Maine Department of Environmental Protection
Program Guidance
On
Combined Sewer Overflow Facility Plans

OVERVIEW

The objective of a Combined Sewer Overflow (CSO) Facility Plan is to abate CSO discharges and the water quality impacts they cause. Bacterial contamination is a universal problem and therefore it is assumed that all CSO discharges will result in the violation of receiving water quality standards for bacteria. Impacts may also include aesthetic problems resulting from solids, turbidity and odors associated with discharges of untreated domestic wastewater. Other pollutants may be of concern depending upon the receiving water or the presence of industrial or high strength wastes. Also, urban runoff should be included in evaluation of storm sewer discharges as they can have significant environmental impacts, and may in many cases, cause water quality violations by themselves. If separation is an option for CSO abatement the effect of new storm water discharges on water quality must not be ignored. Permitting of storm sewers will likely be required in the future and information developed now will benefit that process.

It is recognized from the outset that total CSO control will, in most cases, be an expensive and lengthy process. However, significant improvements can be made cost-effectively within a reasonable time. In order to do so, it is important that a logical plan be developed and implemented.

CSO Facility Plans should begin with a review of the sewer system which identifies and locates all CSO and storm water points. Key monitoring or observation points should be selected to best reflect conditions in the entire sewer system. Consideration should be given to the relationship of discharges to storm events, runoff, groundwater, tidal stages, and inflow sources. In setting up a CSO Facility Plan, it is also important to use currently available information. This may include Infiltration and Inflow (I/I) studies, flow data, pretreatment records and knowledge of problem areas.

Actual development and implementation of a CSO Facility Plan has four major elements. The first is gathering information to define the problem, the causes of the problem and any water quality impacts. The second is taking short term interim measures (Best Management Practices) to abate CSO discharges. These include proper ordinances, control of additions to the sewer system, good operation and maintenance practices and projects to correct known major I/I problems. The third is the analysis of alternatives for CSO and storm water abatement and the development of cost effective solutions that are within the financial capability of the municipality. The fourth element is the development and implementation of a "master plan" to define and prioritize a program for long term CSO abatement activities.

The following pages outline these steps in more detail and will hopefully provide a blueprint for development of an effective CSO control program. These guidelines are intended to be general in nature and must be tailored to address local conditions and problems. In many cases, it may be helpful to hire a consultant to assist in developing the CSO Facility Plan.

Standard Format for the Development of a Combined Sewer Overflow Facility Plan

The municipality shall develop and implement a prioritized, long-term program for evaluation and abatement of Combined Sewer Overflow (CSO) discharges from the sewerage system. The program shall include evaluations of CSO discharge points, (and if appropriate, storm water discharges) characterization of their activity under various conditions, study of water quality impacts, evaluation of the sewer system and development of a Master Plan for future steps to control CSO discharges. In the interim, best management practices (BMPs) for reducing CSO discharges shall be implemented. The Master Plan shall provide the final report of evaluations and studies and shall examine a full range of alternatives for CSO abatement. In developing the Master Plan, consideration shall be given to pollutant loadings and management of urban runoff and separate storm sewers.

1. Scope of Work. The municipality shall submit to the Department for review and approval a Scope of Work for the development of a CSO Facility Plan. The Scope of Work shall contain a critical path of tasks to be performed along with milestones, including dates for submitting interim report(s) and the Master Plan.

2. CSO Assessment. The municipality shall complete an assessment of the sewer system and CSOs based upon or including:

   (a) An up-to-date map of the as-built sewerage system, including proposed modifications;

   (b) The locations of all wastewater or stormwater discharge points within the City or near the City, including CSO structures, stormwater outfalls, industrial discharges, and discharges from neighboring communities;

   (c) A detailed description of the drainage area of each CSO, including the size of the drainage area, topography, population and residential density, average daily volume of water use and/or average daily sewage flow, and all significant industrial, commercial, and other land uses that are likely to affect runoff or wastewater quality;

   (d) A description and map of receiving waters, indicating the existing, designated, and expected future aquatic and wildlife habitat, recreational, and commercial uses of such receiving waters under State water quality standards; and

   (e) A characterization of historic water use impairments.

3. CSO Monitoring Plan. The municipality shall prepare and implement a plan for monitoring to evaluate the frequency, volume, pollutant loads, and impacts of the CSO

discharges and to provide data for prioritizing projects to abate such discharges. This CSO Monitoring Plan shall include: monitoring of the CSO discharge volumes and durations; monitoring of the pollutant loads in CSO discharges; and receiving water monitoring. All CSOs should be monitored for activity. If fewer than all CSOs are to be sampled, the Plan shall include a demonstration that the CSO sampling points selected are representative of the overall sewer system and demonstrate that discharges from points not monitored can be satisfactorily predicted using computer modeling or other techniques. Monitoring shall be performed during both dry (summer) and wet (spring) seasons and shall include storm events of a sufficient range of intensities and durations to characterize CSO discharges in all foreseeable conditions. The points to be measured, length of monitoring, and pollutants to be sample shall be spelled out in the scope of work, (A) 1., and approved by the Department before monitoring begins.

