Chapter 7: Eliminated Technologies

7.1 Introduction

The following technologies have been eliminated from further consideration, based on the screening process discussed in Chapter 2, *Technology/Indicator Analysis*, because of the following:

- The performance is unsatisfactory
- Implementation would not be viable
- The cost is high relative to other technologies
- The reliability is unsatisfactory.

The technologies included in this chapter are listed in Table 7-1.

TABLE 7-1
OUTLINE OF CHAPTER 7 TECHNOLOGIES

7.2	Agricultural – Satellite Treatment
7.3	Alum Treatment
7.4	Equalization Basin at Publicly Owned Treatment Works
7.5	In-line Storage in Combined Storm Sewer Areas
7.6	Publicly Owned Treatment Works – Membrane Bioreactor
7.7	Storage by Block (Home Removal)
7.8	Stormwater Sedimentation Tanks
7.9	Vortex Separators – with Chemical Addition
7.10	Water Softener Prevention Program
7.11	Wet Weather Open Storage – Satellite

7.2 Agricultural – Satellite Treatment

Satellite treatment of stormwater runoff and other process water from concentrated animal feeding operations (CAFOs) involves constructing a wastewater treatment system to treat pollution from sources such as animal waste from barnyards, milk houses, feedlots and other structures or areas where farm animals are concentrated. These operations are defined by the Clean Water Act as point sources for the purposes of the National Pollutant Discharge Elimination System (NPDES) program.(1) This treatment option is rarely implemented due to many factors, which include the complexity of the treatment system, the unreliability of the system as compared to more conventional and less complicated methods, and the cost as compared to other acceptable, effective and more widely used technologies for managing farm animal waste. Therefore, this technology was eliminated from further analysis.

7.3 Alum Treatment

Alum treatment of stormwater involves injecting liquid alum (aluminum sulfate) into runoff entering a pond or into storm sewers. The alum combines with phosphorus, suspended solids, and heavy metals and causes them to be deposited into the sediments of the receiving waters in a stable inactive state. Alum treatment systems can achieve high levels of pollutant removal, such as 90% reduction in total suspended solids and 80% removal of total phosphorus. However, this technology was eliminated because the treatment systems are complex and the capital cost and operation and maintenance costs are high compared to other methods of reducing phosphorus.(2)

7.4 Equalization Basin at Publicly Owned Treatment Works

An equalization basin at a publicly owned treatment works (POTW) provides storage of wastewater during the peak flows of wet weather events when the inflow rates exceed the treatment capacity of the plant. Overflows can be reduced by avoiding backwater effects that result from limiting the flow in the metropolitan interceptor sewer (MIS) to the capacity of the treatment plant. Small equalization basins are common at POTWs to regulate the flow or provide a storage facility that can be used during brief periods of maintenance. Due to space limitations at Milwaukee Metropolitan Sewerage District's (MMSD's) plants, basin size would be limited. Also, construction methods, especially at Jones Island Wastewater Treatment Plant, would result in very expensive installation costs. Consequently, the volume would not be sufficient to provide a significant overall system benefit. This technology was eliminated because of limited potential benefit, high costs and because it is equivalent to the near surface storage technology that was analyzed.

7.5 In-line Storage in Combined Storm Sewer Service Areas

In-line storage in the combined storm sewer service areas (CSSA) could be achieved by enlarging the size of pipes in the CSSA. This is similar to the MIS in-system storage technology that was analyzed in the separate sewer service area. However, the storage volume required to significantly decrease the volume of combined sewer overflows (CSO) is so large, if it were physically achievable, the cost to implement this technology to any significant degree would be prohibitive. Therefore, this technology was not evaluated.

7.6 Publicly Owned Treatment Works – Membrane Bioreactor

The membrane bioreactor (MBR) process is a modification of the conventional activated sludge process in which ultrafiltration membranes are used instead of a large gravity clarifier to achieve solids/liquid separation. The membranes are immersed in the mixed liquor of the aeration tank, and a vacuum is applied to draw the clean water to the final disinfection process. Intermittent airflow is applied to the membranes to scour waste solids away from the membranes. The MBR process combines aeration, secondary clarification and filtration into a single process, producing a high quality effluent, simplifying operation and greatly reducing space requirements. The main limitation of this process is that it is very difficult to achieve an acceptable peak flow-to-average-flow ratio. The MBR process typically has a peaking capacity of 1.5/1.0. Most wastewater treatment plants need a much higher peaking capacity, typically 3.0/1.0 or more. The MMSD wastewater treatment plants require peaking factors of 4.0/1.0 or higher.

