United States
Environmental Protection
Agency, Region 9

December 2014

ASSET MANAGEMENT

Incorporating Asset Management Planning Provisions into NPDES Permits

Overview

Municipalities across the country are facing the challenging obligation to manage their aging sewer and stormwater systems at a time of urban population growth, more stringent water quality protection requirements, and increased exposure to climate change-related risks. At the same time, it has become more difficult for many municipalities to secure new funding for infrastructure improvements or replacement, or even to maintain existing funding levels. Asset management planning is a proven tool for maintaining and elevating levels of service for wastewater and stormwater systems and planning system renewal and upgrades. However, many wastewater and stormwater utilities have not implemented robust asset management planning systems or similar infrastructure planning processes, in part because NPDES permits have rarely required or encouraged their use.

Sewer Collection Systems

By the Numbers…

Number of Sanitary Sewer Systems in U.S.
16,000 Systems

Total Length of Public Sewer Lines
>740,000 Miles

National Wastewater Infrastructure Need
$192.2 Billion*

National Stormwater Management Need
$22.7 Billion*

**Based on 2008 EPA estimate.*

NPDES permitting authorities should consider incorporating asset management provisions into their NPDES permits to ensure permittees implement sound system operation and maintenance practices, properly plan for needed system replacements and upgrades, and meet water quality protection requirements.[1]

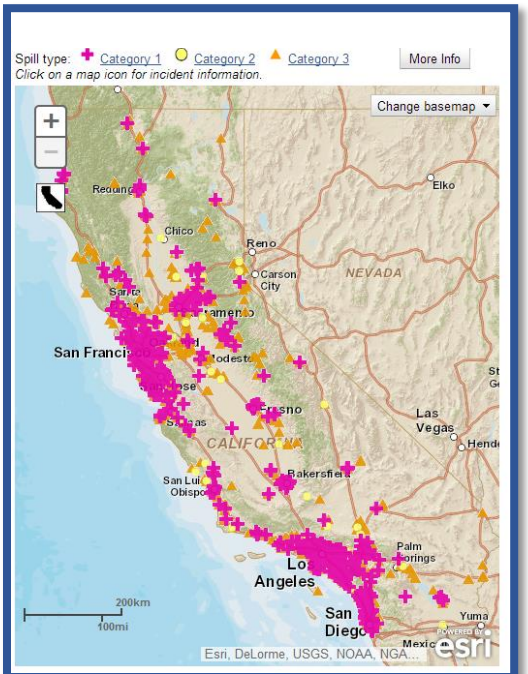
[1]This document is not a formal U.S. Environmental Protection Agency guidance document; nor does it represent official EPA policy. The Clean Water Act (CWA) and EPA's implementing regulations contain the legally binding requirements associated with the development of NPDES permits. This document does not substitute for the CWA or associated permitting regulations. The approaches discussed in this document are not binding; permitting authorities may consider other approaches consistent with the CWA and associated permitting regulations. This document is intended to be consistent with, but does not modify existing EPA policy and guidance.

Introduction

The Clean Water Act ("CWA") National Pollutant Discharge Elimination System ("NPDES") was established to control water pollution by regulating point sources that discharge pollutants into waters of the United States. Publicly Owned Treatment Works ("POTWs") are a significant source of water pollution and are regulated in a variety of ways under the NPDES program to ensure discharges from municipalities do not adversely affect receiving waters.

NPDES permits for POTWs include effluent limitations, monitoring and reporting requirements, best management practices, pretreatment requirements, rules for handling biosolids, and operation & maintenance requirements.

A POTW's ability to comply with its permit depends on the condition of associated wastewater collection and treatment infrastructure. A sanitary sewer system in poor shape is vulnerable to excessive infiltration and other system failures that may result in:



4,840 SSOs resulted in over 9 million gallons spilled across CA in 2012-13.

- Increased flows to POTWs causing pass-through of pollutants into receiving waters or upset of the treatment plant.

- Back-ups in the sewer system resulting in Sanitary Sewers Overflows ("SSOs") of raw sewage onto streets or into homes or yards.

