Operations & Maintenance Plan
Harbor Brook CSO 018
Constructed Wetlands Pilot
Treatment System

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Prepared for

Onondaga County Department of
Water Environment Protection
Onondaga County, New York

Prepared jointly by

CH2MHILL

and

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Save the Rain

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SECTION 1

Project Background and Objectives

Combined sewer overflow (CSO) occurs when the amount of stormwater runoff entering combined municipal/stormwater sewers through roof drains and street inlets exceeds a sewer system's conveyance capacity. CSO discharge is a mix of stormwater, untreated sewage, and urban nonpoint source pollution. CSO outfalls are regulated under the National Pollutant Discharge Elimination System (NPDES), which is also subject to its state-level corollary (SPDES) (EPA 1993). CSO discharges contain a variety of constituents including excess nutrient loads, suspended solids, and organic waste that could have a negative environmental impact. While a wide spectrum of compounds may be found in this highly variable waste stream, the goal of CSO discharge treatment is twofold: (1) attenuate the CSO flow; (2) improve the water quality of CSO effluent by reducing the concentration of floatables, suspended solids, pathogenic bacteria, and excess nutrient loads.

Onondaga Lake (Syracuse, NY) has been the subject of intensive industrial and municipal pollution since the early 1800's. On January 20th, 1998, Onondaga County entered into an Amended Consent Judgment (ACJ) with the State of New York, New York State Department of Environmental Conservation (NYSDEC), and the Atlantic States Legal Foundation (ASLF). The primary goal of the ACJ is to reduce pollutant loads to Onondaga Lake from the Metropolitan Syracuse Wastewater Treatment Plant ("METRO") and the volume of municipal CSO discharges.

One green infrastructure alternative that has been the subject of extensive research for stormwater applications over the past 30 years is the "constructed treatment wetland" (Hammer 1989, Yu et al. 1996, Wong and Geiger 1997). A treatment wetland is an engineered ecosystem consisting of a substrate (soil or composite material), maintained hydrology, and vascular plant species constructed for the purpose of low-maintenance wastewater quality improvement (Kadlec and Wallace 2009).

Three types of treatment wetland systems for treatment of CSO effluent include: surface flow (SF), vertical down flow (VDF) and floating wetland islands (FWI) (Dittmer et al. 2005, Henrichs et al. 2007, Annelies et al. 2009, van Acker et al. 2005). SF systems typically resemble naturally occurring emergent marshes, whereas VDF systems are often operated as batch-loaded reactors in which wastewater seeps vertically through a vegetated sand or gravel substrate (Crites et al. 2006). FWI is a relatively new technology that employs the use of vegetated wetland rafts in a surface water setting (Stewart et al. 2008).

CSO discharge to Harbor Brook, a tributary of Onondaga Lake, is a health concern and a representative point source of pollutant loading in the Lake's sewershed. Pursuant to the Fourth Stipulation and Order to the 1998 ACJ, Onondaga County has expressed interest in creating a pilot-scale treatment wetland system to assess the efficacy of green infrastructure technology in mitigating pollutant loads stemming from CSO 018, located near the intersection of Velasko Road and West Onondaga Street (Figure 1-1).

