

US EPA ARCHIVE DOCUMENT

APPENDIX D

Post Construction Monitoring Program Performance Criteria

Kansas City, Missouri (“the City”) shall implement the Post Construction Monitoring Program (“PCMP”) as follows:

I. INTRODUCTION TO THE POST CONSTRUCTION MONITORING PROGRAM

The implementation of the PCMP shall provide the data necessary to assess and document the extent to which the performance measures contained within Appendix “A” are being met. The PCMP will also identify and evaluate any improvements in receiving water quality that result from the implementation of the control measures set forth in Appendix “A”. During implementation of the control measures set forth in Appendix “A,” the City shall not reroute any flows in the sewer system for the purpose of meeting the performance criteria other than those measures consistent with the Overflow Control Plan (“OCP”) or as otherwise approved in writing by EPA.

Implementation of the PCMP will allow the City to:

- Measure the effectiveness of green solutions projects in the combined sewer system (“CSS”).
- Measure the effectiveness of infiltration and inflow (“I/I”) reduction efforts, including private inflow source reduction projects in the separate sanitary sewer (“SSS”) area.
- Measure the performance of the High-Rate Treatment (“HRT”) facilities in treating wet weather flows.
- Measure the effectiveness of the control measures set forth in Appendix “A”.
- Update and enhance collection system computer models.
- Provide information to educate the public on the need for implementation of wet weather solutions, and the progress made in achieving program objectives.

Performance monitoring and sampling shall be required at many of the monitoring stations identified and used during the development of the OCP and at additional selected locations to compile the data necessary to support the development of a watershed management plan. The use of these locations will enable comparison of post-construction conditions with baseline conditions determined during the development of the OCP.

Short-term flow monitoring of approximately one to two years' duration before and after project completion and activation will be performed to measure and evaluate the performance of green solutions, programmatic elements, and sewer system improvements for the reduction of wet weather flow volumes and peak flow rates. Green solutions will include demonstration projects and green solutions in support of sewer separation projects. Programmatic elements will include private inflow source reduction. Sewer system improvements include I/I reduction projects in the SSS basins, relief sewer construction in the SSS basins, and sewer separation projects in the CSS basins.

Long-term monitoring of the performance of major constructed facilities will be initiated upon the completion of construction and activation of such facilities. Major constructed facilities include pumping station improvements, wet weather storage tanks and conveyance/storage tunnels, expansions and upgrades of existing wastewater treatment plants ("WWTPs"), and any approved HRT facilities planned for the CSS basins. Long-term monitoring of water quality in the receiving streams will be performed in accordance with the Water Quality Monitoring Plan ("WQMP") described below.

Data collected will be periodically evaluated for the extent to which it serves the City's needs for documentation of compliance with the performance measures. Based on such evaluations, the City may propose modifications of the PCMP to EPA, and shall make such modifications to the PCMP once approved by EPA in writing. Proposed modifications may include addition, elimination, or relocation of monitoring stations; addition or elimination of pollutant parameters; modification of data collection techniques; and modification of data evaluation methods.

II. WATER QUALITY MONITORING PLAN ("WQMP")

A WQMP shall be developed by December 31, 2010, and updated as needed. Monitoring locations for receiving waters may include certain sites used during the development of the OCP, existing WSD water quality sampling sites, and one additional site on each of the following water bodies; Indian Creek, Blue River, and Mill Creek. Data collected by the U.S. Geological Survey, Missouri Department of Natural Resources ("MDNR"), or Kansas Department of Health and Environment ("KDHE") may be utilized for this monitoring.

The monitoring plan will focus on water quality parameters related to potential concerns from combined sewer overflows ("CSO") discharges and upstream pollutant sources as follows:

- Indicator bacteria, notably E. coli;
- Dissolved oxygen concentrations; and
- Aesthetics as measured by observations of floatables, debris, odor, and nuisance algal blooms.

The major objectives of the monitoring plan are:

- Further characterization of baseline water quality conditions prior to the development and implementation of the control measures set forth in Appendix “A”.
- Measurement of changes, if any, in water quality during and after implementation of the control measures set forth in Appendix “A”.

The WQMP shall, at a minimum, be structured to permit an assessment of the impact of CSOs remaining after completion of the control measures listed in Appendix “A” in each basin on the water quality in that basin’s receiving stream. Potential receiving stream water quality monitoring sites are listed in Table 1. The WQMP will define the anticipated schedule for monitoring at each site. It is anticipated that this assessment will not require ongoing water quality sampling of remaining CSOs.