(a) CSO discharge volumes and durations. The CSO Monitoring Plan shall specify the measurement points and sampling protocol for a monitoring program to assess the flow volumes and flow durations of CSO discharges. The program shall be designed to establish the relationship between various environmental conditions such as land use; rainfall amounts, intensity and duration; surface runoff conditions; groundwater levels; and tidal influences. Particular attention shall be given to determining the relationship between CSO discharge points to identify those which function most frequently or are indicative of how other points function under given conditions. All overflow points should be block tested for a minimum of 6 months. Block testing is a method of determining what size storms will activate the CSOs. Retrievable blocks of wood or other materials are placed in locations where they will be moved by water if the CSOs activate. Each block is checked after every storm. Repeated rounds of checking will reveal which CSOs are most active and what size storm is needed to activate them. If no modeling of the sewer system is planned, then all overflows should be flow monitored for a minimum of 6 storms between March and September, with at least one 1.5" (3 month) storm. If modeling the sewer system is planned, then a minimum of 25% of the overflow points should be flow monitored for a minimum of 6 storms in order to calibrate the model. The monitored overflow points should drain an area of at least 50% of the total combined sewered area. A second round of monitoring for at least two storms will be needed to verify the model. All overflow points should be surveyed in the spring during dry weather (no storm events) to determine if dry weather discharges exist.

(b) Pollutant loads. The CSO Monitoring Plan shall specify the measurement points and sampling protocol (including the parameters for which samples are to be analyzed) for a monitoring program to define the pollutant loads from CSOs during varying rainfall conditions. This monitoring program shall also conform to the following:

i. Sampling shall be performed during dry periods and during storm events of a sufficient range of intensities and durations to characterize CSO discharges in all foreseeable conditions. Pollutant loads shall be sampled from 25% of the overflows (the same points being flow monitored). A minimum of four storms should be sampled, two in the spring and two in the summer. Each storm should follow a minimum 3 day dry weather period. The storms must be sufficient to cause significant discharges;

ii. In each storm event selected for sampling, sampling must be flow proportioned and performed during the "first flush" and during sustained flow. A suggested sampling procedure to determine first flush is given in Appendix A;

iii. Priority should be given to sampling those CSOs that function first during storm events, that frequently discharge high volumes industrial or medical wastes, or that are believed to impair or threaten impairment of water uses;

iv. Observations of the aesthetic impacts on the receiving water near the sampling location (floatables, debris, scum, oil and grease, odor, etc.) shall be made at the time of sampling.

v. For CSO discharges into lakes, environmentally sensitive receiving water, and Casco Bay, the program shall include testing for the following constituents: suspended solids, biochemical oxygen demand, pH, lead, zinc, chromium, copper, cadmium, mercury, iron, arsenic, silver, total kjeldahl nitrogen, total ammonia, nitrate/nitrite nitrogen, total phosphorus, petroleum hydrocarbons, polyaromatic hydrocarbons, PCB's, and herbicides (2,4-D, and dicamba). As an alternative to testing for these heavy metals and toxics, an Acute Whole Effluent Toxicity (100%) test may be done on a composite of all overflows sampled for each storm. If this test shows a toxicity level of concern, the metals and other toxics tests will be required to determine the specific toxic pollutants in the overflows. The effluent shall be sampled for enterococcus bacteria and fecal coliform bacteria for marine waters and E.coli bacteria for fresh waters. A reduced sampling program may be approved by the Department for less sensitive receiving waters, on a case by case basis.

(c) Receiving water sampling. The CSO Monitoring Plan shall specify the measurement points and sampling protocol (including the parameters for which samples are to be analyzed) for a monitoring program to define the impacts of CSOs on ambient water quality and uses and to provide a basis for predicting the effects of sewer rehabilitation and separation projects on CSO discharges and on the receiving waters.

Selection of monitoring locations will be based on consideration of the locations of overflows, the frequency of overflows, wastewater characteristics and physical conditions in the receiving water such as uses (especially swimming), current, depth, other possible sources of pollutants and tidal influences. The monitoring locations and the rationale for their selection shall be submitted to the Department for review and approval. All water samples collected shall be tested for enterococcus bacteria and fecal coliform bacteria for marine waters and E. coli bacteria for freshwaters.

In tidal waters, ambient water samples will be collected at times of high tide, low tide and half tide (incoming and outgoing), and from locations which best reflect the CSO discharge after the opportunity for initial mixing with the receiving water. In nontidal waters, ambient water samples shall be collected upstream of the overflow point, and in the zone of influence. If several CSO points are in close proximity, one downstream sampling point may be allowed after review and approval by the Department. It is suggested that dye tests be used to determine zones of influence.