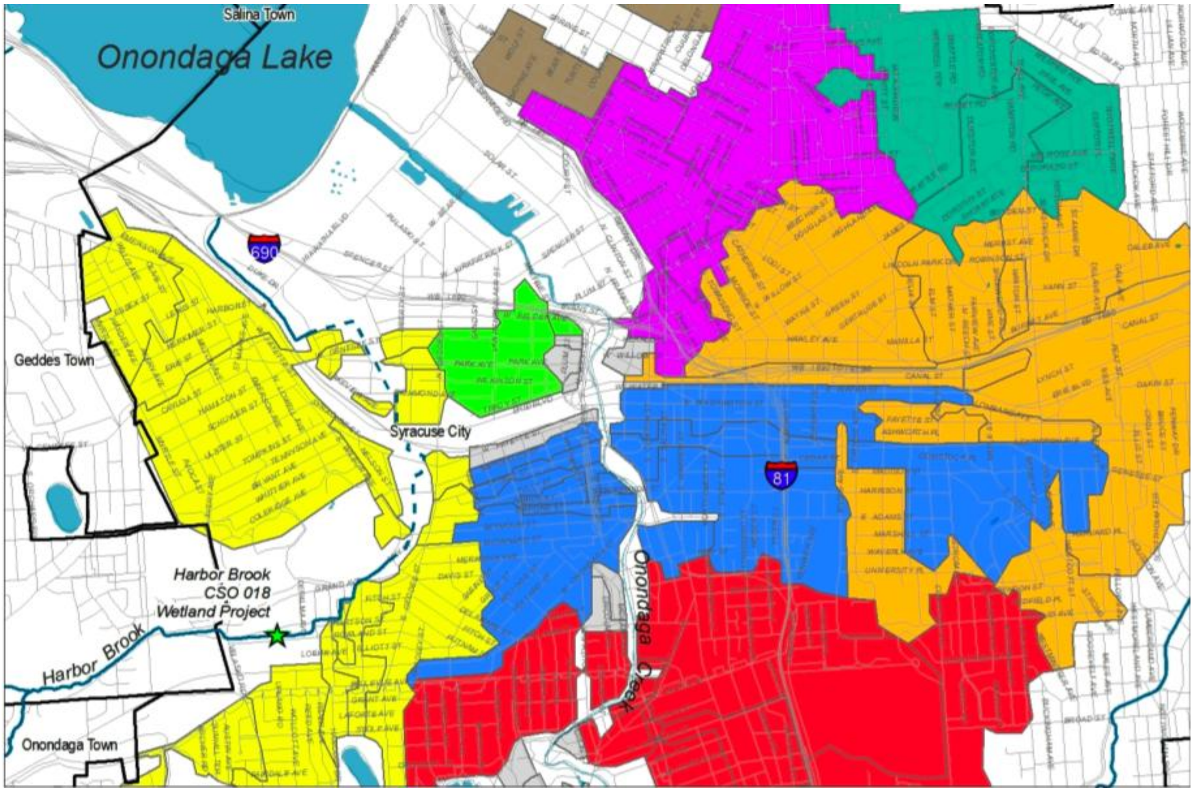

FIGURE 1. Map Indicating Study Area/Shaded Areas Represent CSO Drainage Basins (CH2M HILL and CHA 2011)

To accomplish this goal, CH2M HILL and CHA have proposed a three-module, 2-acre, full-scale pilot constructed wetland treatment system to mitigate CSO events originating from CSO 018 (with the option of expansion to include the nearby CSO 078). The system will include a grit/floatable removal system and three discrete wetland cells, showcasing SF, VDF, and FWI-based designs and technologies. The three cells will be designed to treat pollutant inflows in series, parallel, and series/parallel flow configurations. The primary design objective for the system is to create the capacity for treatment of CSO discharge at loading rates modeled for a 1 year, 2 hour storm event, as indicated in the *Harbor Brook Pilot Project Basis of Design* (CH2M HILL and CHA 2011).

SUNY-ESF will be in charge of overseeing all Operations and Maintenance (O&M) related activities, under the auspices of the CH2M HILL project team. Developing an O&M Plan is an important aspect of this pilot project. O&M Plans developed during the planning stage of a project are designed to outline and highlight general actions and associated protocols to be implemented during post-construction site visits (ITRC 2002). However, for pilot demonstration projects such as the Harbor Brook CSO 018 Treatment Wetland, it is important to create an adaptive management framework. This plan outlines expected O&M related activities and provides contingencies for worst-case scenarios, should they occur. Additionally, as part of the scope of SUNY-ESF's commitment, this Draft O&M Plan will be updated at the end of each monitoring year post-construction. The final version of this plan after the 2-year pilot monitoring phase will be compiled and bound as a comprehensive training guide for operating this wetland system and the basis for other similar constructed wetland systems.

1.1 Draft O&M Objectives

A sound operations and maintenance (O&M) plan promotes optimal system performance and is also essential over the initial monitoring period to obtain a robust and representative dataset, and identify unforeseen issues. The following objectives will be emphasized in the Draft O&M Plan:

1. Creating an adaptive protocol to determine the timing of flow regimes through the pilot wetland system
2. Identify and address potential O&M issues
3. Identify and address cell-specific O&M issues
4. Create a preliminary schedule for O&M related activities

SECTION 2

O&M Responsibilities and Project Organization

2.1 O&M Responsibilities

As stated above, SUNY-ESF will be in charge of overseeing all O&M related activities during the 2-year pilot monitoring phase. However, coordination with the Onondaga County Department of Water and Environment Protection (WEP) and Health Department will be necessary over the pilot monitoring phase. Table 2-1 summarizes all O&M related activities currently anticipated for the project site, and recommends a distribution of responsibilities. SUNY-ESF and CH2M HILL will be in charge of delegating these responsibilities in consultation with the County.

