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Overview Of The Quality And Quantity Of Roadway Runoff And Current Status Of Phase II Storm Water Rules

Minnesota Local Road
Research Board

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This report provides a summary of the current Storm Water rules and proposed rules as they may effect the construction and operation of the streets and highways of Minnesota Cities and Counties. This report also summarizes *The Quantity and Quality of Runoff from Selected Guttered and Unguttered Roadways in Northeast Ramsey County, Minnesota*; a study and resulting report that was conducted for the Minnesota Local Road Research Board (LRRB) by the United States Geological Survey. The rules summarized include the Federal Phase II Storm Water Rules, the Minnesota Pollution Control Agency's response to the proposed rules, and the process of obtaining Industrial and Municipal Storm Water Permits and Construction Storm Water Permits.

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1.0 Executive Summary

On November 16, 1990, the Environmental Protection Agency (EPA) published Phase I Storm Water Rules in an effort to reduce contaminants associated with non-point runoff. These rules require storm water discharge permits for medium (population >100,000) and large (population >250,000) municipalities, certain industrial sites, and construction sites that disturb five acres or more of land.

On January 9, 1998, the EPA published proposed Phase II Storm Water Rules which will require storm water discharge permits for small municipal separate storm sewer systems (MS4s) in communities in urbanized areas with a population of less than 100,000, and for construction sites that disturb one to five acres of land. EPA defines MS4s, in part, as a conveyance or system of conveyances that are owned or operated by a state, city, town borough, county, parish, district, association, or other public body designated or used for collecting or conveying storm water which is not a combined sewer and which is not part of a Publicly Owned Treatment Works (POTW). MS4s covered under the new rules (see Section 4.0) are required to apply for storm water discharge permit coverage by May 31, 2002.

There is concern that the proposed Phase II Storm Water Rules, coupled with the potential for future storm water regulations, will require MS4s to monitor and manage roadway runoff. This concern stems from the fact that roadway runoff is difficult to monitor and manage due to location, diffuse sources of potential contaminants, varied climatic conditions, variable traffic patterns, and other associated factors. Since roadway runoff is a classic non-point pollutant source, there have been a number of studies addressing runoff quality, its impact on receiving waters, and management techniques. The results of these studies and the concern of city and county engineers about roadway runoff management prompted the Local Road Research Board (LRRB), in cooperation with the Minnesota Department of Transportation (Mn/DOT), to enlist the partnership and services of the United States Geologic Survey (USGS) in implementing a three-year study to examine storm water runoff and snow-melt runoff at five municipal roadways in Minnesota. The LRRB asked Braun Intertec to provide a brief summary of this study, which is provided in Section 3.0. Perhaps more importantly, the LRRB also asked Braun Intertec to summarize the proposed Phase II Storm Water Rules, review the MPCA's position on the Storm Water Rules, provide information on obtaining a storm water permit, and provide information and references on best management practices (BMPs).

It should be pointed out that according to the Minnesota Pollution Control Agency (MPCA), who administers the EPA's storm water program, the aim of the proposed rules is not to regulate roadway runoff. At this time, the MPCA does not have a municipal roadway runoff management program in place. The MPCA believes that Minnesota already has effective legislation and rules in place to protect water quality. It is the MPCA's aim to focus on roadway runoff associated with roadway construction and maintenance projects through construction storm water permits. According to the MPCA, there may

be special situations where municipal roadway runoff could impact specially designated habitats or water bodies such as trout streams; these situations may need to be reviewed under the Phase II Storm Water Rules. Since MS4s may own storm water conveyance systems, especially where the point of discharge may be to significantly impaired waters, there is the potential that they may be required to monitor roadway runoff and establish BMPs to control runoff and reduce pollutants. Therefore, MS4 planners and engineers may want to consider reviewing and establishing BMPs prior to obtaining a permit under the Phase II Rules.

This report did not include any research on the cost associated with selection and implementation of BMPs, some of which are very costly. For example, those BMPs associated with removal of dissolved metals using traditional methods are cost prohibitive when implemented on a large scale and may not be effective.

2.0 Introduction

The protection of water quality has long been on the agenda of federal, state, and local governments. Historically, water quality regulations have been directed toward large municipal sewage treatment plants and industries that generate industrial process wastewaters or what has been termed point-source discharges. Consequently, most of the early water regulations required monitoring and improvement of the quality of process wastewaters prior to being discharged. Under the Federal Clean Water Act (CWA), these facilities were required to obtain a National Pollutant Discharge Elimination System (NPDES) permit in order to legally discharge process wastewaters to surface waters of the United States.

In 1987, the United States Environmental Protection Agency (EPA), at the direction of the United States Congress, extended the NPDES rules, requiring that large metropolitan areas and certain industries also monitor the quality of discharges associated with storm water runoff or what have been termed non-point discharges. Since 1992, storm water discharge permits have been required for municipalities with populations greater than 100,000, for certain industries that have "significant materials" exposed to precipitation events, and for construction sites where five acres or more of land has been disturbed. These rules are known as the Phase I Storm Water Rules. A new proposal by the EPA to regulate storm water runoff from small municipalities and construction sites (Phase II Storm Water Rules) was signed in December of 1997 and will be finalized by March 1999. As proposed, these regulations will require storm water discharge permits for municipalities with populations less than 100,000 and for construction activities on one to five acres of land. These new Storm Water Rules may also require municipalities to monitor discharges to selected land-use types within the municipality.

Subsequent to implementation of the Phase I Storm Water Rules, a number of studies were conducted on the impact of population density, agricultural practices, construction, and other conditions associated with the quality of storm water runoff and receiving waters in the United States. One area of concern in the urban setting is the impact of potential contaminants contained in roadway runoff and how they could affect the quality of receiving waters. The potential impact of roadway runoff to surface waters coupled with proposed Federal Phase II Storm Water Rules which may affect up to 3,500 municipalities throughout the nation, presents new concerns and challenges to state and local planners and municipal engineers. For a summary of the Phase II rules, see Section 4.0.

In Minnesota, the impending regulation of smaller municipalities prompted a study to examine roadway runoff issues within the state. The Local Road Research Board (LRRB), in cooperation with the Minnesota Department of Transportation (Mn/DOT), enlisted the partnership and services of the United States Geological Survey (USGS) in implementing the three-year study (1993-1995) to examine storm water runoff and snow-melt runoff at five municipal roadways in Ramsey County, Minnesota. This

study is entitled: *The Quantity and Quality of Runoff from Selected Guttered and Unguttered Roadways in Northeast Ramsey County, Minnesota.* As a result of this study and other storm water-related issues, LRRB requested Braun Intertec to complete the following tasks:

- Provide a brief summary of the study: *The Quantity and Quality of Runoff from Selected Guttered and Unguttered Roadways in Northeast Ramsey County, Minnesota*;
- Provide an overview of the proposed Federal Phase II Storm Water Rules;
- Provide information on the Minnesota Pollution Control Agency's (MPCA) response to the proposed Federal Phase II Storm Water Rules;
- Provide current information on obtaining a storm water permit; and
- Provide information and references on selected BMPs.

This paper addresses the above tasks.

3.0 Summary of: The Quantity and Quality of Runoff from Selected Guttered and Unguttered Roadways in Northeast Ramsey County, Minnesota (1)

Since runoff from municipal roadways may impact receiving waters, and in light of the potential for EPA to require small municipalities to monitor discharges to selected land-use types, the USGS in cooperation with Mn/DOT and the LRRB implemented a three-year study to examine storm water runoff and snow-melt runoff at five municipal roadways in Minnesota. The study was conducted at five sites located in Ramsey County, Minnesota, from 1993-1995. The Abstract, location map, and summary from this report are included in the Appendix. The following is a brief summary of this study.

3.1 Purpose of Study

The overall purpose of the study was to describe the quantity and quality of runoff from selected roadways. The study had the following objectives:

1. To compare rainfall runoff and snow-melt runoff water quality;

2. To determine rainfall runoff event loading of dissolved solids, nutrients, dissolved ions, selected metals, and semi-volatile organic compounds; and

3. To describe the effects of traffic patterns and latent periods on runoff quality from selected guttered and unguttered roadways.

3.2 Description of Selected Roadways

The study centered around five primary and secondary arterial roadways located in Ramsey County, Minnesota. These five sites consisted of the following: county unguttered; residential guttered; county guttered; municipal state-aid unguttered; and, municipal state-aid guttered. A sixth site, an unguttered residential roadway, was also planned in the study, but a satisfactory site could not be located.

3.3 Runoff Volume

Equipment for collecting and recording rainfall data, and monitoring and recording flow measurements was set up at each monitoring site. This equipment was used to monitor all storm water events except those of low-intensity duration. Rainfall and flow data collected during the study period showed considerable variation in rainfall intensity, amount, and duration from event to event and site to site.

Runoff response time to storm water events, which is the interval between the beginning of a precipitation event and the beginning of measurable runoff, was measured at guttered and unguttered sites. The authors concluded that runoff from guttered sites, which are paved and practically impervious, responded much more rapidly - in one third the time - to the onset of rainfall than did unguttered sites. It

was observed during the study that hot, dry guttered pavement responded more slowly to precipitation than did cool, saturated pavement. The authors believe that response times could have been delayed due to absorption into and evaporation from the pavement. According to the authors, even though pavement is impervious, it can absorb some moisture, especially if it is old and weathered.

The unguttered sites consisted of more unpaved area than the guttered sites, which resulted in longer recession periods (period of withdrawal). The authors believe that the longer recession periods are due to the extent and type of ground cover present along the roadway, since pervious, grass covered, undeveloped, and unsaturated soils may absorb more moisture before reaching saturation, resulting in slower response times. Since the unguttered sites underwent longer recession periods, more total rainfall and total runoff were monitored at these sites than at guttered sites. That is, the recession period continued at unguttered sites during pauses in precipitation where at guttered sites runoff had ceased.

The authors calculated rainfall-runoff coefficients (percentage of the rainfall that ran off from the area measured) for primary drainage areas averaging 0.53 for guttered sites and 0.37 for unguttered sites.

