

CE 491 – 002
Storm Water Management
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**“Various State Storm
Water Pollution Prevention
Plans (SWPPP): California,
Michigan, & South
Dakota”**

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October 13, 2005

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I. INTRODUCTION TO STORM WATER POLLUTION PREVENTION PLANS (SWPPP) AND THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

The motivation behind storm water pollution prevention has become prevalent in the last several years. Scientists and engineers alike realize that non-point source runoff contains a multitude of pollutants. This runoff, often untreated before making its way into community lakes, streams, and rivers, has caused growing concern about the ultimate cleanliness of our waterways and water sources.

Since the 1987 amendments to the Clean Water Act (CWA), the United States Environmental Protection Agency (USEPA) has been mobilized to design and implement measures to curb and eventually eliminate these pollutants. Various point sources have been identified and targeted for reductions in runoff pollutant concentrations including:

- Municipal Separate Sewer Systems;
- Construction Sites;
- Industrial Activities.

In 1990, further regulation stated that under USEPA guidelines, municipal and industrial storm water discharges must comply with National Pollutant Discharge Elimination System (NPDES) standards. In some cases, the authority to grant NPDES permits has been delegated to state agencies (specifically in California, the State Water Resources Control Board and nine Regional Water Quality Control Boards are responsible for these permits).

Compliance with these regulations often resides solely with the developing entity and/or the construction contractor associated with said developments. Best management practices (BMP) shall be utilized in order to maintain compliance as needed. Projects not covering more than one acre of land are not included under the current NPDES program. Therefore, these projects do not require coverage under the NPDES permit or a SWPPP plan to be developed. However, in extenuating circumstances where a possible threat to water quality exists, a SWPPP plan may be required for implementation.

This paper seeks to identify and explain several differing approaches to implementing storm water prevention measures and the parameters that serve as a guide to meet these standards. Of the fifty states in the nation, California, Michigan, and South Dakota will be examined for the following:

- Ordinance Coverage – Who must apply for and follow these regulations?
- Numeric Discharge Limits – Concentration restrictions? Load limitations? Required levels of control?
- Volumetric Discharge Limitations – Matching pre-development levels? Percentage of these levels?
- Required Runoff Treatments – Is the first half inch of rain to be treated per storm?
- Storm Water Control Requirements – Detention pond volumes?
- Required Best Management Practices (BMPs)
- Storm Water Control Vendor Requirements – Proof of application functionality?
- Storm Water Modeling Specifications – Are analytical procedures provided?

II. CALIFORNIA STORM WATER POLLUTION PREVENTION PLANS

California requires storm water pollution prevention plans for three various types of discharges including municipal wastewater, industrial, and construction site runoffs. It must be noted that if any of these projects or areas encompass more than one of the nine Regional Water Quality Control Boards jurisdiction, separate plans, Notice of Intent (NOI) and Termination packages must be submitted to each presiding branch of the agency.

Municipal wastewater permitting for discharges developed through a two-stage phasing process and applied to municipal separate storm sewer systems (MS4s). Begun in 1990, Phase One consists of medium and large municipalities being required to establish, implement, and maintain a storm water pollution prevention plan in accordance with NPDES regulations. Medium municipalities are considered to serve 100,000 to 250,000 constituents, whereas large municipalities serve over a quarter of a million people. Due to large numbers and sometimes overlapping water treatment facilities, many permits are held jointly to encompass an entire metropolitan area.

Phase Two consists of coverage through a general permit for storm water discharge from small MS4s and applied to non-traditional discharges. These non-traditional sources included military bases, hospital complexes, prisons, public campuses, and other governmental installations.

Though specific numerical goals are not explicit in the guidelines for SWPPPs set forth by the California Water Board, they are expected to comply with Section 402(p) of the Federal Clean Water Act. This mandates that they must consist of controls that reduce or eliminate pollutants to the “maximum extent practicable” (MEP).

Control measures are also discussed within the various management programs and establish the “best management practices” (BMP) for addressing certain situations. Areas include education and outreach, illicit discharge detection and elimination, construction and post-construction controls, and good housekeeping for municipal operations. Generally speaking, medium to large municipality facilities are also required to conduct chemical monitoring while small facilities require no testing.