TABLE 2-1
Preliminary O&M Activity List with Associated Responsibilities

O&M Activity	Routine	Frequency	Responsibility
Wetland Cells - General			
Flow Configuration Operations	Operate flow diversion structures under prescribed flow regime	~1/month (in pilot phase only – no adjustments required during long-term operations)	SUNY-ESF
Water Levels	Check water levels	Weekly and/or following storm events	SUNY-ESF
Flow Uniformity/Sediment	Check for blockages at all inflow/outflow points	Weekly and/or following storm events	SUNY-ESF; WEP involvement if dredging is required
Vegetation	Monitor health	Weekly	SUNY-ESF
Odor Control	Monitor odors and wind direction	Weekly,	SUNY-ESF
Vector Control	Monitor for presence of mosquito larvae	Weekly	SUNY-ESF; coordinate with Onondaga County Health Department
	Set up bat/bird boxes	Post-construction	

TABLE 2-1
Preliminary O&M Activity List with Associated Responsibilities

O&M Activity	Routine	Frequency	Responsibility
Site Maintenance - General			
Berm Integrity	Monitor sedimentation due to erosion/ inspect for burrows	Weekly	SUNY-ESF
	Mowing/removal of tree seedlings	Monthly during growing season	WEP
Sampling/Flow Monitoring equipment	Maintenance checks	Weekly	SUNY-ESF
Fence Maintenance	Check for debris and damage	Weekly for damage; clean debris after flooding	SUNY-ESF; coordinate with WEP and contractors if repair is required
Treatment System Components - Specific			
FWI (Cell 1)	Check island tethering structures and islands for stability and balance	Weekly	SUNY-ESF
VDF (Cell 2)	Check to see if vegetative health is maintained during dry conditions	Weekly	SUNY-ESF
SF (Cell 3)	Make sure water levels are appropriate for emergent/riparian plant species	Weekly	SUNY-ESF
Grit and Floatables Removal System	General maintenance check	After first 2 CSO Events; monthly for first 6 months of operation; every 6 months after initial monitoring	SUNY-ESF
	Check Screens	Weekly	SUNY-ESF
	Check/Empty grit storage tank	Every 3 months or as required by experience	WEP

2.2 Project Organization and Contacts

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SECTION 3

Wetland Cells: General O&M Considerations

3.1 Flow Configuration Operations

During the 2-year experimental pilot phase, treatment wetland cell flow configurations will be changed on an approximately monthly basis to satisfy sampling requirements described in the project Quality Assurance Project Plan (QAPP). Refer to the QAPP for a 1st year flow configuration schedule. The flow configuration scheduling will be adaptive in order to satisfy sampling requirements for stochastic and unpredictable storm events, so coordination among SUNY-ESF monitoring and O&M personnel will be important to this end.

After the two-year monitoring pilot phase, SUNY-ESF and CH2M HILL will make recommendations for future flow configuration operations.

Paths of flow through the constructed wetland system will be controlled by a series of flow diversion structures, which will utilize weirs and gates to control and direct CSO discharge. Gates will be controlled by pull chains located at the system surface and will only be operated during dry weather. The gates located around FDS-6 may require operation during extreme weather events, and will have manual gate operators and floor stands mounted on the top of the structure. Table 3-1 outlines the gate positions required necessary to achieve each of the three flow scenarios.

TABLE 3-1
Wetland System Diversion Gate Configurations[1]

Gate	Series	Parallel	Series/Parallel
6A	Open	Open	Open
6B	Closed	Closed	Closed
6C	Closed	Open	Closed
7A	Closed	Closed	Open

[1] See 90% design drawing C-5002 for details of flow diversion structures

3.2 Water Levels and Flow Control

Water levels will be monitored using in-cell staff gauges. Water level control will be maintained using a series of automated pressure transducers and 12-inch butterfly valves located within flow diversion structures and/or overflow weirs. At normal pool elevations, water levels in Cells 1 and 3 will be maintained at 396.50 and 393 (NAVD 88), respectively. Staff gauges will be marked to reflect a depth relative to the grade elevation of the wetland cell so that all elevations will indicate a depth at the time of observation. If water levels are above their respective datum and flow does not appear to be occurring out of Cells 1 and/or 3, equipment and flow-through channels will be checked and remedial action taken.

Cells 1 and 2 will be lined with a high-density polyethylene (HDPE) liner. Cell 3 will be left unlined, with a compacted substrate underlying the topsoil. Cell 3 will also contain a "deep zone" for flow distribution across the width of the wetland that will also act as a sump as it is anticipated to be below the average elevation of the water table at the study site (see 90% design drawing C-3003 for details). This will provide some degree of water level buffering in Cell 3. If the water level falls below one foot of standing water in Cell 1 and if this is not due to drought conditions, the cause for the low water level will be determined and corrected. Water from unlined Cell 3 can be pumped to Cell 1 if standing water in the latter cell falls below 2 inches. Water additions to Cell 1 should be economical, and will only serve as a contingency until drought conditions cease or the cause of the low water level is determined. No more than 2 inches of water will be added over the area of Cell 1 at a time. Cell 2 will not have standing water and therefore water level maintenance will not be required however, under drought conditions, irrigation of the plants will be required using Cell 3 water.