3.4 Snowmelt-Runoff and Rainfall Water Quality - Findings and Conclusions

Precipitation and runoff events were monitored for five sections of roadway in Ramsey County, Minnesota, from 1993-1995. Water samples were collected from 31 snowmelt-runoff events representing 10 separate snowmelt events, and 71 rainfall-runoff events representing 31 separate rainfall events. Samples were analyzed for selected physical properties, dissolved solids, nutrients, dissolved ions, selected metals, and semi-volatile compounds. Investigators were also interested in determining if the rainfall itself contributed to constituents found in the roadway runoff. Therefore, additional rainfall samples were collected and analyzed from 19 rainfall events.

The authors noted the following findings and conclusions.

Snowmelt-Runoff Findings

- Mean concentrations for sodium and chloride were approximately 1,000 times greater in snowmelt-runoff samples than in rainfall-runoff samples.

- Mean concentrations of the dissolved metals, aluminum, chromium, lead, and zinc were two to four times higher in snowmelt-runoff samples than in rainfall-runoff samples.

- Median concentrations of total suspended solids (TSS), dissolved chloride, dissolved sulfate, and total chromium in snowmelt-runoff were two to seven times higher at guttered sites than at unguttered sites. Median concentrations of total phosphorus and zinc were not noticeably different between these site types.

- Median concentrations of TSS, dissolved chloride, and total zinc in snowmelt-runoff in 1993 were one half to one third lower than in 1994 and 1995.

- When the median concentrations of TSS and dissolved chloride in snowmelt-runoff were compared with similar data obtained from Metropolitan Minnesota interstate system (1981, 1987, and 1988), they were up to 10 times higher for the study sites.

Conclusions

- The authors believe that the severity of winter conditions and the application of sand and road salt may be responsible for the year-to-year variations in the median concentrations of various constituents. Elevated dissolved ions such as sodium and chloride, as well as other dissolved ions and metals in snowmelt-runoff, may be due to the application of sand and road salt and the corrosive effects of road salt on metals, especially motor vehicles.

Rainfall Findings

- Analysis of rainfall samples showed that dissolved nitrate and dissolved ammonia were present in rainfall in high enough concentrations to be a source in roadway runoff.

Conclusions

- Analysis of collected rainfall at two sites suggested to the authors that rainfall was not a direct source of most constituents. However, the authors did conclude that rainfall can account for up to 50 percent of dissolved nitrate and dissolved ammonia detected in roadway runoff.

3.5 Rainfall-Runoff Quality, Loads, and Yields

Rainfall-runoff samples were collected and analyzed for constituent concentrations. Constituent loads were also calculated. The authors define constituent load (in grams or kilograms) as the total event runoff (cubic feet [A_q]) multiplied by 28.32 L/ft^3 (the cubic-foot to liter conversion factor), multiplied by the constituent concentration (mg/L [A_c]), and divided by 1,000 (the milligrams to grams conversion factor). Load is symbolized by the following equation:

$$Load_c = (A_q \times 28.32 \times A_c)/1{,}000$$

The authors also calculated yields from time-composited samples. The authors define yield (for primary drainage area) as the constituent load (in grams [Lc]) divided by the total rainfall (in inches [P]) multiplied by K, which equals 43,560 square feet per acre/the study site primary drainage area (in square feet). These calculations were performed using the formula:

$$Yield_c = (L_c/P)(K)$$

Rainfall-Runoff Quality Findings

- Flow or time-composited rainfall-runoff samples collected from 31 rainfall events yielded higher concentrations of TSS, total chromium, and total zinc at guttered sites than at unguttered sites.

- Concentrations of total phosphorus and fecal *Streptococcus* bacteria were higher at unguttered sites than at guttered sites.

- The median concentrations of TSS, total phosphorus, total chromium, and total zinc and dissolved chloride in rainfall-runoff were compared with similar data obtained from the Metropolitan Minnesota interstate system. While the median concentrations for total phosphorus, TSS, and total chromium were similar, the concentrations of total zinc were higher at the interstate system than the study sites.

- Concentrations of metals such as aluminum, copper, lead, and zinc in rainfall-runoff exceeded the MPCA's chronic condition standard limits for metropolitan storm water 96 percent, 52 percent, 9 percent, and 20 percent of the time, respectively.

- Samples that were obtained one or two times a year for analysis of semi-volatile compounds were observed to be below the limit of detection.

Conclusions

- The authors believe that vegetated ditches associated with unguttered sites may filter out heavy particulates such as metals and suspended solids and, at the same time, give up nutrients and coliform bacteria as a result of decaying plant and animal matter.

- Although aluminum, copper, lead, and zinc exceeded the MPCA's chronic condition standard limits for metropolitan storm water, the authors note that MPCA's chronic condition standard limits do not necessarily apply to roadway runoff.

Loads and Yields Findings

- Loads and yields were computed for most of the time-composited samples, and for at least one constituent, TSS, 92% of the computed load for the entire study period for one unguttered site occurred in just one rainfall event. This effect was found to be more pronounced at unguttered sites than guttered sites. However, even for guttered sites, the largest runoff event resulted in loadings between 21 and 37 percent of the total loads computed for the study period.

Conclusions

- The authors conclude that the lower percentages of loads for the guttered sites may be due to the shorter response time and recession periods at the guttered sites than at the unguttered sites (see Section 3.3).

3.6 Latent Period and Traffic Volume

The authors hypothesized that the time lapse between consecutive rainfall events, or latent periods, could be a factor that affects water quality; the longer the latent period, the more material that can potentially accumulate on the roadway and be washed to a collection point. Consequently, the authors believed that roadway runoff could transport more accumulated material with longer latent periods, thereby increasing concentrations of constituents, loads, and yields.

Latent Period Findings

- When plotted with length of latent period, concentrations of selected constituents did not increase with the length of latent period. However, when all of the data was compiled and examined statistically, only total phosphorus, dissolved sulfate, and total zinc concentrations showed a statistical correlation with the latent period. Loads for the same constituents did not correlate with latent periods.

Conclusions

- Concentration levels of most of the selected constituents did not tend to increase with length of latent periods. Only total phosphorus, dissolved sulfate, and total zinc concentrations showed a statistical correlation with the latent period. The length of the latent period had no impact on constituent loads.

Similarly, the authors believed that the level of traffic volume could affect the amount of material on the roadway. Leaking automotive fluids, worn materials (tires and brakes) from vehicles, and mud and soil could accumulate and be transported during runoff events.

Traffic Volume Findings

- Average traffic volume for all of the sites averaged 1,888 to 7,122 vehicles per day. Statistical analysis did not reveal significant differences in constituent concentrations, loads, or yields based on traffic volume.

Conclusions

- The volume of traffic did not play a significant role in the concentrations of selected constituents, loads, or yields.

3.7 Reviewers' Note

This investigation is one of many storm water studies conducted in the wake of federal storm water regulations, many of which are ongoing. Much of the data collected in these studies provides scientists, engineers, and regulators with insight into the physical, chemical, and managerial aspects of storm water runoff. Ultimately, these studies provide for the protection of our nation's water resources.

Specifically, this study provides insight into the physical and chemical characteristics of rainfall-runoff and snow-melt runoff, especially as runoff relates to guttered and unguttered sites. This information is beneficial in helping to understand the impact of chemicals on watersheds, and in developing cost-effective and low maintenance BMPs, which are unique challenges in cold weather climates. Furthermore, this study provides baseline information regarding the complexities associated with runoff monitoring and management.

For planners and municipal engineers, this study provides insight into the complexities that engineers face in the development of BMPs and the difficulty that regulators have in balancing community needs and budgets with protection of watersheds. Planners and municipal engineers should use this study as a starting point in understanding the complexities associated with storm water monitoring and management. It should serve as a tool for long-range planning, assemblage of budgets, and the investigation of community-specific, low maintenance and cost-effective BMPs. This study affords the municipal planner and engineer with the opportunity to become more knowledgeable with regard to storm water management.

A brief review of available data on the BMPs appropriate to small municipalities when attempting to mitigate storm water runoff contamination revealed little information at this time relating to financial feasibility. Specifically, the removal of dissolved metals from the runoff is of concern due to the potentially high cost. Traditional methods of dissolved metals removal, for example, include reverse osmosis and precipitation of metals, both of which would likely be cost prohibitive on a large scale. Further efforts are needed to develop BMPs and resolve the financial issues associated Phase II storm water regulatory compliance for small municipalities.

4.0 Overview of Federal Phase II Storm Water Rules

The following is a summary of the Federal Phase II Storm Water Rules obtained from:

Federal Register
Environmental Protection Agency (EPA)
40 CFR Parts 122 & 123
National Pollutant Discharge Elimination System - Proposed Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Proposed Rule

4.1 Background

In 1972, Congress amended the Federal Water Pollution Control Act (referred to as the Clean Water Act (CWA)) to prohibit the discharge of pollutants from point sources unless regulated by a NPDES permit. In 1987, Congress amended the CWA to require implementation of a comprehensive approach for addressing storm water discharges under the NPDES program. Under the current regulations, known as Phase I Storm Water Rules, only medium (>100,000 people) and large (> 250,000 people) municipal separate storm sewer systems (MS4s) are required to obtain an NPDES storm water discharge permit; small municipalities (<100,000 people) are not required to obtain a permit. However, on January 9, 1998, the EPA released proposed amendments to the Federal NPDES program, Phase II Storm Water Rules, which include proposed storm water regulations for revision of the Clean Water Act.

The regulations set forth in the new Phase II Storm Water Rule were conceived by a 32 member, representative subgroup designated by the EPA, called the Storm Water Phase II FACA Subcommittee. The parent group to the Storm Water Phase II FACA Subcommittee originated in March, 1995, when the Office of Management and Budget approved the charter for establishment of the Urban Wet Weather Flows Advisory Committee (FACA Committee). EPA intended for this parent committee to assist with coordinating and implementation of the urban municipal wet weather water pollution control program.