Industrial facility storm water pollution regulations are covered in a broad sweeping general permit and coverage extends over ten categories of industrial activity. Requirements associated with the General Industry Permit include implementing measures that achieve results with the “best available technology” (BAT) that is economically possible along with the “best conventional pollutant control technology” (BCT) available.

Industrial sites are also bound to develop and employ storm water pollution prevention plans according to governing regulations. Monitoring plans must be included to these plans as well. Under the SWPPP, sources of pollutants are to be identified and the means to manage the sources in order to reduce storm water pollution are explained. Additionally, the General Industrial Permit requires that an annual report be submitted each July 1 to the state, ensuring compliance with these regulations.

Construction site storm water prevention plans are required when one or more acres of land are disturbed, or when specific projects are within a larger development of one or more acres. Coverage is maintained under the General Permit for Discharges of Storm Water Associated with Construction Activity. Activities subject to this permit include clearing, grading and ground disturbances such as stockpiling, or excavation. Other activities not included are regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

Storm water pollution prevention plans are also required with construction activities. Site specific features of this plan include site drawings with proposed construction, perimeters of project area, external discharge points and watershed areas to one quarter of a mile outside the project edges, topology, geographic features that may affect drainage patterns across the site, impervious percentages across the site including roadways, rooftops, sidewalks, empty lots, etcetera, and storm water collection and discharge points.

Best management practices are also established for construction sites and must be listed. The BMPs utilized to reduce and/or eliminate storm water pollutants must be noted on the site map as well. In addition to the BMPs, monitoring by both visual and chemical methods for various pollutants must be established, performed, and documented. If discharges into an impaired waterway due to sedimentation occur, an additional sedimentation plan must be drawn up and maintained as well.

Though traditional schools of thought would typically indicate that numeric discharges limits would be included in documentation associated with the California Storm Water Pollution Prevention Plans, no reliable and blanketing information was available. Given the subjective nature of various sites where storm water runoff can be monitored, each site maintains unique features that may or may not fall under criteria for another site elsewhere in the state. The most sweeping of statements found consisted of relying on the federally mandated standards of waterways in accordance with the Clean Water Act.

Further, though some data was found regarding establishing runoff and run-on coefficients from Caltrans (California Department of Transportation), no set limits or parameters are set. Run-on discharges can utilize the Rational Method for determining external drainages that may cross the project site, but application is limited to areas less than 1.3 km². Rainfall intensity standards are not specified either which seems rather counterintuitive. However, there are guides for plotting intermediate return periods and determining rainfall depths in order to calculate these intensities in millimeters per hour.

Additionally, though there are no specifications on BMPs, there are listings for minimum requirements to be considered. These practices cover soil stabilization, sediment controls, wind erosion, tracking controls, non-storm water management, and waste management and materials pollution controls. Obviously, given the fact that no officially prescribed BMPs are mandated, no information can be provided about specific vendor policies, and/or the required sizing of various controls (i.e. detention ponds).

III. MICHIGAN STORM WATER POLLUTION PREVENTION PLANS

Michigan information regarding Storm Water Pollution Prevention Plans is extremely thorough. In addition to reliance on the NPDES standards from the Federal government, the Department of Environment and Natural Resources provides a wealth of information regarding required levels and tolerances of various pollutants. A brief history of storm water practices is also included and briefly reviewed here.

Michigan has broken up the conventional thought patterns associated with storm water pollution and flooding into various paradigms. This stems back to the unsightly open ditches of sewage and stagnant waters in the 19th century to the current thoughts of creating sustainable and environmentally friendly areas through structural and institutional practices. Many of the current ordinances associated with Michigan's storm waters focused first on flood detention where flooding occurred often from ice jams or snow melt in addition to large storm events.

This thought pattern has progressed and now considers pollution controls and water quality concerns. Based on modeling and research, pollutants tend to decrease concentration over time with larger storm events. Through the widely accepted practice of treating the first half of an inch of rainfall, many of the pollutants are contained. Michigan scientists, however, feel this "First Flush" criterion only applies to single site scenarios. A better treatment process in their minds is to create a ninety percent (90%) treatment capability for multiple sites or for a watershed basin. By capturing and treating 90% of the storm water runoff, they presume that due to the varying time of runoff to reach the treatment point that much more of the pollutants are removed.