Field measurements and collection of water quality samples will be conducted at the recommended sites on a bi-weekly basis throughout the April 1 – October 31 recreation season. Monitoring will begin April 1, 2011, and will be conducted at approximately the same time of day, on the same day of the week, at each location, to obtain an appropriate representation of storm event and non-event conditions. Monitoring will not be delayed because of weather, except for safety reasons. The monitoring frequency will provide data sufficient to calculate a geometric mean E. coli concentration consistent with applicable water quality standards and for tracking long term trends.

Field measurements recorded at each site will consist of temperature, pH, and dissolved oxygen. Field observations will be recorded for floating debris, submerged debris, algal growth, odor, and recreational use. Samples will be collected and analyzed for conductivity, E. coli, and total suspended solids. Monitoring activities will be conducted in accordance with the WSD’s Quality Assurance Plan which is currently the OCP Water Quality Monitoring Quality Assurance Project Plan; LimnoTech; April 14, 2005.

Table 1 - Potential Receiving Water Monitoring Locations

Site Identifier	Location Description	Rationale for Selection
BC-1	Brush Creek at Belinder St., KS	Characterize upstream water quality
BC-2	Brush Creek at Ward Parkway	Characterize water quality at state line
BC-3	Brush Creek at Rockwell Lane	Characterize impact of CSO and storm water loads
BC-4	Brush Creek at Broadway Street	Characterize impact of CSO and storm water loads
BC-5	Brush Creek at Rockhill Road	Characterize impact of CSO and storm water loads
BC-6	Brush Creek at Prospect Avenue	Characterize impact of CSO and storm water loads
BC-7	Brush Creek at Elmwood Avenue	Characterize cumulative impacts to Brush Creek
TF-1	Town Fork Creek at 51 st Street	Characterize loads from Town Fork Creek
BR-1	Blue River at Bannister Road	Characterize conditions upstream of all Kansas City, Missouri CSOs
BR-2	Blue River at Hickman Mills Dr.	Characterize impact of CSO, storm water, and small tributary loads to Blue River
BR-3	Blue River at Gregory Blvd	Characterize impact of CSO, storm water, and small tributary loads to Blue River
BR-4	Blue River at Blue Parkway	Characterize impact of CSO, storm water, and small tributary loads to Blue River upstream of Brush Creek
BR-5	Blue River at Stadium Drive	Characterize impact of CSO, storm water, and small tributary loads to Blue River
BR-6	Blue River at 23 rd Street	Characterize impact of CSO, storm water, and small tributary loads to Blue River
BR-7	Blue River at 12 th Street	Characterize impact of CSO, storm water, and small tributary loads to Blue River
BR-8	Blue River at train bridge upstream of I-435	Characterize cumulative impacts to Blue River
BR-9	Blue River south of Kenneth Drive, and west of Missouri-Kansas border	Characterize pollutant loads from Johnson County, KS
PV-1	Penn Valley Lake at outlet	Characterize conditions in Penn Valley Lake
MC-1	Mill Creek south of Kenneth Drive, and north of border between Jackson County and Cass County	Characterize Mill Creek pollutant loads tributary to the Blue River
IC-1	Indian Creek north of US Highway 435 in the vicinity of 103 rd Street, and west of Missouri-Kansas border	Characterize pollutant loads from Johnson County, KS
	Kansas River Upstream of outfall W005	At center or east bank of river

390543094363800	Kansas River at Interstate 670	At center or east bank of river
390552094364301	Kansas River below outfall WOO5	At center or east bank of river
390636094361201	Missouri River downstream of Westside WWTP	At center or south bank of river
390642094351901	Missouri River at Hannibal Bridge	At center or south bank of river
39070094335201	Missouri River at Paseo Bridge	At center or south bank of river
390744094280401	Missouri River below Blue River	At center or south bank of river
390745094281000	Missouri River downstream of Kansas River	At center or south bank of river
390815094323101	Missouri River at Riverfront Park	At center or south bank of river
390843094291801	Missouri River downstream of Blue River WWTP	At center or south bank of river

III. PCMP FOR CSO CONTROLS AND MAJOR WET WEATHER FACILITIES

Effectiveness of Sewer System Improvements Projects

Flow metering will be performed as part of sewer system improvements to evaluate flow reduction effectiveness. Sewer system improvements consist of I/I reduction in the SSS area, private inflow source reduction, and sewer separation projects in the CSS area.

Specific details for monitoring programs will be developed as part of the planning for sewer system improvements. This monitoring is expected to be highly project-specific and relatively short term in nature. A detailed monitoring plan for the sewer system improvements shall be submitted in accordance with the schedule contained in Appendix “A”.