The Storm Water Phase II FACA Subcommittee consists of representative outside members including municipalities, industrial and commercial sectors, agriculture, environmental and public interest groups, States, Indian Tribes, and EPA staff. The Storm Water Phase II FACA Subcommittee met twelve times, between September 1995 and October 1997, and conducted numerous conference calls to discuss the regulatory framework that serves as the basis for this proposed storm water rule.

4.2 Applicability

Small municipalities and construction sites that are not currently required to obtain storm water permits may soon fall under the new Phase II Storm Water Regulations proposed by the EPA. On January 9, 1998, the EPA released a draft rule proposal (Phase II) that expands the existing NPDES storm water regulations (Phase I) and permit requirements under 40 CFR Parts 122 and 123 and the CWA, Section 402(p)(6). The public comment period for this new rule ended on April 9, 1998, with the finalized regulation to be released by March 1, 1999.

Under the proposed Phase II requirements, the following entities will *automatically* be required to obtain an NPDES storm water discharge permit by May 31, 2002:

- construction sites that disturb 1 to 5 acres; and
- small municipalities (< 100,000 persons) located within urbanized areas, as defined by the National Census Bureau, that operate MS4s.

A list, by state, of U.S. counties, municipalities, and incorporated townships or villages located in urbanized areas that will be regulated under the proposed rule is provided in Appendix 6 of the Preamble to the Federal Register document. Those counties, municipalities, and incorporated townships or villages that are in Minnesota and that will be regulated under the proposed rule are provided in Table 1.

Table 1

Incorporated Townships or Villages and Counties, within Urbanized Areas*, in Minnesota to be Regulated Under the Proposed Phase II Storm Water Rule**

Andover	Eagan	Lexington	Newport	Shorewood
Anoka	East Grand Forks	Lilydale	North Oaks	South St. Paul
Apple Valley	Eden Prairie	Lino Lakes	North St. Paul	Spring Lake Park
Arden Hills	Excelsior	Little Canada	Oakdale	Spring Park
Benton County	Falcon Heights	Long Lake	Olmsted County	St. Anthony
Birchwood Village	Farmington	Loretto	Orono	St. Cloud
Blaine	Fridley	Mahtomedi	Osseo	St. Louis County
Bloomington	Gem Lake	Maple Grove	Plymouth	St. Paul Park
Brooklyn Center	Golden Valley	Maple Plain	Prior Lake	Stearns County
Brooklyn Park	Greenwood	Maplewood	Proctor	Sunfish Lake
Burnsville	Ham Lake	Medicine Lake	Ramsey	Tonka Bay
Champlin	Hennepin County	Medina	Ramsey County	Vadnais Heights

Table 1 (continued)

Incorporated Townships or Villages and Counties, within Urbanized Areas*, in Minnesota to be Regulated Under the Proposed Phase II Storm Water Rule**

Chanhassen	Hermantown	Mendota	Robbinsdale	Victoria
Circle Pines	Hilltop	Mendota Heights	Rochester	Waite Park
Clay County	Hopkins	Minnetonka	Rosemount	Washington County
Coon Rapids	Houston County	Minnetonka Beach	Roseville	Wayzata
Cottage Grove	Inver Grove Heights	Minnetrista	Sartell	West St. Paul
Crystal	La Crescent	Moorhead	Sauk Rapids	White Bear Lake
Dayton	Lake Elmo	Mound	Savage	Willernie
Deephaven	Lakeville	Mounds View	Scott County	Woodbury
Dilworth	Landfall	New Brighton	Sherburne County	Woodland
Duluth	Lauderdale	New Hope	Shoreview	

* As defined by the U.S. Census Bureau.

** From the 1990 Census of Population and Housing, U.S. Census Bureau.

In addition, MS4s located outside of urbanized areas that have a population of at least 10,000 or more and have a population density of at least 1,000 people per square mile may *potentially* be subject to these new regulations. EPA is proposing designation criteria to be applied to these municipalities, including:

- discharge to sensitive waters;
- high growth or growth potential;
- high population density;
- contiguity to an urbanized area;
- significant contributor of pollutants to waters of the United States; and
- ineffective control of water quality concerns by other programs.

A list, by state, of U.S. counties, municipalities, and incorporated townships or villages located outside of urbanized areas that may be *potentially* regulated under the proposed Phase II rule is provided in Appendix 7 of the Preamble to the Federal Register document. Those MS4s that are in Minnesota and may be *potentially* regulated under the proposed Phase II rule are provided in Table 2.

The permitting authorities may, however, regulate any additional sources of pollution if there is sufficient evidence indicating impairment to waters of the U.S. It is important to note that only separate storm sewer systems are subject to regulation. Combined sewer systems, which include both storm and sanitary waste water that flows to a wastewater treatment plant, are not included in the new rule coverage.

Table 2

Incorporated Townships or Villages, outside of Urbanized Areas*, in Minnesota to be Potentially Regulated Under the Proposed Phase II Storm Water Rule**

Albert Lea	Faribault	Mankato	Northfield	Winona
Austin	Fergus Falls	Marshall	Owatonna	
Bemidji	Hastings	New Ulm	Stillwater	
Brainerd	Hutchinson	North Mankato	Willmar	

* As defined by the U.S. Census Bureau.

** From the 1990 Census of Population and Housing, U.S. Census Bureau.

Under the proposed Phase II rule, the NPDES permitting authority is allowed to waive otherwise applicable requirements for a regulated MS4 if the jurisdiction served by the system includes a population of less than 1,000 persons and meets additional water quality-based conditions. Water quality-based conditions would be the basis for a waiver of requirements for construction activities between 1 and 5 acres as well. A proposed rule summary is presented in Section 4.3.

4.3 Proposed Rule Requirements

The proposed Phase II Storm Water Rule requires regulated MS4s to develop and implement a storm water management program. Program components, known as the six minimum controls, include the following:

- measures to address requirements concerning public education and outreach;
- public involvement;
- illicit discharge detection and elimination;
- construction site runoff control;
- post-construction storm water management in new development and redevelopment; and
- pollution prevention and good housekeeping of municipal operations.

These program components will be implemented through NPDES permits. Regulated MS4s will be required to submit to the NPDES permitting authority a description of best management practices (BMPs) to be implemented in their watershed and measurable goals for each of the six minimum control measures listed above. Flexible requirements for permittees are built into the process by allowing BMPs to be tailored to the needs of a particular watershed.

The EPA is advocating the use of general permits and partnerships in the proposed Phase II rule. The rule is intended to facilitate a watershed approach as the management framework for efficiently, effectively, and consistently protecting and restoring aquatic ecosystems, and protecting public health.

The watershed approach is a decision-making process based on the following standards for all stakeholders within a watershed:

- a common strategy for gathering data;
- a common understanding of roles;
- a common understanding of priorities; and
- a common understanding of responsibilities.

For instance, the proposed rule would allow a regulated municipality to join as a co-permittee with another regulated municipality, referencing a common storm water management program. EPA is also recommending use of the watershed approach for storm water management, which focuses on coordination between public and private parties to address the highest priority waters within hydrologically defined geographic areas.

Under the proposed rule, a permittee is expected to reduce pollutants to the maximum extent practicable (MEP) by implementing BMPs with measurable goals to achieve the six minimum control measures mentioned above. EPA intends for MEP compliance to be evaluated with respect to a specific region or basin and for the character of identified BMPs to reflect this evaluation. The MEP compliance evaluation process would consider such factors as:

- conditions of receiving waters;
- specific local concerns;
- the effectiveness to address the pollutant(s) of concern;
- public acceptance;
- cost;
- technical feasibility; and
- compliance with federal, state and local laws and regulations.

Small MS4s located within urbanized areas and automatically regulated based on the 1990 or 2000 census must apply for a permit or submit a notice of intent (NOI) to be covered by a general permit by May 31, 2002. Small MS4s located outside urbanized areas that are found to be regulated are required to submit a permit application within 60 days of designation. Also, NPDES permitting authorities are required to designate non-urbanized MS4s by May 31, 2002.

5.0 Minnesota Pollution Control Agency's Response to the Proposed Federal Phase II Storm Water Rules (2)

On January 9, 1998, the EPA published proposed regulations for the Phase II Storm Water Rules, followed by a public review and comment period which ended in April, 1998. Since the MPCA administers EPA's environmental programs for the State of Minnesota, they formed a focus group of stakeholders, partners, and affected parties to discuss the proposed regulations and offer comments to the EPA. A consensus of comments was reached and provided to EPA in a letter dated April 9, 1998.

Braun Intertec spoke with Mr. Gene Soderbeck, (MPCA) on July 29, 1998, regarding MPCA's position on EPA's proposed Phase II Storm Water Rules. Mr. Soderbeck reiterated the MPCA's position as outlined in their April 9 comment letter to EPA. As can be seen in the attached letter, the MPCA believes that the proposed regulations will add conflict and confusion between federal and state rules in trying to reach similar goals, much like the conflict associated with federal wetland protection regulations. The MPCA also believes that Minnesota already has the legislation and a network of rules in place to bring about the federal government's desired outcome. The MPCA is therefore requesting exemption from portions of the federal rules. The MPCA, however, does believe that eventually there will be changes in Minnesota's storm water program. At this time, the MPCA has not formatted or proposed any municipal storm water permits nor could they predict the final outcome and the net effect of the federal government's proposed rules. Once the Phase II Storm Rules are finalized, the MPCA will provide informational and outreach programs to assist the regulated community.

Some changes will also occur in Minnesota's General Storm Water Permit for Construction Activity in the near future. According to Mr. Soderbeck, the MPCA has recently mailed a reissued General Storm Water Permit for Construction Activity to various interested parties for public review and comment. Although the reissued permit reflects no changes from the previous permit, changes are anticipated over the next several years. Mr. Soderbeck indicated that a working group will be established to allow participants to work with the MPCA in the development of both the Municipal Storm Water Permit and Construction Storm Water Permit programs under the Phase II Storm Water Rules. Planning for the working group is currently being carried out under the MPCA's Policy and Planning Division. To be included in the working group, interested participants should call Ms. Marge Velky or Mr. Don Jakes, both with Policy and Planning at the MPCA.