If flooding occurs, site access will only be allowed if it is determined to be safe to do so. . If flooding is close to an elevation of 402 (NAVD 88), which is the average elevation of the surrounding berms, water depths at site access roads and paths will be determined. If accessible, monitoring personnel will be required to wear wading boots and personal floatation devices. If flooding is above this level, site visits will be rescheduled when water levels have subsided below the elevation of the surrounding berms. After flooding, any debris should be cleared from the site and all equipment checked.

3.3 Flow Uniformity and Sediment Removal

Blockages within flow-through channels may result in the backing-up of the treatment system. Weekly checks will be made of inflow/outflow structures to clear them of vegetation and debris. Timing of these checks will typically occur immediately following a rain event if one occurs during that week. Flow sensors will be cleaned weekly using a brush on a long pole from the surface and flow rate checked before and after cleaning. This will be supplemented by analysis of weekly downloads of all active in-pipe flow meters to ensure systemic functionality and identify any potential blockages during wet weather conditions.

Sediment accumulation at the wetland cell's inflow/outflow structures and at sampling/flow metering locations should be noted. Sediment should be removed if it negatively impedes flow or sample collection at these points. If dredging is necessary and/or debris is not easily removed the WEP will be contacted to assist SUNY-ESF and CH2M HILL personnel.

3.4 Vegetation Management

Vegetation removal/harvesting is seldom required in treatment wetlands and will not be undertaken unless the wetland islands become adversely affected by wind action (Cell 1) or flow through wetland cells is impeded and is reducing the treatment efficiency (Cells 2 and 3). As a rule of thumb, to prevent adverse effects of wind on vegetation in Cell 1, plant height should not exceed the width of the individual floating wetland islands (Headley and Tanner 2006). For this reason, the wetland planting plan for Cell 1 is for mid-height or shorter vegetation. Vegetation management will focus on maintaining a robust and ecologically diverse plant community within the wetland. Removal of invasive species will be considered on a case-by-case basis as recommended by quarterly monitoring reports. Note that invasives will not negatively impact treatment performance but may impact wildlife diversity and aesthetics. Re-plantings will occur in the case that mortalities are reported for >50% of all species once the cause of the die-back has been determined. In this case, roots and other organic plant materials will be left in the wetland, if appropriate, and provide nutrients and substrate for new plantings.

3.5 Odor Control

Odor control is rarely an issue in properly designed and constructed treatment wetlands. If odors are suspected to be emanating from the wetland, check the wind direction, determine where the complaint came from to determine if it is downwind of the wetland, and walk around the perimeter of the outside wetland berm to determine the source. If no odor is detected then the source of odor is offsite. However, if the odor is present at the wetland then further investigation will be required. Odors may occur when a wetland system is not properly operated and the water level drops to below the normal operating level exposing the anoxic zone. This should be corrected by increasing the water level to the normal operating level or at least above the anaerobic bottom sediment. If this does not ameliorate the situation, fresh water can be pumped into the offending cell(s) from one of the other cells, providing sufficient dissolved oxygen (DO) is present in the latter area. A contingency plan that could be considered is to install solar powered bubblers to aerate the offending cell(s).

3.6 Vector Control

Mosquito control is an important consideration in constructed wetlands where free-standing water is present. Since no standing water will be present in Cell 2, it is not anticipated that mosquitoes will be an issue in that cell. Water levels in Cells 1 and 3 will be maintained at one foot and six inches of standing water respectively or more under normal weather conditions so as to encourage the proliferation of aquatic predators that feed on mosquito larvae before they emerge as a biting nuisance. Bat and swallow populations will also be encouraged to feed in the vicinity through the construction of roosting/nesting boxes. If these preliminary measures are not effective, bacterial larvacides such as BTI (*Bacillus thuringiensis israelensis*) and BS (*Bacillus sphaericus*) could be employed and will fall under the County mosquito control program. These techniques have been used successfully to control insect populations in most treatment wetlands that have standing water (EPA 2000). Coordination with the Onondaga County Health Department will be an essential component of any remedial action taken if insects do become a problem at the study site.

SECTION 4

Site Maintenance: General O&M Considerations

4.1 Berm Integrity

Berms should be checked for structural stability and erosion during weekly site visits and following major storm events. Once a cover of vegetation is established, they will also require periodic mowing and removal of tree seedlings, which will be managed by WEP staff. Burrows should be filled with heavy gravel or bentonite to discourage muskrats and other potentially harmful wildlife populations, and ensure that berms remain structurally sound (EPA 2000). However, burrowing by muskrats is not expected to be a concern as long as the fence integrity is maintained and that gates will not be left open during routine maintenance. If muskrats are found within the wetland, an immediate trapping program will be required.