- Increased costs of pumping and treating addition water entering the system.

- Costly emergency responses to spills and urgent reactive reparations.

- Inability to meet new water quality-based permit requirements.

- Inability to function properly as system components become more vulnerable to climate change-related impacts (e.g. sea level rise, flood risk, meteorological changes).

- Additional damage to the collection system resulting in further infiltration.

Complementing sanitary sewer collection systems, Municipal Separate Storm Sewers Systems ("MS4s") transport polluted runoff into local waterbodies during storm and non-storm conditions. MS4s are also regulated under the NPDES program in order to reduce discharges of contaminated stormwater runoff through the implementation of stormwater management

programs. While most municipal stormwater systems have different types of conveyance and treatment infrastructure elements than sanitary sewer systems, stormwater assets are similarly vulnerable to system failures that cause upsets, flooding, and system damage if they are not properly maintained and upgraded when necessary. Managing stormwater system assets is equally critical in order to minimize stormwater pollution, achieve water quality objectives, and protect communities from flooding.

Background and Benefits

For sewer and stormwater systems, asset management is the process of managing infrastructure capital assets to minimize total cost of owning and operating them, while delivering an established and consistent level of service to customers. A high-performing asset management program incorporates detailed asset inventories, operation and maintenance tasks, and long-range financial planning to build system capacity, resulting in both environmental benefits and financial savings. Similar approaches are also used by many drinking water systems.

An infrastructure asset is any long-lived capital asset that is operated as part of a system or network. Sewers, manholes, and pump stations are the primary asset components of a sewer collection systems, however buildings integral to the function of the network (e.g., pump station houses) are also considered assets.

The scope of resources can be additionally expanded to include hard, natural and soft assets. **Hard assets** are physical components and equipment used to operate a sewer system. **Natural assets** are municipally-managed, hydrological resources such as waterbodies, runoff, and land. **Soft assets** are social resources such as personnel, public opinion, policies and relationships with partners and regulators. Accounting for resources other than hard assets is a holistic approach to asset management planning particularly relevant to stormwater sewer systems.

AMP Components

The key elements of an Asset Management Plan are:

- Level of service definition.
- Selection of performance goals.
- Information system.
- Asset identification and valuation.
- Failure impact evaluation and risk management.
- Condition assessment.
- Rehabilitation and replacement planning.
- Capacity assessment and assurance.
- Maintenance analysis and planning.
- Financial management.
- Continuous improvement.

By incorporating model components into an Asset Management Plan ("AMP"), a municipality can reliably forecast needs for maintaining a consistent level of service and meeting current and future regulatory requirements. This planning framework helps municipalities weight difficult investment decisions, educates the public and political decision makers about system needs, and ensures proper allocation and acquisition of funding for construction, operation, and maintenance.

Asset management planning can also help maximize energy efficiency of wastewater treatment and collection operations, yielding further economic benefits.

Regulatory Basis

The Federal Code of Regulations requires a NPDES permittee to properly operate and maintain their facility to ensure compliance with other conditions of the permit. Specifically, all permittees are required to comply with the following provisions:

> **40 CFR 122.41(e)** *Proper operation and maintenance*. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

A NPDES permittee must establish appropriate quality assurance procedures to ensure facilities meet technology and water quality-based requirements. Quality assurance procedures ensure a desired level of quality or service. AMPs provide a framework for setting and operating these quality assurance procedures and ensure permittees have sufficient financial and technical resources to continually maintain a targeted level of service. At the discretion of a permitting authority, AMP requirements may be established to ensure compliance with the provisions of 40 CFR 122.41(e). Moreover, AMP provisions may be incorporated as part of compliance actions to ensure permittees take proper steps to repair and maintain failed infrastructure to address permit violations and prevent their recurrence.

Permit Language for Sanitary Sewer Systems

This section provides permit recommendations and sample language for use in incorporating AMP provisions in permits. In order to incorporate AMP language into NPDES permits, permitting authorities need to address the key elements of an AMP plan identified in the box on page 3. The level of detail established in the permit requirements may vary based on the size of the collection system.