6.0 Obtaining a Storm Water Permit

6.1 Industrial and Municipal Storm Water Permits

Under the current Phase I Storm Water Rules, industrial and municipal dischargers of storm water with certain Standard Industrial Classification (SIC) codes are required to obtain an NPDES storm water permit. A list of these SIC codes can be found in the Minnesota Pollution Control Agency's "Application Instructions for a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Storm Water Permit for Industrial Activity" report. (3) A second list of SIC codes, also found in the application instructions, designates those facilities for whom permit coverage is at the discretion of the MPCA. These facilities must apply for a storm water permit; however, a permit will be issued to the facility only if storm water comes in contact with significant materials, which are defined as follows:

- Raw, intermediate or final products: in addition to those products and materials listed on the application, this category includes, but is not limited to other manufactured products used or created by the facility.

- Industrial waste/byproducts: in addition to those materials listed on the application, this category includes, but is not limited to slag, ash, and other waste resulting from the manufacturing or industrial process.

- Loading, unloading, or other handling of industrial waste or byproduct, raw, intermediate, or final product: includes but is not limited to storage, transportation, or conveyance of raw, intermediate, final products or waste materials.

- Vehicle or process equipment maintenance: in addition to those activities listed on the application, this category includes, but is not limited to vehicle rehabilitation, lubrication, and servicing of loading, unloading, and processing equipment.

Note that both the mandatory and discretionary SIC codes lists apply also to facilities that are owned by municipalities. Municipalities serving less than 100,000 individuals are deferred from Phase I Storm Water Regulations as stated above; however, airports, landfills and steam electric generating facilities are not granted this deferment and are required to obtain a permit under the Phase I rules.

If a facility's SIC code is not listed, then permit coverage is not required. The storm water permit application must be completed and mailed to the MPCA, excluding a permit fee. Prior to application for coverage, a permitee must develop a Storm Water Pollution Prevention Plan (SWPPP) to meet permit requirements. Plan requirements are spelled out in detail in the permit, but generally the SWPPP must

contain BMPs to minimize contact of storm water with potentially polluting materials or treat storm water runoff prior to release from the facility.

Frozen conditions can present special challenges in implementing BMPs. The BMPs outlined in the following Table were excerpted from *Stormwater BMP Design Supplement for Cold Climates,* Caraco, D., Claytor, R., and Center for Watershed Protection, December 1997, under cooperative grant - EPA Region V and Office of Wetlands Oceans and Watersheds.

Type	BMP	Classification	Notes
Ponds	Wet Pond	◗	Can be effective, but needs modifications to prevent freezing of outlet pipes. Limited by reduced treatment of volume and biological activity in the permanent pool during ice cover.
	Wet Extended Detention Pond	●	Some modifications needed to conveyance structures needed. Extended detention storage provides treatment during the winter season.
	Dry Extended Detention Pond	◗	Few modifications needed. Although this practice is easily adapted to cold climates, it is not highly recommended overall because of its relatively poor warm season performance.
Wetlands	Pond/Wetland System	◗	Pond/Wetland systems can be effective, especially if some Extended Detention storage is provided. Modifications for both pond and wetland systems apply to these BMPs. This includes changes in wetland plant selection and planting.
	Extended Detention Wetland	●	See Wet Extended Detention pond. Also needs modifications to wetland plant species.
Infiltration	Infiltration Trench	◗	Can be effective, but may be restricted by groundwater quality concerns related to infiltrating chlorides. Also, frozen ground conditions may inhibit the infiltration capacity of the ground.

Type	BMP	Classification	Notes
	Infiltration Basin	◗	Can be effective, but may be restricted by groundwater quality concerns related to infiltrating chlorides. Also, frozen ground conditions may inhibit the infiltration capacity of the ground.
Filtering Systems	Underground Sand Filter	●	When placed below the frost line, these systems can function effectively in cold climates.
	Bioretention	◗	Problems functioning during the winter season because of reduced infiltration. It has some value for snow storage on parking lots, however.
	Submerged Gravel Wetland	◗	Some concerns of bypass during winter flows. Has been used in relatively cold regions with success, but not tested in a wide range of conditions.
Open Channel Systems	Grassed Channel	◗	Reduced effectiveness in the winter season because of dormant vegetation and reduced infiltration. Valuable for snow storage.
	Dry Swale	◗	Reduced effectiveness in the winter season because of dormant vegetation and reduced infiltration. Very valuable for snow storage and meltwater infiltration.
	Vegetated Filter Strip	◗	Reduced effectiveness in the winter season because of dormant vegetation and reduced infiltration. Valuable for snow storage.
	Wet Swale	◗	Reduced effectiveness in the winter season because of dormant vegetation. Can be valuable for snow storage.

- ● Easily applied to cold climates; can be effective during the winter season.
- ◗ Can be used in cold climates with significant modifications; moderately effective during the winter season.

For more information on implementing BMPs and monitoring storm water runoff, please refer to the following guides:

U.S. Environmental Protection Agency, Office of Water (EN-336), July 1992, *NPDES Storm Water Sampling Guidance Document*: EPA 833-B-92-001.

U.S. Environmental Protection Agency, Office of Water (WH-547), September 1992, *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices*: EPA 832-R-92-006.

Permit requirements include inspections every two months during non-frozen conditions as well as submittal of first and second annual reports certifying that the BMPs outlined in the SWPPP are being implemented.

Upon completion of the application for coverage, a general storm water permit is issued for the site. At the discretion of the MPCA, an individual storm water permit may instead be issued. In addition to the requirements outlined above, individual permits also require discharge monitoring and reporting on a regular basis. Individual permits are issued to sites where there is a greater potential for contamination of storm water runoff.

6.2 Construction Storm Water Permits

During a storm, silt, sediment, and other pollutants are washed off construction sites. Sediment losses from construction sites can range from 30 to 750 tons per acre. Sediment loading rates from construction sites are as high as 100 times that of agricultural lands, and 1,000 to 2,000 times that of forest lands. In a short period of time, construction sites can contribute more sediment to surface waters than was previously deposited over several decades. Examples of other pollutants that can wash off of construction sites include: phosphorous, nitrogen, petroleum products, construction chemicals, and solid wastes. In urban areas, streets and other paved areas carry polluted storm water into storm sewer systems where, unless diverted to a storm water detention basin, it is directly released into surface waters. In rural areas, storm water runs off construction sites into drainage ditches and other conveyances where it is directly released into rivers, streams, lakes, and wetlands.

Anyone conducting a construction activity that disturbs five or more acres of total land area is required to apply for coverage under the MPCA's General NPDES Construction Storm Water Permit. (4) (MPCA's answers to common questions and the instructions for permit application are included in the Appendix.) nstruction activity includes the following:

- Clearing
- Grading

- Excavation
- Road Building
- Construction of:
    - Residential Houses
    - Office Buildings
    - Commercial Facilities
    - Industrial Buildings
    - Landfills
    - Airports
    - Feedlots

The General Construction Storm Water Permit requires that a Temporary Erosion and Sediment Control Plan be developed for the project. The goals of this plan are to:

- prevent erosion from occurring;
- keep sediment on the site during construction; and
- minimize the tracking of soil and other sediment from the construction site onto paved surfaces by vehicles.

The permit also requires that a Permanent Erosion and Sediment Control Plan be developed for the project. The goal of this plan is to minimize negative impacts caused by storm water runoff from the project's ultimate development. The plans must contain BMPs developed to meet the goals of each plan. Neither the project's plans and specifications, nor the Temporary or Permanent Erosion and Sediment Control Plans need to be submitted to the MPCA for review and approval. The *only* document that needs to be submitted is a completed application form certifying that the plans were completed and incorporated into the construction project's final plans and specifications.

The owner will be responsible for completing the application form and certifying (signing) that the Temporary and Permanent Erosion and Sediment Control Plans have been prepared for the project. The owner is responsible for compliance with all parts of the permit.

At the owner's discretion, the general contractor will also be responsible for signing the application form prepared by the owner, certifying that the Temporary and Permanent Erosion and Sediment Control Plans will be implemented on the project. The general contractor is a co-permittee with the owner for certain parts of the permit.

The MPCA and the EPA have developed the following guidance manuals to assist applicants with developing Temporary and Permanent Erosion and Sediment Control Plans:

MPCA Water Quality Division, *Protecting Water Quality in Urban Areas*

U.S. Environmental Protection Agency, National Technical Information Service, *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices,* Document Number 832-R-92-005.

7.0 Best Management Practices

In the wake of storm water regulations there are number of proven BMPs as well as a number that are in various stages of development. A number of references for relevant BMP research, practices, and information are listed below (also see Section 6.0):

1. Michael V. Keblin, Michael E. Barrett, Joseph F. Malina, Jr., and Randall J. Charbeneau. "The Effectiveness of Permanent Highway Runoff Controls: Sedimentation/Filtration Systems, Research Report 2954-1." *Center for Transportation Research, University of Texas at Austin* 1997.

2. Patrick M. Walsh, Michael E. Barrett, Joseph F. Malina, Jr., and Randall J. Charbeneau. "Use of Vegetative Controls for Treatment of Highway Runoff, Research Report 2954-2." *Center for Transportation Research, University of Texas at Austin* 1997.

3. Michael E. Barrett, Michael V. Keblin, Patrick M. Walsh, Joseph F. Malina, Jr., and Randall J. Charbeneau. "Evaluation of the Performance of Permanent Runoff Controls: Summary and Conclusions, Research Report 2954-3F." *Center for Transportation Research, University of Texas at Austin* 1997.

4. Matthias St. John and Richard Horner. "Effect of Road Shoulder Treatments on Highway Runoff Quality and Quantity." *Washington State Transportation Center, University of Washington, University District Building, 1107 N.E. 45th St., #535, Seattle, WA 98105-4631*, TD 100: WA 97-429.1, July 1997.

5. Bruno Maestri and Byron N. Lord. "Guide for Mitigation of Highway Storm Water Runoff Pollution." *The Science of the Total Environment* 59, pp. 467-476, 1987.

6. Chin Y. Duo and Jun-lin Zhu. "Design of a Diversion System to Manage the First Flush." *Water Resources Bulletin* Paper No. 88010, June 1989.