In addition to the 90% Rule, Michigan has taken a more "holistic" approach to storm water treatment. By examining channel-forming flow features associated with bankfull conditions (which occur every one or two years), Michigan approaches control of these flows as a remedy to water quality and facilitate stream stabilization. These control measures help reduce scour at the upstream end of the reach and downstream sedimentation issues. In addition to controlling peak flows, the durations are also addressed as bankfull conditions often weaken stream banks, compounding erosion and stability problems.

Continued efforts regarding storm water runoff research, modeling, treatment, and maintenance reside in the state legislature. Through governmentally imposed laws and regulations, local watershed entities can organize and prepare specific plans to aid in the integration, coordination, and implementation of these initiatives. Once these plans have been devised, site-specific "best management practices" (BMP) can be installed. Some of these as listed by the Michigan Department of Environmental Quality include rain gardens; green roofs; grass swales; and infiltration basins. These control measures help to maintain ecological stability in an environmentally friendly and consistent manner.

Michigan storm water listings also include “acceptable limits” for various pollutants including bacteria (fecal coliform and E. coli), phosphorous, total suspended solids, biochemical oxygen demands, dissolved oxygen, and temperature and pH concerns. Table II-A below lists these pollutants along with the associated limiting discharge amounts from storm water runoff. These effluent limits are dictated by the Michigan Water Quality Standards, passed down within state Act 451.

<i>POLLUTANT</i>	<i>ACCEPTABLE LIMITS</i>	<i>POSSIBLE SOURCES</i>
Fecal Coliform	200 bacteria/100 mL water (monthly average) 400 bacteria/100 mL water (7-day average)	Point Source Pollution (Municipal treatment plant bypass/overflow discharges)
E. Coli (Waters classified as full body contact)	130 bacteria/100 mL water (30-day average) 300 bacteria/100 mL water (Anytime)	Illicit Connections (Wastewater flowing into storm sewer systems)
E.Coli (Waters classified as partial body contact)	1000 bacteria/100 mL water (Anytime)	Non-Point Source Pollution (Agricultural runoff, animal waste, septic seepage)
Phosphorous	1 mg/L (Typical – DEQ can impose stricter limits where assimilative capacities must not be exceeded)	Point Source Pollution (Sewage treatment plants primarily from toothpaste, detergents, pharmaceuticals, and food-treating compounds) Non-Point Source Pollution (Lake sediment during turnover; phosphate deposits and/or rocks from weathering, erosion, and leaching; urban runoff; agricultural areas; mining operations)
Total Suspended Solids	30 mg/L (30-day average) ⁽¹⁾ 45 mg/L (7-day average) ⁽¹⁾	Any solids that will not pass through a filter – typically there are only “narrative” limits dealing with turbidity and color, oil films, floating solids, foam, settling solids, suspended solids, and deposits.
Biochemical Oxygen Demands	Nitrogenous Oxygen Demand ⁽²⁾ Carbonaceous Oxygen Demand ⁽²⁾	Point Source Pollution (Wastewater treatment facilities, pulp and paper mills, and meat and food processing plants) Non-Point Source Pollution (Agricultural and urban runoff, and livestock operations)

Dissolved Oxygen (DO)	7 mg/L (Coldwater Fisheries) ⁽³⁾ 5 mg/L (Warmwater Fisheries) ⁽³⁾	Diurnal plant processes; Seasonal waterbody turnover; Water flows/stagnations; Microbes versus organic matter present
Temperature	Heat loading limitations: 2°F – Coldwater Fisheries 5°F – Warmwater Fisheries	Cooling waters; Urban runoff; Soil erosion (cloudy waters affect sunlight/warmth absorption)
pH	6.5 – Daily minimum 9.0 – Daily maximum	Acid rain; Industrial facilities; Wastewater treatment plants

⁽¹⁾Total Suspended Solids limits are given as “narrative” guidelines. No specific limitations are imposed, but rather determined on a specific basis as required.