4.2 Perimeter Fencing (Wildlife and Vandalism)

A chain link fence will be installed around the perimeter of the wetland study site on top of surrounding berms (top of berms vary from elevation 307 to 402 NAVD 88) to prevent people contacting or being impacted by the water, reduce potential for vandalism, and keep out muskrats and other small mammals that may present a threat to vegetation establishment. The fence will be inspected after flooding, and debris will be routinely removed. The gate will be kept closed and locked at all times including during site visits.

4.3 Equipment

Automated ISCO 6712 portable units will be installed to take water quality measurements at up to six sampling locations. Flow (Q) will be measured using in-pipe ISCO flow-meters. An ISCO 2150 Area Velocity Flow Module will record flows discharging into Harbor Brook. Event flow will also be recorded at all sampling points using ISCO 730 Bubbler Flow Modules. All flow metering and sampling will occur at manhole grates (MHs) or flow diversion structures (FDSs). Measurements will be downloaded onto a portable field laptop during weekly site visits (Table 4-1).

TABLE 4-1
Treatment System Sampling and Flow Metering Locations[1]

Flow Configuration	Series	Parallel	Series/Parallel
Sampling Locations	MH-1, FDS-6, FDS-11, FDS-13, MH-18	MH-1, FDS-6, FDS-11, FDS-13, MH-18	MH-1, FDS-6, FDS-11, FDS-13, MH-18
Flow Metering Locations	MH-1, MH-3, FDS-6, FDS-11, FDS-13, MH-18, MH-19	MH-1, MH-3, FDS-6, FDS-8, FDS-13, MH-18, MH-19	MH-1, MH-3, FDS-6, FDS-11, FDS-13, MH-18, MH-19

[1] See 90% design drawings C-3001 and C-2002 for locations of MH's and FDS's

Automated samplers will be housed in subsurface "cages" below MH's and FDS's (see 90% design drawing C-5001 for details). In some cases, due to the confined space at certain sampling points, samplers will be housed above the surface in secure metal boxes to prevent theft and keep them out of the elements. All *in-situ* monitoring equipment will be checked during weekly site visits. The following guidelines should be followed when maintaining ISCO automated sampling units and flow meters.

4.3.1 ISCO 6712 Maintenance Checklist (Teledyne ISCO 2001)

- Inspect pump tube for wear and replace if necessary
- Clean the pump tubing housing
- Change suction line if needed
- Clean bottles, suction line, strainer, and pump tube
- Check the humidity indicator
- Check the controller's internal battery status and replace every 5 years
- If keyboard label has bubbles under it, the air inside the controller has expanded. To release pressure, unscrew flow meter cable or connector cap on the back of the controller. Push down on the label to force air out and retighten cable or connector cap
- Check for correct date and time
- Replace desiccant if needed

Detailed protocols for the maintenance procedures outlined above can be found in the ISCO 6712 Installation and Operation Guide.

4.3.2 ISCO 730 Bubbler Module Maintenance Checklist (Teledyne ISCO 1995)

- Inspect bubble line to ensure it is not kinked or damaged

- Clean and replace hydrophobic filter if needed
- Reactivate desiccant if pink or green
- Replace external marine battery packs as needed

Detailed protocols for the maintenance procedures outlined above can be found in the ISCO 730 Bubbler Module Installation and Operation Guide.

In the event of a power outage to the treatment system, 12” butterfly valves that channel flow from Cell 1 to Cells 2 and 3 in series and series-parallel flow configurations will lose power. In such a case, Cell 1 has the capacity to hold discharge from the 1 year, 2 hour storm until power is restored. Additional flow will crest over spillways and travel through wetland cells to outfall.

4.4 Winter Maintenance

Mechanics and moving parts of water control structures will be checked for frost damage. Mooring structures for Floating Wetland Islands (Cell 1) will also be inspected regularly. Cell 1 and 3 water levels will be managed to retain a minimum depth of unfrozen standing water within the wetlands over the winter. Water levels in Cells 1 and 3 will be adjusted in response to observations made by site personnel. Cell 2 will naturally remain drained and the organic layer at the surface along with snow cover will insulate the bed. During the winter, all sampling and flow metering equipment will be removed with the exception of the ISCO 2150 Area Velocity Flow Module located at the system outfall.

4.5 Monitoring Access Maintenance

All access paths to the locations of routine water level measurement and water quality sampling locations will be kept free of visible obstruction in all seasons to create safe access and working conditions. This will require periodic edging or mowing in the summer and snow removal during the winter.