7. United States Department of Energy, Sustainable Systems, Inc., and Greening America. "Greening Federal Facilities: An Energy, Environmental, and Economic Resource Guide for Federal Facilities Managers." *U.S. Department of Energy, Federal Energy Management Program Internet webpage* 1997.

8. Munoz, Hernandez A. and Garcia, Hontoria E. J. "Pollutant Removal From Highway Surfaces in Madrid Using Irrigation Techniques." *The Science of the Total Environment* 59, pp. 369-389, 1987.

9. Y.A. Yousef, T. Hvitved-Jacobsen, M.P. Wanielista, and H.H. Harper. "Removal of Contaminants in Highway Runoff Flowing Through Swales." *The Science of the Total Environment* 59, pp. 391-399, 1987.

10. N.P. Kobriger, T.V. Dupuis, W.A. Kreutzberger, ET AL. "Guidelines for the Management of Highway Runoff on Wetlands." *National Cooperative Highway Research Program Report 264* Ch.1-Ch.8, pp. 1-55, 1983.

11. C.J. Pratt, L.D.G. Mantle, and P.A. Schofield. "Urban Stormwater Reduction and Quality Improvement Through the Use of Permeable Pavements." *Water Science Technology* 21, pp. 769-778, 1989.

12. C. Nicholas Hewitt and M.B. Rashed. "Removal Rates of Selected Pollutants in the Runoff Waters From a Major Rural Highway." *Water Research* 26, No. 3, pp. 311-319, 1992.

13. Robert J. Kaighn and L. Yu Shaw. "Testing of Roadside Vegetation for Highway Runoff Pollutant Removal." *Transportation Research Record* 1523, pp. 116-123, 1996.

14. Shari Schaftlein. "Washington State's Stormwater Management Program." *Transportation Research Record* 1523, pp. 124-129, 1996.

15. M. Barber. "Evaluation for Handling and Treating Stormwater in Confined Situations." *TRAC/Washington State University, Project Workplan* December 1995.

16. D. Yonge, M. Barber, W. Hathorne, and S. Chen. "Wet Detention Pond Design for Highway Runoff Pollutant Control." *NCHRP Grant Project 25-12 Proposal* November 1995.

17. Falcon A. Price and David R. Yonge. "Enhancing Contaminant Removal in Stormwater Detention Basins by Coagulation." *Transportation Research Record* 1483, pp. 105-111, July 1995.

18. Chris Dunn, Scott Brown, G. Kenneth Young, Stuart Stein, and Mark P. Mistichelli. "Current Water Quality Best Management Practices Design Guidance." *Transportation Research Record* 1483, pp. 80-88, July 1995.

19. Albert H. Burgess. "Stormwater Management System." *American Ceramic Society Bulletin* v16 n3, pp. 28-31, May-June 1995.

20. S. Tenney, M.E. Barrett, J.F. Malina, Jr., and R.J. Charbeneau. "An Evaluation of Highway Runoff Filtration Systems, Research Report, Project 7." *Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin* CTR 7-1943-6, March 1996.

21. J. Bryan Ellis, D. Owen Harrop, and D Michael Revitt. "Hydrological Controls of Pollutant Removal from Highway Surfaces." *Water Research* v20 n5, pp. 589-595, 1986.

22. "Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff." *U.S. Department of Transportation, Federal Highway Administration, Volume I: Research Report* Publication No. FHWA-RD-96-095, November 1996.

23. "Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff." *U.S. Department of Transportation, Federal Highway Administration, Volume II: Design Guidelines* Publication No. FHWA-RD-96-096, November 1996.

24. "Evaluation and Management of Highway Runoff Water Quality." *U.S. Department of Transportation, Federal Highway Administration* Publication No. FHWA-PD-96-032, June 1996.

25. "Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22." *U.S. Department of Transportation, Federal Highway Administration* Publication No. FHWA-SA-96-078, November 1996.

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2. Minnesota Pollution Control Agency. "Proposed Phase II Storm Water Rules," pp. 1-6, April 9, 1998.

3. Minnesota Pollution Control Agency. "Application Instructions for a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Storm Water Permit for Industrial Activity, pp. 1-26, October 1997.

4. Minnesota Pollution Control Agency. "Commonly Asked Questions and Answers About The Storm Water Permit Program for Construction Activities," August 1997.

Appendix A
Excerpts from USGS Report

Quantity and Quality of Runoff from Selected Guttered and Unguttered Roadways in Northeastern Ramsey County, Minnesota

By Gregory B. Mitton and Gregory A. Payne

Abstract

Five roadway sections in northeastern Ramsey County, Minnesota were monitored during 1993-95, to evaluate water quality and loading of constituents from roadway runoff. Two snowmelt-runoff and five rainfall-runoff events were monitored per year at each site. Additional samples of rainfall were analyzed to determine if rainfall was a direct source of constituent loading to roadway runoff. Roadway-runoff samples were analyzed for selected physical properties, dissolved solids, nutrients, dissolved ions, selected metals, and semi-volatile compounds.

Concentrations of dissolved ions such as sodium, chloride, and metals such as aluminum, chromium, lead, and zinc were detected at much greater levels for snowmelt-runoff samples than rainfall-runoff samples. Analysis of chemical samples from rainfall indicate that rainfall was not a direct source for most constituents. Dissolved nitrate and dissolved ammonia in rainfall, however, can contribute up to one-half the amounts detected in roadway runoff.

Concentrations of total phosphorus and fecal *Streptococcus* bacteria were greater at unguttered sites than at guttered sites. Concentrations of dissolved solids, and some metals were greater at guttered sites than at unguttered sites. This suggests that the vegetated road ditches associated with unguttered sites may filter out heavier particles such as metals and solids, while contributing additional organic matter. Concentrations of aluminum, copper, lead, and zinc exceeded chronic condition standard limits established by the Minnesota Pollution Control Agency for metropolitan storm water from 96 percent, 52 percent, 9 percent, and 20 percent of the samples collected, respectively. Chemical loadings of specific constituents, such as suspended solids, from an individual rainfall-runoff event accounted for greater than 90 percent of the cumulative loadings of that constituent for all monitored events at site 4, for the entire study period.

Length of latent period was statistically compared to constituent concentration levels of total phosphorus, dissolved sulfate, and total zinc and there was a correlation. Constituent loads were not associated with latent period. No correlation was found between traffic volumes—which ranged from 1,888 to 7,172 vehicles per day—and constituent concentrations or loads for this study.

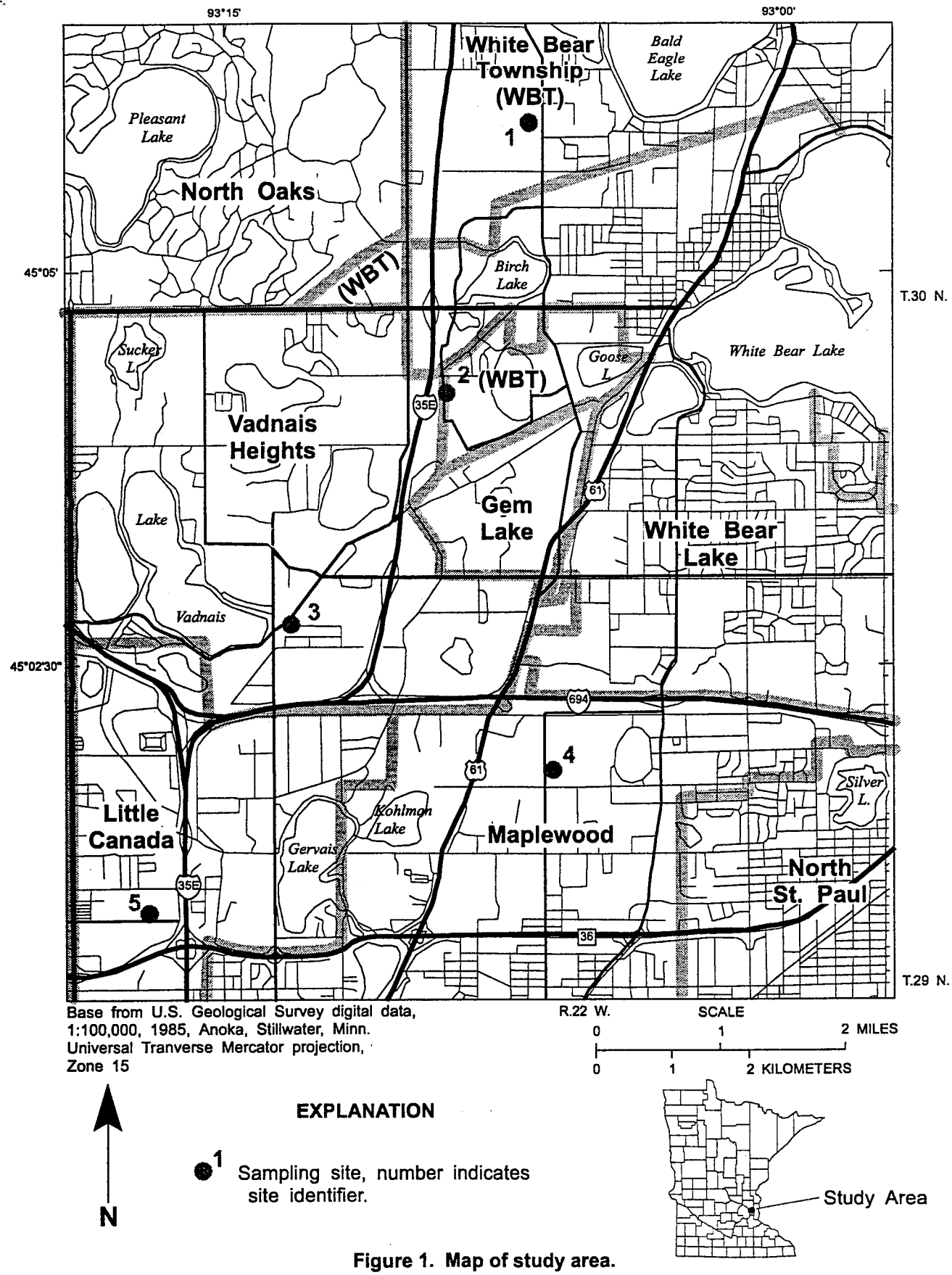

Figure 1. Map of study area.