⁽²⁾Biochemical oxygen demands are determined in conjunction with dissolved oxygen (DO) limits. These limits are based on several factors including organic material present, ammonia, and nitrogen levels. Again, these limits are simply “narrative” guidelines.

⁽³⁾Dissolved oxygen (DO) levels are given as minimum guidelines based on USEPA requirements for cold and warm water fisheries in order to support waterborne wildlife. These limits are established in concordance with biochemical oxygen demands as noted above.

TABLE II-A

Summarizing the Michigan approach to storm water runoff control and treatment can be reduced to three rather simplified ideologies listed below. While following these seemingly simple steps, governmental influence and scientific methods can be applied to aid in their execution. This ultimately aids in the repair, restoration, remediation, or achievement of desired results.

1. Manage runoff from large storms to limit flooding;
2. Treat the “First Flush” of storm water runoff (often the initial half inch); and
3. Controlling the channel-forming flows and volumes to protect channels from excessive scour and sedimentation.

Again, though Michigan discusses many of the state water quality limitations regarding effluent levels, there are no specific BMPs that are required by state regulations. Obviously no vendor or sizing requirements associated with implementation of these practices are stipulated as long as they are conducive to limiting storm water runoff to the limits stated above. Additionally, according to Michigan’s interpretation of the NPDES requirements, permits are required of “anyone discharging, or proposing to discharge, waste or wastewater into the surface waters of the State...[and] is intended to control direct discharge into the surface waters of the State by imposing effluent limits and other conditions necessary to meet State and federal requirements” (Michigan DEQ, 2002).

IV. SOUTH DAKOTA STORM WATER POLLUTION PREVENTION PLANS

South Dakota storm water pollution prevention plan guidelines seemed extremely vague and rather repetitive. While requiring permitting to be secured for construction sites, industrial facilities, and municipal wastewater treatment plants as mandated in federal regulatory ordinances, the application process almost replicates itself for each coverage area.

Construction site permitting is both covered under the General Permit for Storm Water Discharges. The minimum requirements for preparing a storm water pollution prevention plan include:

- A description of the project;
- The total area that will be disturbed;
- A description of how you will control run-off and reduce pollutants, both during and after construction;
- A site map showing the direction of any drainage, the slopes after grading, and the location of any storm water controls such as hay bales, sedimentation fences, settling ponds, etc.;
- The name of any bodies of water near the site; and
- An inspection and maintenance schedule for storm water controls at the site.

Enforcement and monitoring of the SWPPP in South Dakota is marginal, as a copy of the plan is not required for submittal to the Department of Environmental Services office, but rather simply kept onsite unless specifically requested. NOI (to discharge) is required for submittal no less than fifteen (15) days before commencement of projects and updates are to be kept onsite in the SWPPP.

Industrial permitting coverage is also provided under a General Permit for Storm Water Discharges. Minimum plan requirements are very similar to the construction site discharge requirements listed above with little variation. The pollution prevention plan must include:

- A description of the project;
- A description of how you will control run-off and reduce pollutants;
- A site map showing the direction of any drainage, and the location of any storm water controls;
- The name of any bodies of water near the site; and
- An inspection and maintenance schedule for storm water controls at the site.

Also similar to construction project guidelines, the NOI is required fifteen days (15) in advance though provisions are listed for projects already underway. In addition, those projects within city limits may have additional requirements and must be met accordingly (those these are municipally instituted and not listed on the statewide plan guidelines). Waivers for industrial facilities may also be filed if the pollutant prone materials do not

come in contact with precipitation or runoff waters. Proper forms are provided for requesting these exemptions and must be filed with the proper state agency.

Municipal wastewater treatment plants also require permitting under the federal statutes. Municipal separate storm sewer systems (MS4s) serving all localities are required to provide verification of discharge limiting treatment procedures. Similar to the federal program mandates, South Dakota requirements pull directly from the USEPA guidelines for storm water management and list the following six control measures to be implemented:

- Public education and outreach;
- Public participation/involvement;
- Illicit discharge detection and elimination;
- Construction site storm water runoff control;
- Post-construction storm water management; and,
- Pollution prevention/good housekeeping for municipal operations.