This report provides an example framework to establish conditions that will provide an impetus for municipalities to engage in AMP targeting, assessing, planning and forecasting. Requiring permittees to utilize AMPs is not only legally defensible, but will minimize environmental damage while saving money for municipalities for years to come.

Asset management planning language can be simplified into four permit sections: *Targeting*, *Assessment*, *Planning*, and *Forecasting*.

Targeting

Targeting requires a permittee to delineate the purpose and goals of their AMP and includes a *level of service definition* and *selection of performance goals*. Written as an NPDES permit requirement, the definition of level of service must identify, but is not limited to, a level of service necessary to maintain NPDES compliance. For wastewater treatment plants, the level of service should include reducing SSOs and peak flows to the facility and meeting other permit conditions, such as effluent limitations.

Targeting

Example Language

The permittee shall identify desired levels of service for its sewer system. Levels of service shall address relevant permit requirements including, but not limited to, minimizing the likelihood and frequency of sanitary sewer overflows, reducing peak flow volumes to the wastewater treatment facility, and meeting effluent limitations. The permittee shall also develop specific performance measurements and metrics to ensure that levels of service are met.

Performance goals are specific metrics to assess how the defined levels of service are being met. Such goals could include inspection frequencies, peak flow volumes, FOG build-up, or water-quality concentrations.

Levels of service and performance goals may also be established on the individual asset level to set qualitative and quantitative expectations for specific pieces of equipment.

Assessment

Example Language

The permittee shall identify and inventory all critical wastewater assets valued over $5,000 into a single database. Each entry shall include:

a) Name and identification number.
b) Location (GPS coordinate or equivalent identifier)
c) Desired level of service (quantitative expected performance).
d) Current performance.
e) Purchase and installation date.
f) Purchase price.
g) Replacement cost.
h) Consequence of failure.
i) Likelihood of failure.

Assessment

Assessing a system requires not only inventorying all assets, but also assessing possible failure paths and potential impacts if system components fail.

To assess the system, the permittee must first select an appropriate *information system*, enabling them to adequately collect and maintain the information necessary to implement an AMP. Once an information system has been selected, the permittee may initiate *asset identification and valuation*, a process of identifying and numbering the primary components in the sewer system. Asset data such as location (i.e., GPS coordinate or equivalent identifier), size, age, cost, and desired level of service (quantitative expected performance) are all examples of the essential information to be compiled. Asset data inventories provide very useful maps of the locations and interrelationships among individual system components along with meta data about the histories and replacement/inspection schedules for individual components.

Once inventoried, the permittee may carry out *failure impact evaluation and risk management* assessments. This process is designed to project the likelihood and consequences of failure should the asset no longer operate. Factors to consider in evaluating consequences of failure may include location, function, depth, or proximity to public areas or environmental resources.

The last phase of assessment is the *condition assessment*, performed to identify assets that are underperforming, determine the reason for the deficiencies, predict when failure is likely to occur, and determine what corrective action is needed and when. During this phase, municipalities evaluate the condition of each asset and assign an appropriate numeric grade based on an established scale.

Comparing consequences of failure with likelihoods of failure is the basis of asset management planning and ultimately allows a municipality a quantitative mechanism for prioritizing asset reparation and replacement.

Planning

Once assets are fully inventoried and assessed, the permittee will use the information to make more informed decisions on how to improve their system to meet a desired level of service and plan for future needs and requirements.

Proactive *rehabilitation and replacement planning* provides the best opportunity for capital cost savings and environmental protection. By balancing factors such as condition of the asset, consequence of asset failure, and cost of replacement, a municipality can systematically prioritize the rehabilitation and replacement of assets.

Planning

Example Language

As part of the Asset Management Plan, the permittee shall create and implement a Maintenance, Rehabilitation, and Replacement Plan. The MRRP shall evaluate data obtained through asset assessment in order to inform a strategy for prioritizing and scheduling maintenance of the sewer system and rehabilitation and replacement of inventoried assets. The MRRP shall be re-assessed annually to address changing conditions and resources.