5,129 vehicles per day (site 4) and 6,686 vehicles per day (site 1) (table 1). No differences were found between unguttered sites with respect to loads and yields of total suspended solids, total phosphorus, dissolved sulfate, total chromium, and total zinc. Differences were indicated between the unguttered sites (site 1 and 4) with respect to concentrations of total suspended solids and total chromium. However, concentrations of these constituents were lower at the site that had the higher traffic volume (site 1). There was a significant difference in total rainfall amounts between site 1 and site 4 (table 4). Constituent concentrations were negatively correlated with total rainfall. The difference in concentrations of total suspended solids and total chromium may be associated with higher total rainfall amounts at site 1.

Summary

Five roadway sections located in northeastern Ramsey County, Minnesota were monitored during 1993-95 to evaluate water quality and loading of constituents from roadway runoff. Water-quality samples were collected from 31 snowmelt-runoff events representing 10 separate snowmelt periods, and 71 rainfall-runoff events representing 31 separate rainfall events. Rainfall samples were collected from 19 rainfall events to determine contribution of rainfall directly to runoff water quality. Additional data collected included total rainfall, total runoff volume, and physical parameters including pH and specific conductance.

Runoff volumes were determined for rainfall-runoff events. On-site equipment collected rainfall data, and monitored flow rates for all but low- intensity runoff events. Runoff from guttered sites, which have catchment basins that were predominantly paved, responded in one-third the time to the onset of rainfall than did unguttered sites. The unguttered sites, which had greater unpaved surface areas, also had longer recession periods. These longer recession periods at unguttered sites resulted in more total rainfall (from recurring rains) and total runoff. Rainfall-runoff coefficients for primary drainage areas averaged 0.53 for guttered sites and 0.37 for unguttered sites. Total runoff from one major rainfall event accounted for at least 50 percent of all runoff from monitored events at unguttered sites and about 20 percent of all monitored runoff at guttered sites.

Wetfall rainfall samples were collected at two sites. Chemical analysis suggests that rainfall was not a direct source of most constituents; for some constituents, such as dissolved nitrate and dissolved ammonia, rainfall can contribute up to one-half of the amounts present in runoff. Mean concentrations for sodium and chloride were approximately 1,000 times greater for snowmelt-runoff samples than for rainfall-runoff samples while mean concentrations of metals such as aluminum, chromium, lead, and zinc were two to four times greater in snowmelt runoff than in rainfall runoff.

Snowmelt runoff was sampled two or three times per year. Median concentrations of total suspended solids, dissolved chloride, dissolved sulfate, and total chromium were two to seven times greater at guttered sites than at unguttered sites while total phosphorus and total zinc median concentrations were not noticeably different. Year to year variations in median concentrations of these same constituents may reflect variations in winter severity and road salt applications. Elevated levels of sodium and chloride, and to a lesser extent, other dissolved ions and metals, in snowmelt runoff suggest not only the application of road salts, but also the corrosive effect of these salts on metals from vehicles. Median concentrations of total suspended solids and dissolved chloride were as much as 10 times greater in runoff from the study sites than from interstate roadway runoff.

Flow- or time-composited rainfall-runoff samples were collected from 31 separate rainfall events. Concentrations of total suspended solids, total chromium, and total zinc were greater at guttered sites while concentrations of total phosphorus and fecal *Streptococcus* bacteria were greater at unguttered sites. This suggests that vegetated road ditches associated with unguttered sites may trap out heavier particles such as metals and suspended solids, while contributing additional organic matter including nutrients and coliform bacteria. Concentrations of metals such as aluminum, copper, lead, and zinc exceeded chronic condition standard limits established by the Minnesota Pollution Control Agency for metropolitan storm water

for some runoff events. These limits were exceeded 96 percent, 52 percent, 9 percent and 20 percent of the time, respectively. Semi-volatile compounds were not detected in any of the samples.

Rainfall-runoff loads and yields were computed for most flow- or time-composited samples. For some constituents, such as total suspended solids, as much as 92 percent of the computed loads at one site (site 4) for the entire study occurred in just one rainfall event. The dominating effect of one event was more apparent at unguttered sites. However, even for guttered sites, the percentage of loadings of any constituent from the largest runoff event was between 21 percent and 37 percent of the total loads computed for the study period.

The length of the latent period (elapsed time between runoff events) was identified as a factor that could affect water quality at the study sites. Plots of concentrations of selected constituents with latent period show that concentration levels did not tend to increase when the latent period increased. Nonparametric-correlation measures were used to compare concentration levels with length of latent period. When data for all sites were examined collectively, only total phosphorus, dissolved sulfate, and total zinc concentrations showed a correlation with latent period. Constituent loads for the same constituents did not correlate with latent periods.

Traffic volume also was identified as a factor that could affect water quality of roadway runoff. However, a statistical analysis, using nonparametric methods, showed no significant differences in constituent concentrations, loads, or yields, based on traffic volume.

Site selection criteria such as being within 30 minutes of the U.S. Geological Survey District office, location away from influences such as intersecting streets, driveways, or sloped lawns, limited the sites selected to narrowly-defined characteristics, and to a limited region within the Minneapolis-St. Paul metropolitan area. Because of these limitations, results from this study may not be applicable to other roadways of similar design and classification.

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Appendix B
Commonly Asked Questions and Answers about The Storm Water Permit Program for Construction Activities

Minnesota Pollution Control Agency

August 1997

Commonly asked questions and answers about

The Storm Water Permit Program for Construction Activities

Part I. General questions about the permit

Q: Where did the permit come from?

The 1987 amendments to the federal Clean Water Act required the U.S. Environmental Protection Agency (EPA) to develop regulations for storm-water discharges associated with *industrial activity.* In November 1990, the regulations included construction activities which disturb five or more acres of land in their definition of industrial activity. The regulations required that storm-water discharges associated with industrial activity be authorized under a National Pollutant Discharge Elimination System (NPDES) Permit. Since MPCA has been delegated authority by EPA to administer the NPDES program, applicants will receive NPDES authorization by applying to the MPCA for coverage under the General Construction Storm Water Permit.

Q: What types of construction activities need coverage under the General Construction Storm Water Permit?

Anyone conducting a construction activity, including clearing, grading, and excavation, which results in the disturbance of five or more acres of land, is required to apply for coverage under the permit. Such activities may include road building and construction of residential houses, office buildings, industrial or commercial buildings, landfills, airports, and feedlots.

Q: The General Construction Storm Water Permit's definitions require that construction activities smaller than five acres still must be covered under this permit if they are part of a "larger common plan of development or sale that is larger than five acres." What does that mean?

"Part of a larger common plan of development or sale" is where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under one plan.

Q: When will I need to submit an application?

The original regulations required that construction activities disturbing five or more acres of land be authorized by an NPDES permit after October 1, 1992. However, the MPCA recognizes that the permit will likely result in changes to ongoing

construction projects. For administrative efficiency, MPCA is *not requiring coverage for any projects starting before January 1, 1994.* (This includes all ongoing projects which started before, but are continuing past, that date.) All new construction projects breaking ground and starting construction after January 1, 1994 will be required to apply for coverage under the General Construction Storm Water Permit (MNR100000) prior to starting construction.

Q: Are photocopies of the application form acceptable?

Yes. Applicants are encouraged to photocopy any of the documents in the application packet as needed. Additional copies of the *Inspector's Compliance Guide for Erosion and Sediment Control* can be obtained by calling (612) 296-6619.

Q: What are the permit's basic requirements?

The General Construction Storm Water Permit requires that a Temporary Erosion and Sediment Control Plan be developed for the project in accordance with **Appendix A** of the permit. The goal of the temporary plan is to prevent erosion from occurring, and to keep sediment on-site *during* construction. The permit also requires that a Permanent Erosion and Sediment Control Plan be developed for the project in accordance with **Appendix B** of the permit, to address potential negative impacts from the final site's storm-water runoff *after* construction.

Q: Will I need to submit an entire set of plans and specs to the MPCA's Storm Water Program for review and approval of the Temporary and Permanent Erosion and Sediment Control Plans?

No, neither the plans and specifications nor the Temporary and Permanent Erosion and Sediment Control Plans need to be submitted to the Minnesota Pollution Control Agency (MPCA). The only document that will need to be submitted to the MPCA is a completed application form certifying that the two plans were completed.

The plans and specifications which have incorporated the requirements of both the Temporary and Permanent Erosion and Sediment Control Plans must be available at the construction site. They can be in either a field office, inspector's vehicle, or contractor's vehicle, and must be retained in accordance with Appendices A and B of the General Storm Water Permit, under "Plan Retention."

Q: Who is responsible for applying for coverage under the permit?

The project owner will be responsible for completing the application form and certifying (signing) that the Temporary and Permanent Erosion and Sediment Control Plans have been prepared for the project. The owner is responsible for compliance with all parts of the permit. (See page 17 of the General Construction Storm Water Permit for a definition of "owner").

Where the project's owner wishes to have the general contractor as a co-permittee, the general contractor will also be responsible for signing the application form prepared by the owner. This means that the general contractor is certifying that the Temporary and Permanent Erosion and Sediment Control Plans designed by the owner will be implemented on the project. The general contractor is a co-permittee with the owner for certain parts of the permit. (See page 16 of the permit for a definition of "General Contractor.")

Where the owner believes he or she needs a permit prior to the letting of bids or awarding of contracts, the owner can sign both portions of the applicant's certification (Sections IV and V of the application form). After the construction contract is

signed, the owner can then have the general contractor sign the application as a co-permittee. In this case, the owner will need to submit a Storm Water Permit Transfer/Modification Form (available from the MPCA) and include an $85 application fee.

To avoid possible delays on projects, applicants may wish to consider including a photocopy of the application form in the bidding documents and require that all bidders include a signed copy of the application with the bid. This may also aid in establishment of the "lowest responsible bidder."

