SECTION 9

SCREENING AND EVALUATION OF CONTROL ALTERNATIVES

9.1 INTRODUCTION

The Portland Water District (PWD), City of South Portland and Town of Cape Elizabeth (Town) are committed to effective operation and maintenance of their existing facilities and/or infrastructure to minimize the frequency and duration of overflow events at the Ottawa Road CSO. As is typical, the current MEPDES permit for the CSO requires that the Nine Minimum Controls (NMCs), as put forth by the US Environmental Protection Agency (EPA) in its CSO Control Policy[1], be implemented where applicable. The NMCs are minimum technology-based controls that can be used to address CSO issues without extensive engineering studies or significant construction costs and are intended to be implemented prior to implementing any long-term control measures. As noted in Section 2, the current MEPDES permit also requires the three parties to take the next step beyond NMCs to develop this CSO Master Plan including screenings and evaluation of control alternatives to reduce or eliminate the impacts of CSO overflow events on the receiving waters. This Section discusses the NMCs as they pertain to the Ottawa Road CSO, ongoing efforts to meet those controls, and the screening and evaluation of long-term control alternatives.

9.2 SUMMARY OF NINE MINIMUM CONTROLS

9.2.1 Proper Operation and Regular Maintenance

The Ottawa Road Pump Station has an Operation and Maintenance (O&M) Manual in place to ensure that the facility functions properly and to minimize non-wet weather related CSO events. However, equipment failures do occur. As such, rapid notification and response by maintenance crews is critical to minimizing the impact of such events. PWD inspects the station on a weekly basis to ensure proper operation and the station has been provided with radio telemetry with

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[1] Combined Sewer Overflows, Guidance for Nine Minimum Controls; EPA 832-B-95-003; May 1995

remote alarming capabilities which is monitored constantly. Since 2006, there have only been two non-wet weather events.

Additionally, both the City and PWD have implemented a maintenance plan through which all sewer piping and structures that they maintain are cleaned and TV inspected every ten years. The purpose of these programs is to maximize the capacity of the sanitary systems, to confirm the condition of the pipes, to locate all service connections and to establish pipe and manhole refurbishment or replacement priorities.

9.2.2 Maximum Use of the Collection System for Storage

As noted above, the cleaning programs allow the full existing capacity of the infrastructure to be utilized to store as much of the high flows as possible. Unfortunately, there is very minimal storage capacity available in the Ottawa Road Pump Station drainage area due to the relatively small pipe sizes and the slopes of the lines. Any further attempts to maximize storage would result in flows backing up into individual homes before any effective volume of storage would be achieved in the collection system.

9.2.3 Review and Modification of Pretreatment Requirements

As the majority of sewer users in this drainage area are residential with only a handful of small commercial users (e.g. gas station and bakery), pretreatment is not required.

9.2.4 Maximization of Flow to the Treatment Facility

Because of limitations within the collection and pumping systems downstream of the Ottawa Road Pump Station (discussed in Section 8), increasing the capacity of the Ottawa Road Pump Station may result in sanitary sewer overflows from downstream manholes or Family Field Pump Station. As such, any increase in capacity of the Ottawa Road Pump Station must take into account downstream impacts. Further, in the 2007 Flow and Hydraulic Analysis (included in Appendix B), interceptors between the Family Field Pump Station and the flow metering structure in South Portland were identified to have capacity limitations that would preclude a capacity upgrade to the Family Field Pump Station without significant downstream interceptor replacements.

In order to maximize capacity during power outages, the Ottawa Road Pump Station has been provided with a permanent generator to allow the station to continue to operate.

9.2.5 Elimination of CSOs during Dry Weather

As noted previously, there have only been two non-wet weather related events since 2006 as a result of mechanical failure of pumping system due to pump clogging and station flooding and air binding.

9.2.6 Control of Solid and Floatable Material in CSO

There are currently no systems in place to remove or capture solids or floatable materials in the CSO.

9.2.7 Pollution Prevention Program

Both the City and the Town have several programs in place addressing municipal solid waste collection and disposal, reduction, and recycling including curbside or drop-off waste disposal and recycling; bulky waste collection (City); transfer station recycling and source separation of materials such as used motor oil and mercury; leaf collection and composting; and spill cleanup during collection operations. All of these programs are essential in contributing to pollutant reduction in the CSO and stormwater system.

Each year every catch basin is cleaned and a stencil is spray painted in front of the basin stating: "No Dumping. Drains To Casco Bay". Additionally, both the City and the Town are considered Municipal Separate Stormwater Sewer Systems (MS4s) under the Stormwater Phase II regulations. As a result, they are required to follow the BMP requirements of the program which are designed to reduce pollutants in stormwater runoff.

9.2.8 Public Notification

The CSO is currently posted with the following signage for public notification:

TOWN OF CAPE ELIZABETH
PORTLAND WATER DISTRICT
CITY OF SOUTH PORTLAND
WET WEATHER
SEWAGE DISCHARGE
OUTFALL #001, OTTAWA ROAD PUMP STATION

As mentioned previously, all shellfish areas in proximity of the CSO discharge are closed; therefore no special notification to temporarily restrict shellfish areas is required.

9.2.9 Monitoring to Effectively Characterize CSO Impacts and Effectiveness of CSO Controls

The CSO is continuously monitored with a dedicated overflow meter. The CSO is inspected and the data is retrieved periodically. In addition, the pump station has a flow meter which records flow data continuously.

9.3 DESCRIPTION OF GENERIC CONTROL ALTERNATIVES

The long-term CSO abatement alternatives considered as a part of this Plan are listed below:

- Develop a program of cost-effective/high benefit inflow/infiltration removal
- Collection system and/or pumping capacity increase
- In-line storage
- Off-line storage
- Satellite treatment (swirl concentrator with high-rate disinfection)

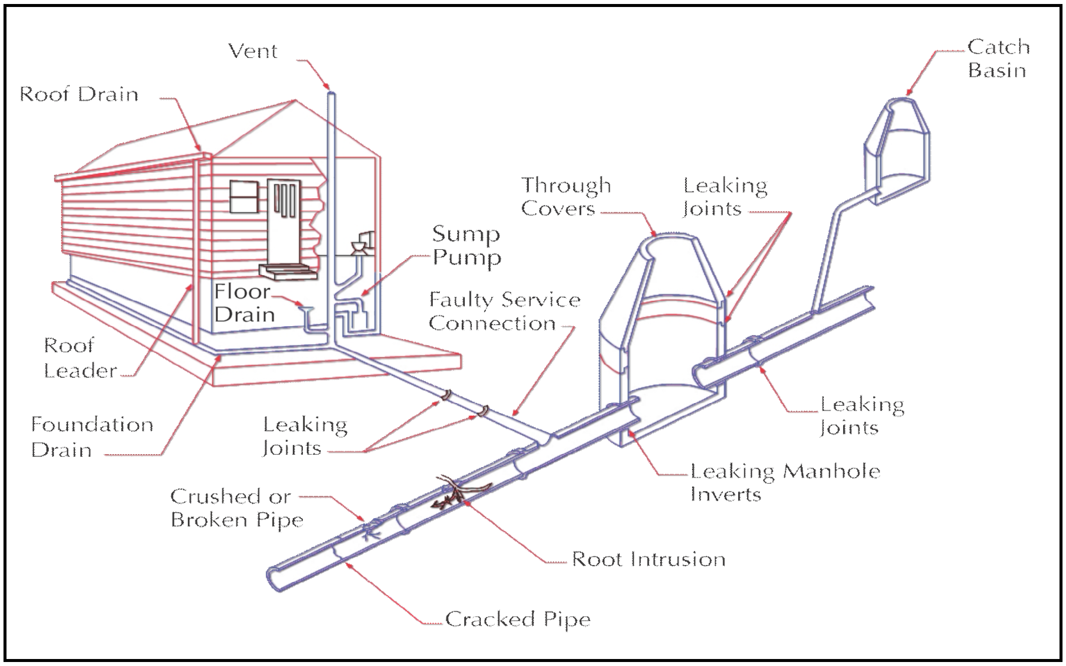
Each of these abatement alternatives is described in general in Sections 9.3.1 through 9.3.5 below, followed by an evaluation of their applicability to the CSO in Section 9.5 below. Section 9.4 contemplates the level of CSO control for which various alternatives will be considered.

9.3.1 Infiltration/Inflow Removal

Infiltration and inflow can come from many sources as show in Figure 9-1 below. Typical inflow sources include catch basins connected to the sewer, roof drains/leaders and leakage into manhole covers. Flows within a collection system with inflow sources rise very quickly during a rainfall event and fall very quickly once the event is over. Typical infiltration sources include leaking manhole/pipe joints and crushed/cracked/broken pipes. Flows within a collection system with infiltration sources rise and fall more slowly and have a longer duration. Other sources of clean water into the sewer system include foundation drains, floor drains and sump pumps. While these sources could be considered inflow sources, they tend to impact the collection system more like infiltration sources as they do not react immediately to a rainfall event and have a longer duration. As noted in Section 5, the collection systems in South Portland and Cape Elizabeth that were monitored as part of the CSO Master Plan development demonstrated high rates of both infiltration and inflow.

Infiltration and inflow can occur both within the public right-of-way as well as on private property, as shown in Figure 9-1. As such, even if sources of infiltration and inflow are removed on public property, high volumes of infiltration and inflow could still occur on private property. In the case of infiltration, sewer piping and service connections installed in trenches over ledge are especially susceptible to rapid, storm-induced infiltration. When the trenches fill with groundwater (storm-induced or seasonally), infiltration takes the path of least resistance. Even when main sewer lines are relined or replaced, the groundwater may rise to the elevation where infiltration into service connection lines occurs. When designing rehabilitation and reconstruction projects, serious consideration should be given to completely replacing services from the sewer main to the house foundation to ensure this does not happen. In the case of inflow, the replacement of sewers and manholes in the public right-of-way will not eliminate the impact of sump pumps, foundation drains and floor drains in private homes or businesses. As such, it is important to have a good understanding of the types and locations of inflow and infiltration sources within a drainage area in order to effectively plan projects in the areas with the highest incidence of I/I.

FIGURE 9-1
INFILTRATION AND INFLOW SOURCES



PWD, the City and the Town should continue to build on their current knowledge base of flow monitoring data and manhole/sewer inspection efforts to identify those projects that are cost-effective for removal of I/I. Additionally, as it is suspected that the drainage area tributary to the Ottawa Road Pump Station has a high occurrence of illicit connections such as sump pumps, floor drains, roof leaders, etc., priority should be placed on implementing a home inspection program to identify all sources and on developing methods for removing these connections from the collection system.

As street reconstruction projects occur, a high priority should be placed on reviewing documented I/I sources and determining whether or not they have been removed. A single broken pipe/abandoned service in a low-lying area could have a major impact on the amount of extraneous flow being conveyed to the pump station with potential CSO consequences. In an ideal world, complete elimination of CSOs could be realized cost-effectively by implementing this alternative alone; however, identification and removal of I/I can range greatly in cost per gallon of I/I removed. This also assumes that replacement of a pipe completely eliminates I/I, which is not usually the case. I/I removal projects on the low end of the cost range should be targeted for stand alone projects; however, if there is other work such as storm drain replacement, road resurfacing, water main replacement, etc. occurring on a specific street, the ease and cost of replacing the sewer and manholes may support the project even if the stand-alone cost is on the high end of the range.

9.3.2 Collection System and/or Pump Capacity Increase

Currently, the area draining to the Ottawa Road Pump Station is essentially built out and there is little or no additional growth expected and little chance for redevelopment to another use. As there are no known capacity issues within the gravity collection system tributary to the Ottawa Road Pump Station, increasing the size of the gravity sewers would do nothing to mitigate the CSO. Additionally, due to the layout of the collection system infrastructure and the elevation of service connection in relation to the pump station, there is very minimal in-line storage available. Overflows occur when the capacity of the pump station is exceeded and flows back up into the collection system.

Upgrading the capacity of the Ottawa Road Pump Station will be considered as an alternative. However, due to capacity limitations in the Shore Road interceptor that accepts flow from the Ottawa Road Pump Station (discussed in Section 8), increasing the capacity of the Ottawa Road Pump Station will also require increasing the capacity of certain sections of the Shore Road interceptor to prevent sanitary sewer overflows. Additionally, for purposes of this Plan it was assumed that the capacity of the Family Field Pump Station would not be increased due to impacts to the downstream interceptors draining to South Portland. Therefore, any increase in the capacity at the Ottawa Road Pump Station will either require that an equivalent amount of I/I be removed from the system or that an off-line storage facility be provided for peak flow events.

9.3.3 In-Line Storage

In-line storage refers to the temporary containment of sewage flows within the conveyance conduit (i.e. the sewer). In-line storage can consist of existing sewer piping, if existing piping is of suitable design, or of new below-grade concrete conduits (e.g., concrete box culverts). In both cases, the conduit is designed to contain peak design flows by employing a flow restriction device to surcharge the conduit. In addition, instrumentation and control systems are provided to allow for automation of activities and remote annunciation of alarm conditions (e.g. flow measurement, volume/level measurement, flow restriction device control, etc.) to the extent desired. The primary advantages of in-line storage are: captured flows receive secondary treatment at the WWTF; captured flows do not need to be pumped back to the system; post-storm maintenance is minimal; and existing facilities can be utilized at relatively low cost, if available. The primary disadvantages are: limited capacity available for storage and high capital cost if existing facilities are not available. Typically, this abatement alternative is applicable with deep, long, large and relatively flat interceptor piping with large easements or adjacent land available to install below-grade concrete conduits. Due to the relatively small size and minimal slope of the existing sewer mains as well as the elevation of sewer services, in-line storage is not a feasible alternative for the Ottawa Road CSO. For this reason, this alternative has been eliminated from further consideration.

9.3.4 Off-Line Storage

Off-line storage refers to the temporary containment of diverted combined sewage in storage facilities. Storage facilities considered would consist of below-grade concrete tanks and pumping facilities to either pump to the new storage tank during high flows or pump from the new storage tank after the flows have receded. Tank wash down facilities would be provided to assist in cleanup. In addition, instrumentation and control systems would be provided to allow for automation of activities and remote annunciation of alarm conditions (e.g. flow measurement, volume/level measurement, pump controls, etc.) to the extent desired. The primary advantage of off-line storage is that captured flows receive secondary treatment at the WWTF. The primary disadvantages of off-line storage are: high capital cost, real estate needs, the potential for odors if the combined wastewater needs to be stored for long periods, and labor intensive operation and maintenance requirements.

9.3.5 Satellite Treatment

Satellite treatment refers to the treatment of wet weather discharges at or near the CSO location (i.e., remote from the WWTF). Satellite treatment would be designed to provide the equivalent of primary treatment via vortex separator devices and possibly disinfection/dechlorination. Tank wash down facilities would be provided to assist in cleanup. In addition, instrumentation and control systems would be provided to allow for automation of activities and remote annunciation of alarm conditions (e.g. flow measurement, volume/level measurement, pump controls, etc.) to the extent desired. The primary advantages of vortex treatment are: relatively small footprint required and few moving parts. Vortex treatment devices have been tested at pilot-scale and full-scale and are an effective method of removal of floatables, gross solids and bacteria (primarily via solids removal). Disinfection and dechlorination may be required, including chemical storage tankage and feed systems (sodium hypochlorite for disinfection and sodium bisulfite for dechlorination). The disadvantages of satellite treatment are the high capital cost, the operations and maintenance cost and complexity of the system (particularly at a remote site requiring a high degree of instrumentation/automation).

9.4 LEVEL OF CSO CONTROL

One of the first steps required prior to evaluating any CSO elimination or abatement alternatives is to identify the appropriate level of CSO control (i.e., for which storm events will the CSO be mitigated). A few approaches that have been utilized and should be considered are as follows:

- Provide controls to eliminate CSO events generated by a certain design storm. The EPA CSO guidance document regularly refers to CSO flows generated during a 1-year, 24-hour recurrence interval storm or less[2].

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[2] Combined Sewer Overflows: Guidance for Long-Term Control Plan, U.S. EPA Office of Water. EPA 932-B-05-002. September 1995.

- Provide controls to reduce the total number of overflow events below a certain number each year. Criterion 1 of the presumptive approach outlined by EPA suggests no more than 4 overflow events per year.
- Provide controls to reduce the total volume of overflow events below a certain value per year. Criterion 2 of the presumptive approach outlined by EPA suggests elimination or capture for treatment of no less than 85% by volume of the combined sewage collected during precipitation events on an annual average basis.

The final approach selected for any system will depend on an analysis of the available CSO and precipitation data to define the parameters discussed in each of the approaches above as well as a cost-effective analysis of the various alternatives. This cost-effective analysis, otherwise known as a "knee of the curve" analysis, seeks to determine the cost of CSO abatement for various flow levels and to identify the point at which the abatement is no longer cost-effective or affordable by the community. It should be noted that the cost of abating CSOs represents only one of many costs that rate payers must bear to comply with state and federal regulations associated with wastewater collection and treatment.

A summary of the CSO data analyzed is included in Table 4-1 in Section 4 and includes the following: rainfall information; total volume of combined wastewater and stormwater overflowed; duration of overflow; peak 15-minute overflow rate; and estimated storm frequency based on a comparison of actual rainfall volume and intensity of 24-hour, 12-hour and 1-hour design storms. In addition, Table 9-1 below, defines the 1-year, 2-year, 5-year and 10-year design storms for 24-hour, 12-hour and 1-hour periods.