CSS, CSO Outfalls, and Major Wet Weather Facilities

Data collected through flow monitoring of selected CSO outfalls, selected collection system locations, and major wet weather facilities, such as pumping station improvements, in-line storage facilities, storage tanks, and conveyance/storage tunnels, shall enable determination of the level of control achieved as performance criteria implementation progresses and will also support:

- Characterization of sewer flow data for evaluation of long-term collection system

performance.

- Collection of information on overflows at critical CSS diversion structures.
- Collection of additional data, such as discharge rates at new pumping facilities and gate positions at the Blue River Wastewater Treatment Plant (“WWTP”), which would assist in optimizing sewer system operations.
- Development of a database of flow data for use in future design efforts related to controlling both CSOs and Sanitary Sewer Overflows (“SSOs”).
- Enhanced operation and maintenance actions to further control wet weather discharges and achieve NPDES permit compliance.

Table 2, set forth below, presents the initially planned suite of flow monitoring locations for selected CSO outfalls and CSS collection system locations. The monitoring locations were selected with an emphasis on the CSS areas for evaluation of sewer system improvements, facilities performance, system operational characteristics, and dry-weather flows in the CSS areas. No reduction or relocation of sites listed in Table 2 will be made without prior written approval from EPA.

Flow monitoring of the selected CSO outfalls and collection system locations listed in Table 2 will be performed beginning April 1, 2011. Monitoring of each major constructed wet weather facility will commence within six months of Achievement of Full Operation of that facility.

A detailed monitoring plan for each of the following major wet weather facilities will be prepared approximately one year prior to the scheduled substantial completion of construction of that facility and submitted in accordance with the schedule contained in Appendix A:

- In the SSS:
 - Storage tank(s) at the 87th Street Pumping Station.
 - Collection system and diverted flows at each downshaft to the North Bank Tunnel System.
 - Deep tunnel pumping station at the downstream end of the North Bank Tunnel System.
 - Expanded Treatment at the Birmingham WWTP.

- In the CSS:
 - Modifications at Blue River WWTP for diversion of up to 80 MGD of primary-plant effluent directly to disinfection facilities for treatment and discharge to the Blue River during wet-weather events.
 - Construction of a 50-MGD wet weather treatment facility with disinfection at Blue River WWTP.
 - HRT facility at the confluence of Brush Creek and the Blue River.
 - Deep tunnel pumping station at the lower end of the Brush Creek/Town Fork Creek CSO storage tunnel.
 - New outfall to Brush Creek at the intersection of the Brush Creek and Town Fork CSO storage tunnels (near existing CSO 030).
 - Deep tunnel pumping station at the lower end of the OK Creek CSO storage tunnel.
 - Reconstructed Turkey Creek Pumping Station.
 - In-line storage gates at the lower end of the existing OK Creek sewer.
 - In-line storage gates at the Santa Fe Pumping Station (CID storm sewers).
 - In-line storage gates and new pumping station at the lower end of the Gooseneck Creek arch.
 - Construction of 30 to 32 MGD enhancement of peak treatment capacity at Westside WWTP.
 - Construction of a 32 MGD HRT/disinfection facility for Turkey Creek Basin.