Q: How long before I'm authorized under the General Construction Storm Water Permit?

Permittees are authorized under the permit (i.e., can start construction) **48 hours** after the postmarked date of the *completed application form* received by the MPCA. A completed application is one containing all required information and "Yes" responses to questions 6, 7, and 8 of the application form.

Q: When will the MPCA let me know I'm covered?

Unless notified to the contrary by the MPCA, permit applicants will be automatically granted coverage under the General Construction Storm Water Permit as long as a completed application is submitted to the MPCA. A completed application certifies that the minimum level of design criteria established in the permit has been met. This "honor system" approach was developed to streamline the traditional permit application review process by reducing direct oversight. Since this is the method chosen by the MPCA, applicants do not need to be immediately notified that the MPCA received their application. The MPCA will, however, send applicants a "Notice of Storm Water Permit Coverage" card as soon as possible, but in no case longer than 30 days. This card must be posted in accordance with the requirements of the General Construction Storm Water Permit (see page 4 of the permit), and a photocopy sent to the local permitting authority within 14 days of receipt (see page 3 of the permit).

Q: How much is the application fee?

Currently, the General Construction Storm Water Permit requires an application fee of $240 for each project requiring coverage. The revenue from this program is used to fund many activities including reviewing and acting upon permit applications, data management, public education and training, guidance and educational materials, compliance evaluation, inspections, and enforcement of permit conditions.

Q: How long is the permit valid?

All NPDES permits have a duration of five years, at which time the permit will be modified by the MPCA if needed. Regardless of the five-year permit modification status, applicants will remain covered under the permit until construction is complete, all maintenance activities required in the permit have been satisfied, the entire site has undergone final stabilization, and a Notice of Termination has been submitted to the MPCA.

Q: Is there any guidance available to help us comply with the permit?

The MPCA and EPA have developed guidance manuals to assist applicants in developing Temporary and Permanent Erosion and Sediment Control Plans. To obtain copies of these manuals, call the telephone numbers below:

Protecting Water Quality in Urban Areas: Best Management Practices for Minnesota, MPCA Water Quality Division, (612) 296-3890.

Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, (#832-R-92-005), National Technical Information Service, (703) 487-4650.

Q: How can I learn more about erosion and sediment control and the MPCA's General Storm Water Permit?

The MPCA has participated in many erosion and sediment control training programs and will continue to work closely with trade and professional associations and local units of government. In addition, the MPCA will publish a newsletter and staff are planning on traveling around the state offering a variety of workshops and training seminars. To receive a copy of available brochures, interested parties should leave their name, company or agency and address at (612) 296-7219 or toll-free at (800) 657-3804.

Part II. Questions about specific requirements of the permit.

Q: The General Construction Storm Water Permit requires that I keep track of my inspections and dates of rainfall events. How do I do this?

Permittees are encouraged to photocopy and use the Inspector's Log provided in the application packet to document their inspections and dates of rainfall events. This form contains all information required by the General Construction Storm Water Permit, with spaces for longer, detailed comments on the back side. If more space is required for comments, permittees can use additional paper and attach them as needed.

Q: What's the difference between "erosion control" and "sediment control?" Why have requirements for both?

Since erosion is "the process that wears away soil," and sediment is "the result of the erosion process," there are different practices to address each of them. In general, a system of erosion- and sediment-control best management practices (BMPs) will more effectively reduce off-site sediment transport than can a single practice. This is why the General Construction Storm Water Permit has different requirements for control of each.

Q: What is meant by "horizontal slope grading" and "other construction practices that minimize erosion"?

Horizontal slope grading is a method of surface roughening to minimize the potential for erosion on slopes. After the rough grading is done, tracks made by bulldozers and other equipment are made parallel to the horizon, but perpendicular to the direction of storm-water sheet flow. A roughened surface like this reduces runoff velocity, aids in the establishment of vegetation, increases infiltration, and provides for sediment trapping. It is an inexpensive and simple erosion-control measure, but should not be used alone for controlling erosion. See **Figures 1, 2 and 3,** at the end of this document for examples of horizontal slope grading and other surface-roughening techniques.

"Construction practices that minimize erosion" are simple, common-sense methods to use during construction that focus on reducing the potential for erosion from the start. General examples could include:

1) Clear only those areas essential for construction;
2) Locate stockpiles and borrow areas away from steep slopes, highly erodible soils, and areas that drain directly to surface waters;
3) Schedule projects so clearing and grading are done during the time of minimum erosion potential;
4) Stage construction;
5) Minimize the length of time that exposed soils are left unprotected.

Q: What are some examples of "temporary protection"?

Examples of temporary protection include but are not limited to straw cover, wood chips, wood fiber blanket, and other methods employed to prevent erosion on exposed soil areas.

Q: Will stockpiles or surcharge areas of sand, gravel, aggregate, concrete or bituminous need temporary protection or permanent cover placed on them?

Although this type of protection is encouraged by the MPCA, the permit does not require temporary or permanent cover for these areas because of their small potential to erode. However, stockpiles and surcharge areas do need some sort of perimeter sediment control (e.g., silt fence, straw bale barrier, sedimentation basin, berms, etc.) around them to retain the material that may erode from them.

Q: When is a temporary sedimentation basin required?

Only where 10 or more contiguous acres of exposed soil contributes to a discernible point of discharge will a temporary sedimentation basin be needed to settle out pollutants (i.e., sediment and other suspended solids) prior to the runoff leaving the site or entering waters of the state.

Q: Is a temporary sedimentation basin always required on every project?

The general permit provides some exemptions from this requirement (see page 6 of the permit) for certain types of projects where the installation of a temporary sedimentation basin may not be possible.

Q: The permit suggests using an outlet consisting of a "perforated riser pipe wrapped with filter fabric and covered with crushed gravel that allows for complete basin draw-down" in a sed basin. What does such an outlet look like?

Figure 4 at the end of this document provides a schematic of this type of outlet.

Q: What is a Temporary Erosion and Sediment Control Plan?

The goal of the Temporary Erosion and Sediment Control Plan is to prevent sediment on a construction site from entering waters of the state during construction. The plan must be prepared for the proposed project in accordance with **Appendix A** of the permit, and include standard plates and/or specifications of erosion- and sediment-control BMPs to be used on the project.

If desired, the Temporary Erosion and Sediment Control Plan can be developed as a separate document from the project's final plans and specifications. This could be done simply by duplicating the plan sheets and specifications containing information on erosion and sediment control, and fastening them together as a separate document.

Q: Will I need to show every single "water of the state" within half a mile of the exposed soil area on the plan sheets?

The General Construction Storm Water Permit does not require showing all waters of the state within a half-mile on the plans, but rather, only those that will receive direct storm-water runoff from the exposed soil areas.

Where surface waters of the state receiving direct storm-water runoff will not fit on a plan drawing, the permit allows the surface water's name be shown with an arrow indicating both direction and approximate distance.

Q: What if I need to make *last-minute* changes to the Temporary Erosion and Sediment Control Plan in the field?

MPCA staff agree that flexibility is important, and allows for changes to be made to the Temporary Erosion and Sediment Control Plan during construction to accommodate phased construction, sequenced work, timing issues, or changed site conditions provided that Parts I.d. through I.e. of the permit are complied with.

Q: What is a Permanent Erosion and Sediment Control Plan?

The goal of the Permanent Erosion and Sediment Control Plan is to prevent pollutants in storm-water runoff from a project's ultimate development from entering waters of the state after construction has been completed. The plan must be prepared for the proposed project in accordance with **Appendix B** and include standard plates and/or specifications of the permanent erosion and sediment BMPs to be used on the project.

If desired, the Permanent Erosion and Sediment Control Plan can be developed as a separate document from the project's final plans and specifications. This could be done simply by duplicating the plan sheets and specifications containing information on permanent erosion and sediment control and fastening them together as a separate document.

Q: Local governments with jurisdiction over my project have different requirements for permanent water-quality/storm-water detention basins. Which do I follow?

The MPCA's General Construction Storm Water Permit does not supersede the requirements of existing local permitting authorities. Only where all runoff has not been accounted for in a local unit of government's existing storm-water management plan or practice (i.e., draining to either an on-site or regional detention pond), will the runoff need to be discharged to a wet sedimentation basin prior to entering waters of the state.

Q: How can project designers learn more about designing storm-water detention basins for the protection of water quality as required by the MPCA's General Construction Storm Water Permit?

The MPCA sponsors a two-day workshop entitled "Storm-Water-Quality Management Through the Use of Detention Basins." To receive more information, interested parties can leave thir names, company or agency, and address at (612) 296-7072 or toll-free at (800) 657-3804.

Appendix C
Application Instructions for General Storm Water Permit: Construction Activity

Application Instructions for General Storm Water Permit

CONSTRUCTION ACTIVITY

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Instructions for completing an application

Submission of an application is notice that the owner and general contractor identified on the application intend to be authorized by an NPDES permit issued for storm water discharges associated with a construction activity in the State of Minnesota.

Section I Construction Site Information

1. List the construction project's **name**. If the project does not have a name, list the **type of project** and a **brief description** (**for example,** "I-35E/I-494 Interchange" or "Highway 169 bridge replacement (#79605) at the Rum River").
2. Provide a brief description of the construction activity's **location**, and an address if available (**for example,** Intersection of 45th Street and Irving Avenue, Minneapolis, MN).
3. Provide the names of all counties, cities, and townships the construction activity takes place in (**for example,** a roadway may cross county, city, or township boundries).
4. BRIEFLY describe which waterbody(s) will receive storm water runoff from the construction site. To determine where storm water runoff discharges to, make a brief survey of the project's surrounding area.
5. List the **start** and **completion dates** of the construction project (**for example,** 7/18/93, 7-18-93, or July 18, 1993). Also indicate the cumulative estimated area (in acres) the project will disturb (**for example,** 15 acres, or 42.5 ac.).

Section II Prerequisites for Applying for a Permit

For **Questions 6-8**, please refer to the **NPDES General Storm Water Permit**, and flowchart on the back of these instructions.