(d) CSO Monitoring Report. The municipality shall submit a report of the results of CSO monitoring to the Department for review and approval. This Monitoring Report shall include summaries of all sampling data and a discussion of any deviations from the approved monitoring plans.

4. Sewer System Evaluation. Concurrently with the CSO monitoring referred to above, a sewer system evaluation shall be conducted in order to evaluate volumes and sources of groundwater and surface runoff entering the system. The study shall be conducted in accordance with a plan of study included in the Scope of Work submitted to the Department for review and approval. Monitoring points shall be established within the sewer system in order to measure the flows contributed from various drainage areas. The impact of flows from each area may be evaluated through use of a sewer system model or other means of predictive analysis. In conducting the study, sources of extraneous water entering the sewer system shall be identified and prioritized according to their contribution to CSO discharges and feasibility of corrective actions to abate them. A report of the study shall be submitted to the Department for review and approval.

5. Sewer System Master Plan. A Master Plan shall be developed describing steps and timetables for abatement of CSO discharges. The plan will include the findings of the studies and evaluations referred to above and methods to be used in rehabilitating or

improving the sewer system. Prioritized implementation schedules for this work shall be provided.

Specifically, the Plan shall include: an evaluation of the effectiveness of the Best Management Practices, pretreatment program, and secondary treatment plant, and an assessment of alternative measures to abate CSO discharges or to apply treatment technology to improve the quality of such discharges, selection of abatement strategies for individual or groups of CSOs, an environmental assessment discussing impacts, positive and negative, for the alternatives selected, a financial capability analysis, and a timetable for completing CSO abatement projects. In developing an implementation schedule, consideration shall be given to water quality impacts, cost effective abatement alternatives selected and the municipality's capacity to finance such measures.

(a) The Master Plan must assess a full range of possible alternatives, including various combinations of elimination, reduction in discharge frequency or discharge volumes, relocations, and storage and treatment. In assessing each alternative the Municipality shall consider:

i. The minimum size and intensity storm required to activate each overflow, volume discharged from each overflow for various size storms, number of overflow events and water quality violations per year based on historic rainfall data;

ii. The existing and designated uses of receiving waters under the State water quality standards in the area affected by each CSO discharge;

iii. The alternative's expected effects on in-stream water quality and uses;

iv. Other environmental effects of the alternative, both positive and negative;

v. The effects of the best management practices to be implemented under paragraph 6 as well as the pretreatment program and the improvements of the secondary treatment plant;

vi. The estimated cost and construction dates for implementing the CSO control strategies;

vii. A cost-effectiveness analysis of the costs (including operation and maintenance) of each control strategy for each CSO or group of CSOs;

viii. The effectiveness in improving storm water management and reducing urban runoff; and

ix. A sewer rate and financial capability analysis, including but not limited to an examination of grant funding, phasing of projects, and rate stabilization.

(b) In selecting and scheduling CSO abatement projects, priority shall be given to abating CSO discharges in the following order:

i. Those which occur for reasons other than rain or snowmelt;

ii. Those which may impair water contact recreation uses or create public health concerns in the receiving waters;

iii. Those which discharge into areas determined to have redeemable shellfish resources;

iv. Those which contain significant industrial, high strength, or medical wastes;

v. Those which function during the months of June through September;

vi. Those which cause localized nuisance conditions; and

vii. All other CSO discharges.

Additionally, high priority should be given to abating all CSO discharges which occur during the so-called "first flush" of suspended sediments from the sewer system at the beginning of a storm event.

(c) The CSO Master Plan shall also include a Compliance Monitoring Plan for the regular monitoring of the CSO discharges which may remain during and after implementation of the CSO Master Plan and the waters receiving those discharges.

(d) The CSO Master Plan shall be reviewed periodically in order to evaluate the effectiveness of abatement projects. These reviews shall serve to supplement and/or amend the Master Plan as may be appropriate, taking into consideration projects completed, Compliance Monitoring Plan results or changes in the assumptions upon which the Master Plan was approved. Amendments to the Master Plan shall be approved by the Department. Reviews shall be made in accordance with a schedule provided in the Master Plan, but at least every two years.

(e) It is recommended that the public be given ample opportunity to give input throughout the CSO Facility Planning process, especially after the Master Plan recommendations have been made. Public participation is a requirement if

State or Federal funds are requested to assist in the implementation of the Master Plan.