The process was eliminated from further analysis because of the low peak flow-to-average flow capacity of the process, the capital cost of the new equipment and the increased operating cost related to the use of a vacuum instead of gravity for solids/liquid separation.

7.7 Storage by Block (Home Removal)

Reduction of CSO by this method typically involves clearing one lot per block in fully developed neighborhoods in a combined sewer service area for the development of a stormwater storage area. This usually involves removing one existing home. The storage area may have alternative open space uses during dry weather. This technology, although potentially effective, only would provide significant benefit if the home removed is in an optimum location such as the corner lot on the low end of a city block. This technology would have a very high capital cost and low community acceptance due to the disruptive nature of eliminating corner homes.

7.8 Stormwater Sedimentation Tanks

Stormwater sedimentation tanks are a stormwater treatment technology where stormwater is directed into a tank or vault. The tank provides sufficient settling time for particulates in the stormwater. After settling, the water is discharged and the sediment is properly disposed of. The tanks may include baffles or bypasses to prevent re-suspension or loss of sediment. Regular removal of the accumulated sediment is required. The concept of this technology is used in series in the stormwater filtration devices discussed in Chapter 4, *Nonpoint Source Technology Analysis*, under subsection 4.7.10 of this report; therefore, it was not analyzed as a stand-alone technology.

7.9 Vortex Separators – with Chemical Addition

A vortex separator is a circular chamber used in a storm sewer or combined sewer system to remove sediment and other solids from stormwater. Water enters the circular chamber and flows in a centrifugal direction. Due to the circular motion, sediment and other suspended solids settle out more quickly than they would in a straight line flow. Sediments that settle out of the stormwater are retained on the floor of the unit or may be piped to a sanitary sewer. Floating solids are trapped by a surface weir or screen. Additional treatment of the stormwater can be provided by adding chemicals. However, due to the limited research, complexity of the chemical feed system, and the limited time the stormwater is in contact with the chemicals in the vortex separator, this technology is not considered reliable. Also, this technology is not considered cost effective when compared to a vortex separator without chemical addition or when compared to other technologies that are designed for chemical use. A vortex separator without chemical addition is discussed in Chapter 4, *Nonpoint Source Technology Analysis*, under subsection 4.10.4 of this report.

7.10 Water Softener Prevention Program

The common method used in residential water softening is to exchange calcium and magnesium cations with sodium cations. This is accomplished by passing the hard water through a resin. Periodically, the resin is recharged using a salt (sodium chloride) solution. The recharge solution or brine is discharged to the sanitary sewer. The brine contains significant concentrations of the chloride anion, which is not removed in conventional wastewater treatment and is discharged to the receiving water, thereby increasing its salinity. Treated water from Lake Michigan is considered moderately soft and most users find it acceptable without softening. Groundwater in the Milwaukee area is moderately hard and most users consider softening to be required. However, for those groundwater users supplied by a utility, softening could be provided by the utility with a non chloride-containing chemical.

Softened water is needed for many residential water uses. Hard water not only makes soap less effective, it can cause maintenance issues for entire plumbing systems. Another issue to consider is that enforcing a water softener ban would prove difficult to implement.

There are salt-free water softener options available for residential use, such as electronic water conditioners, reverse osmosis systems and salt-free filtration media. These salt-free options are discussed in Chapter 4, *Nonpoint Source Technology Analysis*, under subsection 4.10.11. Because preventing the use of softeners is not practical and there are salt-free options available, banning water softeners was not analyzed further.

7.11 Wet Weather Open Storage - Satellite

Open storage of excess wet weather flow serves the same function as covered near surface storage. During wet weather, excess sewage is stored in open lagoons, similar to a stormwater detention basin, until the treatment system is able to handle the flow. Because it is not covered, open storage systems usually cost less than covered systems. However, the primary disadvantage of open storage is the inability to provide odor control. Also, the proximity of this type of technology to inhabited areas makes it very difficult to implement as the public typically does not want to reside near open sewage storage systems. Therefore, this technology was not analyzed further.

References

(1) Federal Register, Part II - Environmental Protection Agency, 40 CFR Parts 9, 122, 123, and 412 National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations (CAFOs); Final Rule, Vol. 68, No. 29, Rules and Regulations (February 12, 2003)

(2) Georgia Stormwater Management Manual, Volume 2: Technical Handbook (August 2001) [Internet]; available from http://www.georgiastormwater.com/vol2/3-3-9.pdf