Capacity assurance planning is commonly addressed as a standard condition in most NPDES permits, however it can be required by the permit as a component of a permittee's asset management planning effort. A robust capacity assurance plan compares peak flow data with operational difficulties and SSO occurrences, and then identifies how regional growth patterns and new permit requirements might affect such system shortfalls. The capacity assurance effort can be incorporated into the asset management planning effort to prioritize replacements and upgrades.

Effective *maintenance analysis and planning* programs keep sewer systems running smoothly and help prevent premature deterioration. The goal of the planning process is to maximize planned maintenance activities while minimizing unplanned, or "reactive," maintenance activities. By conducting strategic maintenance to analyze past failures, municipalities can anticipate and prevent future failures.

Forecasting

Information collected through the assessment phase of asset managing planning is not used only to inform infrastructure maintenance and replacement priorities, but also to forecast the funding needed to meet levels of service goals. With proper *financial management*, a municipality may identify funding it will need and when it will need it in order to establish a basis for planning user fees, debt financing, and other funding solutions.

Forecasting

Example Language

The permittee shall project costs necessary to meet each desired level of service. The permittee shall then compare these projections with available funding sources to determine the best manner in which to fund operation and maintenance, repair, rehabilitation, and replacement of assets to sustain service and performance.

The permittee shall re-evaluate its asset management plan on an annual basis and make the plan available to the permitting authority upon request.

The last component of an effective AMP is acknowledgment of its iterative nature and the need to regularly update the AMP. A municipality must focus on *continuous improvement* by periodically reviewing their system against performance measures to identify any shortfall in their AMP. If the permittee is unsuccessful in meeting performance measures despite implementing the components of their AMP, then the strategy must be adjusted to better achieve their desired outcomes.

Stormwater Systems

Although asset management planning is a popular tool in maintaining levels of service for water and wastewater systems, stormwater system managers are only beginning to explore its use. While stormwater system assets are very different than sanitary sewer system assets, the AMP principles are consistent across water systems.

Compared to wastewater management, stormwater less frequently receives direct treatment to remove pollutants discharged through stormwater outfalls, thereby making it more challenging to meet numeric effluent limitations. However, a stormwater system's obligation to meet limitations, particularly those introduced through Total Maximum Daily Loads ("TMDLs"), is no less important than it is for discharges from more conventional point sources. For stormwater systems, asset management planning becomes increasingly essential as a means of leveraging assets to meet performance measures, such as TMDL or other water quality based pollutant reduction requirements or goals. An AMP system can also provide a basis to identify funding needs, set priorities among competing control demands, and demonstrate how resources will be dedicated to achieve specific results.

Stormwater

Example Language

The permittee shall develop an asset management plan ("AMP") in order to establish intended levels of service for their stormwater system consistent with the conditions of this permit. The AMP shall inventory and assess the condition of all critical hard and natural assets and evaluate costs required to achieve intended levels of service, linking those costs to funding sources.

Permit language for MS4 permits can be developed on a permit-specific basis and account for natural, and potentially soft assets, in addition to conventional hard assets more prevalent in a sanitary sewer system. Stormwater permits may also include asset management targeting, planning, forecasting, and implementation language similar to the examples provided above.

Permittees may also be able to use this opportunity to demonstrate compliance with effluent limitations through the implementation of their AMP. By setting a target level of service, such as meeting TMDL-based numeric effluent limitations, a permittee may model what best management practices are necessary to meet that goal and how much it will cost to build and maintain them over the course of time required to attain their desired water quality. Permitting authorities may then decide to allow for attainment of effluent limitations through the implementation of an AMP.

Sustainability

The deterioration of aging infrastructure, population growth, and asset failure patterns are all factors that should be incorporated into an effective AMP. An AMP can also be used to forecast relevant needs and costs associated with *climate change*-related impacts, particularly in communities that will be impacted by sea level rise or increased flooding risk. By outlining how changing weather patterns and natural disasters might affect municipal wastewater and stormwater systems, municipalities can develop long-term construction and funding plans for upgrading or relocating critical infrastructure.