6. Best Management Practices. During the time that studies, evaluations, and sewer system improvements are being completed and until modified through implementation of the approved Master Plan, the municipality shall immediately take steps to minimize the discharge of pollutants from CSO points. These steps shall include but not be limited to the following:

   (a) Adoption and enforcement of an ordinance or rules prohibiting the introduction of uncontaminated water into the sewer system from private sources such as roof or cellar drains, surface drainage, and non-contact cooling water;

   (b) Development and implementation of a plan for the removal of existing sources of water into the sewer system from private sources such as roof or cellar drains, surface drainage, and non-contact cooling water;

   (c) Formal plans for regular cleaning of sewer lines, especially in those sections where the deposition of solids may restrict flow and cause surcharges which result in overflows;

   (d) Development and implementation of a high flow management plan designed to optimize the use and overall effectiveness of the treatment system during high flows;

   (e) Formal plans for maintaining overflow control structures, pumping stations, tide control gates and other structures in the sewer system in good working condition and adjusted to minimize CSO discharges;

   (f) Addition of septic tank wastes only to the treatment plant during times when all flows being received are given full secondary treatment;

   (g) Special efforts to assure that industrial high strength wastewater and other non-"conventional" pollutants (such as hospital wastes) do not overflow and that such wastewater receives full treatment;

   (h) Regulating the addition of new or increased volumes of industrial process or high-strength wastewaters into the sewer system under circumstances in which they could be discharged through a CSO point;

   (i) Conducting periodic surveys of all municipal discharges (CSO and stormwater) during dry weather to verify that no dry weather sanitary discharge exists;

   (j) Effective street sweeping and catch basin cleaning; and

(k) New sources of wastewater or extensions may be added to sewer systems having CSO discharge points if the municipality is conducting an approved CSO study and if the additional sources do not increase pollutants discharged from CSO points. In developing programs to offset new pollutants, municipalities may consider, but are not limited to any combination of the following:

(1) Implementation of best management practices as described in Section 6, above;

(2) Removal of extraneous, uncontaminated water from private or public sources;

(3) Physical improvements alterations, or upgrades which result in reduced CSO activity;

(4) Pollution prevention programs; or

(5) Sewer separation projects.

Reports of additions of new wastes will be made to the Department and will contain the volumes and characteristics of wastewaters added or authorized for addition, and descriptions of pollutant reduction projects to offset additions.

NOTE: Stormwater runoff may contain various pollutants. Before separation projects are carried out, care should be taken to assure runoff borne pollutants are not simply redirected to the receiving water through another piping system. This is a particular concern in heavily developed areas where pollutant concentrations are likely to be higher. Before completing Master Plans, municipalities proposing sewer separation projects should seek Department review and concurrence on a case by case basis.

Appendix A

Determining First Flush Characteristics In CSO Discharges.

For the purposes of conducting CSO studies, the first flush is an increased loading of pollutants due resuspension of solids in a sewer system and/or surface runoff entering the system. Normally, this would be expected to occur during the first portion of a storm event, but the actual timing can be affected by storm intensity and system hydraulics. Indeed CSO discharges may not contain first flushes at all. Ideally, a sewer system should convey the first flush to treatment plant, and accomplishing this should be high priority goal of any CSO abatement program.

If present, a first flush can be identified as an increase and then gradual decline of pollutant concentrations over the duration of the duration of the discharge event. Using the pre-discharge concentration as a baseline, the first flush will cause a marked, often sharp increase to a peak. Following this, the concentration will drop to levels below the dry weather condition as stormwater dilutes the wastewater in the system. In order to evaluate first flush events, either settleable solids or suspended solids can be used. Settleable solids have the advantage of being a quick, easy test which can be done in conjunction with sample compositing. Suspended solids are quantitative and may be more indicative of other pollutants of concern, such as metals.

Before conducting a full sampling program, preliminary observation or gauging is recommend. This will provide some understanding of how CSO points respond to a storm event and will allow design of a more representative sampling program. Individual samples must be taken over the duration of the discharge periods. During the first portion of the discharge, the samples should be collected more frequently; a 15 minute interval is recommended. After the first flush period has passed, the frequency can be reduced to one grab every 1 - 2 hours. For prolonged discharges, sampling can be terminated before the end of the event, if it is apparent that the pollutant concentrations have stabilized at a relatively low level. In any case, sampling should be for at least 6 hours. However, flow recording must continue for the entire discharge period.

Once all the samples have been collected, they should be examined to determine if a first flush did in fact occur, based on settleable or suspended solids concentrations. If a first flush is present, two composites are needed. The break point can be made where the concentration is clearly declining from its peak. Absent a first flush, only one composite is necessary. In either case, compositing must be done flow proportionally. Each composite is then analyzed for the required pollutants. Laboratory results, along with the recorded flows for the respective periods, will allow calculation of mass loadings for both the first flush and the total discharge event. This information can be used to evaluate CSO control alternatives for first flushes independently, as well as part of the entire discharge.

ME DEP September 1994

CSOFORM