Table 2 - CSS Flow Metering Sites

Project Area	Area Type	Site ID or Other Designation	Conduit Dimensions [inches or as shown]	Manhole Number	Comment
Middle Blue River					
Middle Blue River	CSS	BR056	15	S097-061	Measurement of flow to Blue River
Middle Blue River	CSS	BR059	6' x 6' box	S147-011	Measurement of Overflow
Middle Blue River	CSS	BR061	48	S097-005	Measurement of Overflow
Middle Blue River	CSS	BR062	12 dry weather line; 54 wet weather line	S106-032 (dry weather line); S106-034 (wet weather line)	Measurement of dry-weather line; and wet weather flow
Middle Blue River	CSS	BR063	60	To be determined	Measurement of Overflow
Middle Blue River	CSS	BR064	2' - 3" x 4' - 0" overflow	S122-206	Measurement of overflow
Middle Blue River	CSS	BR066	24 overflow	S148-039	Measurement of Overflow
Middle Blue River	CSS	BR067	96	S148-051	Measurement of Overflow
Middle Blue River	CSS	BR069	5' - 8" x 5' - 8" DB	S128-356	Measurement of Overflow
Brush Creek					
Brush Creek	CSS	BR008	72	S078-174	Stormwater separation
Brush Creek	CSS	BR026	48	S082-010	Provides Q from all Town Fork prior to discharge into BRIS.
Brush Creek	CSS	BR030	78	S082-053	Represents a large portion of the Brush Creek basin before discharge to the Blue River Interceptor Sewer (BRIS)
Brush Creek	CSS	BR017	88	S079-219	Diversion structure located in vicinity of Plaza.
Brush Creek	CSS	BR018	12'x6'	S079-640	Diversion structure located in vicinity of Plaza.
Brush Creek	CSS	BR021	24	S080-620	Diversion structure located in vicinity of Plaza.
Town Fork Creek					
Town Fork Creek	CSS	BR090	7' - 3" x 10' - 6" DB	S104-351	Major outfall
Town Fork Creek	CSS	BR090	36	S104-264	Represents a large portion of the Town Fork Creek basin.
Lower Blue River					
Lower Blue River	CSS	BR036	60	S048-800	Overflow at BRIS
Lower Blue River	CSS	BR037	24	S059-009	Overflow at BRIS
Lower Blue River	CSS	BR039	24	S059-001	Overflow to combined sewer outfall
Lower Blue River	CSS	BR040	72	S073-037	Overflow to Parrish Creek
Lower Blue River	CSS	BR054	30	S048-058	Downstream of sewer separation area
Lower Blue River	CSS	BR034	102	S035-431	At lower end of Basin within the BRIS
Lower Blue River	CSS	BR039	36	S058-077	Tributary area into BRIS at the midpoint of this basin.
Lower Blue River	CSS	BR037	96x96 egg	S082-166	At mid-point of BRIS from several upstream CSS basins.
Lower Blue River	CSS	BR055	33	S059-030	Overflow to Blue River
Lower Blue River	CSS	BR036	60	S048-120	BRIS overflow
Gooseneck Creek					
Gooseneck Creek	CSS	BR032	39 to 48	S024-209	Overflow to Blue River
Gooseneck Creek	CSS	BR033	64	S024-091	CSS Interceptors
Gooseneck Creek	CSS	BR033	NA	S024-087	BRIS overflow

(Cont'd. next page)

Table 2 (Cont'd) - CSS Flow Metering Sites

Project Area	Area Type	Site ID or Other Designation	Conduit Dimensions [inches or as shown]	Manhole Number	Comment
Turkey Creek					
Turkey Creek/CID	CSS	W005	15'-8" x 15'	S053-127	CSS Interceptors
Turkey Creek/CID	CSS	W005	15'-8" x 15'	S053-127	CSS Interceptors
Turkey Creek/CID	CSS	W005	18' H x 17' W	S053-018Sa	Turkey Creek Pump Station overflow.
Turkey Creek/CID	CSS	W005	18' H x 17' W	S053-018Sa	Turkey Creek Pump Station overflow.
Turkey Creek/CID	CSS	W003	60	S029-811	Westside WWTP outfall
Turkey Creek/CID	CSS	W003	120	S029-820	Santa Fe Pump Station overflow
Turkey Creek/CID	CSS	W002	48	S029-058	Broadway Avenue outfall
Turkey Creek/CID	CSS	W006	24	S055-290	Upstream of Penn Valley Lake
NEID					
NEID	CSS	BR071	18	S028-035	Delaware St. outfall
NEID	CSS	BR072	78	S028-302	Main St. outfall
NEID	CSS	BR073	42	S028-954	Gillis Avenue outfall
NEID	CSS	BR074	72	S027-860	Lydia Avenue outfall
NEID	CSS	BR075	84	S009-017	Prospect Avenue pump station outfall
NEID	CSS	BR076	6' H x 8' W	S006-801	Milwaukee/Choteau outfall
NEID	CSS	BR077	52	S028-955	Holmes Avenue outfall
NEID	CSS	BR100	102 x 114 Horseshoe	S024-807	One of the bypasses at the Blue River WWTP influent box. Install at 1/3 points
NEID	CSS	BR031	42	S023-844	Near Blue River WWTP, overflow to Blue River

For each CSS basin, following implementation of the CSO control measures listed in Appendix "A", the City shall conduct activation monitoring at all CSO outfalls in that basin to determine the number of activation events at each CSO outfall, and submit the activation information to EPA in the Annual Reports. Such activation information shall be submitted as an actual number of events as well as using the City's collection system hydraulic model to correlate system performance to the "typical year" identified in the OCP.

IV. OTHER MONITORING

The PCMP for CSO controls and other major wet weather facilities will augment WSD's existing wastewater system monitoring. The City shall implement the following additional monitoring:

Satellite Communities

Flow meter data collected from satellite communities that contribute substantial discharges to the City's wastewater collection systems will be used to improve and maintain

calibration of the City's collection system hydraulic models in the SSS. Those models will be used in the assessment of compliance with the performance measures, particularly but not limited to I/I reduction initiatives and sewer system improvements in SSS basins. At present, the majority of wastewater flows received from the City of North Kansas City, Missouri, the City of Liberty, Missouri, and Johnson County, Kansas are metered.

