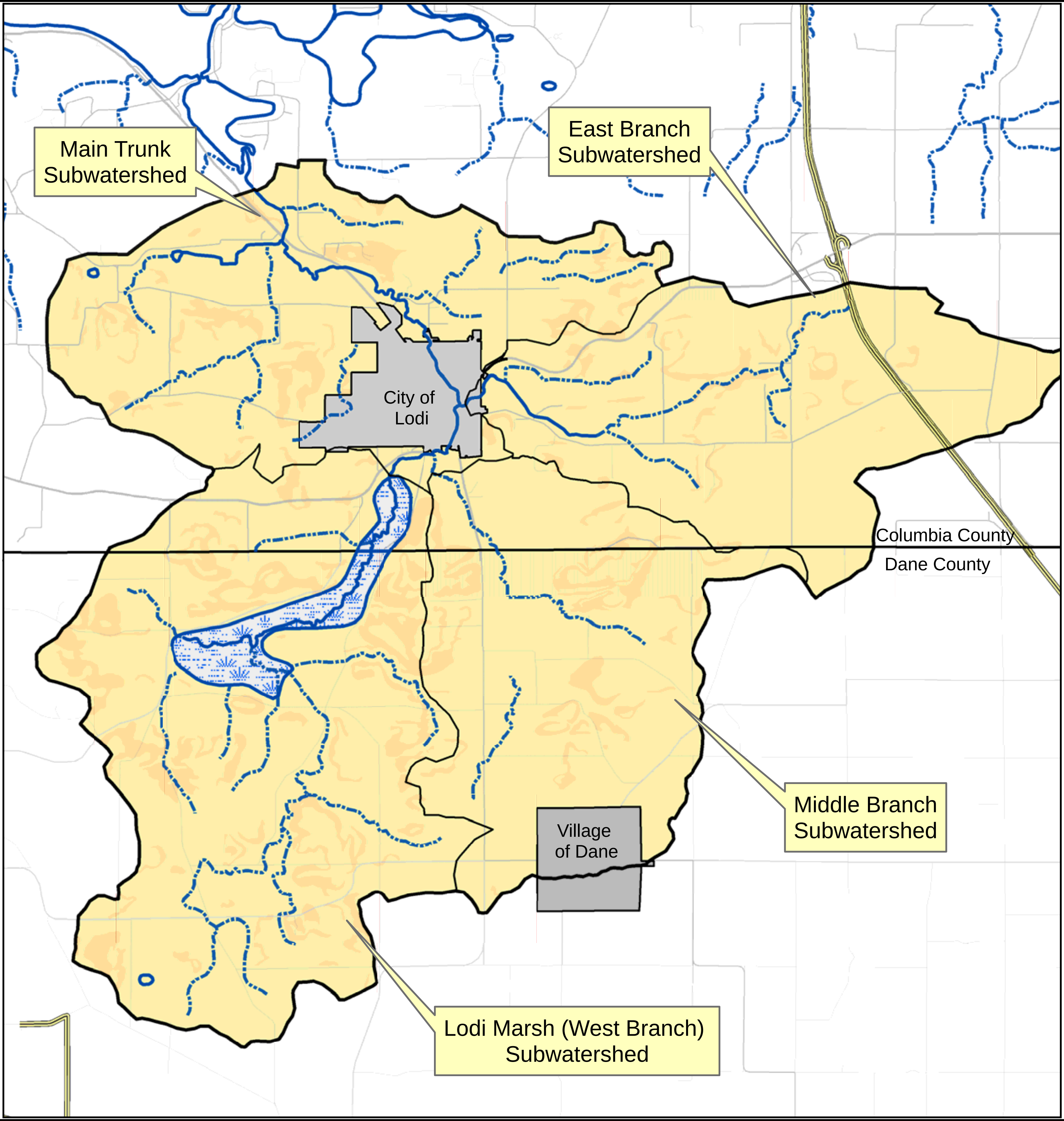


Soil Loss (tons/acre/year)

0 | 1 - 5 | 6 - 10 | 11 - 15 | 16 - 17 | 18 - 21 | 22 - 27 | 28 - 32 | 33 - 36 | 37 - 48

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...



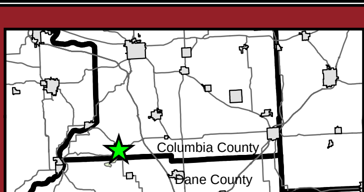
SNAP+ PREDICTED SEDIMENT DELIVERY RATES

FIGURE B-6

Rotation 2 with Contouring & Filter Strip

Spring Creek Watershed, WI

Location Map



Feet

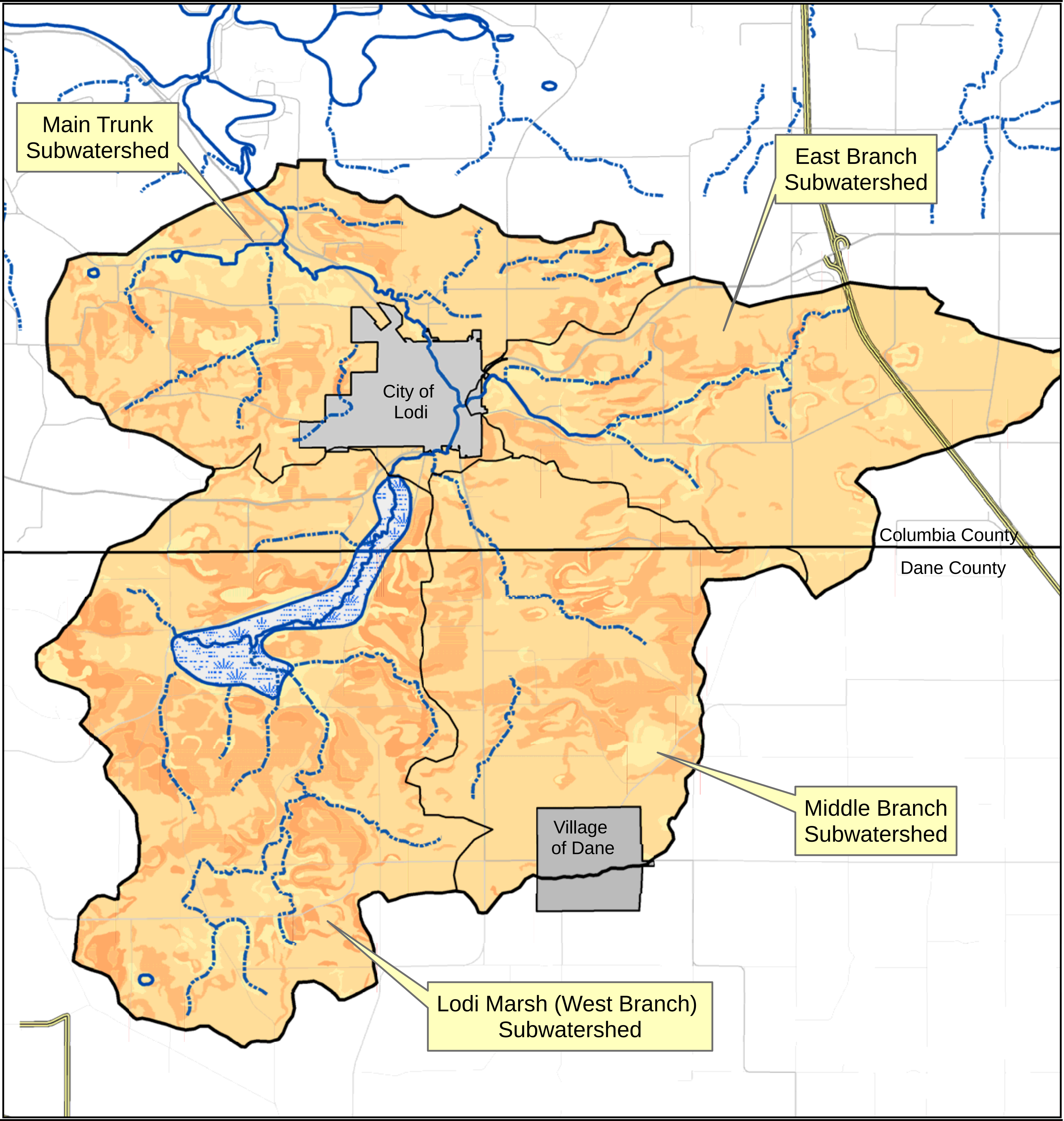
0 2,400 4,800

Sediment Delivery (tons/acre/year)

0 | 1 - 5 | 6 - 10 | 11 - 15 | 16 - 17 | 18 - 21 | 22 - 27 | 28 - 32 | 33 - 36 | 37 - 48

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...



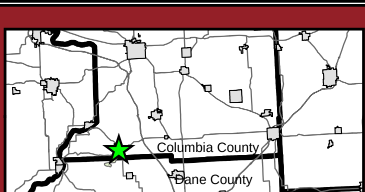
SNAP+ PREDICTED SOIL LOSS RATES

FIGURE B-7

Rotation 3

Spring Creek Watershed, WI

Location Map



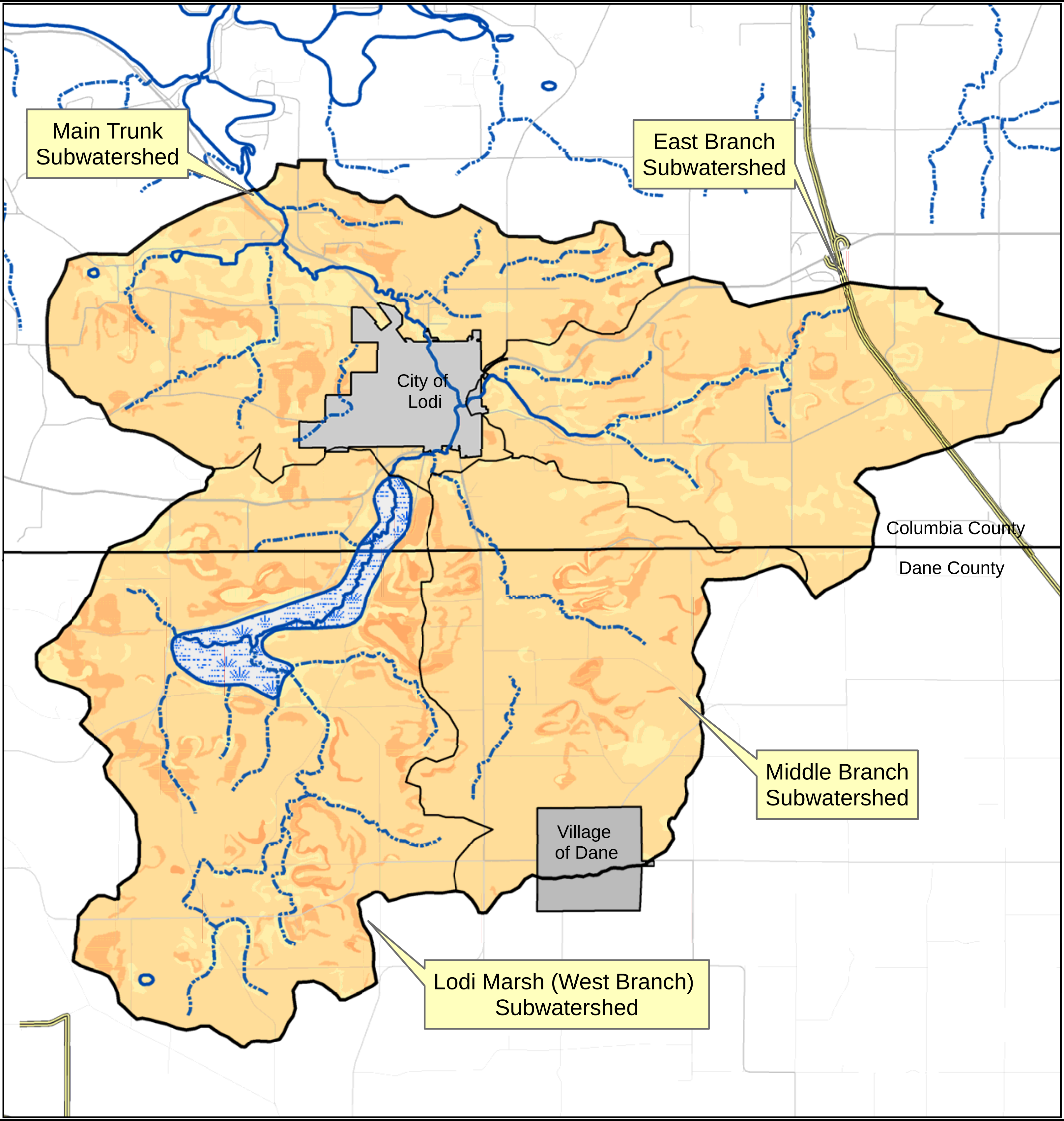
Feet
0 2,400 4,800

Soil Loss (tons/acre/year)

0 | 1 - 5 | 6 - 10 | 11 - 15 | 16 - 17 | 18 - 21 | 22 - 27 | 28 - 32 | 33 - 36 | 37 - 48