Unlike the construction site or industrial pollution prevention plans, municipal treatment plans are required to be submitted to the state environmental agency.

Based on state legislative Act 74:54:01, basic water quality standards were established for effluent limitations and runoff concentrations. These parameters are listed in Table III-A below:

<i>POLLUTANT/CONDITION</i>	<i>EFFLUENT LIMITATIONS</i>
Suspended Solids ⁽¹⁾	10 mg/L (24-hour composited sampling)
Biochemical Oxygen Demand ⁽¹⁾	10 mg/L (5-day sample)
Temperature Loading	Coldwater Fisheries: +4° maximum
	Warmwater Fisheries: +5° maximum
	Incremental Hourly Gains: +3° maximum
Flow Rates	High Quality Fishery Waters: Not to exceed design flow of the minimum 7-day average low flow that can be expected to occur once in every 25 years
	Low Quality Fishery Waters: Not to exceed design flow of the minimum 7-day average low flow that can be expected to occur once in every five years (7Q5) or 1.0 cubic foot per second, whichever is greater

⁽¹⁾Limits for suspended solids and biochemical oxygen demand are not to exceed 17.5 mg/L in any “single grab” sampling at anytime.

TABLE III-A

South Dakota storm water prevention plan design and implementation as stated in state online references seems vague at best. Given the perceived nature of possible funding and/or manpower limitations for the state, these programs may be difficult to implement – much less enforce. This is evident in the construction site and industrial facility permitting in particular due to the “self regulating” nature of the requirements.

Additionally, there are no provisions or discussions related to BMPs or control measure implementation, vendors, or proof of adequacy in regard to functionality or size of these devices. Continuing in the vague nature of the South Dakota Department of Environmental Services, there is also no discussion of discharge volume or flow rate limitations or treatment of a certain amount of runoff.

V. SUMMARY AND CONCLUSIONS

In reviewing the approach of three different states in different parts of the country, several conclusions can be drawn related to not only the various states' interpretations of the federally mandated regulations associated with Storm Water Pollution Prevention Plans, but also their implementation procedures. Surprisingly, given the referenced materials, Michigan seemed to have the most comprehensive and readily available information dealing with a majority of the topics dealt with in the scope of this project.

Many similarities pervaded each of the state approaches, obviously a result of the USEPA guidelines for SWPPP development, implementation, and maintenance. The various permits required included construction activities, industrial facilities, and municipal wastewater treatment plants in all states. Approaches at that point differed greatly based on each state's legislative guidance policies for water quality standards. Depending on the appropriate measures from a "top-down" perspective (Clean Water Act regulatory guidelines being the most preemptive), specific state guidelines referred to those or in some cases were a little more stringent due to onsite conditions and/or extenuating circumstances in site-specific situations.

Again, Michigan seemed to lead the way in the most comprehensive and "holistic" approach to storm water pollution prevention and remedy plans. Through not only water quality concerns, but also channel-forming flows and stability issues along with flood control, their approach dealt with underlying factors of contribution to pollution discharges and not only with the storm waters themselves.

Further, it was noted that in all cases, very little specification was provided regarding the institution of "best management processes" (BMP). While implicitly provided for in the water quality guidelines, none of the three states covered delineated specific control measures. Instead, narrative and suggestive measures were incorporated for a wide array of solutions to be considered on a case-by-case basis.

Additionally, no explicit discharge limitations for flow rates or volumes were imposed other than those established through legislative water quality standards acts. Though Michigan addressed various control methods that *could* be implemented, sizing and/or functionality guarantees from vendors were never mentioned across the board.

Based on the results of these examinations along with the relatively wide spread knowledge of funding and manpower concerns, the storm water pollution prevention plans can be widely considered as "self regulating" procedural issues. Though routine inspections may be performed by the appropriate state agencies, given the sheer magnitude of ongoing construction projects, industrial facility waste production, and municipal treatment plants, it may be nearly impossible to ensure that water quality standards are not violated in each and every case. It must also be noted that site-specific implementation provides for an enormous "gray" area where BMP may need constant attention and remediation before appropriate discharge levels are attained to meet water quality standards.

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