

## 12 POST-CONSTRUCTION MONITORING

### 12.1 INTRODUCTION

Post-construction monitoring is intended to provide sufficient information to estimate the effectiveness of the control measures constructed during the 20-year implementation phase of the City's CSO Long Term Control Plan Update (LTCPU). It includes measures appropriate for determining the success of the *Green City, Clean Waters* program in achieving the goals of the integrated watershed management plans and in meeting the water quality requirements of the Clean Water Act.

The development and implementation of efforts both to measure the progress of runoff control projects and to monitor the effectiveness of those projects in meeting program objectives is described in Section 10. The continuing regional receiving waters sampling and monitoring described in Section 3 includes measures of water chemistry and living resources. The results of these efforts will be evaluated continuously to facilitate the adaptive management of the City's LTCPU, and will provide a continuous evaluation of program success throughout the 20-year implementation period.

As the LTCPU implementation period draws to a close, PWD will develop a detailed post-implementation status report, including the results of an intensive post-construction monitoring effort. A post-implementation monitoring plan describing the proposed intensive monitoring effort will be submitted to the Pennsylvania Department of Environmental Protection in 2027 for review and approval. That plan will be based on the results of evaluations of the success factor monitoring conducted throughout the LTCPU implementation period, and on water quality parameters monitoring procedures and water quality standards as they exist at that time. The post-implementation intensive monitoring program will take place over the course of a two-year period beginning in 2029 and ending in 2031, resulting in a report documenting the degree of program success based on the metrics that will be prescribed in the monitoring plan, and those that are developed during the period of monitoring.

The efforts to produce the post-implementation status report will need to identify and evaluate critical program success factors. Those success factors require objective, measurable and quantifiable indicators that likely will fall into three categories:

- Administrative
- Control performance
- Receiving water conditions

### 12.2 ADMINISTRATIVE MEASURES

Administrative measures track the implementation and progress of the LTCPU in terms of accounting-based factors recorded on a watershed basis. Examples of accounting-based factors include, by watershed:

- Area greened - area of impervious cover mitigated attributable to the green programs
- Volume of source control storage constructed
- Length and value of stream corridor restored or improved
- Area and value of wetlands created or enhanced
- Habitat area created or restored and associated value
- Annual mass of solid materials removed from storm inlets

- Annual removal of debris from waterways (tons of debris removed)
- Number of projects completed
- Maintenance effort expended
- Private-sector development plans reviewed
- Constructed projects progress compared to implementation schedule
- Running sum of benefits – mass of carbon sequestered/avoided, etc.
- Other measure as appropriate.

## 12.3 CONTROL PERFORMANCE MEASURES

### 12.3.1 Source Control Performance Monitoring

Performance monitoring of structural elements will be integrated into the design of a number of the green stormwater controls constructed during the 20-year LTCPU implementation period. These typically include small monitoring chambers at outflow control points that provide for the installation of devices to record the depth of water in the storage beds over time, and the depth of flow over or through the hydraulic control devices. The monitoring technique tracks the filling and emptying of the storage provided by the stormwater control structure, allowing for evaluations of the effectiveness of the hydraulic control and the effectiveness of the storage and release process, relative to the design goals.

The monitoring and assessment of individual control performance provides valuable information to refine control measure design standards, to refine predictive hydraulic models, and to inform the process leading to decision points in the adaptive management process.

### 12.3.2 Sewer System Monitoring

Continuing the monitoring of the combined sewer system response to precipitation provides a direct measure of the cumulative performance of controls at the sewershed level and provides information for the continuing process of validating the hydrologic and hydraulic models of the sewer system.

The sewer system monitoring that will be available for the post-implementation monitoring efforts will include the following sources at fixed long-term monitoring locations:

- Water Pollution Control Plan influent flow data including hourly flow quantities and daily water quality monitoring of suspended solids, biochemical oxygen demand, and fecal coliform
- Outlying community metering chamber flow data
- Permanent metering of water levels at selected locations such as CSO regulators, along interceptors, and in key locations that control the hydraulic grade line in the system
- Pumping station records

In addition to these sources of data from fixed long-term monitoring locations, PWD's continuous portable flow monitoring program will be focused on the goals of the post-implementation monitoring plan. The plan will detail the portable flow monitoring program design in terms of monitor location; frequency and duration of deployments; and deployment number and schedule over the two year post-implementation monitoring period.

Flow monitoring locations primarily target combined trunk sewers draining sewersheds where stormwater green infrastructure is implemented. PWD will implement a synoptic instrumentation deployment program covering a representative area within selected sewershed drainage areas. The deployment duration goal will be twelve continuous months intended to capture a full range of hydrologic conditions and wet weather event sizes and durations.

The data collected during the post-implementation compliance monitoring period will be evaluated and used to further validate the hydrologic and hydraulic models that in turn will be used to evaluate the effectiveness of the controls.

## **12.4 RECEIVING WATER QUALITY MEASURES**

Receiving water monitoring and sampling will continue to be conducted directly by PWD staff and the United States Geologic Survey (USGS). It is assumed that monitoring and sampling programs conducted by the Delaware River Basin Commission (DRBC) and the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce will continue.

The PWD, through its cooperative agreements with the USGS, will continue to provide hydrologic and water quality monitoring data in the form of continuous 15-minute stream stage measurement and flow estimation, and water quality data, as described in Section 3.

At this point in time, it is not possible to know what degree of monitoring and sampling information will be available from other agencies. The post-implementation plan will identify data necessary to characterize receiving water quality, and to the degree that is not available from other agencies, the plan will be provide for collection of that data by the PWD.