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

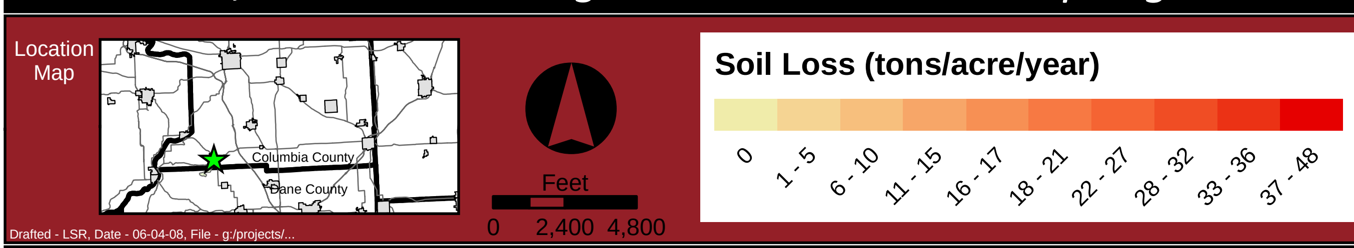


SNAP+ PREDICTED SOIL LOSS RATES

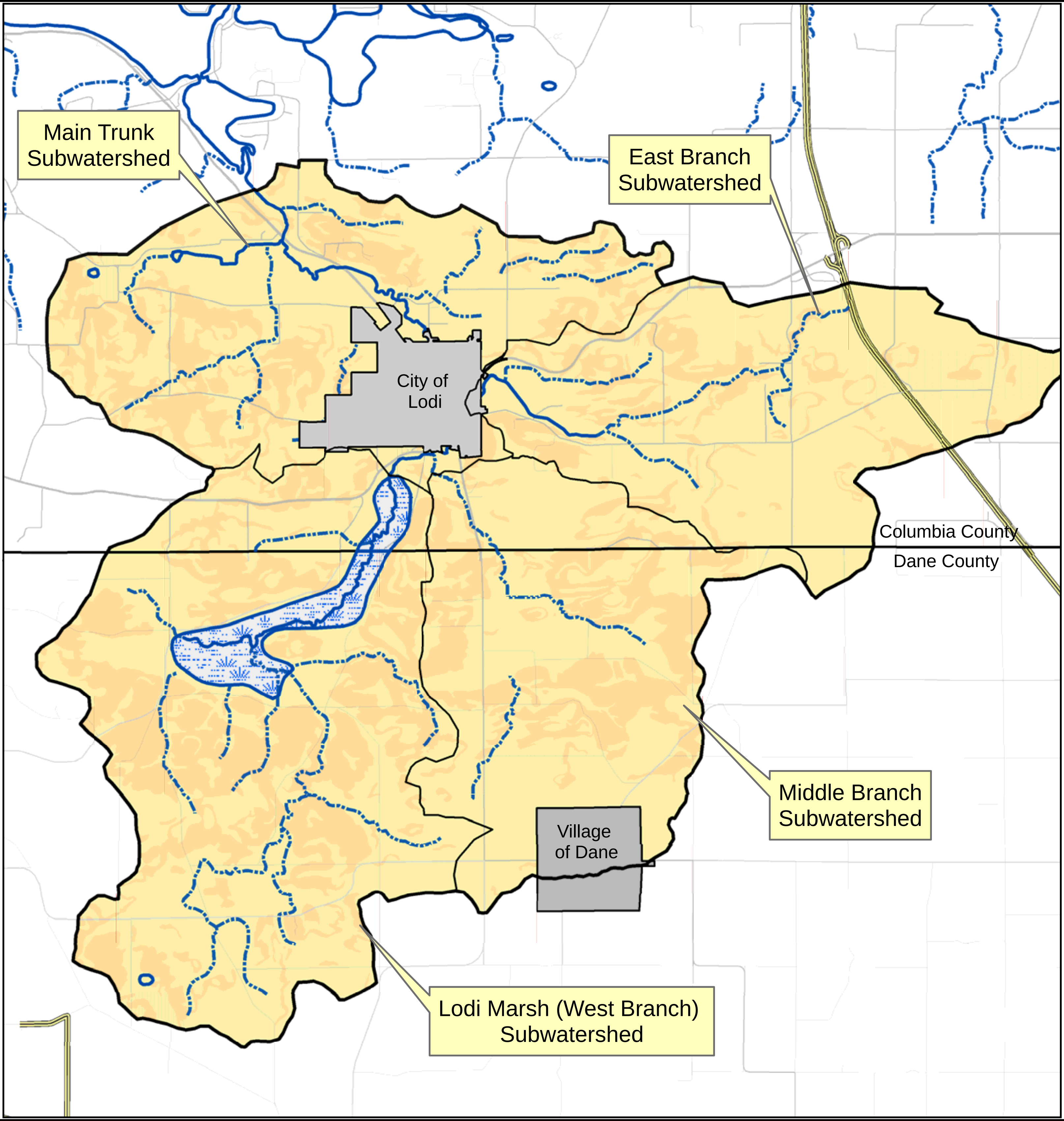
FIGURE B-8

Rotation 3, With Contouring

Spring Creek Watershed, WI

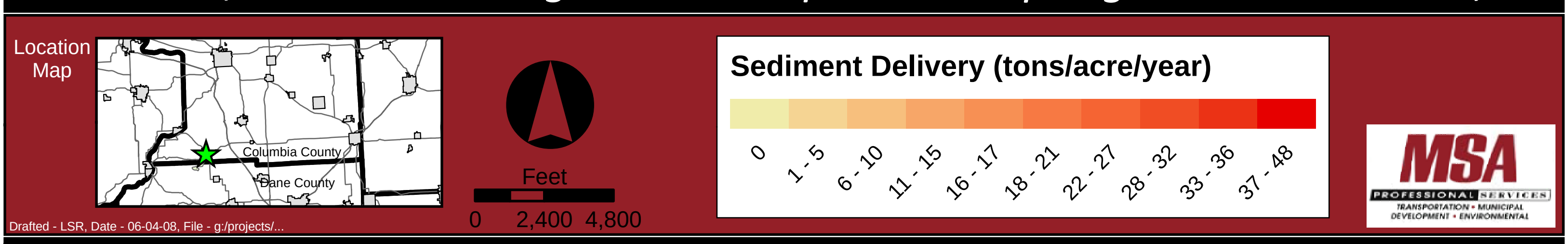


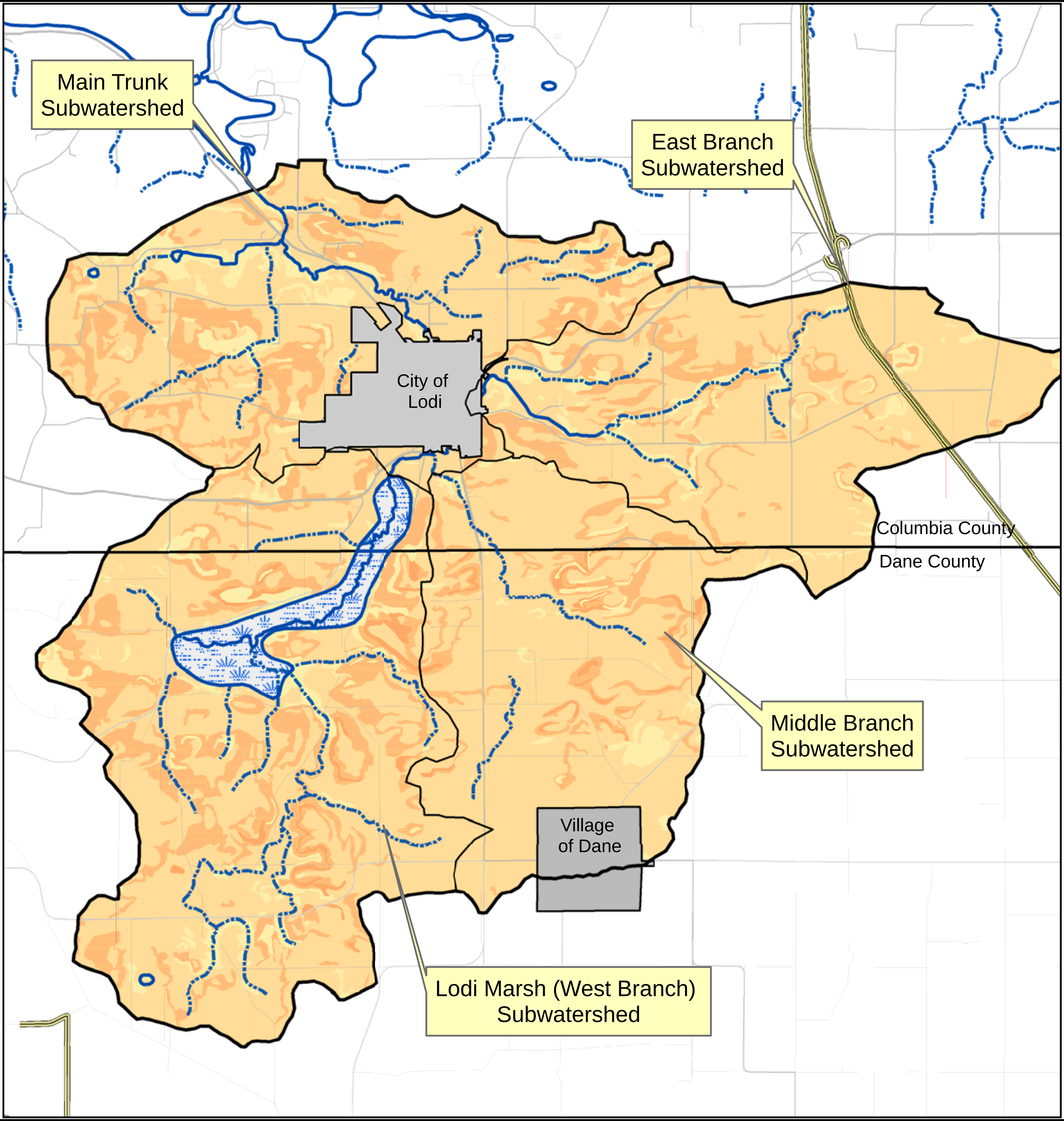
Drafted - LSR, Date - 06-04-08, File - g:/projects/...



SNAP+ PREDICTED SEDIMENT DELIVERY RATES FIGURE B-9

Rotation 3, with Contouring & Filter Strip *Spring Creek Watershed, WI*



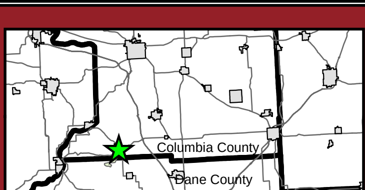


SNAP+ PREDICTED SOIL LOSS RATES

FIGURE B-10

Rotation 4

Spring Creek Watershed, WI

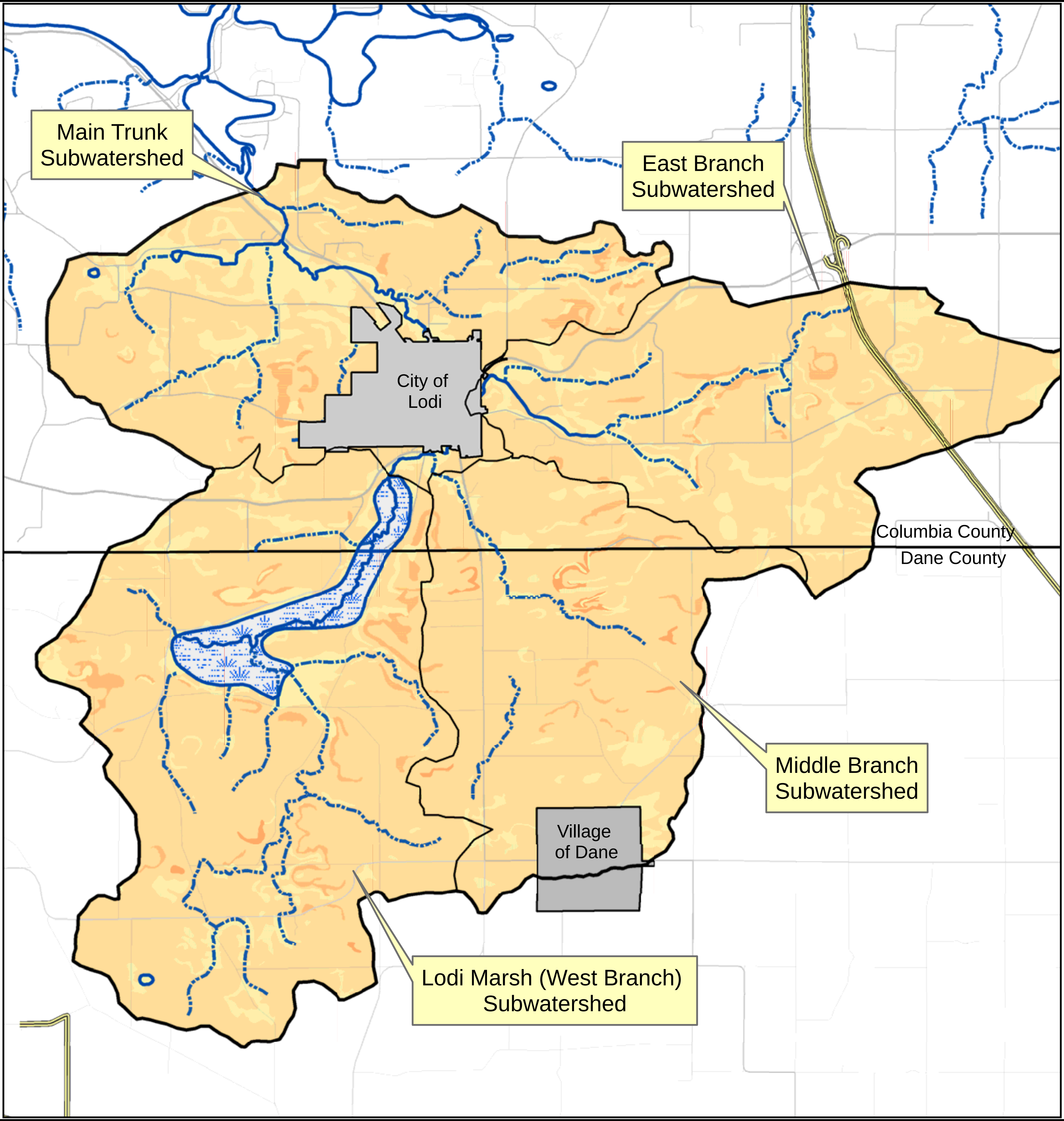


Feet
0 2,400 4,800

Soil Loss (tons/acre/year)

0, 1 - 5, 6 - 10, 11 - 15, 16 - 17, 18 - 21, 22 - 27, 28 - 32, 33 - 36, 37 - 48

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

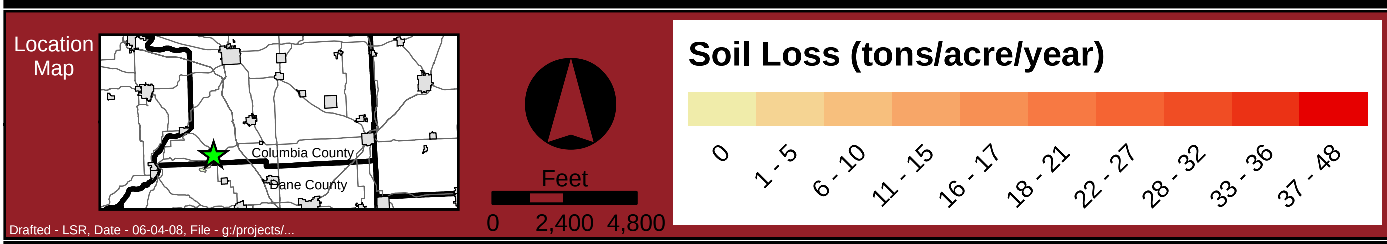


SNAP+ PREDICTED SOIL LOSS RATES

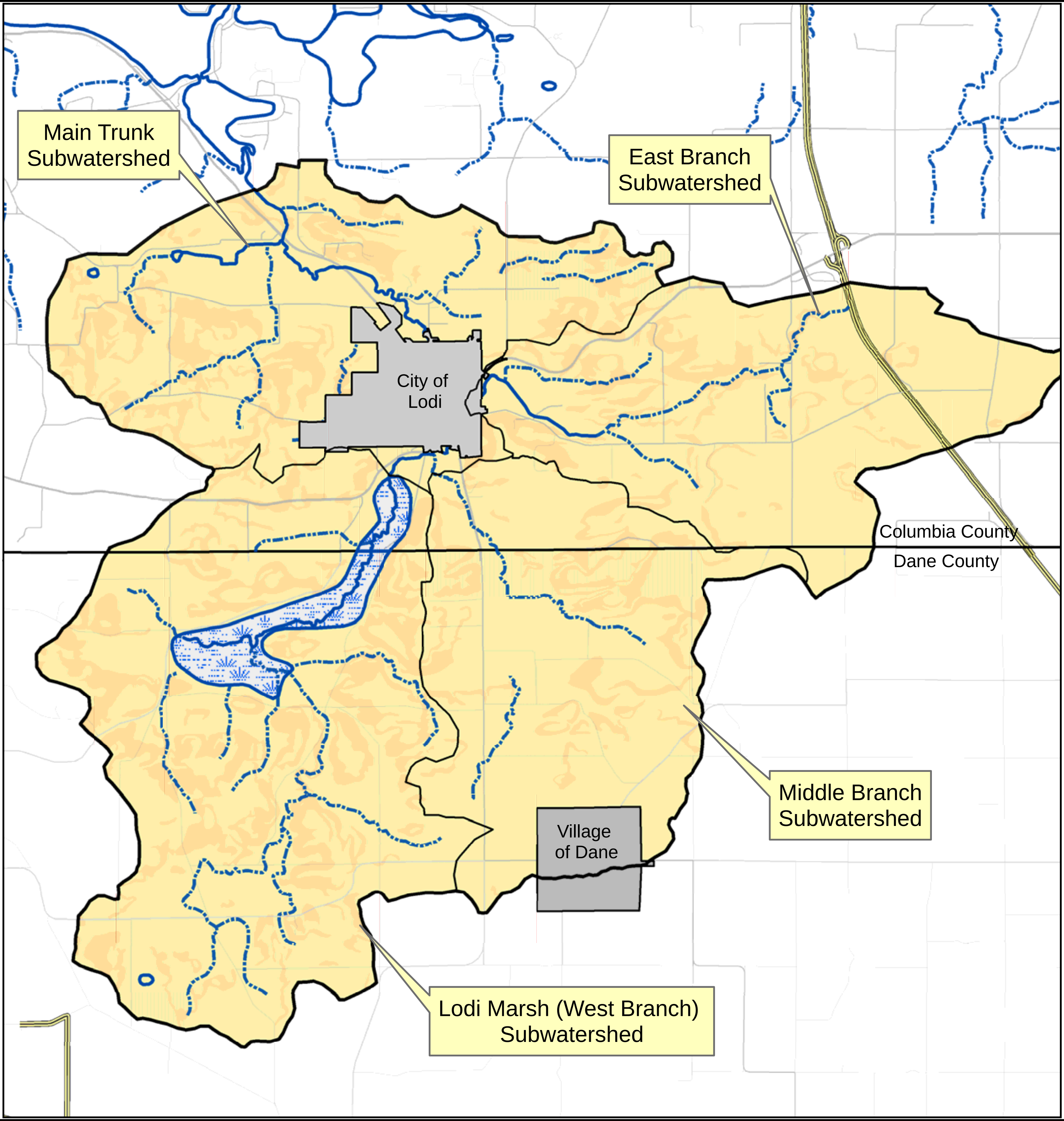
FIGURE B-11

Rotation 4, With Contouring

Spring Creek Watershed, WI



Drafted - LSR, Date - 06-04-08, File - g:/projects/...

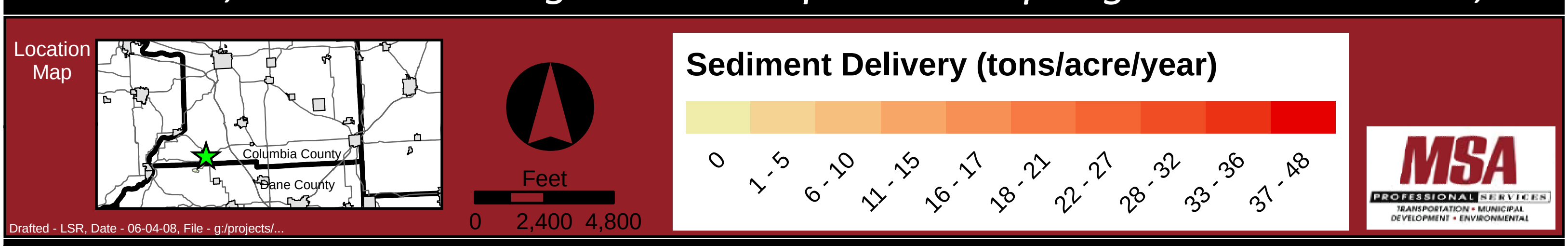


SNAP+ PREDICTED SEDIMENT DELIVERY RATES

FIGURE B-12

Rotation 4, with Contouring & Filter Strip

Spring Creek Watershed, WI



NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FILTER STRIP

(Ac.)

CODE 393

DEFINITION

A strip or area of herbaceous vegetation that removes contaminants from overland flow.

PURPOSE

- Reduce suspended solids and associated contaminants in runoff.
- Reduce dissolved contaminant loadings in runoff.
- Reduce suspended solids and associated contaminants in irrigation tailwater.

CONDITIONS WHERE PRACTICE APPLIES

Filter strips are established where environmentally-sensitive areas need to be protected from sediment, other suspended solids and dissolved contaminants in runoff.

CRITERIA

General Criteria Applicable to All Purposes

Overland flow entering the filter strip shall be uniform sheet flow.

Concentrated flow shall be dispersed before it enters the filter strip.

The maximum gradient along the leading edge of the filter strip shall not exceed one-half of the up-and-down hill slope percent, immediately upslope from the filter strip, up to a maximum of 5%.

State-listed noxious plants will not be established in the filter strip. Filter strips shall not be used as a travel lane for equipment or livestock.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Runoff

The filter strip will be designed to have a 10-year life span, following the procedure in the Agronomy Technical Note No. 2 (Using RUSLE2 for the Design and Predicted Effectiveness of Vegetative Filter Strips (VFS) for Sediment), based on the sediment delivery in RUSLE2 to the upper edge of the filter strip and ratio of the filter strip flow length to the length of the flow path from the contributing area. The minimum flow length through the filter strip shall be 20 feet.

The filter strip shall be located immediately downslope from the source area of contaminants.

The drainage area above the filter strip shall have a slope of 1% or greater.

Vegetation. The filter strip shall be established to permanent herbaceous vegetation

Species selected shall be:

- able to withstand partial burial from sediment deposition and
- tolerant of herbicides used on the area that contributes runoff to the filter strip.

Species selected shall have stiff stems and a high stem density near the ground surface.

Species selected for seeding or planting shall be suited to current site conditions and intended uses. Selected species will have the capacity to achieve adequate density and vigor within an appropriate period to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Species, rates of seeding or planting, minimum quality of planting stock, such as PLS or stem caliper, and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

Site preparation and seeding or planting shall be done at a time and in a manner that best ensures survival and growth of the selected species. What constitutes successful establishment, e.g. minimum percent ground/canopy cover, percent survival, stand density, etc. shall be specified before application.

Planting dates shall be scheduled during periods when soil moisture is adequate for germination and/or establishment.

The minimum seeding and stem density shall be equivalent to a high quality grass hay seeding rate for the climate area or the density of vegetation selected in RUSLE2 to determine trapping efficiency, whichever is the higher seeding rate.

Additional Criteria to Reduce Dissolved Contaminants in Runoff

The criteria given in **"Additional criteria to reduce suspended solids and associated contaminants in runoff"** for location, drainage area and vegetation characteristics also apply to this purpose.

The minimum flow length for this purpose shall be 30 feet.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Irrigation Tailwater

Filter strip vegetation shall be a small grain or other suitable annual plant

The seeding rate shall be sufficient to ensure that the plant spacing does not exceed 4 inches.

Filter strips shall be established early enough prior to the irrigation season so that the vegetation is mature enough to filter sediment from the first irrigation.

The minimum flow length for this purpose shall be 20 feet.

CONSIDERATIONS

General. Filter strip width (flow length) can be increased as necessary to accommodate harvest and maintenance equipment.

Filters strips with the leading edge on the contour will function better than those with a gradient along the leading edge.

Seeding rates that establish a higher stem density than the normal density for a high quality grass hay crop will be more effective in trapping and treating contaminants.

Reducing Suspended Solids and Associated Contaminants in Runoff. Increasing the width of the filter strip beyond the minimum required will increase the potential for capturing contaminants in runoff.

Creating, Restoring or Enhancing Herbaceous Habitat for Wildlife and Beneficial Insects. Filter strips are often the only break in the monotony of intensively-cropped areas. The wildlife benefits of this herbaceous cover can be enhanced by:

- Increasing the width beyond the minimum required, and planting this additional area to species that can provide food and cover for wildlife. This additional width should be added on the downslope side of the filter strip.
- Adding herbaceous plant species to the filter strip seeding mix that are beneficial to wildlife and compatible for one of the listed purposes. Changing the seeding mix should not detract from the purpose for which the filter strip was established.