4.6 Health, Safety, & Training

Considering the Harbor Brook treatment wetland will be capturing stormwater and diluted municipal wastewater flows, health and safety for field staff will be an important concern. All field personnel will be supplied with pertinent Personal Protective Equipment (PPE), consistent with the requirements of the Onondaga County Department of Water Environment Protection (WEP) sample collection field staff. A list of the required equipment with winter modifications is supplied in Appendix A.

All field training for WEP field staff is done in-house. To maintain consistency with the county, all field personnel associated with the Harbor Brook treatment wetland will receive field training apropos to “grey infrastructure” wastewater treatment facilities by County employees. A minimum of two staff members will accompany each other on field visits that occur at night or during inclement weather.

SECTION 5

Treatment System Components: Site-Specific O&M

5.1 Floating Wetland Islands (Cell 1)

Floating Wetland Islands require mooring structures, which typically take the form of synthetic ropes or chains attached to 3-4 tethering points between the island unit and adjacent basin shore. Alternatives to this include an anchoring system, tethering the island to a weight located at the bottom of the cell, or the installation of a pole that has one end buried into the bottom of the cell and the other end extends above the water surface, around which the island can rise and fall with fluctuating water levels. All of these mooring devices must be both strong and versatile enough to withstand extreme flow rates, wind, and changing water levels during peak storm events. Each of these strategies will require frequent inspection to ensure functionality and upkeep of tethering materials (Headley and Tanner 2006).

An ancillary benefit of the FWI system, besides providing storage capacity and flow attenuation, is providing additional sediment removal capabilities for the treated water leaving the grit and floatables system. Depth of sedimentation should be assessed after the 2-year pilot period and dredging is recommended if necessary (Headley and Tanner 2006) understanding that the liner will need to be protected.

Water levels will be maintained as discussed in section 3.2 of this report.

5.2 Vertical Down Flow (Cell 2)

The Vertical Down Flow system is designed to be low maintenance and will be subject to applicable general wetland cell O&M strategies, as described in Section 3.0 of this report. One of the goals of this two-year pilot study will be to determine additional O&M concerns associated with this design under various flow sequences.

Cell 2 is a vertical down flow (VDF) treatment system, and is designed to drain relatively rapidly. However, some water will be available to deeply rooted plants at the base of the treatment cell (see 90% design drawing C-3003 for Cell 2 details). Additionally, drought resistant grasses will make up the majority of the vegetation planted in Cell 2. However, in the case that during dry conditions, grasses planted in Cell 2 show signs of stress or experience significant die-off (i.e. >50% of all plant species), Cell 2 will be watered using on-site irrigation through a hose or excess water from Cell 1, if available.

5.3 Surface Flow (Cell 3)

Water levels should be observed carefully in this cell. Long periods of either excessively high (flooded) or low water (desiccated) levels can adversely impact emergent vegetation. If significant die off occurs (i.e. >50% all plant species), investigation by a botanist will be completed and recent water level fluctuations will be taken into account. Care should be taken to ensure that decaying plant materials or other floatables do not impede the outflow point of this cell. SUNY-ESF personnel will remove any such material that is within reach and typically in the discharge end of the wetland cell with a pool skimmer or rake attached to a long pole.

5.4 Grit and Floatables Removal System

5.4.1 General

The grit and floatables removal process includes a vortex separator for grit and floatables separation from the combined sewage flow and a grit storage tank to prevent the removed grit from being discharged into the Harbor Brook Interceptor Sewer (HBIS). When combined sewage flow enters the vortex separator, there are four (4) discharge configurations: (1) dry weather flow to HBIS; (2) flow greater than the capacity of the HBIS which flows to the wetland cells; (3) grit to the grit chamber and floatables to the HBIS; and (4) emergency overflow to the HBIS or CSO.

The Storm King® with Swirl Cleanse or equal has been specified for grit and floatables removal before CSO discharge is conveyed to the wetland cells. The Storm King® has no moving parts and little maintenance. Although wash downs may not be necessary after each storm for the self-cleansing system, they are recommended following CSO events to prevent foul odors from developing.

Once the grit and floatables separator unit has been brought on-line, it should be visually inspected after the first two overflow events. After the initial inspection, visual inspection of the equipment should be carried out twice a year. The system should be checked for blockages, the screen panels checked for accumulation of solids, and all joints checked for leaks. If present, accumulated solids, oils and grease should be removed by hosing down.

The grit and floatables separator unit should be monitored for at least 6 months on a monthly basis to ensure that there are no unusual characteristics. Thereafter, it is suggested that the unit should be inspected every 6 months.