In addition, the majority of flows discharged from the City's collection system to the Little Blue Valley Sewer District ("LBVSD") is metered by LBVSD. That meter data will also be used to assess performance of I/I reduction efforts in the City's Little Blue Valley Basin in the SSS.

If necessary, adjustments or additions to flow meter locations will be negotiated with the various satellite communities.

Supervisory Control and Data Acquisition (SCADA)

The wastewater utility capital improvement program includes expansion and enhancement of the wastewater SCADA system. That expansion will emphasize control and data acquisition at the various existing pumping stations and at the WWTPs.

Flow Metering at Pumping Stations

The wastewater utility capital improvements program includes additional or significant improvement of flow metering capabilities at the following major pumping stations, all of which will provide key data for the long-term assessment of the performance criteria and overall system compliance with the performance measures:

- 87th Street Pumping Station (discharges to the BRIS).
- Round Grove Pumping Station (discharges to the BRIS).
- Santa Fe Pumping Station (discharges to the Westside WWTP).
- NEID Pumping Station (discharges to the Blue River WWTP).
- Line Creek Pumping Station (discharges to both the Westside WWTP and the Hillside Bond Sewer in the Line Creek/Rock Creek basin).
- Buckeye Creek Pumping Station (discharges to the NEID interceptor).
- Birmingham Pumping Station (discharges to Birmingham WWTP).

V. RAINFALL MONITORING

Rainfall monitoring is an essential component of the PCMP. Detailed analysis of precipitation data is necessary to fully evaluate compliance with the performance measures. Precipitation data of interest consist of total rainfall depth, duration, intensity, and event distribution.

Rainfall data will be compiled and analyzed as part of the PCMP. The source of rainfall data is planned to be the City's ALERT flood warning system ("FWS"), which presently consists of 44 rain gauges spaced throughout the City's service area. Rainfall data collected by the ALERT FWS will be used for analysis in connection with other post-construction, monitoring data.

VI. DATA MANAGEMENT

The City has developed a Data Management System ("DMS") and associated protocols for the storage, management, retrieval, and analysis of all data of importance in assessment of the performance of the City's collection system.

VII. QUALITY CONTROL

Quality control and quality assurance procedures and protocols prepared as part of the development of the OCP will continue to be used for the implementation of the PCMP. The relevant documents are:

- Appendix A of Administration Manual; OCP; 2005
- Water Quality Monitoring Quality Assurance Project Plan; OCP; April 14, 2005.

The City shall update the quality control and quality assurance procedures and protocols from time to time as appropriate. All monitoring plans shall incorporate the procedures and protocols available at the time of submittal.

VIII. ANALYSIS, PROGRESS REPORTING, AND COMPLIANCE DEMONSTRATION

Data from the PCMP will be used to evaluate the performance and effectiveness of the

control measures set forth in Appendix “A”.

Data from the PCMP shall be used to update and improve calibration and verification of the City’s collection system models. The updated collection system models will be used to demonstrate compliance with both the Percent Capture of Wet Weather flows and Performance Criteria as set forth in Appendix “A” using the same design storms and design typical year hyetograph used in development of the OCP. Due to the inherent 20 percent variability in model predictions, the Performance Criteria of six “Typical Year” Overflow Events for the Brush Creek Basin shall be met if the City demonstrates seven or fewer such events using the updated collection system models and rainfall patterns used to develop the design storms. Also, the Performance Criteria of seven “Typical Year” Overflow Events for the Lower Blue River, Middle Blue River, and Town Fork Creek basins, and Outfall W005 shall be met if the City demonstrates eight or fewer such events using the updated collection system models and rainfall patterns used to develop the design storms.

The results and progress of the PCMP will be reported to the EPA in the Annual Report and as set forth in Section IX of the Consent Decree. This progress report will include a summary of CSS basin performance to-date, consisting of:

- CSO and collection system sampling and flow monitoring data.
- Rainfall data.
- Receiving water monitoring results.
- Flow monitoring for green solutions, programmatic elements, sewer system improvements, and pilot facilities.
- Flow monitoring and sampling results for major wet weather facilities.
- Re-evaluation of collection system hydraulic models to confirm continued acceptable calibration. Necessary model modifications, re-calibration, and re-verification will be indicated and documented.
- Identification and documentation of deficiencies and performance limitations.
- Identification and documentation of proposed supplemental remedial measures.