Maintain or Enhance Watershed Functions and Values. Filter strips can:

- enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed.
- enhance the aesthetics of a watershed.
- be strategically located to reduce runoff, and increase infiltration and ground water recharge throughout the watershed.

Air Quality. Increasing the width of a filter strip beyond the minimum required will increase the potential for carbon sequestration.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for each field site where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements.

As a minimum, the plans shall include:

a) Length, width (flow path), and slope of the filter strip to accomplish the planned purpose (width refers to flow length through the filter strip).

b) Species selection and seeding or sprigging rates to accomplish the planned purpose

c) Planting dates, care and handling of the seed to ensure that planted materials have an acceptable rate of survival

d) A statement that only viable, high quality and regionally adapted seed will be used

e) Site preparation sufficient to establish and grow selected species

OPERATION AND MAINTENANCE

For the purposes of filtering contaminants, permanent filter strip vegetative plantings shall be harvested as appropriate to encourage dense growth, maintain an upright growth habit and remove nutrients and other contaminants that are contained in the plant tissue.

Control undesired weed species, especially state-listed noxious weeds.

If prescribed burning is used to manage and maintain the filter strip, an approved burn plan must be developed.

Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas and take other measures to prevent concentrated flow through the filter strip.

Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.

Periodically re-grade and re-establish the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function. Reestablish the filter strip vegetation in these regraded areas, if needed.

If grazing is used to harvest vegetation from the filter strip, the grazing plan must insure that the integrity and function of the filter strip is not adversely affected.

REFERENCES

Dillaha, T.A., J.H. Sherrard, and D. Lee. 1986. Long-Term Effectiveness and Maintenance of Vegetative Filter Strips. VPI-VWRRC Bulletin 153.

Dillaha, T.A., and J.C. Hayes. 1991. A Procedure for the Design of Vegetative Filter Strips: Final Report Prepared for U.S. Soil Conservation Service.

Foster, G.R. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Science Documentation (In Draft). USDA-ARS, Washington, DC. 2005.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture. Agriculture Handbook 703.

1.0 INTRODUCTION

This section of the report summarizes the results and findings of a field inspection of the Spring Creek stream corridor and Lodi Marsh. The inventory included an inspection of riparian buffers, channel erosion, and the functional values of Lodi Marsh as they relate to the quality of stormwater runoff. The channel erosion and riparian buffer inventory was conducted via field investigation at road crossings and recent aerial photos. The marsh investigation was conducted in the field at eleven (11) observation points within the marsh.

2.0 BACKGROUND

2.1 RIPARIAN BUFFERS

Riparian buffer is a term used to describe lands adjacent to streams where vegetation is influenced by the presence of water. Riparian buffers are an important water quality feature for several reasons. First, riparian zones slow runoff and allow pollutants to settle, thereby reducing the amount of sediment, nitrogen, phosphorus, and pesticides that reach a stream. Furthermore, overhanging riparian vegetation can help keep streams cool, which is especially important for trout streams such as Spring Creek. Riparian buffers also provide valuable habitat for wildlife, as they provide them with food, cover and a corridor or travel way. Finally, riparian vegetation can slow floodwaters and stabilize the stream channel thereby helping to maintain stable streambanks minimize channel erosion.

2.2 BANK EROSION

Bank erosion occurs when the force exerted by flowing water on a stream channel's bed and banks is stronger than the resistance of bank materials. Under such conditions, the energy of the flowing water erodes the streambank materials and carries and deposits the materials somewhere downstream. Erosion is a natural process that occurs even in healthy streams, however, erosion can be accelerated in areas where human activity has altered watershed characteristics. This is often the case in urban watersheds and agricultural watersheds with drainage improvements, where increased impervious surfaces cause a flashy response to precipitation events within stream channels. In addition to the increase in flood peaks and peak discharge, the frequency of higher or bankfull flow also increases in streams draining urbanized and urbanizing watersheds. The increased frequency of high flows provides greater opportunity for erosion to occur.

2.3 LODI MARSH

Lodi Marsh is a 400 acre wetland complex on the Dane-Columbia County line that is owned by the DNR and designated as a state natural area. The marsh is dominated by cattails, bulrushes, and sedges, and home to a diversity of animal and insect species indicative of high quality prairie and wetland habitat. Among the areas of note within the marsh are a knob on the south side of the marsh that supports a forest of red oak, sugar maple and basswood; and a seepage along the base of the southern hillslope which supports an abundance of skunk cabbage, marsh marigold, marsh fern, northern bedstraw and swamp loosestrife, spring cress cabbage and mountain mint. The marsh is also home to numerous species of the Papaipema moths, which are generally considered indicators of high-quality wetland habitat. Breeding birds found here include great-blue heron, Sandhill crane, common snipe, willow and alder flycatcher, sedge wren, marsh wren, yellow warbler, blue-winged warbler, and a large number of red-winged blackbirds. (WDNR, 2005, *Lodi Marsh - State Natural Area - No. 374*, http://dnr.wi.gov/org/land/er/sna/sna374.htm). The WDNR believes that the wetland helps buffer the stream from the impacts of agricultural activities in the upstream watershed.

3.0 METHODOLOGY

3.1 RIPARIAN BUFFERS

The field assessment of stream buffers was completed by recording the buffer width and vegetation (or land use type) at each road crossing. Vegetation and land use were categorized as one of the following: mowed grass, tall grass, woods, crops, pasture and developed. In areas where there was tall or mowed grass, or woods it was considered to have a riparian buffer. In areas where there were crops, pasture and/or development along the stream it was determined to have no buffer. These field observations were supplemented with aerial photo review of the watershed to "connect the dots" or interpolate between data points.

3.2 BANK EROSION

Assessment of creek bank erosion was completed using the method outlined in the document, "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" by L.J. Steffen, 1982. The Wisconsin Natural Resources Conservation Service reproduced this information in the document "Field Office Technical Guide" dated 2003. Field inspections were conducted at each stream-road crossing during September and October, 2008. Additional data points were taken in navigable portions of the stream within City limits (where trespassing wasn't an issue). The open channels inspected in this report are natural channels with defined beds and banks that are part of or directly tributary to Spring Creek. This includes approximately 50 miles of channels.

In total, there were 48 crossing points. At each crossing where erosion was qualitatively classified as "slight" or greater, data was collected. In cases where erosion differed between right and left bank, or upstream and downstream of crossing, each of these was recorded as a separate data point.

3.3 LODI MARSH

The assessment of Lodi marsh was conducted in the field by photographing and recording observations at 11 representative locations. The WDNR's Rapid Assessment Methodology for Evaluating Wetland Functional Values was performed as a means of evaluating the marsh's stormwater attenuation, water quality protection, and groundwater recharge and discharge functions.

4.0 RESULTS

4.1 RIPARIAN BUFFERS

The results of the riparian buffer inventory indicate that there is some type of vegetative buffer immediately adjacent to Spring Creek along 93% of the stream corridor. This percentage is slightly higher within the City of Lodi, (96%) and slightly lower in the rural areas of the watershed (93%). The width of buffer varies along the stream corridor. For example, the buffer extends from 21-60 feet along 64% of stream and >100 feet along 54% of the stream. The type of riparian buffer also varies somewhat with in the watershed; in rural areas tall grass is the most common type (54%), while woods (44%) and mown grass (2%) are less common. Within the City of Lodi, 64 % of the length of riparian buffer immediately adjacent to the creek is woods, while the remaining 36% is tall grass. Refer to Table C-1 and Figures C1 and C2 to see how buffer width and type varies within different areas of the watershed.

Table C-1. Creek Corridor Buffer With

	Buffer Width	
	1-5 ft	**>100 ft**
Rural Areas	93%	53%
City of Lodi	96%	81%

Figure C-1. Spring Creek Corridor Buffer With

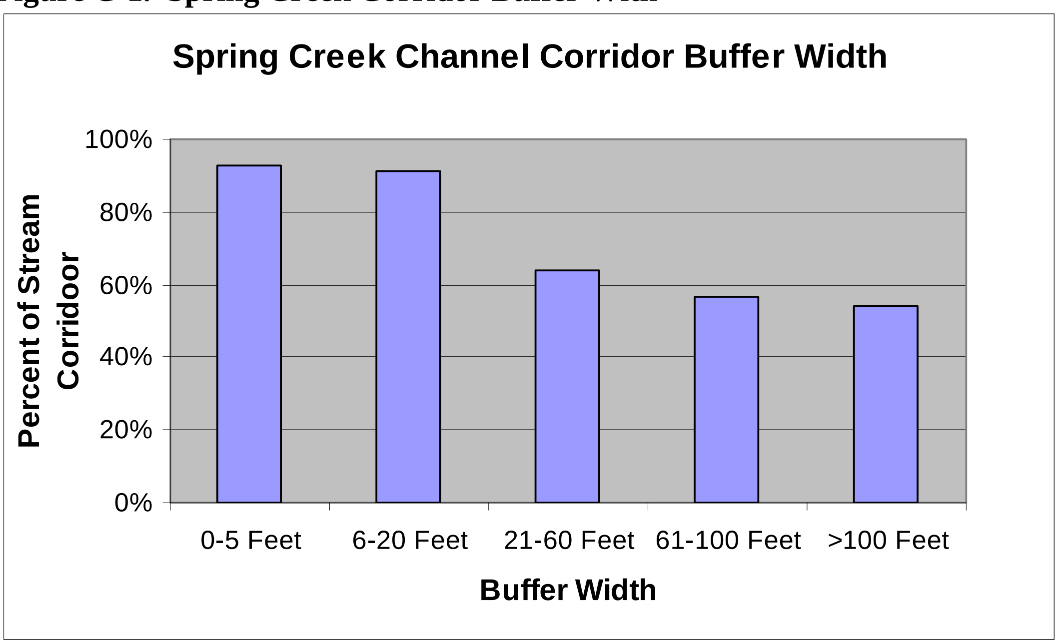
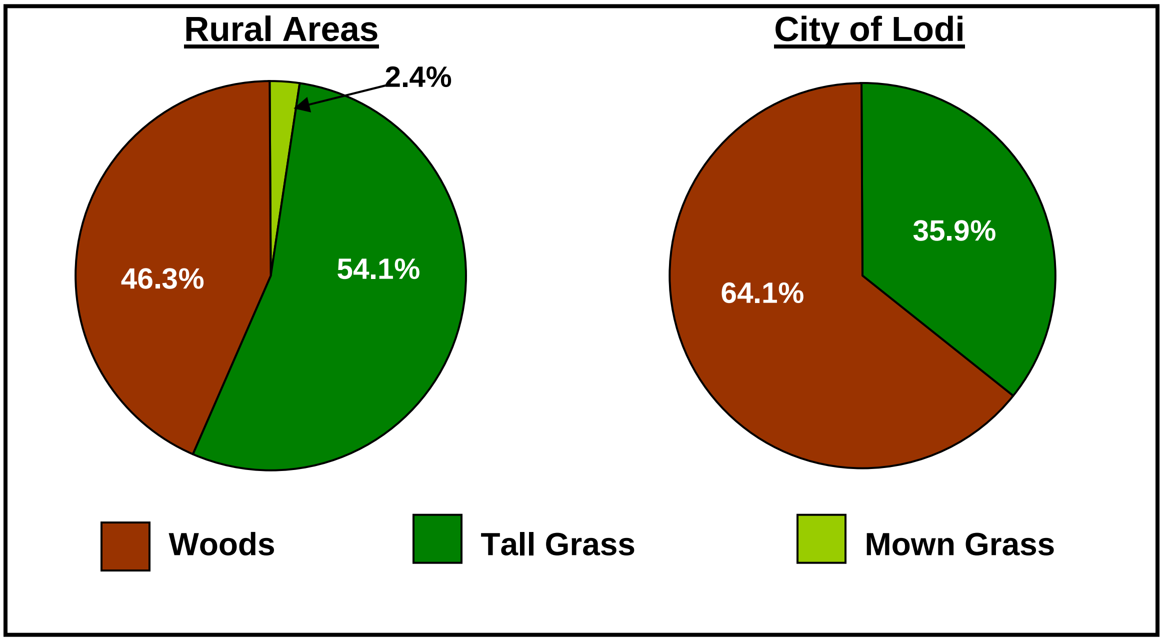


Figure C-2. Stream Buffer Type immediately adjacent to Stream



4.2 CHANNEL EROSION

The field investigation included 48 crossing locations. There were 78 occurrences of erosion which were classified as greater than slight. At 21 data points, the erosion was moderate and 5 locations severe. Locations with moderate and severe erosion were generally found along stream segments with sandier soils. Figures C-4 and C-5 identify the locations where erosion was observation. The approximate total length of channel, including the main branch and sub-branches, both upstream and downstream of the City is approximately 50 miles, which translate into 100 miles of channel bank. The soils along the stream banks within and upstream of the City were found to be primarily silt loam, with a few areas of sandy loam. Data sheets for all observation points can be found in Appendix C-1.

The average erosion rate calculated from the 78 observed data points, if prorated along the entire channel length would be equivalent to 5216 tons of sediment loss annually, or 0.17 tons per acre of watershed per year.

4.3 LODI MARSH

Field observations at 11 locations within Lodi Marsh were consistent with WDNR reports that it is a high quality wetland with a high density of vegetation, wide variety of plant communities, and relatively high plant diversity. Several springs were observed in areas near sandstone hills along the sides of the marsh, indicating that the wetland is a source of baseflow for the creek.

Field observations were consistent with WDNR reports that the marsh acts as a buffer and filter for stormwater runoff between the creek and upstream areas of the watershed. It appeared that the marsh's dense vegetation could utilize nutrient inputs and trap sediment from agricultural runoff.

The Table C-2 below summarizes the Functional Value Assessment for Lodi Marsh. The full functional values assessment is attached to this report in Appendix C-2. Photos and descriptions of each of the eleven observation points can also be found in Appendix C-2.

Table C-2. Lodi Marsh Functional Values Summary

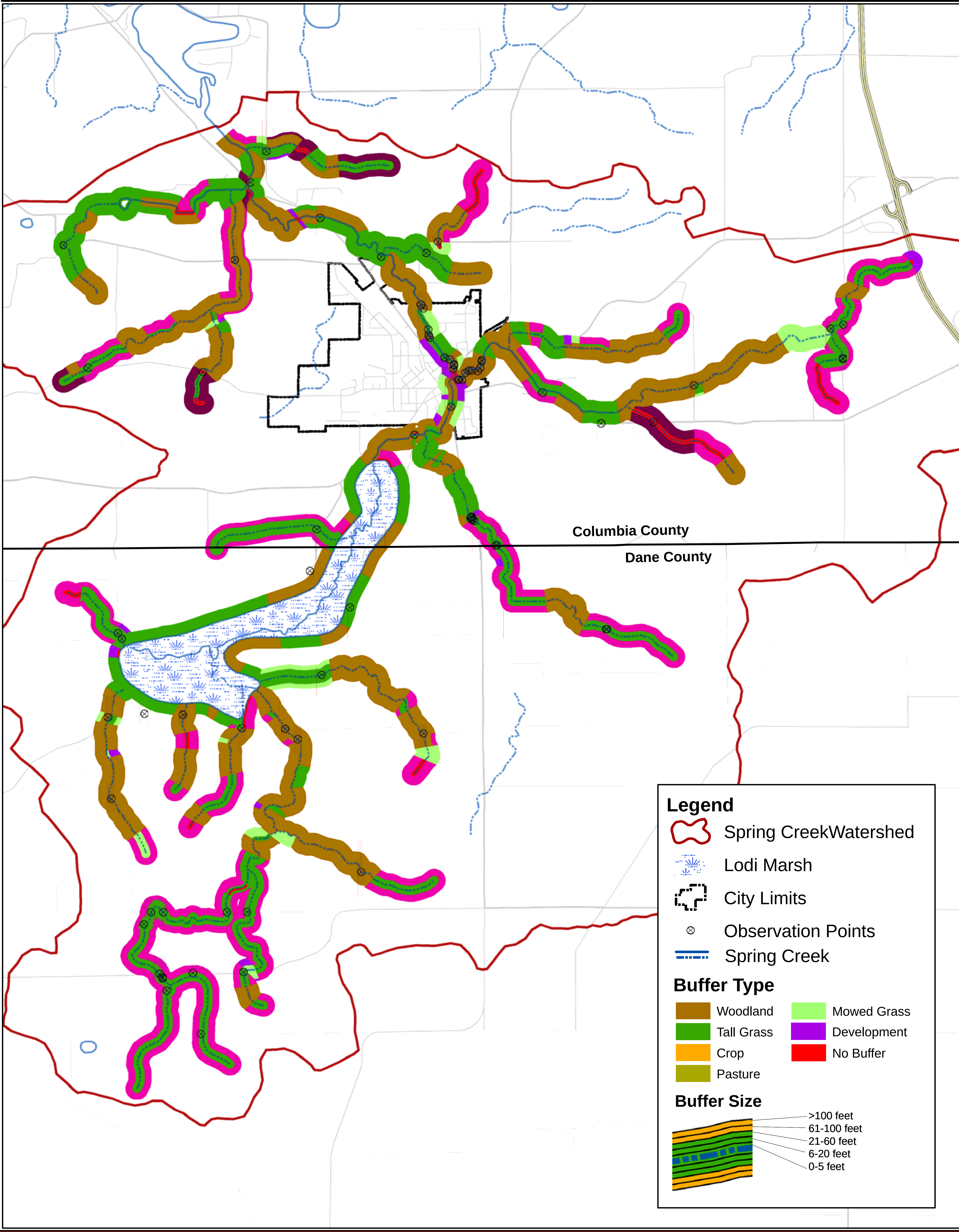
Function	Significance			
	Low	Med	High	Exceptional
Floral Diversity			X	
Wildlife Habitat			X	
Fishery Habitat			X	
Stormwater Attenuation				X
Groundwater Recharge & Discharge				X
Water Quality Protection				X
Aesthetics/Recreation/Educations			X	

Based on the field observations and functional values assessment, the effects of soil loss from farm fields and sedimentation into Spring Creek in areas upstream of Lodi Marsh appears to be minimal due to the buffering ability of the marsh.

5.0 RECOMMENDATIONS

Based on the findings documented in the previous section, the following recommendations should be considered:

1. Maintain the current network of riparian buffers, and identify opportunities and locations for enhancing their pollutant filtering abilities. For examples, areas where there is a mown grass buffer could be converted to an un-mown grass buffer. Areas with narrow buffers could be widened.
2. Along areas of the creek draining highly erodible farm lands, consider modifying the buffer to create a filter strip consistent with NRCS Conservation Practice Standard 393 (Appendix B-1).
3. Maintain and enhance the buffering capacity of Lodi Marsh. (Since this is a designated state natural area, presumably there are no plans to modify the Marsh in a way that would significantly reduce its functional values).
4. Conduct an erosion inventory along all navigable reaches of the Spring Creek, focusing especially on areas with sandy soils. If significant stretches of channel bank with severe erosion are discover, work with the landowner and county to stabilize the channel bank. Restrict land uses along the channel bank that may cause an increase in channel erosion.

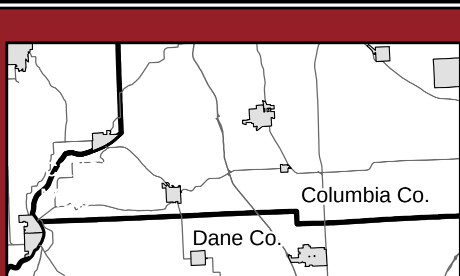


RIPARIAN BUFFER INVENTORY

FIGURE C-1

Spring Creek Watershed

Dane and Columbia Counties, Wisconsin

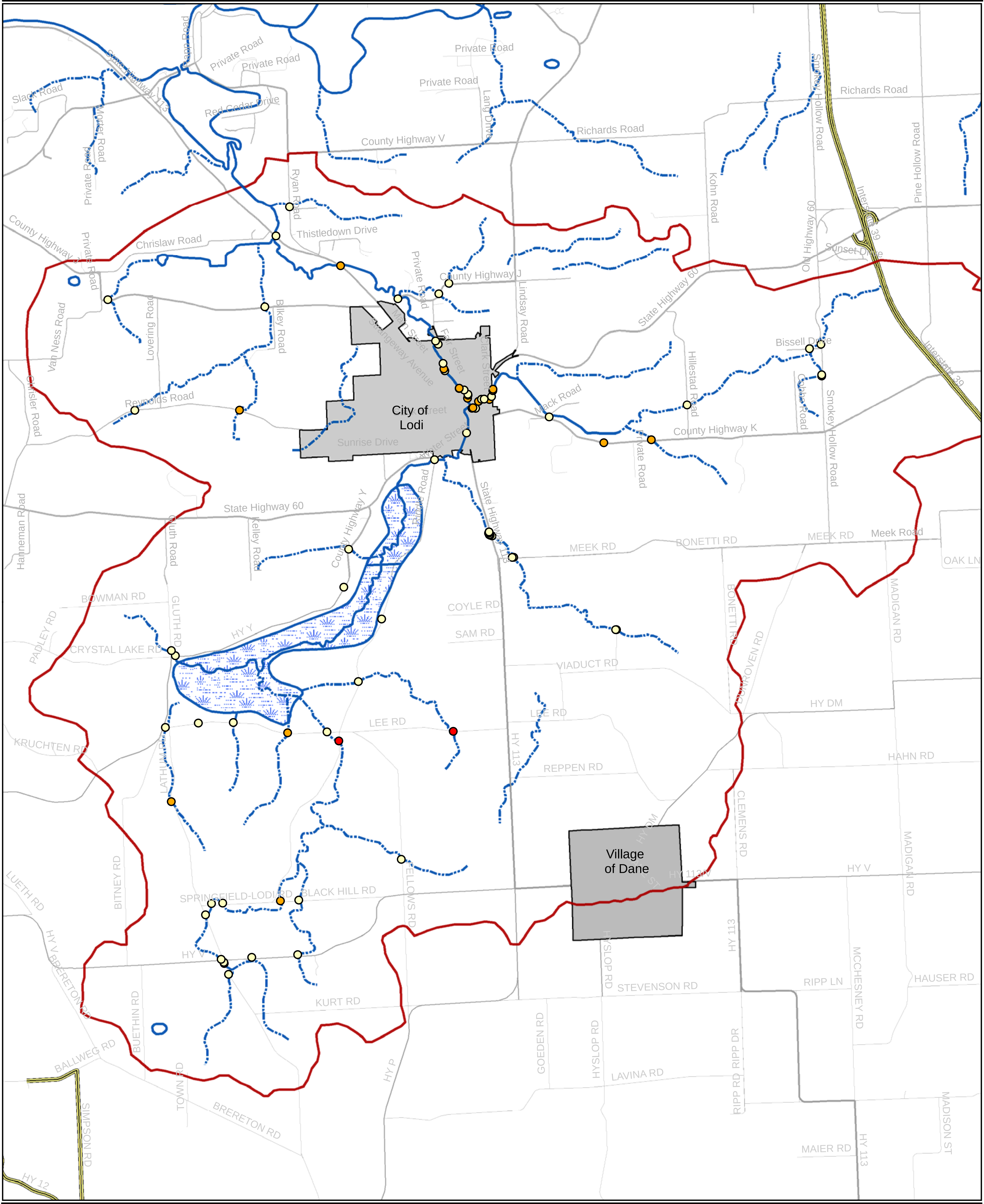


Feet

0 2,400 4,800

MSA PROFESSIONAL SERVICES TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

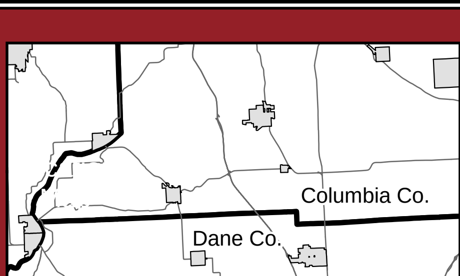


CHANNEL EROSION DATA POINTS

FIGURE C-4

Spring Creek Watershed

Dane and Columbia Counties, Wisconsin



Feet

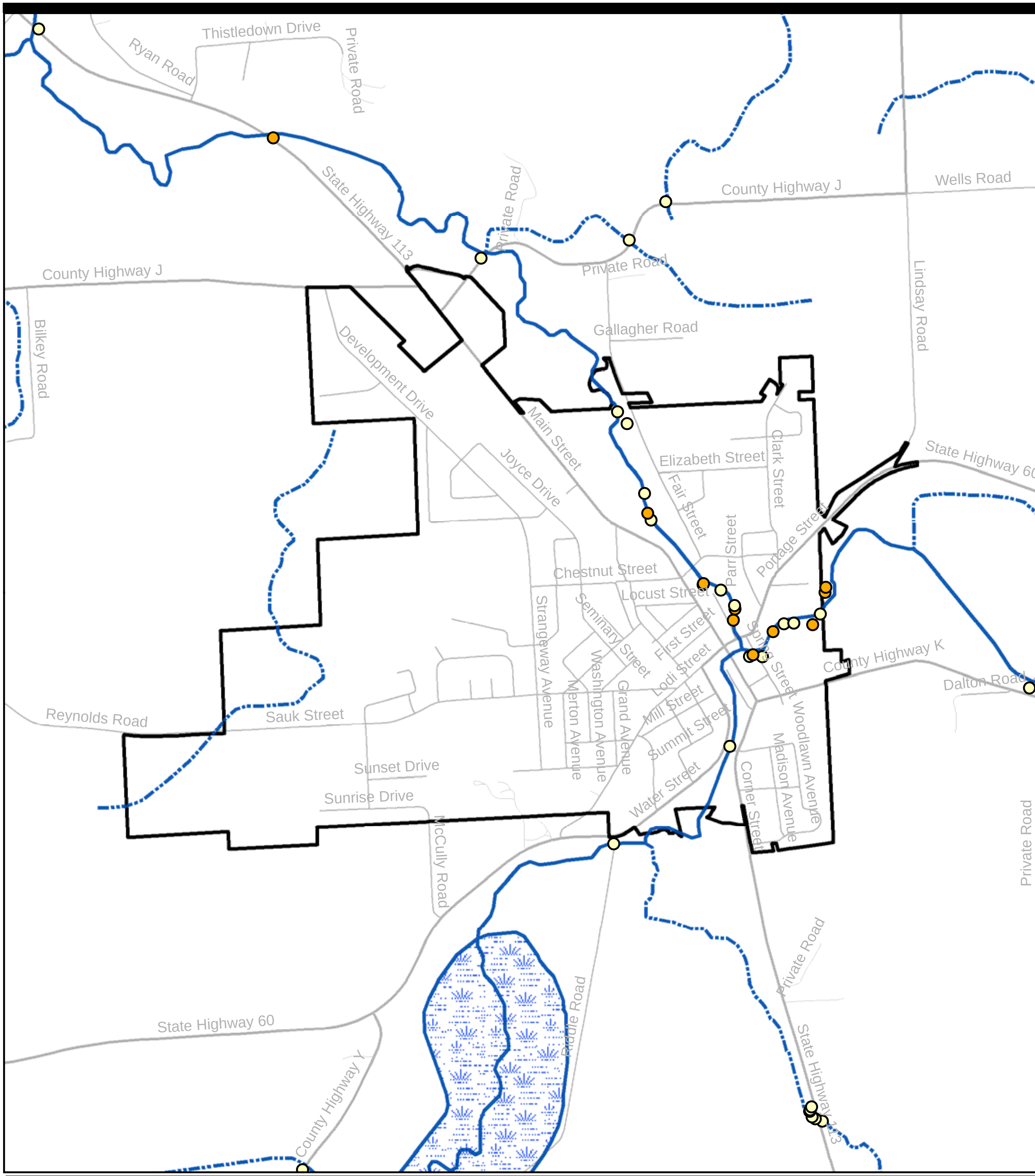
0 2,400 4,800

Channel Erosion

- Slight or None
- Moderate
- Severe
- Municipal Limits
- SpringCreekWatershed
- Lodi Marsh

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

Drafted - LSR, Date - 06-04-08, File - g:/projects/...

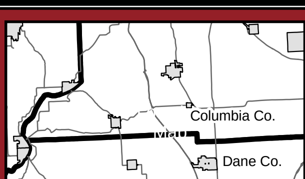


CHANNEL EROSION DATA POINTS

FIGURE C-5

City of Lodi

Columbia County, Wisconsin



Drafted - LSR, Date - 06-04-08, File - g:/projects/...

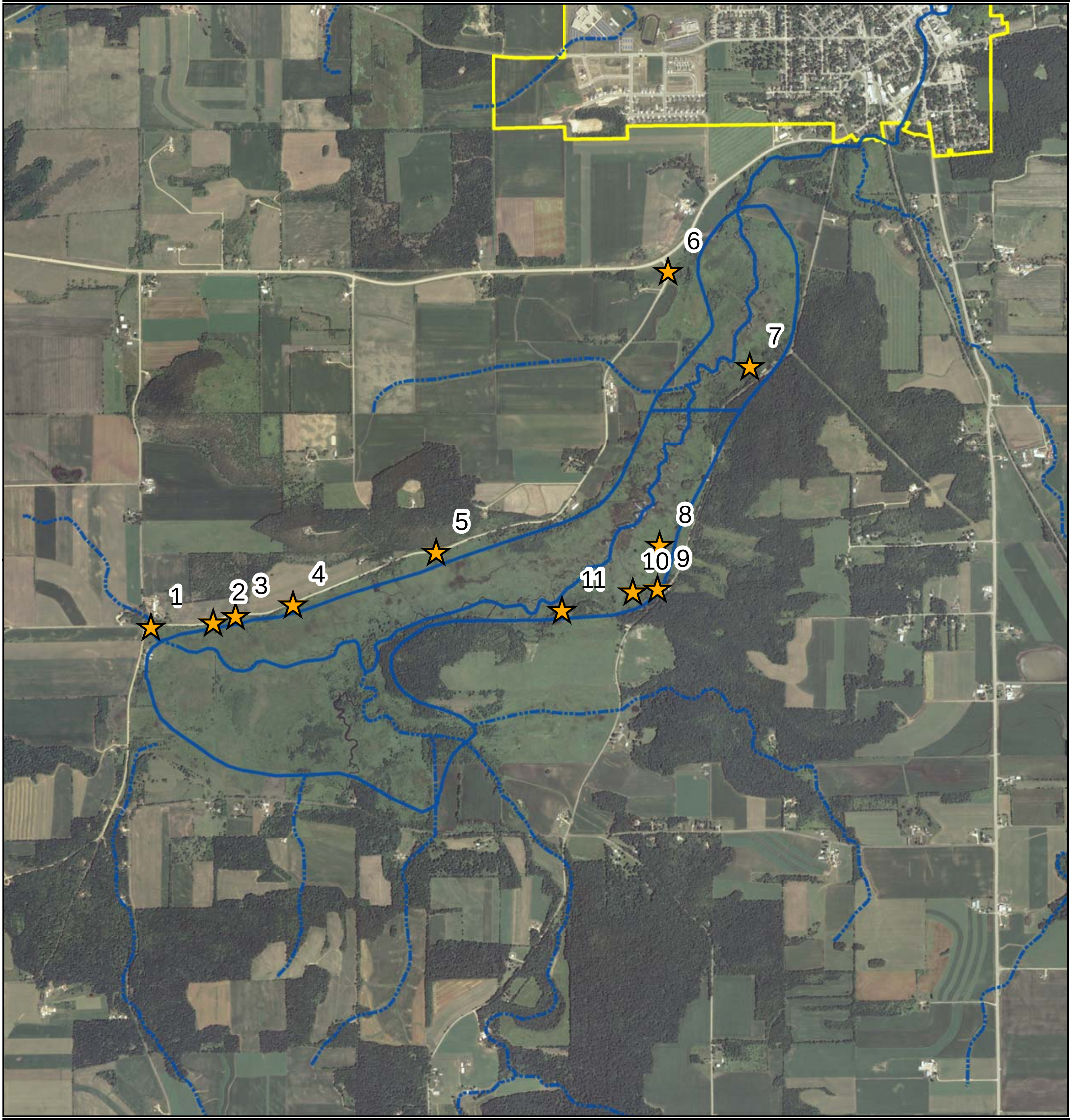
Feet

0 2,400 4,800

Channel Erosion

- Slight or None
- Moderate
- Severe
- Lodi City Limits
- Lodi Marsh

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL



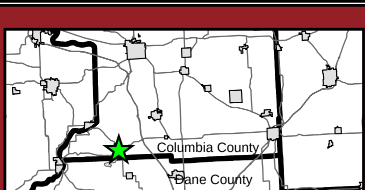
MARSH OBSERVATION POINTS

FIGURE C-6

City of Lodi

Columbia County, Wisconsin

Location Map



Feet

0 2,400 4,800

Observation Point

Lodi City Limits

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL

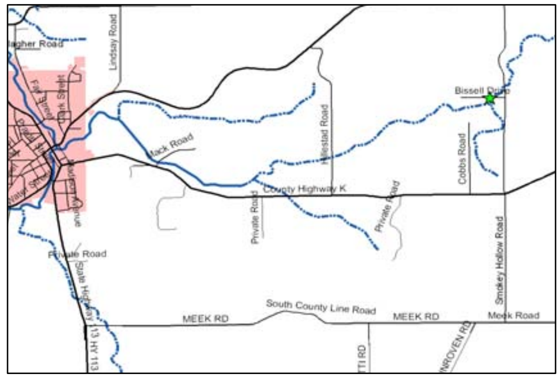
Drafted - LSR, Date - 06-04-08, File - g:/projects/...

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 2
Location: Upstream right of Bissel Drive culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

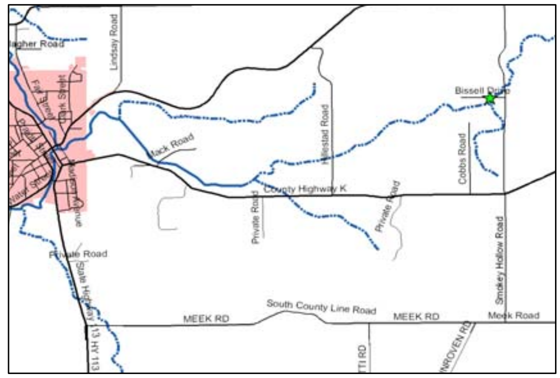
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 2
Location: Downstream left of Bissel Drive culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	4
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.01

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

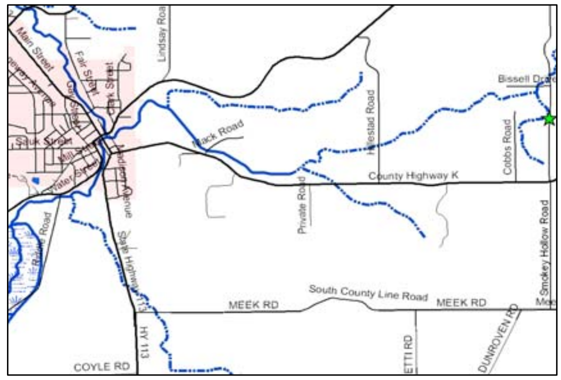
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 3
Location: Downstream right of Smokey Hollow Road culvert crossing
Date Sampled: 4/28/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	15
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.09

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

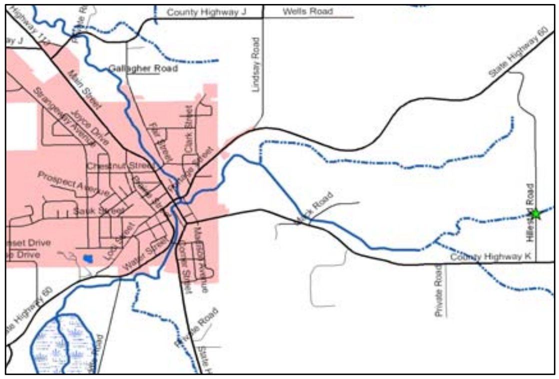
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 4
Location: Downstream left of Hillstad Road crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	10
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.02

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

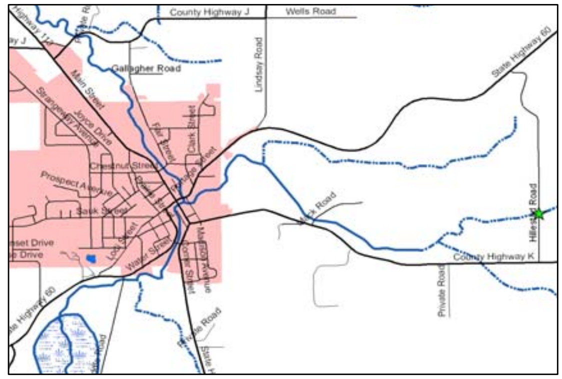
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 4
Location: Downstream right of Hillstad Road crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.04

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

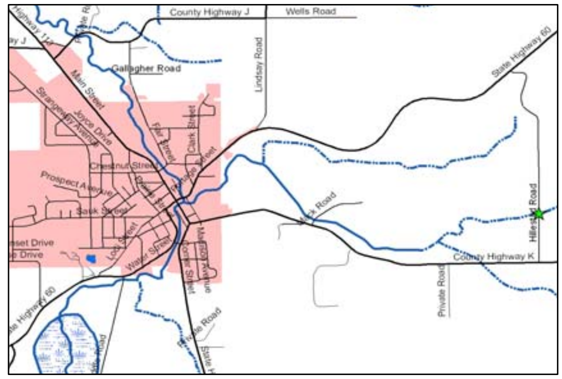
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 4
Location: Upstream right of Hillstad Road crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

Soil Texture	Unit Weight (lb/ft^3)	Soil Texture	Unit Weight (lb/ft^3)
☐ Gravel	110 - 120	√ Silt	75-90
☐ Gravely Loam	110 - 120	☐ Clay	60-70
☐ Sand	90 - 110	☐ Loam	80-100
☐ Sandy Loam	90 - 110		

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.02

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

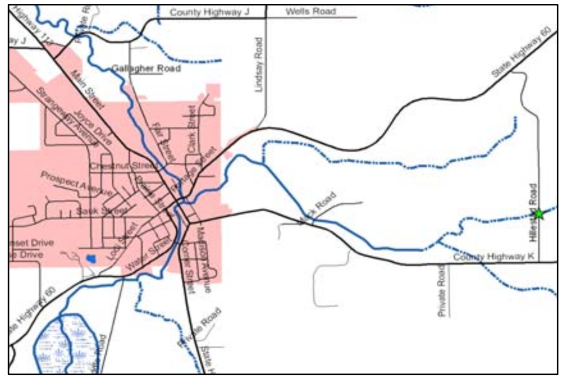
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 4
Location: Upstream left of Hillstad Road crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

Soil Texture	Unit Weight (lb/ft^3)	Soil Texture	Unit Weight (lb/ft^3)
☐ Gravel	110 - 120	√ Silt	75-90
☐ Gravely Loam	110 - 120	☐ Clay	60-70
☐ Sand	90 - 110	☐ Loam	80-100
☐ Sandy Loam	90 - 110		

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	10
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.08

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

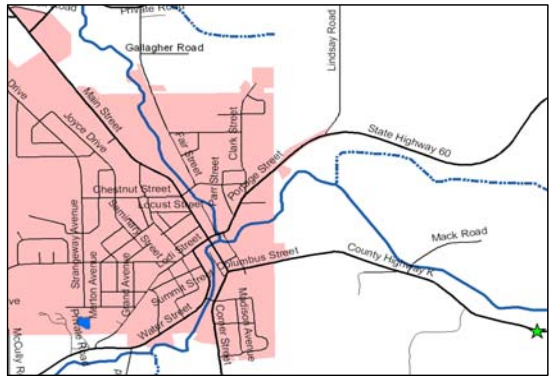
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 5
Location: Downstream right of C.T.H. K culvert
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	15
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.07
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.17

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

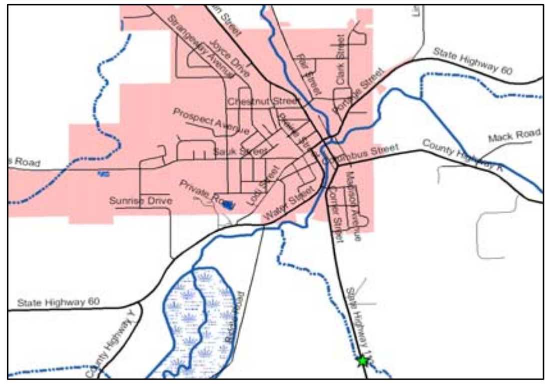
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 8a
Location: Upstream right of S.T.H. 113 culvert
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	8
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.01

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

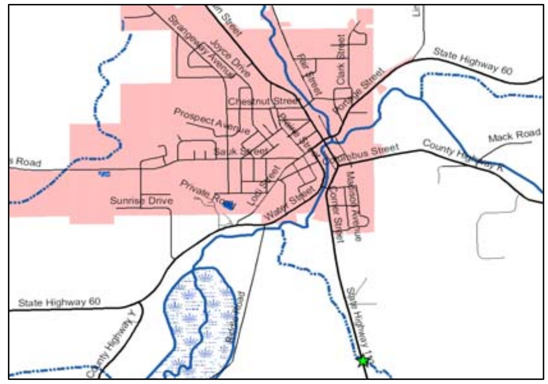
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 8b
Location: Upstream left of S.T.H. 113 culvert
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	15
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.04

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

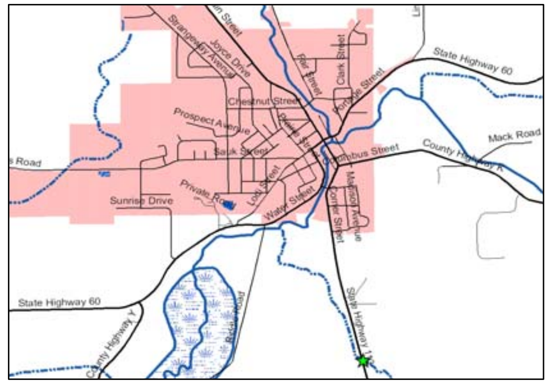
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 8c
Location: Downstream left of S.T.H. 113 culvert
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	15
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.07

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

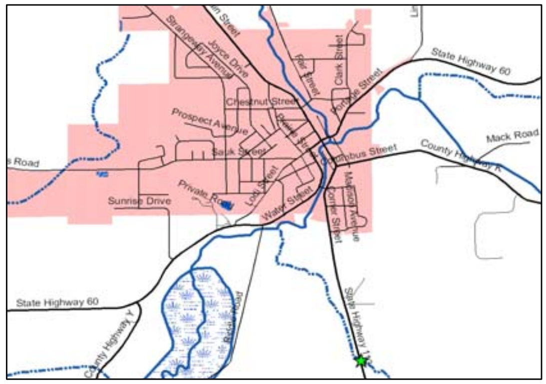
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 8d
Location: Downstream right of S.T.H. 113 culvert
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	6
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.02

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

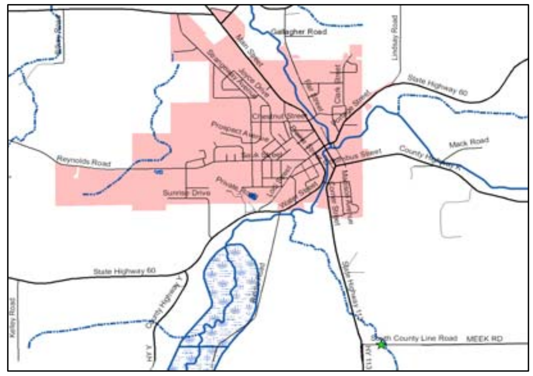
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 9a
Location: Upstream left of Meek Road culvert crossing
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

* Soils were found to be sandy clays. Sandy Loam

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	6
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.03

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).

"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

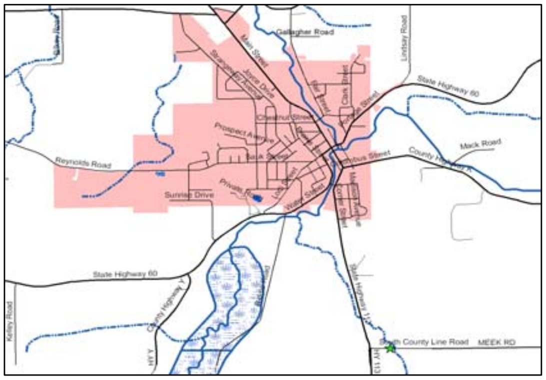
MSA
PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 9b
Location: Downstream right of Meek Road culvert crossing
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	12
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.03

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

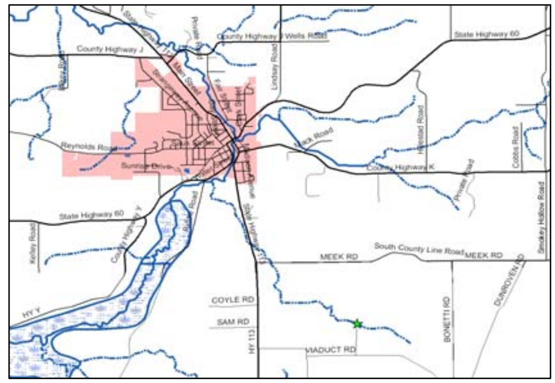
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 10a
Location: Upstream right of Benson Road culvert crossing
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	6
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.04

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

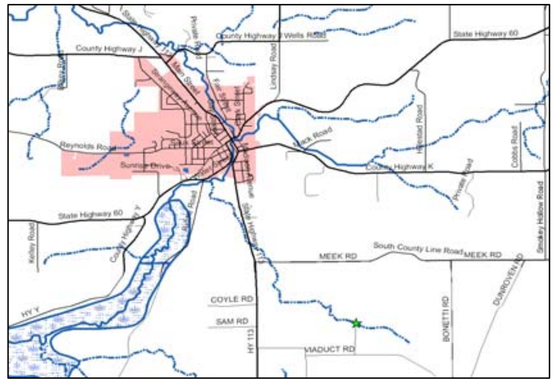
MSA
PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 10b
Location: Downstream right of Benson Road culvert crossing
Date Sampled: 8/21/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	7
Height (ft)	5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.06

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

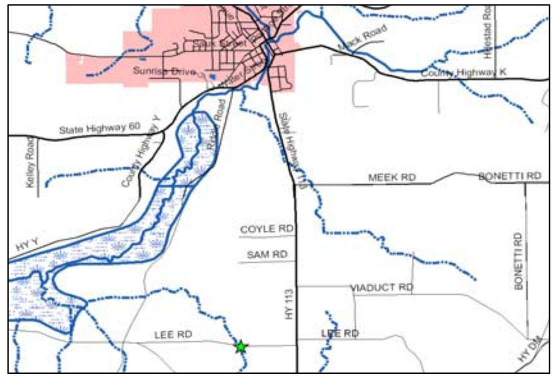
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 11
Location: Upstream right of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).

"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

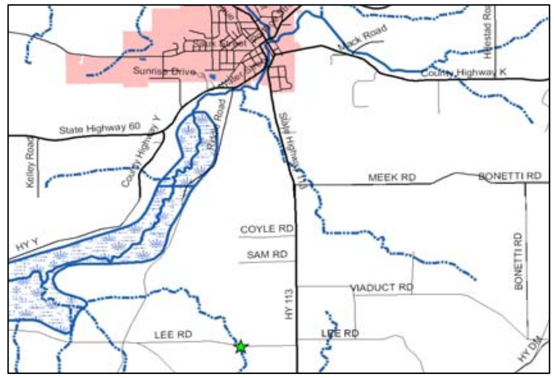
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 11
Location: Upstream left of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	20
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

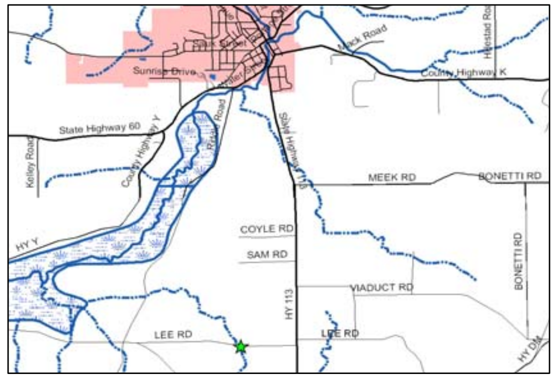
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 11
Location: Downstream left of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	100
Height (ft)	4.5
Lateral Recession Rate (ft/yr)**	0.3
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	6.8

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

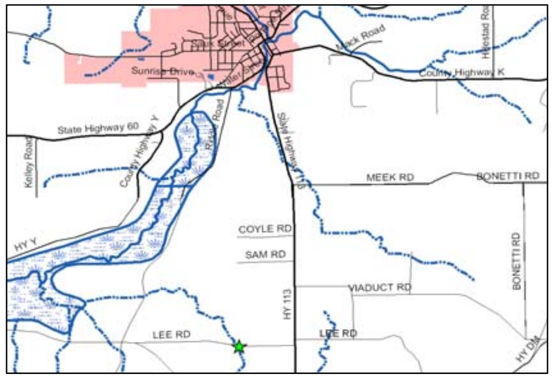
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 11
Location: Downstream right of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	100
Height (ft)	4.5
Lateral Recession Rate (ft/yr)**	0.3
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	6.8

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

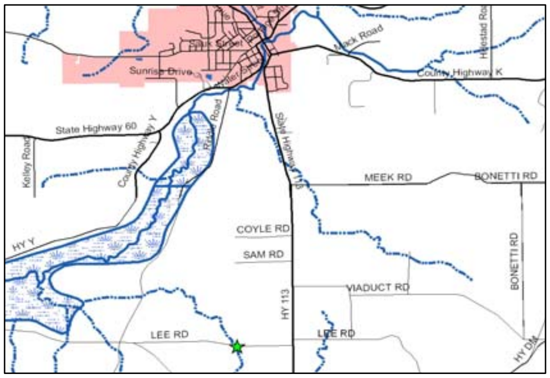
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 11
Location: Downstream of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Both
Length (ft)	100
Height (ft)	6
Lateral Recession Rate (ft/yr)**	0.3
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	9.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

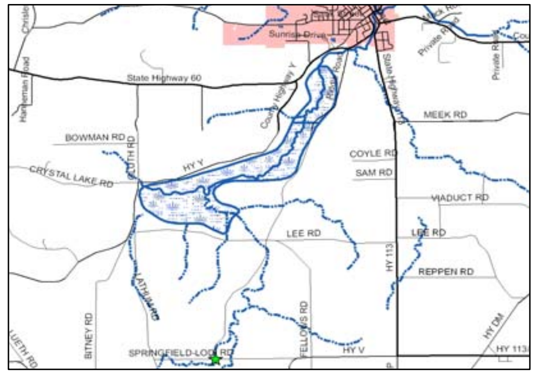
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 12
Location: Downstream right of Black Hill Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Photo of Streambank Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

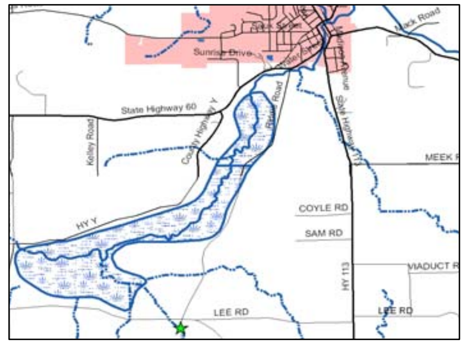
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 19
Location: Upstream left of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	100
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.3
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	6.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

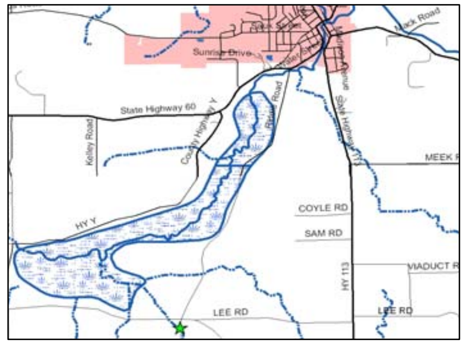
MSA
PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 19
Location: Upstream right of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

Soil Texture	Unit Weight (lb/ft^3)	Soil Texture	Unit Weight (lb/ft^3)
☐ Gravel	110 - 120	☐ Silt	75-90
☐ Gravely Loam	110 - 120	☐ Clay	60-70
☐ Sand	90 - 110	☐ Loam	80-100
√ Sandy Loam	90 - 110		

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	40
Height (ft)	6.5
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	1.3

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

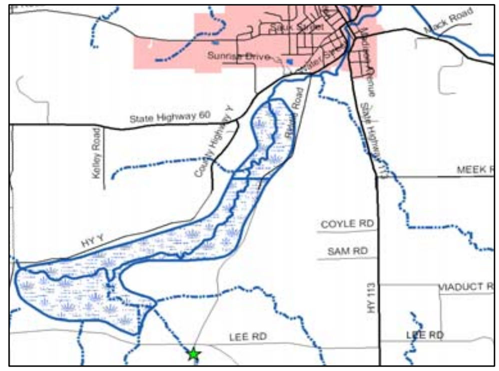
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 19
Location: Downstream right of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	10
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

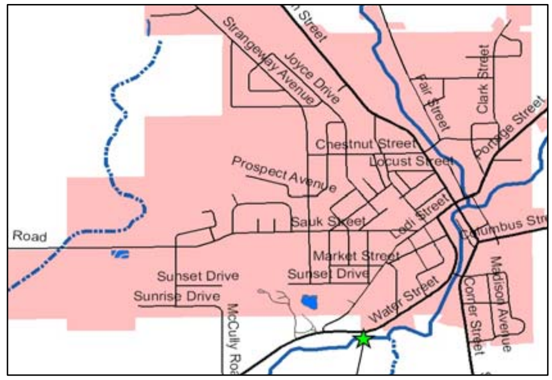
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 20
Location: Downstream of Highway V culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Both
Length (ft)	4
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

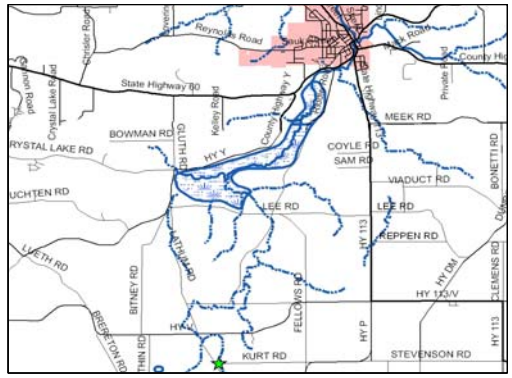
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 22
Location: Downstream right of Kurt Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	40
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

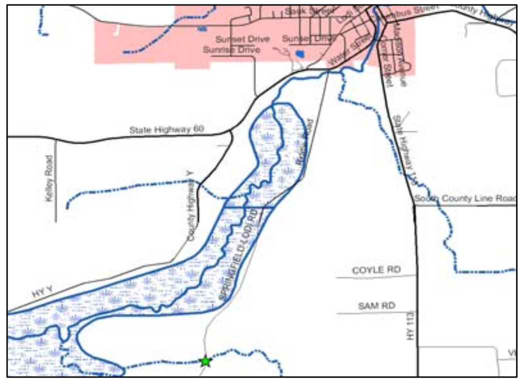
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 23
Location: Upstream right of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	☐	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
√	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	5
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	100
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

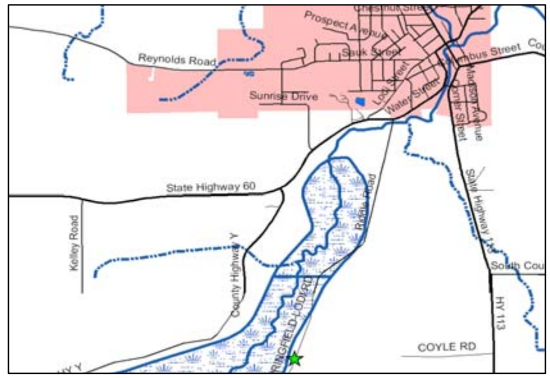
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 24
Location: Downstream left of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	15
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

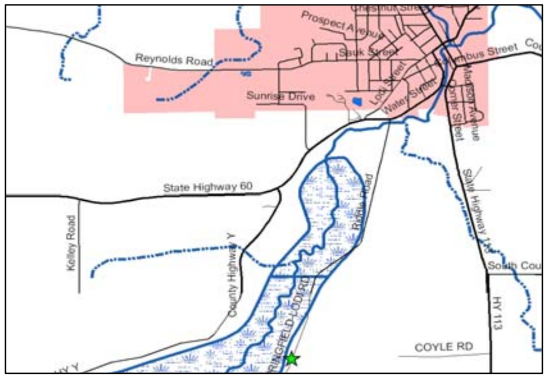
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 24
Location: Downstream right of Lodi Springfield Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	10
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

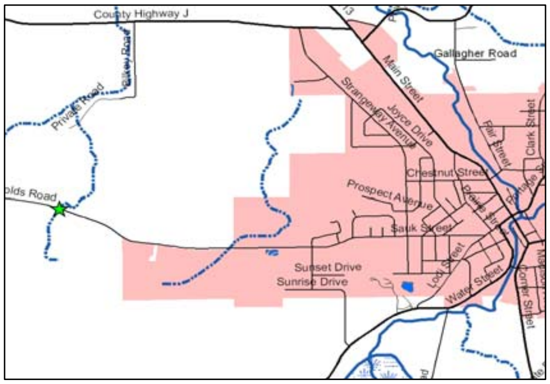
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 25
Location: Upstream right of Reynolds Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	15
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

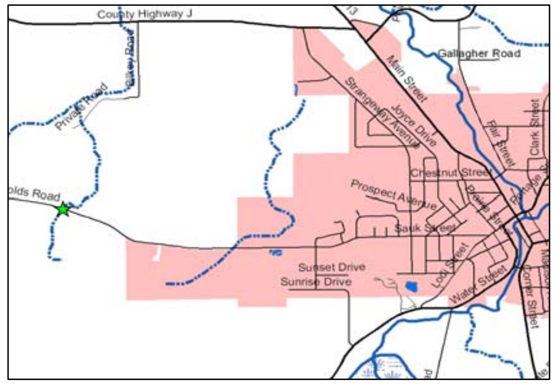
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 25
Location: Upstream left of Reynolds Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	15
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

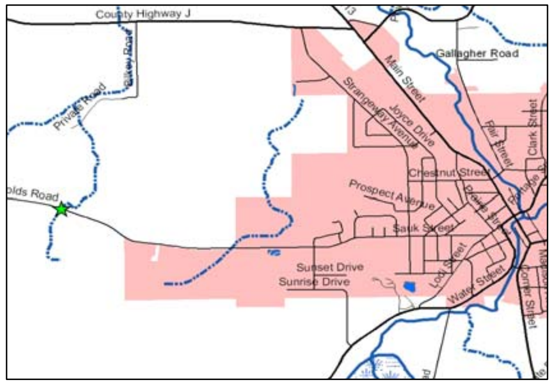
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 25
Location: Downstream left of Reynolds Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	20
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

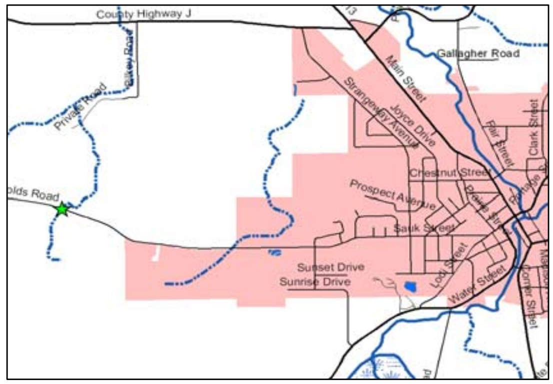
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 25
Location: Downstream right of Reynolds Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.5

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

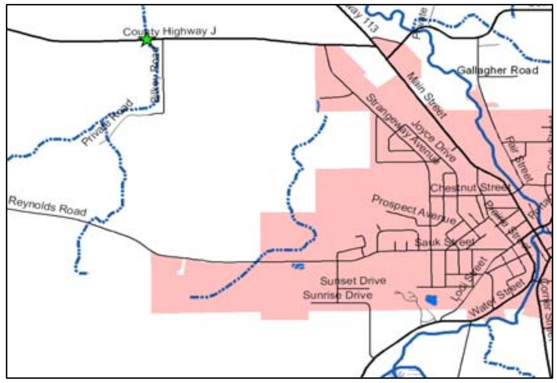
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 27
Location: Upstream right of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

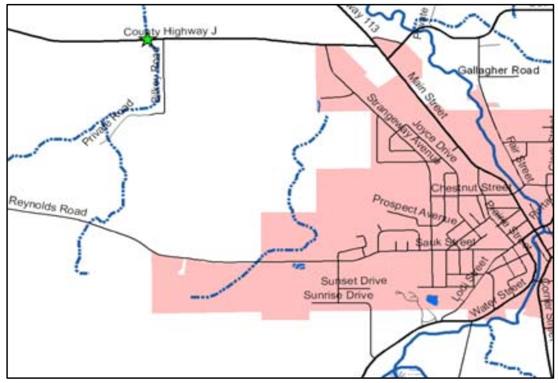
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 27
Location: Upstream left of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	12
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

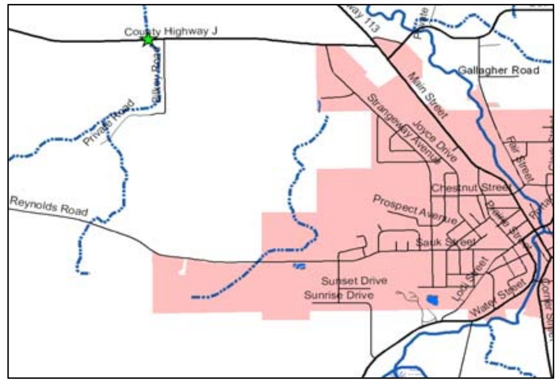
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 27
Location: Upstream left Road Ditch of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	20
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

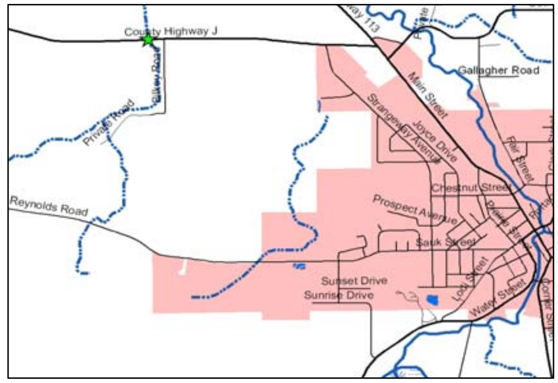
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 27
Location: Downstream left of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	20
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

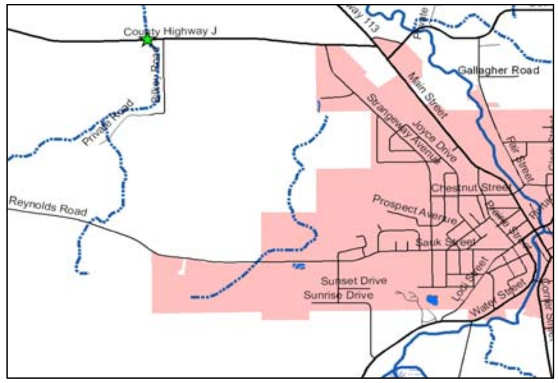
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 27
Location: Downstream right of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	15
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

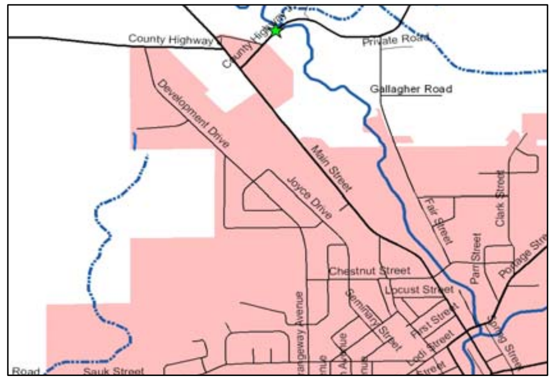
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 28
Location: Downstream right of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	5
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.01
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

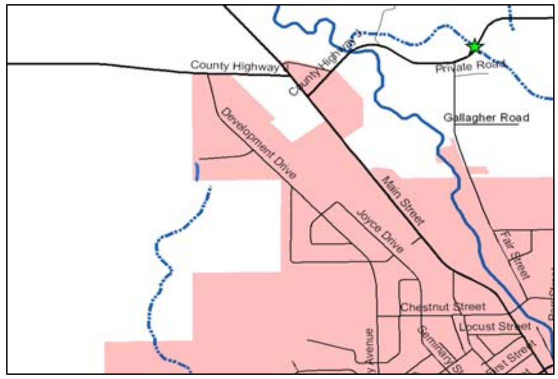
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 29
Location: Upstream right of CTH J culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	10
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

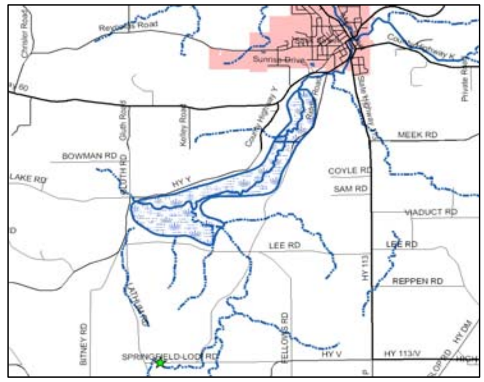
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 31
Location: Upstream left of Black Hill Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	3
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

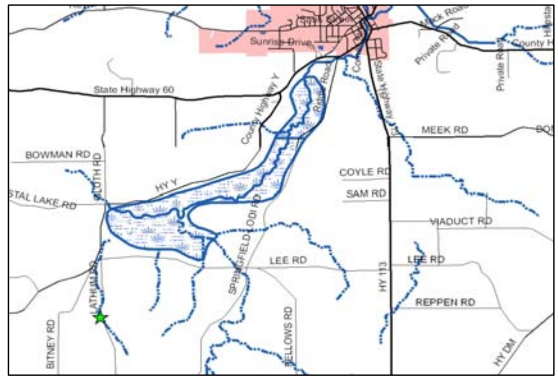
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 37
Location: Upstream left of Lathum Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	4
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

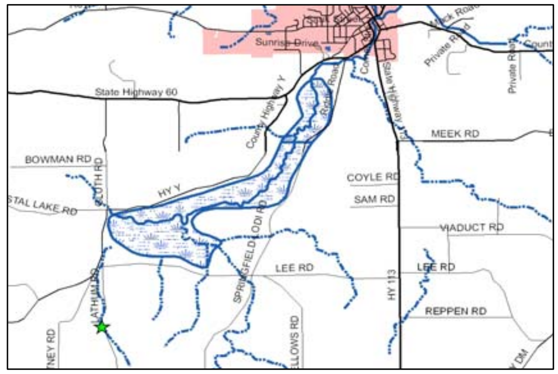
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 37
Location: Upstream right of Lathum Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	6
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.7

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

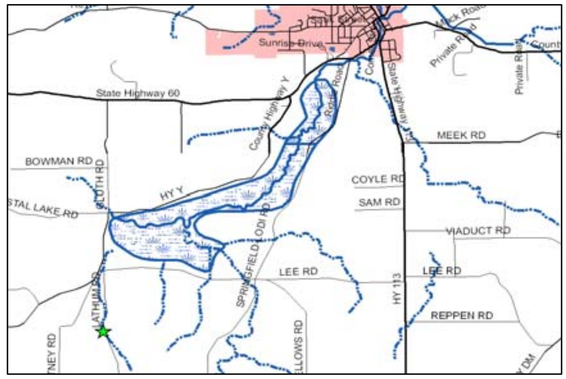
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 37
Location: Downstream left of Lathum Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	10
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.08
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

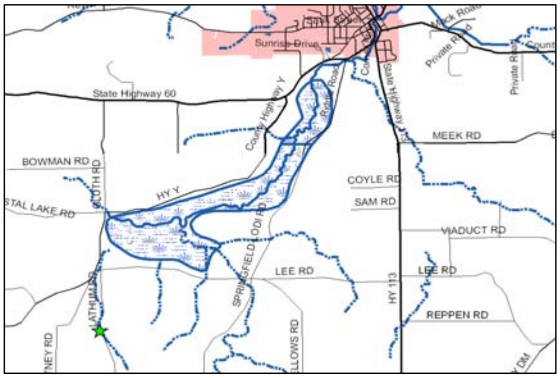
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 37
Location: Downstream right of Lathum Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

Soil Texture	Unit Weight (lb/ft^3)	Soil Texture	Unit Weight (lb/ft^3)
☐ Gravel	110 - 120	√ Silt	75-90
☐ Gravely Loam	110 - 120	☐ Clay	60-70
☐ Sand	90 - 110	☐ Loam	80-100
☐ Sandy Loam	90 - 110		

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

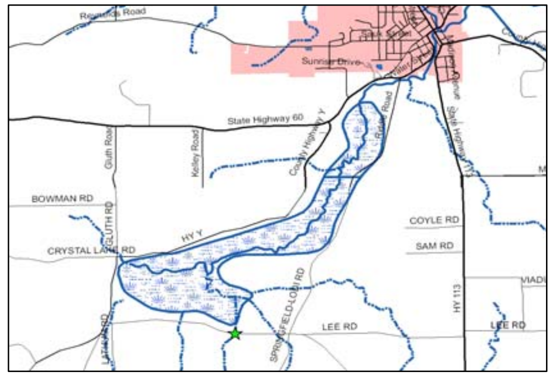
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 39
Location: Upstream right of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

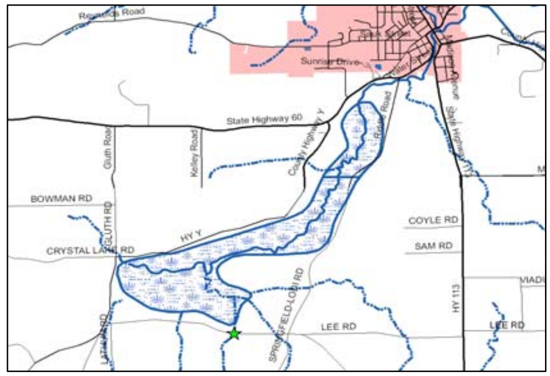
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 39
Location: Upstream left of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	20
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

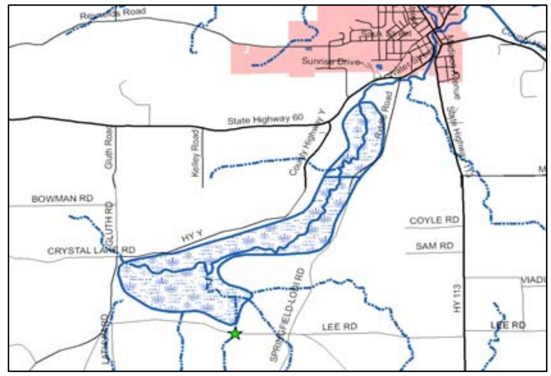
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 39
Location: Downstream left of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	40
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.4

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

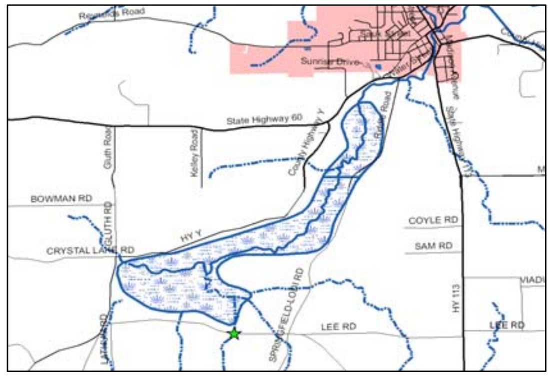
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 39
Location: Downstream right of Lee Road culvert crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	15
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

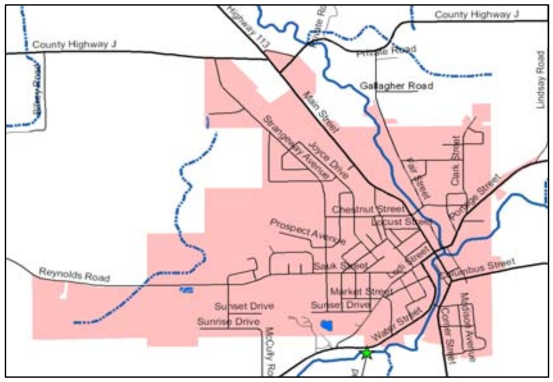
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 41
Location: Upstream right of Riddle Road bridge crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	35
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

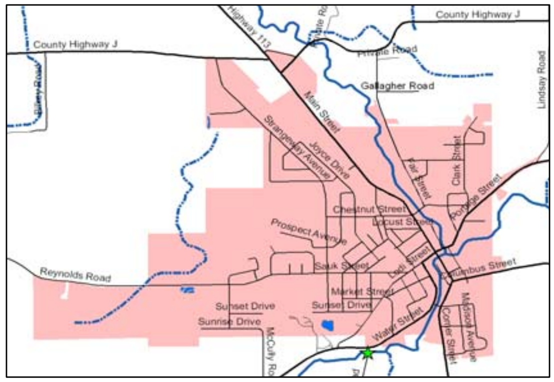
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 41
Location: Downstream left of Riddle Road crossing
Date Sampled: 8/26/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	50
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

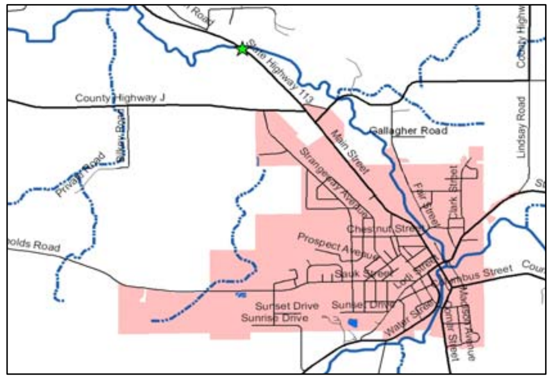
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 44
Location: Upstream right of STH 113 bridge crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

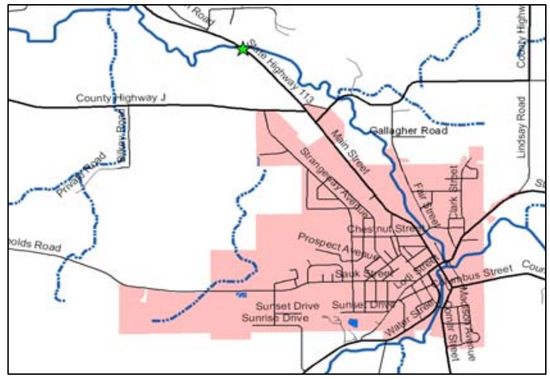
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 44
Location: Upstream left of STH 113 bridge crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	30
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.0

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

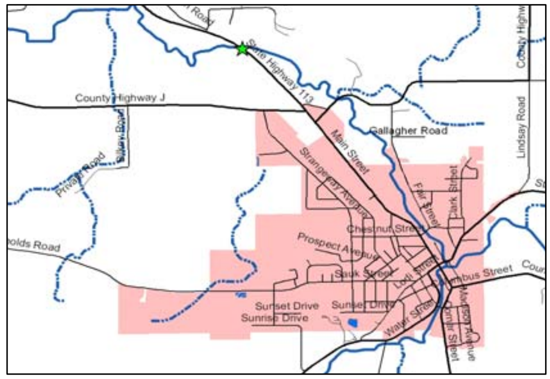
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 44
Location: Downstream left of STH 113 bridge crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	40
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

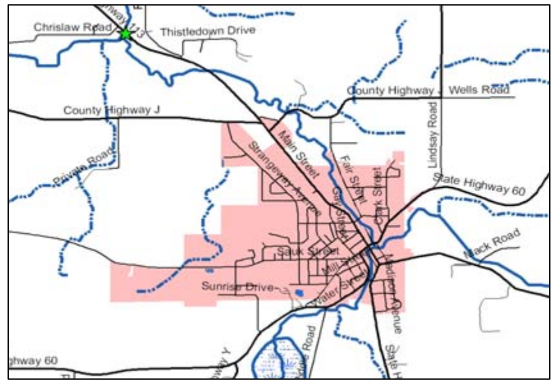
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 45
Location: Downstream right of STH 113 bridge crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	40
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

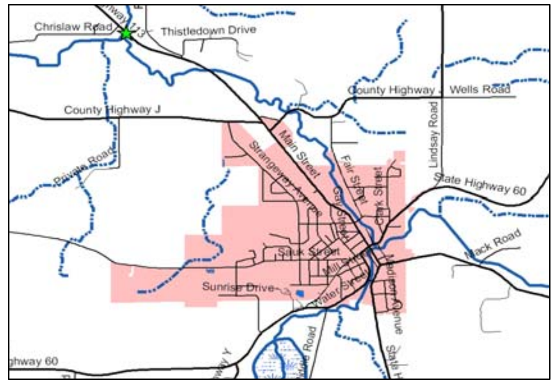
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 45
Location: Upstream right of STH 113 bridge crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

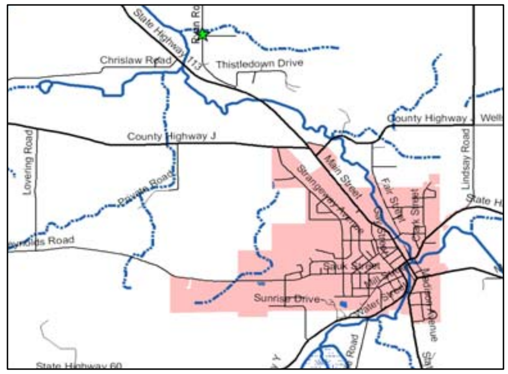
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 46
Location: Upstream ditch left of Ryan Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	40
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

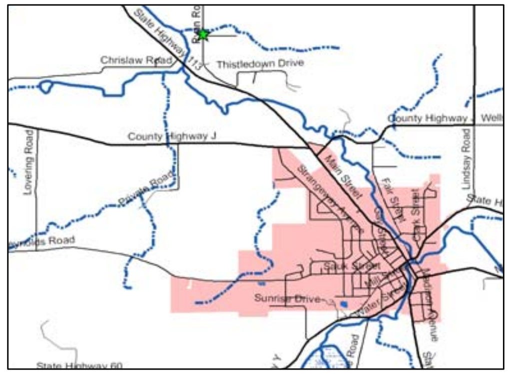
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 46
Location: Downstream right of Ryan Road culvert crossing
Date Sampled: 9/3/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

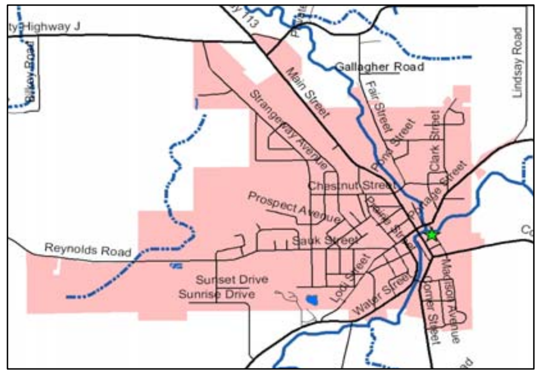
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 51
Location: East Branch, just downstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	50
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.06
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

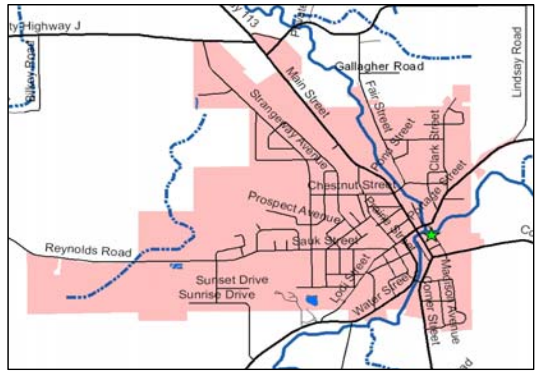
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 51
Location: East Branch, just downstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

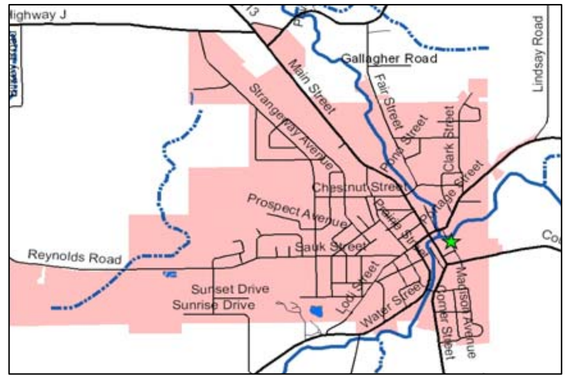
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 52
Location: East Branch, just upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	100
Height (ft)	1
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

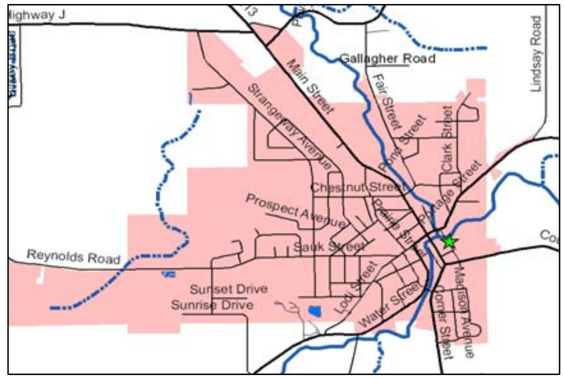
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 52
Location: East Branch, just upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	150
Height (ft)	6
Lateral Recession Rate (ft/yr)**	0.2
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	7.4

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be meandering.

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

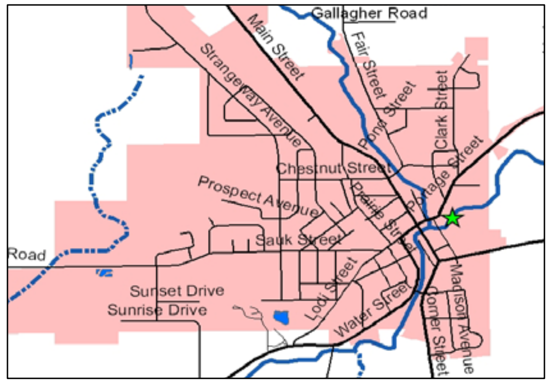
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 53
Location: East Branch, upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	50
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.08
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.7

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

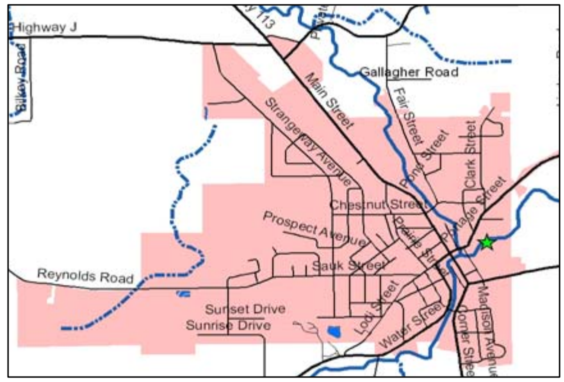
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 54
Location: East Branch, upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	200
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.8

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

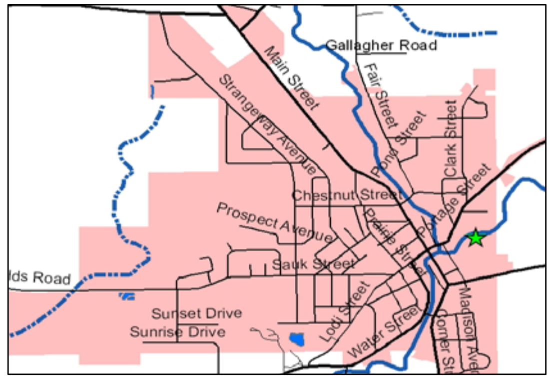
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 55
Location: East Branch, upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	50
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

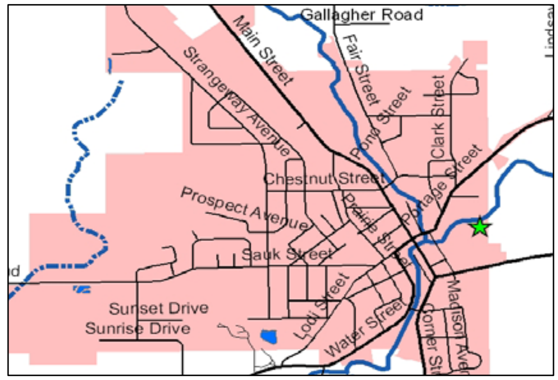
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 56
Location: East Branch, upstream of Spring Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	200
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.2
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	4.9

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

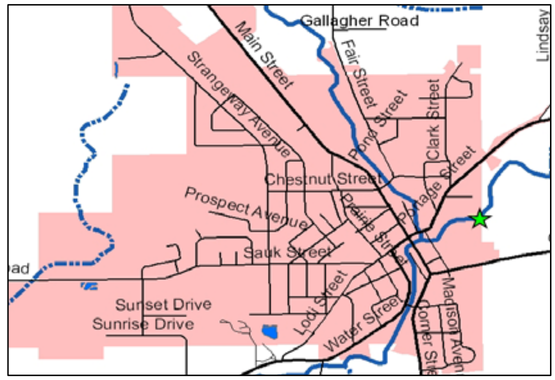
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 57
Location: East Branch, near city limits
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	50
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

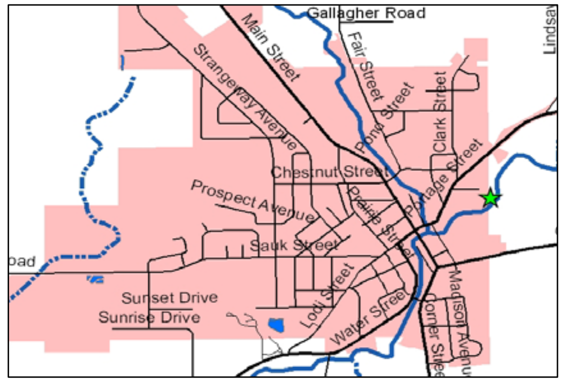
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 58
Location: East Branch, just outside of city limits
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	150
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	1.8

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

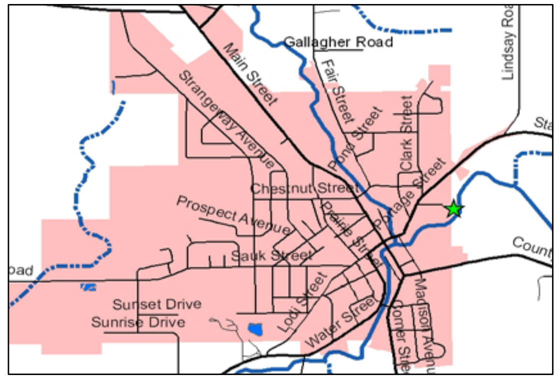
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 59
Location: East Branch, just outside of city limits
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	50
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.5

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 60
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

Location

Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	30
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

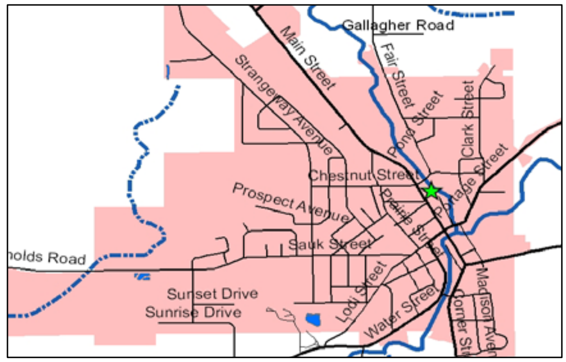
Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 61
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

No Photo Available

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

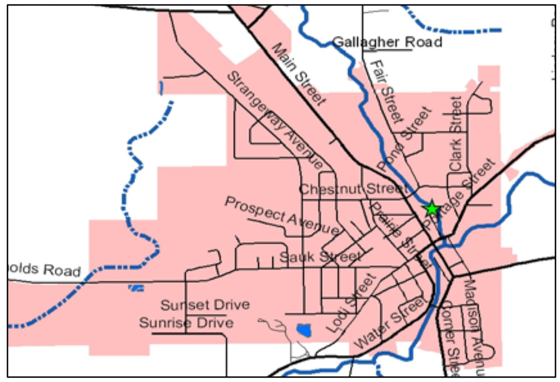
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 61
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	150
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	2.5

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 62
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

Location

Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	35
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.05
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

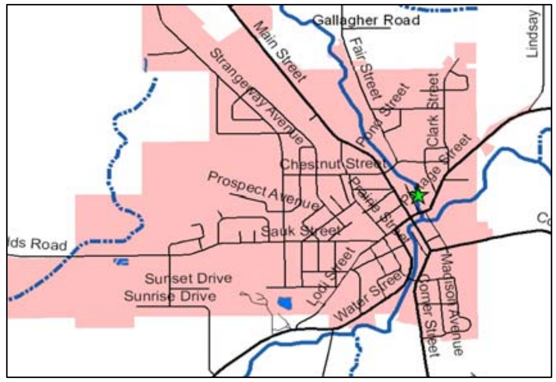
MSA
PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 63
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	100
Height (ft)	4
Lateral Recession Rate (ft/yr)**	0.08
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	1.3

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 64
Location: Main Branch, between Fair St. and Portage Street
Date Sampled: 9/12/2008

Photo of Streambank

Location

Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	40
Height (ft)	3
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.5

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).

"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 65
Location: Main Branch, north of Fair St
Date Sampled: 9/12/2008

Photo of Streambank

Location

Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	20
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

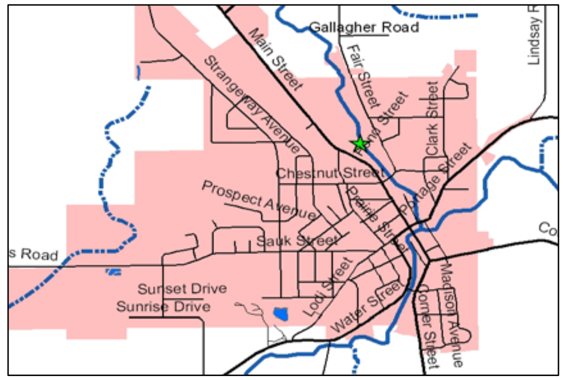
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 66
Location: Main Branch, north of Fair St
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Left
Length (ft)	50
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.1
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.5

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.

**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the LRR. Please refer to the table below for typical values.

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

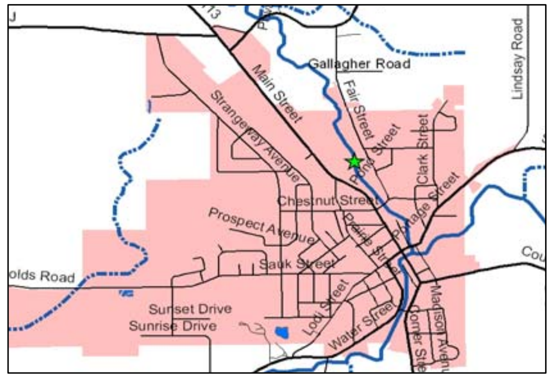
MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 67
Location: Main Branch, north of Fair St
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	30
Height (ft)	2.5
Lateral Recession Rate (ft/yr)**	0.03
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 68
Location: Main Branch, northside of City
Date Sampled: 9/12/2008

Photo of Streambank

Location

Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	40
Height (ft)	1.5
Lateral Recession Rate (ft/yr)**	0.04
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.1

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

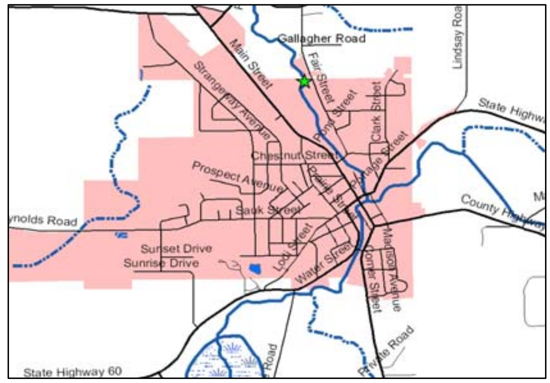
Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide* ."

Streambank Erosion Estimation

City: Lodi, WI
Watercourse: Lodi Creek
Location ID Number: 69
Location: Main Branch, northside of City
Date Sampled: 9/12/2008

Photo of Streambank

Location



Soil Textural Class Information (Check One)

	Soil Texture	Unit Weight (lb/ft^3)		Soil Texture	Unit Weight (lb/ft^3)
☐	Gravel	110 - 120	√	Silt	75-90
☐	Gravely Loam	110 - 120	☐	Clay	60-70
☐	Sand	90 - 110	☐	Loam	80-100
☐	Sandy Loam	90 - 110			

Streambank Characteristics

Parameter	
Stream Side (Left or Right)*	Right
Length (ft)	100
Height (ft)	2
Lateral Recession Rate (ft/yr)**	0.02
Soil Unit Weight (lb/ft^3)	82
Soil P Concentration (lb/lb soil)	
Stream Bank Erosion (tons/yr)	0.2

*Stream Side is defined as the 'left' or 'right' side of the stream when facing in the direction of stream flow.
**Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgment may be required to estimate the

LRR (ft/yr)	Category	Description
0.01 - 0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06 - 0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3 - 0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen tress and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-Shaped and streamcourse or gully may be

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surfac
"Reproduced by Wisconsin NRCS. 2003. Streambank Erosion, printed in *Field Office Technical Guide*."

Observation Point 1

Observation Point 1 is an inundated area located in the west corner of the marsh where a tributary enters the marsh through a box culvert beneath CTH Any water entering the marsh at this location loses velocity because of the dense vegetation and the flat topography present. There was no visible channel present, so flow from the tributary

appears to spread out within the marsh. The vegetation present in this location is typical of seasonally inundated, emergent vegetation, such as Angelica, cattails, arrowhead, and reed canary grass.

Observation Point 2

Observation Point 2 is a forested wetland area across from a farm field, which slopes down and towards a flat, wet sedge meadow. The herbaceous layer of the forested area has dense vegetation which appears capable of trapping sediment prior to the reaching the wet sedge meadow area.

Observation Point 3

Observation Point 3 is located across from a farm field in a low area along CTH Y that is inundated or saturated in most areas. The area supports a mixture of an emergent marsh and sedge meadow habitat, dominated by cattails, sedges, Joe Pye-weed, and dogwood shrubs. The meadow appeared to provide an approximately 1000 ft buffer between the road and the main channel of Spring Creek.

Observation Point 4

Observation Point 4 is a shrub habitat along CTH Y dominated by willow and dogwood shrubs, and a good mix of sedges, grasses and flowering plants in the herbaceous layer.

The area was saturated to the surface. This area also appeared to provid an approximately 1000 ft buffer between the road and the main channel of Spring Creek.

Observation Point 5

Observation Point 5 is an open sedge meadow across from a forested sandstone hill. This area also contains a spring which discharges to Spring Creek. The area had the highest diversity of plants, with a high density of vegetation. This area also had a buffer over 1,000 wide adjacent to the main channel of Spring Creek.

Observation Point 6

Observation Point 6 is a mosaic of forest, wet meadow dominated by reed canary grass, and farm land. It is located in the northeast portion of the marsh, just prior to where Spring Creek enters the City of Lodi. In this location, the marsh provides a 1,000 to 1,400 feet wide buffer of dense vegetation between the farm field and creek channel.

Observation Point 7

Observation Point 7 is located near the north parking area along Lodi Springfield Road, observed to be saturated or inundated. This area is a mix of shrubs and wet/sedge meadow habitat, with a high density and diversity of vegetation, bordered by a moist undisturbed forest forested east of the road.

Observation Point 8

Observation Point 8 is a mosaic of mesic and wet meadow habitats, with areas dominated by reed canary grass.

Observation Point 9

Observation Point 9 is a seepage area on a slope on the east side of the marsh that was dominated by skunk cabbage and jewelweed.

Observation Point 10

Observation Point 10 is a wet/sedge meadow with many small channels cutting through marsh that were fed by springs on the east side of the marsh.

Observation Point 11

Observation Point 11 is a large spring and pond fed by the spring at the base of a sandstone hill.

January, 2001

File or Docket Number

Wisconsin Department of Natural Resources

RAPID ASSESSMENT METHODOLOGY FOR EVALUATING WETLAND FUNCTIONAL VALUES

GENERAL INFORMATION

Name of Wetland/Owner:
Location: County Dane + Columbia ; ~~¼,~~ ¼, Section 4,5 8,9, Township 9N, Range 8E
Project Name: Lodi Marsh
Evaluator(s): Ken Gradall
Date(s) of Site Visit(s): 7/14/09

Description of seasonality limitations of this inspection due to time of year of the evaluation and/or current hydrologic and climatologic conditions (e.g. after heavy rains, snow or ice cover, during drought year, during spring flood, during bird migration):

WETLAND DESCRIPTION

Wisconsin Wetlands Inventory classification:
Wetland Type: shallow open water, deep marsh, shallow marsh, seasonally flooded basin, bog, floodplain forest, alder thicket, sedge meadow, coniferous swamp, fen, wet meadow, shrub-carr, low prairie, hardwood swamp
Estimated size of wetland in acres: 545 Ac

SUMMARY OF FUNCTIONAL VALUES

Based on the results of the attached functional assessment, rate the significance of each of the functional values for the subject wetland and check the appropriate box. Complete the table as a summary.

FUNCTION	SIGNIFICANCE				
	Low	Medium	High	Exceptional	N/A
Floral Diversity				X	
Wildlife Habitat			X		
Fishery Habitat			X		
Flood/Stormwater Attenuation				X	
Water Quality Protection				X	
Shoreline Protection					X
Groundwater				X	
Aesthetics/Recreation/Education			X		

List any Special Features/"Red Flags":

SITE DESCRIPTION

I. HYDROLOGIC SETTING

A. Describe the geomorphology of the wetland:

- ☐ Depressional (includes slopes, potholes, small lakes, kettles, etc.)
- ☒ Riverine
- ☐ Lake Fringe
- ☐ Extensive Peatland

B. **Y N** Has the wetland hydrology been altered by ditching, tiles, dams, culverts, well pumping, diversion of surface flow, or changes to runoff within the watershed (circle those that apply)?

C. **Y N** Does the wetland have an inlet, outlet, or both (circle those that apply)?

D. **Y N** Is there any field evidence of wetland hydrology such as buttressed tree trunks, adventitious roots, drift lines, water marks, water stained leaves, soil mottling/gleying, organic soils layer, or oxidized rhizospheres (circle those that apply)?

E. **Y N** Does the wetland have standing water, and if so what is the average depth in inches? 0-3"
Approximately how much of the wetland is inundated? 90 %

F. How is the hydroperiod (seasonal water level pattern) of the wetland classified?

- ☒ Permanently Flooded
- ☒ Seasonally Flooded (water absent at end of growing season)
- ☒ Saturated (surface water seldom present)
- ☐ Artificially Flooded
- ☐ Artificially Drained

G. **Y N** Is the wetland a navigable body of water or is a portion of the wetland below the ordinary high-water mark of a navigable water body? List any surface waters associated with the wetland or in proximity to the wetland (note approximate distance from the wetland and navigability determination). Note if there is a surface water connection to other wetlands.

Spring Creek

II. VEGETATION

A. Identify the vegetation communities present and the dominant species.

	floating leaved community dominated by:
	submerged aquatic community dominated by:
X	emergent community dominated by: Typha latifolia, Reed canarygrass + Carex stricta
X	shrub community dominated by: Red osier dogwood + pussy willow
	deciduous broad-leaved tree community dominated by:
	coniferous tree community dominated by:
	open sphagnum mat or bog
X	sedge meadow/wet prairie community dominated by: Carex stricta
	other (explain)

B. Other plant species identified during site visit:

See Attached Table

III. SOILS

A. NRCS Soil Map Classification: Ho, Af

B. Field description:

☒ Organic (histosol)? If so, is it a muck or a peat?

☐ Mineral soil?

- Mottling, gleying, sulfidic materials, iron or manganese concretions, organic streaking (circle those that apply)
- Soil Description: ______
- Depth of mottling/gleying: ______
- Depth of A Horizon: ______
- Munsell Color of matrix and mottles
  - -Matrix below the A horizon (10"depth): ______
  - -Mottles: ______

V. SURROUNDING LAND USES

A. What is the estimated area of the wetland watershed in acres? 16 mi.^{2}

B. What are the surrounding land uses?

LAND-USE	ESTIMATED % OF WETLAND WATERSHED
Developed (Industrial/Commercial/Residential)	
Agricultural/cropland	30%
Agricultural/grazing	10%
Forested	40
Grassed recreation areas/parks	20%
Old field	~~[illegible]~~
Highways or roads	
Other (specify)	

VI. SITE SKETCH

See Attached Figures.

FUNCTIONAL ASSESSMENT

The following assessment requires the evaluator to examine site conditions that provide evidence that a given functional value is present and to assess the significance of the wetland to perform those functions. Positive answers to questions indicate the presence of factors important for the function. The questions are not definitive and are only provided to guide the evaluation. After completing each section, the evaluator should consider the factors observed and use best professional judgement to rate the significance. The ratings should be recorded on page 1 of the assessment.

SPECIAL FEATURES/"RED FLAGS"

1. **Y N** Is the wetland in or adjacent to an area of special natural resource interest (NR 103.04, Wis. Adm. Code)? If so, check those that apply:

- [x] Cold water community as defined in s. NR 102.04(3)(b), Wis. Adm. Code, including trout streams, their tributaries, and trout lakes
- [ ] Lakes Michigan and Superior and the Mississippi River
- [ ] State or federal designated wild and scenic river
- [ ] Designated state riverway
- [ ] Designated state scenic urban waterway
- [x] Environmentally sensitive area or environmental corridor identified in an area-wide water quality management plan, special area management plan, special wetland inventory study, or an advanced delineation and identification study
- [ ] Calcareous fen
- [x] State park, forest, trail or recreation area
- [x] State and federal fish and wildlife refuges and fish and wildlife management areas
- [ ] State or federal designated wilderness area
- [ ] Designated or dedicated state natural area
- [ ] Wild rice water listed in ch. NR 19.09, Wis. Adm. Code
- [x] Surface water identified as an outstanding or exceptional resource water in ch. NR 102, Wis. Adm. Code

2. **Y N** According to the Natural Heritage Inventory (Bureau of Endangered Resources) or direct observations, are there any rare, endangered, or threatened plant or animal species in, near, or using the wetland or adjacent lands? If so, list the species of concern:

3. **Y N** Is the project located in an area that requires a State Coastal Zone Management Plan consistency determination?

Floral Diversity

1. **Y N** Does the wetland support a variety of native plant species (i.e. not a monotypic stand of cattail or giant reed grass and/or not dominated by exotic species such as reed canary grass, brome grass, buckthorn, purple loosestrife, etc.)?

2. **Y N** Is the wetland plant community regionally scarce or rare?

Wildlife and Fishery Habitat

1. List any species observed, evidenced (e.g. tracks, scat, nest/burrow, calls), or expected to utilize the wetland: Deer, raccoons, Red-wing blackbird, Sand-hill cranes, blue-jay, Barn swallows, Yellow Throat, Yellow warbler, Cedar waxwings Crow, Flycatchers, Great blue heron,

2. Y N Does the wetland contain a number of diverse vegetative cover types and a high degree of interspersion of those vegetation types?

3. Y N Is the estimated ratio of open water to cover between 30 and 70 percent? What is the estimated ratio? 5 %

4. Y N Does the surrounding upland habitat likely support a variety of animal species?

5. Y N Is the wetland part of or associated with a wildlife corridor or designated environmental corridor?

6. Y N Is the surrounding habitat and/or the wetland itself a large tract of undeveloped land important for wildlife that requires large home ranges (e.g. ~~bear~~, woodland passerines)?

7. Y N Is the surrounding habitat and/or the wetland itself a relatively large tract of undeveloped land within an urbanized environment that is important for wildlife?

8. Y N Are there other wetland areas near the subject wetland that may be important to wildlife?

9. Y N Is the wetland contiguous with a permanent waterbody or periodically inundated for sufficient periods of time to provide spawning/nursery habitat for fish?

10. Y N Can the wetland provide significant food base for fish and wildlife (e.g. insects, crustaceans, voles, forage fish, amphibians, reptiles, shrews, wild rice, wild celery, duckweed, pondweeds, watermeal, bulrushes, bur reeds, arrowhead, smartweeds, millets...)?

11. Y N Is the wetland located in a priority watershed/township as identified in the Upper Mississippi and Great Lakes Joint Venture of the North American Waterfowl Management Plan?

12. Y N Is the wetland providing habitat that is scarce to the region?

Flood and Stormwater Storage/Attenuation

1. Y N Are there steep slopes, large impervious areas, moderate slopes with row cropping, or areas with severe overgrazing within the watershed (circle those that apply)?

2. Y N Does the wetland significantly reduce run-off velocity due to its size, configuration, braided flow patterns, or vegetation type and density?

3. Y N Does the wetland show evidence of flashy water level responses to storm events (debris marks, erosion lines, stormwater inputs, channelized inflow)? at outlet of marsh, North end

4. Y N Is there a natural feature or human-made structure impeding drainage from the wetland that causes backwater conditions?

5. Y N Considering the size of the wetland area in relation to the size of its watershed, at any time during the year is water likely to reach the wetland's storage capacity (i.e. the level of easily observable wetland vegetation)? [For some cases where greater documentation is required, one should determine if the wetland has capacity to hold 25% of the run-off from a 2 year-24 hour storm event.]

6. Y **N** Considering the location of the wetland in relation to the associated surface water watershed, is the wetland important for attenuating or storing flood or stormwater peaks (i.e. is the wetland located in the mid or lower reaches of the watershed)?

Water Quality Protection

1. Y **N** Does the wetland receive overland flow or direct discharge of stormwater as a primary source of water (circle that which applies)?

2. Y **N** Do the surrounding land uses have the potential to deliver significant nutrient and/or sediment loads to the wetland? agricultural land

3. Y **N** Based on your answers to the flood/stormwater section above, does the wetland perform significant flood/stormwater attenuation (residence time to allow settling)?

4. Y **N** Does the wetland have significant vegetative density to decrease water energy and allow settling of suspended materials?

5. Y **N** Is the position of the wetland in the landscape such that run-off is held or filtered before entering a surface water?

6. Y N Are algal blooms, heavy macrophyte growth, or other signs of excess nutrient loading to the wetland apparent (or historically reported)?

Shoreline Protection

1. Y **N** Is the wetland in a lake fringe or riverine setting? If NO, STOP and enter "not applicable" for this function. If YES, then answer the applicable questions.

2. Y N Is the shoreline exposed to constant wave action caused by long wind fetch or boat traffic?

3. Y N Is the shoreline and shallow littoral zone vegetated with submerged or emergent vegetation in the swash zone that decrease wave energy or perennial wetland species that form dense root mats and/or species that have strong stems that are resistant to erosive forces?

4. Y N Is the stream bank prone to erosion due to unstable soils, land uses, or ice floes?

5. Y **N** Is the stream bank vegetated with densely rooted shrubs that provide upper bank stability?

Groundwater Recharge and Discharge

1. Y **N** Related to discharge, are there observable (or reported) springs located in the wetland, physical indicators of springs such as marl soil, or vegetation indicators such as watercress or marsh marigold present that tend to indicate the presence of groundwater springs? Angelica, skunk cabbage.

2. Y **N** Related to discharge, may the wetland contribute to the maintenance of base flow in a stream?

3. Y N Related to recharge, is the wetland located on or near a groundwater divide (e.g. a topographic high)?

Aesthetics/Recreation/Education and Science

1. Y N Is the wetland visible from any of the following kinds of vantage points: roads, public lands, houses, and/or businesses? (Circle all that apply.)

2. Y N Is the wetland in or near any population centers?

3. Y N Is any part of the wetland is in public or conservation ownership?

4. Y N Does the public have direct access to the wetland from public roads or waterways? (Circle those that apply.)

5. Is the wetland itself relatively free of obvious human influences, such as:

   a. Y N Buildings?
   b. Y N Roads?
   c. Y N Other structures?
   d. Y N Trash?
   e. Y N Pollution?
   f. Y N Filling?
   g. Y N Dredging/draining?
   h. Y N Domination by non-native vegetation? Reed canary grass

6. Is the surrounding viewshed relatively free of obvious human influences, such as:
   a. Y N Buildings?
   b. Y N Roads?
   c. Y N Other structures?

7. Y N Is the wetland organized into a variety of visibly separate areas of similar vegetation, color, and/or texture (including areas of open water)?

8. Y N Does the wetland add to the variety of visibly separate areas of similar vegetation, color, and/or texture (including areas of open water) within the landscape as a whole?

9. Does the wetland encourage exploration because any of the following factors are present:
   a. Y N Long views within the wetland?
   b. Y N Long views in the viewshed adjacent to the wetland?
   c. Y N Convoluted edges within and/or around the wetland border?
   d. Y N The wetland provides a different (and perhaps more natural/complex) kind of environment from the surrounding land covers?

10. Y N Is the wetland currently being used for (or does it have the potential to be used for) the following recreational activities? (Check all that apply.)

ACTIVITY	CURRENT USE	POTENTIAL USE
Nature study/photography	X	
Hiking/biking/skiing	X	
Hunting/fishing/trapping	X	
Boating/canoeing		
Food harvesting		
Others (list)		

11. Y N Is the wetland currently being used, and/or does it have the potential for use for educational or scientific study purposes (circle that which applies)?

Plant List
Lodi Marsh
Lodi, Wisconsin

Scientific Name	Common Name	Wetland Indicator Status	1	2	3	4	5	6	7	8	9	10
Acer negundo	box elder	FACW-						x				
Agrostis gigantea	Redtop	FACW				x						
Angelica atropurpurea	Angelica	OBL	x	x					x			
Aster prenanthoides	Crooked stem aster	NI		x	x		x		x	x		x
Aster novae-angiea	NE aster	FACW			x					x		x
Aster simplex	Marsh aster	FACW				x	x		x			
Calamagrostis canadensis	Canada bluejoint grass	OBL							x			
Carex lacustris	Lake sedge	OBL								x		x
Carex lurida	Shallow sedge	OBL							x			
Carex scoparia	Broom sedge	FACW							x	x		x
Carex stricta	Tussock sedge	OBL			x		x		x	x		x
Carex vesicaria	Sedge	OBL		x								
Carex vulpinoidea	Fox sedge	OBL		x					x	x		x
Caltha palustris	marsh marigold	OBL					x		x			
Cicuta maculata	water hemlock	OBL					x			x		x
Cornus stolonifera	Red-osier dogwood	FACW			x	x			x	x		x
Epilobium leptophyllum	American marsh willow-herb	OBL			x							
Equisetum palustre	marsh horsetail	FACW				x				x		x
Eupatorium maculatum	Joe pye weed	OBL				x	x		x	x		x
Eupatorium perfoliatum	Boneset	FACW+				x	x		x			
Fragaria virginiana	Strawberries	FAC-				x						
Galium boreale	Northern bedstraw	FAC				x						
Glyceria canadensis	Rattlesnake grass	OBL				x	x		x			
Hasteola suaveolens	false Indian plantain	OBL							x			
Impatiens capensis	Jewelweed	FACW	x	x			x		x			
Juncus effusus	Common rush	OBL			x							
Juncus dudleyi	Path rush	FAC			x	x				x		x
Lycopus uniflorus	northern bugleweed	OBL				x				x		x
Metha arvense	Wild mint	FACW			x							
Nasturtium officinale	Watercress	OBL					x					
Parthenocissus quinquefolia	Virginia Creeper	FAC-		x								

Plant List
Lodi Marsh
Lodi, Wisconsin

Scientific Name	Common Name	Wetland Indicator Status	1	2	3	4	5	6	7	8	9	10
Pedicularis lanceolata	Swamp lousewart	FACW+					x					
Phalaris arundinacea	Reed canary grass	FACW+	x	x		x	x	x				
Phleum pratense	Timothy	FACU				x						
Polygonum lapathifolium	Dock-leaved smartweed	FACW+					x					
Polygonum sagittatum	Aroow-leaved tearthumb	OBL				x						
Populus tremula	Quacking aspen	FAC				x		x				
Quercus bicolor	Swamp white oak	FACW+							x			
Rhamnus frangula	Glossy buckthorn	FAC+		x		x						
Ribes americanum	Black current	FACW		x								
Rubus idaeus	Red raspberry	FACW-		x		x						
Rumex crispus	Curly dock	FAC					x		x	x		x
Saggittaria latifolia	Arrowhead	OBL	x	x			x					
Salix exugia	Sandbar willow	OBL								x		x
Salix bebbiana	Bebb's willow	FACW+	x			x						
Salix discolor	Pussy willow	FACW	x			x			x			
Salix nigra	Black willow	OBL		x					x			
Scirpus atrovirens	Green bulrush	OBL			x	x	x		x	x		x
Sambucus canadensis	American black elderberry	FACW-	x	x								
Solidago canadensis	Common goldenrod	FACU		x	x							
Sparganium americanum	Giant bur-reed	OBL								x		x
Spiraea alba	Meadowsweat	FACW+					x					
Stachys hispida	hedgenettle	OBL					x		x			
Symplocarpus foetidus	Skunk cabbage	OBL		x			x				x	
Thalictrum dioicum	early meadow-rue	FACU								x		x
Thelypteris palustris	marsh fern	FACW				x	x		x			
Typha angustifolia	Narrow-leaved cattail	OBL			x							
Typha latifolia	Broad-leaved cattail	OBL	x	x	x	x	x		x	x		x
Urtica dioica	Stinging nettle	FAC+	x									
Vitis riparia	Riverbank grape	FACW		x		x						
60		**Totals**	**10**	**17**	**11**	**24**	**21**	**13**	**23**	**18**	**1**	**18**