5.4.2 Swirl Cleanse Screen

During inspection, if screening units are greater than 50% blinded, they should be hosed down. If screens are more than 50% blinded, it must be noted and reported to a CH2M HILL and CHA personnel. Care should be taken to ensure that any material deposits that are hosed off pass directly through the downstream vortex valve and on to treatment. Refer to the manufacturer’s O&M manual for detailed information on the grit and floatables separator unit.

5.4.3 Grit Storage Tank

The grit storage tank is an 8-foot diameter manhole with a 10-foot deep grit sump below the downstream pipe invert. The velocity of the sanitary sewer flow is reduced as it passes through the grit chamber, which causes heavier girt particles to settle into the sump.

The grit storage tank should be inspected every three (3) months. Check for odors and grit level. If the grit level is above 50 percent of chamber depth, remove the grit to maintain capacity of grit chamber. Clean as needed to minimize odors. WEP will maintain the grit storage tank.

SECTION 6

Summary and Contingencies

The timing of routine O&M activities and associated contingencies are included in Table 6-1. A preliminary O&M field checklist is included in Appendix B. This O&M plan is part of an adaptive management strategy, and will be revised after the final design has been completed, and reviewed for accuracy once quarterly after that for the duration of the two year monitoring program.

TABLE 6-1
Preliminary O&M Activity List with Associated Contingencies

O&M Activity	Routine	Frequency	Contingency
Wetland Cells - General			
Flow Configuration Operations	Operate flow diversion structures under prescribed flow regime	~1/month (in pilot phase only – no adjustments required during long-term operations)	Flow configurations will adapt to sampling protocol described in project QAPP
Water Levels	Check water levels	Weekly and/or following storm events	Transfer water from Cell 3 if levels are low; check for blockages if levels are high
Flow Uniformity/Sediment	Check for blockages at all inflow/outflow points	Weekly and/or following storm events	Manual sediment/vegetation removal; dredging
Vegetation	Monitor health	Weekly	Re-vegetation
Odor Control	Monitor odors and wind direction	Weekly; Hotline from residents	Adjust water level; pump in fresh water, installation of solar powered bubblers
Vector Control	Monitor for presence of mosquito larvae	Weekly	Biological treatment (BTI, BS) if required and/or County control method
	Set up bat/bird boxes	Post-construction	
Site Maintenance - General			
Berm Integrity	Monitor sedimentation due to erosion/ inspect for burrows	Weekly	Added erosion control if required; fill burrows with heavy gravel or clay; trapping

TABLE 6-1
Preliminary O&M Activity List with Associated Contingencies

O&M Activity	Routine	Frequency	Contingency
	Mowing/removal of tree seedlings	Monthly during growing season	
Sampling/flow monitoring equipment	Maintenance checks	Weekly	Battery replacement; equipment replacement
Fence Maintenance	Check for debris and damage	Weekly for damage; clean debris after flooding	Fence repair/replacement
Treatment System Components - Specific			
FWI (Cell 1)	Check island tethering structures and islands for stability and balance	Weekly	Repair tethers; vegetation removal to restore balance if overgrown
VDF (Cell 2)	Check to see if vegetative health is maintained during dry conditions	Weekly	Watering of stressed vegetation during dry conditions
SF (Cell 3)	Make sure water levels are appropriate for emergent/riparian plant species	Weekly	Remove blockages/sediment that may adversely impact water levels
Grit and Floatables Removal System	General maintenance check	After first 2 CSO Events; monthly for first 6 months of operation; every 6 months after initial monitoring	Report any systemic failures to ESF who will inform CH2M HILL and system distributer
	Check Screens	Weekly	Wash screen with high pressure hose if more than 50% blocked
	Check/empty Grit storage tank	Every 3 months or as required by experience	Report any problems to ESF, who will inform CH2M HILL and system distributer

SECTION 7

References

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APPENDIX A
County Personal Protective Equipment Requirements

OCDWEP-ETS Wastewater Technician Field Staff Personal Protective Equipment Requirements