6. Indicate if a **Temporary Erosion and Sediment Control Plan** has been prepared in accordance with **Appendix A** of the NPDES General Construction Storm Water Permit, and incorporated into the project's final plans and specifications by answering **"Yes"** or **"No."**
7. Indicate if a **Permanent Erosion and Sediment Control Plan** has been prepared in accordance with **Appendix B** of the NPDES General Construction Storm Water Permit, and incorporated into the project's final plans and specifications by answering **"Yes"** or **"No."**
8. The application requires a $240.00 application fee. Indicate if the application fee has been enclosed by answering **"Yes"** or **"No."** Please make checks payable to: **Minnesota Pollution Control Agency** and submit the check with the application to: MPCA, Water Quality Division, Nonpoint Source Compliance Section, 520 Lafayette Road North, St. Paul, Minnesota 55155-4194.

IV. Owner Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person, or persons, who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete (Minnesota Rules part 7001.0070).

I also certify under penalty of law that I have read, understood, and accepted all terms and conditions of the National Pollutant Discharge Elimination System (NPDES) General Storm Water permit (MNR100000) that authorizes storm water discharges associated with the construction site identified on the front side of this form.

I understand that as a permittee, I am legally accountable under the Clean Water Act, to ensure compliance with the terms and conditions of the NPDES General Storm Water Permit (MNR100000).

I also understand that MPCA enforcement actions (pursuant to Minnesota Statutes sections 115.07, 116.072, and 609.71 and Section 309 of the Clean Water Act) may be taken against my company if the terms and conditions of the NPDES General Storm Water Permit (MNR100000) are not met.

Printed Name | Title (Manager, CEO, etc.)

Authorized Signature | Date

V. General Contractor Certification

I certify under penalty of law that I have read, understood, and accepted all terms and conditions of the National Pollutant Discharge Elimination System (NPDES) General Storm Water permit (MNR100000) that authorizes storm water discharges associated with the construction site identified on this form.

I understand that for Parts I.B. through I.E, Appendix C, and Appendix D of the General Storm Water Permit (MNR100000) I am becoming a co-permittee with the owner of the facility for which I have been contracted to perform professional construction services. As a co-permittee I understand that my company is legally accountable, under the Clean Water Act, to ensure compliance with the terms and conditions of the General Storm Water Permit (MNR100000).

I also understand that MPCA enforcement actions (pursuant to Minnesota Statutes sections 115.07, 116.072, and 609.71 and Section 309 of the Clean Water Act) may be taken against my company if the terms and conditions of the NPDES General Storm Water Permit (MNR100000) for which I am a co-permittee, are not met.

Company or Firm | Telephone

Printed Name | Title (Manager, CEO, etc.)

Authorized Signature | Date

Address

City | State | Zip Code

Contact Person | Telephone

Submit to: MPCA, Water Quality Division, Industrial Section, 520 Lafayette Road North, St. Paul, MN 55155-4194

Application for General Storm Water Permit for Construction Activity (#MNR100000)

Minnesota Pollution Control Agency
520 Lafayette Road North; St. Paul, MN 55155-4194

I. Construction Site Information

1. Name of project: _____

2. Brief description of where the construction activity occurs (please include address, if available):

_____

_____

3. Indicate ALL cities, counties, and townships where the construction activity will take place:

_____

_____

4. Name of waterbody(s) that will receive storm water from the construction site:

_____

_____

5. Project start date: _____ Project completion date: _____ Area to be disturbed by project: _____ (in acres)

II. Prerequisites for Applying for a Permit

For the following questions, please refer to the **NPDES General Storm Water Permit** (MNR100000).

A **"No"** answer for any question will result in this form being returned to the owner with no permit issued to authorize the construction activity. This application will need to be completed and returned to the MPCA before a permit to authorize the construction activity may be issued.

6. Has a **Temporary Erosion and Sediment Control Plan** been developed for this project in accordance with Appendix A and incorporated into this project's final plans and specifications? **Yes** ☐ **No** ☐

7. Has a **Permanent Erosion and Sediment Control Plan** been developed for this project in accordance with Appendix B and incorporated into this project's final plans and specifications? **Yes** ☐ **No** ☐

8. Has the Application Fee been enclosed? **Yes** ☐ **No** ☐

III. Owner Information

Name _____ Telephone _____

Address _____

City _____ State _____ Zip Code _____

Contact Person _____ Telephone _____

Section III Owner Information

Provide the name, telephone number, address, city, state, and zip code of the owner of the company, organization, or other entity for which the construction project in **Section I** is being done. The owner is the party responsible for the *design* of the Temporary and Permanent Erosion and Sediment Control Plans, and overall *management* of the project's operations (for example, Stearns County Highway Department, City of Duluth, Summit Developers Inc., etc). The **contact person** should be the owner's representative in charge of the project (for example, Sandy Smith, Inspector; Joe Johnson, Project Manager; etc).

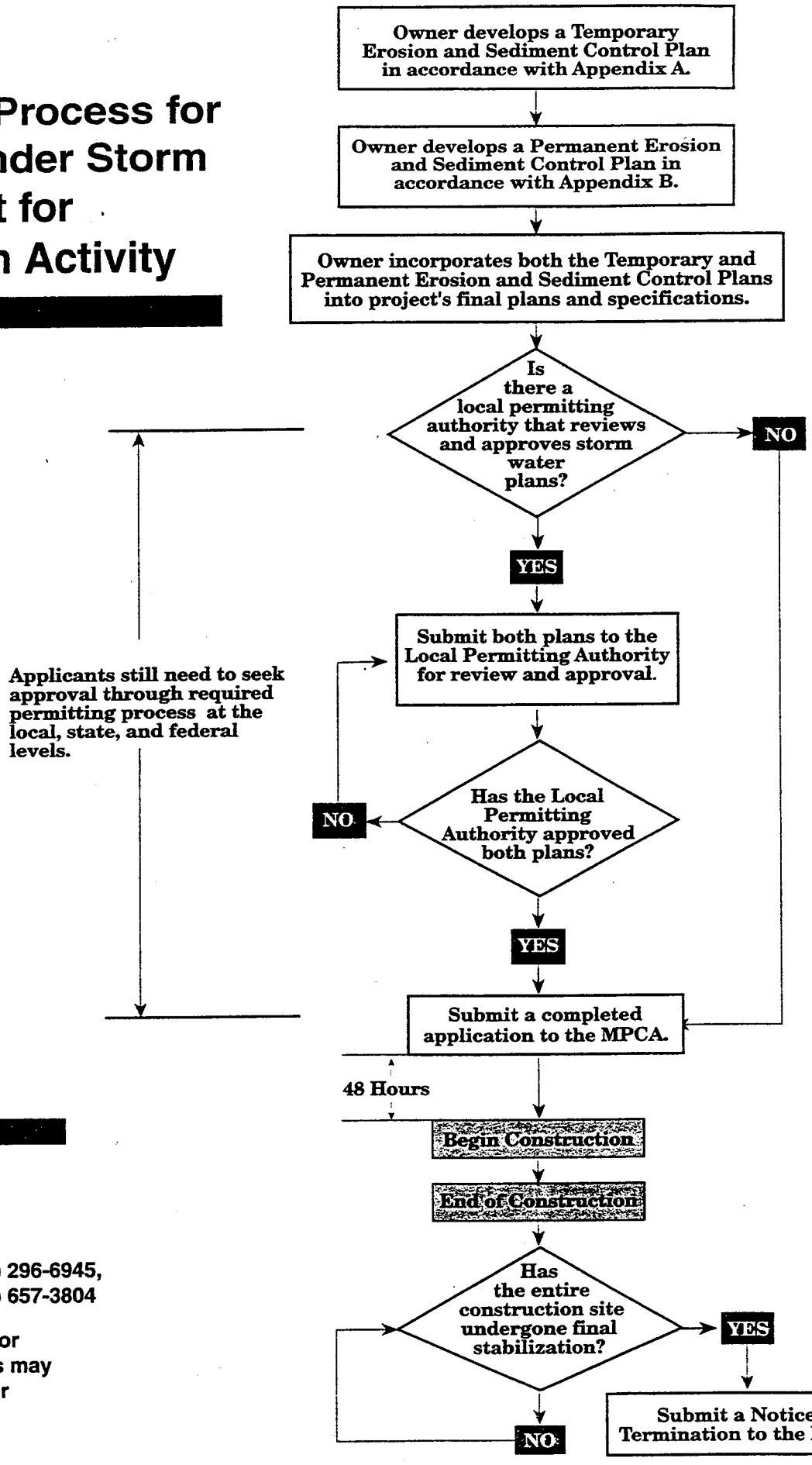
Section IV Owner Certification

After completing this application, certify it with a signature from an individual authorized to sign the application. This application form must be signed by either a principal executive officer, vice president, representative agent responsible for overall operations, general partner, or a proprietor. If the activity is being conducted by a unit of government (state, county, municipality, or township), this application must be signed by a principal executive officer, ranking elected official, (for example, city or county engineer, administrator, or manager; director of public works; mayor, etc.) For additional information, reference Minnesota Rules 7001.0060). After signing, print the name of the individual signing the application, title, and date of signature.

Section V General Contractor Certification

After this application form has been completed by the owner, the general contractor must certify it with a signature from an individual authorized to sign the form. The application must be signed by either a principal executive officer, vice president, representative agent responsible for overall operations, general partner, or a proprietor. If the general contractor is a unit of government (state, county, municipality, or township) the application must be signed by a principal executive officer, ranking elected official, administrator, manager, coordinator, or engineer. (For additional information, reference Minnesota Rules 7001.0060). After signing, print the name of the person signing the application, title, and date of signature. The **contact person** should be the general contractor's representative in charge of the project (for example, Jim Williams, Head Foreman; Ann Johnson, Project Manager, etc).

Application Process for Coverage Under Storm Water Permit for Construction Activity



For additional information call:

(612) 296-6798, (612) 296-6945,
(612) 296-7219, (800) 657-3804

People with speech or hearing impairments may call (612) 282-5332 or 1-800-627-3529

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