Climate Change

Example Language

The permittee shall identify new or increased threats to the sewer system resulting from climate change that may impact desired levels of service in the next 50 years. The permittee shall project upgrades to existing assets or new infrastructure projects, and associated costs, necessary to meet desired levels of service.

Asset management planning for climate change requires a dynamic understanding of the effects of climate change on local communities. Permittees must model what effects extreme weather events, sea level rise, shifting precipitation and runoff patterns, temperature changes, and resulting changes in water quality and availability will have on their sewer systems before being able to identify adaptation strategies and secure funding for implementation.

Permitting authorities may consider including climate change requirements into an NPDES permit after a municipality has already demonstrated an ability to implement an effective AMP. USEPA's Climate Ready Water Utilities Program has

resources to help wastewater utilities prepare for a changing climate at http://water.epa.gov/infrastructure/watersecurity/climate.

Aside from accounting for impact resulting from climate change, sewer systems have an obligation to optimize their *energy efficiency*. Drinking water and wastewater systems account for approximately 3-4 percent of energy use in the United States. Using asset management planning to maximize the energy efficiency of wastewater treatment and collection operations can yield substantial economic benefits, in addition to helping cut down on associated emissions.

Many state and federal programs are available to fund energy efficiency projects, and improvements are often eligible for rebates from energy utilities to reduce the payback periods even further. USEPA Region 9's Sustainable Water Infrastructure website (http://www.epa.gov/region9/waterinfrastructure/index.html) describes a recommended approach for implementing an energy efficiency program at wastewater utilities.

Permitting authorities may additionally consider mandating energy efficiency audits as part of the asset management planning process in NPDES permits.

Implementation

Asset management planning is currently underway across the country. EPA Region 9 is putting together a series of case studies to showcase the status of asset management planning for various wastewater and stormwater systems in the U.S., with a focus on California. The case studies will be available on EPA Region 9's website.

Case Studies

Cities of Folsom and San Diego

Folsom

By developing a Rehabilitation and Replacement Program, Folsom has secured $33 million over 16 years for R&R projects. Since 1998, the City has reduced sewer spill events by 80%.

San Diego

The City's Watershed Asset Management Plan identified a nearly $20 billion need over the next 100 years to meet level of service goals, including TMDL compliance.

As AMP efforts gain momentum, appropriate NPDES permit requirements are beginning to be developed for permits in EPA Regions 1 and 5 in the Northeast and Midwest. Specifically, most permits issued in Region 1 and Wisconsin include provisions for incorporating EPA's Capacity, Management, Operations and Maintenance program, while permits issued by Region 5 and in Michigan require inventorying, level of service planning, critical asset identification, life cycle costing, and long-term funding strategizing.

Depending on the structure of permits, asset management requirements may be incorporated as a "special condition," if applied on a facility-specific basis, or even a "standard condition," when applied generically across all permits. Language may also be incorporated into a distinct "operation & maintenance" or "asset management planning" section.

As sewers age, cities grow, and the climate changes, the need for increasingly sophisticated infrastructure management will become more prevalent. By incorporating asset management planning as a requirement into NPDES permits, we are taking one step closer to achieving the Clean Water Act goal of eliminating all sources of pollutant discharge.

Reference Materials

Fact Sheet: Asset Management for Sewer Collection Systems. U.S. EPA. Apr 2002. http://water.epa.gov/polwaste/npdes/sso/upload/assetmanagement.pdf

Asset Management Language; A Guide; Draft. Michigan Department of Environmental Quality. Dec 2012.

Clean Watersheds Needs Survey 2008 Report to Congress. U.S. EPA. EPA-832R-10-002. http://water.epa.gov/scitech/datait/databases/cwns/upload/cwns2008rtc.pdf

Energy Efficiency in Water and Wastewater Facilities. U.S. EPA. 2013, EPA-430-R-09-038. http://epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf

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