Job Activity	Hazards: Electrical	Falls	Airborne Particles	Foot Injury	Hand Injury	Potentially Harmful Dust	Head Injury	Sun Exposure/Radiation	Chemical Exposure	Hearing/Noise	Harmful Gases	Drowning	Hypothermia	Personal Protective Equipment: Apron	ANZI Z87 Safety Glasses	Chemical Splash Goggles	Dust Mask	Face Shield	Gloves	Hard Hat	Hearing Protection	Lanyards/Harness	Air Monitor	Floor Fall Protection	Safety Shoes	Safety Vest (Class II)	Safety Vest (Class III)	Class III Rain Suit	Ventilation	Life Jackets	First Aid Kit	Waders	Mustang Exposure Suit	Sunscreen	Tyvek Suit	Other
General ETS Sample Collection		X	X	X	X	X	X		X	X	X				X	XP	A	A	X	P	P	S	P,S	S	X	S	S	S			X					
General ETS Sample Preservation			X		X	X			X		X				X	XP	A	A	X				A						X		X					
Lake/River/Tributary- Sampling																																				
By Boat		X		X	X			X	X	X		X	X		X	XP	S	A	X		S			X	X					X	X	S		Av		
Wading (Day)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X	X				X	X	X		Av		
Wading (Night - Dry Weather)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X		X			X	X					
Wading (Night - Wet Weather)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X			X		X	X					
Crane Use (Day)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X	X				X	X			Av		
Crane Use (Night - Dry Weather)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X		X				X					
Crane Use (Night - Wet Weather)		X		X	X		X	X	X			X	X		X	XP	S	A	X	S		S			X			X			X					
Wintertime- Lake/River																																				
Tributary		X		X	X		X	X	X			X	X		X	XP		A	X					X		X				X	X	X	X	Av		
Boat		X		X	X		X	X	X			X	X		X	XP		A	X		S	S		X						X	X	X	X	Av		
Ice		X		X	X		X	X	X			X	X		X	XP		A	X					X						X	X	X	X	Av		Refer to SOP.
Electrofishing																																				
Boat	X	X							X	X		X	X	X	X	XP		A	X		X	X			X					X	X					Linesman gloves
Tributary/Backpack	X	X						X	X			X	X	X	X	XP		A	X						X						X			Av		
Larval Trawls		X		X	X			X	X	X		X	X	X	X	XP		A	X		X			X	X					X	X	X		Av		
Macroinvertebrate																																				
Tributary		X						X	X			X		X	X	XP		A	X			X			X						X	X		Av		
Lake		X		X	X			X	X			X		X	X	XP		A	X						X					X	X			Av		
Juvenile Seines		X						X	X			X		X	X	XP		A	X			X			X						X	X		Av		
Nesting Survey		X						X				X										X		X	X					X	X	X		Av		Polarized glasses
Zebra Mussel (Lake and River)		X		X	X			X	X			X		X	X	XP		A	X			X									X	X		Av		
Macrophyte Collection		X						X	X			X		X	X	XP		A	X			X		X						X	X	X		Av		
YSI Sonde Replacement at USGS Sites		X		X	X		X	X				X			X				X			X		X						X	X	X		Av		
Mooring and YSI Buoy Deployment		X		X	X			X				X	X			XP		Av	X			X		X	X					X	X	X	X	Av		
Mooring and YSI Buoy Removal		X		X	X		X	X	X			X	X	X	X	XP		Av	X	X		X		X	X					X	X	X	X	Av	Av	

Key For PPE : **X** - Required, **XP** - Required during preservation, **P** - Required in Posted Areas/Operations (including Industries), **A** - As Recommended by Applicable MSDS, **S** - Refer to Supervisor and SOP, **Av** - Available for Use.

Please Take Notice: This is a summary of PPE equipment for various ETS Field Staff activities, and does not supersede any SOP requirements. If you have trouble locating a specific SOP, please contact your immediate supervisor.

APPENDIX B
Preliminary Harbor Brook CSO 018 Treatment Wetlands O&M Checklist

Name of Staff Member:
Date:
Time of Visit:
Weather:
Temperature:
Current Flow Configuration (circle one): S SP P
Changed Flow Configuration: No change S SP P

Wetland Cells

<u>Water Levels</u> (staff gauge readings)

Cell 1: [ ] Cell 3: [ ]

<u>Flow Uniformity/Sediment</u>

Blockages present?	Yes	No	Location:	
Abnormal flow?	Yes	No	Location:	

Notes

<u>Vegetation</u>

Cell 1:	Die-offs?	Y/N	Coverage lost (%):	
Cell 2:	Die-offs?	Y/N	Coverage lost (%):	
Cell 3:	Die-offs?	Y/N	Coverage lost (%):	

Notes (Species specific information, general health/density)

<u>Odors</u>

Present? Yes No

If yes, where?
Describe.

<u>Vector Control</u>

Mosquitoes or larvae present? Yes No

If yes, where?
Describe

General Maintenance Checklist

Additional Notes:

Inspect Berms
Inspect Equipment
Inspect Fencing

Treatment System Component Checklist

Cell 1

Check island mooring structures
Islands stable? Yes No

Notes:

Cell 2

Irrigated? Yes No

Notes:

Cell 3

Notes:

Grit and Floatables Removal System

Maintenance Check? Yes No

Screens Checked? Yes No

Grit Storage Chamber Checked? Y/N Emptied? Y/N

Notes: