Nine Minimum Control Plan

WASTEWATER DIVISION

CAPITAL REGION | WATER™

March 2024
v.10.0

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History of Capital Region Water

Capital Region Water (CRW) began its life in 1957 as the Harrisburg Sewerage Authority, a government agency created with the purpose of financing projects related to the City's sewers. In 1987, Harrisburg amended the Sewerage Authority's articles of incorporation, converting it to the Harrisburg Water and Sewer Authority. The purpose of the new authority was still broadly within the confines of the original authority, borrowing for public projects that encompassed drinking water as well as sewerage. In 1990, the City modified the Authority again, changing it to a "general purpose" authority and rechristened it as the Harrisburg Authority.

In January 2012, the City entered Act 47, the state program for distressed municipalities, and City Council received financial recovery plans submitted by both the state-appointed coordinator and the mayor. Even before the City entered Act 47, Authority leaders had contemplated turning the Harrisburg Authority into an operating authority for the water and sewer systems. It was believed if the various components of the sewer and water utilities could be combined, and the Authority could take over their operation, then a major burden could be lifted from the City while retaining local control. On August 26, 2013, the City Receiver filed his recovery plan for the City, which was nicknamed the Harrisburg Strong Plan. Among its provisions was the creation of the new Authority—an owner and operator of the water and sewer systems, under the control of a locally appointed board. Following a vote by City council, its name was changed from the Harrisburg Authority to Capital Region Water.

In late 2013, CRW took over the City's sewer and water systems as part of the Harrisburg Strong Plan. CRW was faced with the challenge of knowing the City's sewer collection systems had suffered from years of deferred maintenance. Updated sewer maps would need to be created from original City paper sewer drawings, supplemented by field investigations, and utilizing a Geographic Information System (GIS) database to manage the sewer system information. Decades of deposited debris and solids would need to be cleaned from the collector sewers, and subsequent closed circuit television (CCTV) inspections would need to be conducted to ascertain the condition of the sewers and identify any significant rehabilitation needs. Catch basins that had become clogged and structurally deteriorated would need to be cleaned and reconstructed. CRW expanded the labor force dedicated to the operation and maintenance of the sewer system and began to develop a plan to identify urgent needs and mitigate the impacts of decades of deferred maintenance under the City.

Regulatory Context for the Nine Minimum Control Plan

The nine minimum controls (NMCs) are identified in the Combined Sewer Overflow (CSO) Control Policy as minimum technology-based controls that can be used to address CSO problems without extensive engineering studies or significant construction costs, prior to the implementation of long-term control measures[1]. The CSO Policy required communities with combined sewer systems to document their implementation of the NMCs by January 1, 1997. Under Paragraph 11 of the partial Consent Decree (CD), the United States Environmental Protection Agency (EPA) directed CRW to

[1] Guidance for Nine Minimum Controls, EPA Office of Water, May 1995

prepare, submit, and annually update a *Nine Minimum Controls Plan* (NMC Plan) rather than the documentation of NMC implementation required under the CSO policy. In doing so, EPA recognized the extensive amount of investigative and remedial work that must be completed before CRW will be in a position to fully implement all aspects of the NMCs.

This NMC Plan is divided into two categories for each NMC activity:

1. Documentation of Current Control Practices
2. Plan for Completing Implementation of Minimum Control Practices

CRW also implemented an Operation and Maintenance (O&M) program for inspecting and maintaining the combined and separate sanitary sewer systems and their related facilities. The details of the current O&M program are provided in CRW's Operation & Maintenance Manual (OMM), which describes the current O&M practices for CRW employees. The OMM is a key reference document for this NMC Plan. In particular, NMC-1 summarizes the majority of the OMM contents as they relate to fulfillment of the recommended measures. CRW's OMM is also updated annually as implementation of its O&M program proceeds.

Requirements of the National CSO Control Policy

The EPA National CSO Control Policy outlines the following Nine Minimum Controls:

1. Proper operation and regular maintenance programs for the sewer system and CSO outfalls
2. Maximum use of the collection system
3. Review and modification of pretreatment requirements to ensure that CSO impacts are minimized
4. Maximization of flow to the POTW for treatment
5. Elimination of CSOs during dry weather
6. Control of solid and floatable materials in CSOs
7. Pollution prevention programs to reduce contaminants in CSOs
8. Public notification to ensure that the public received adequate modification of CSO occurrences and CSO impacts
9. Monitoring to effectively characterize CSO impact and the efficacy of CSO controls

The CSO policy and guidance documents require the evaluation and documentation of the current level of implementation of the NMCs within the combined collection system.

Requirements of CRW's NPDES Permit

CRW's National Pollution Discharge Elimination System (NPDES) Permit (Section V-A) requires CRW to continue the implementation of the NMCs, demonstrate system-wide compliance with the NMCs, and submit discharge monitoring reports and annual reports to the Pennsylvania Department of Environmental Protection (PADEP).

Requirements of the Modified Partial Consent Decree

CRW's modified partial CD (August 2023) outlines specific additional elements for CRW to address in its NMC Plan and its OMM as CRW progresses with the vast amount of remedial work that is required for the combined and sanitary sewer systems.

- Evaluate and document the "Conveyance and Collection Systems," which include both the combined and separate sanitary sewer systems.
- Develop an implementation schedule for actions necessary for achieving full compliance with all aspects of the NMC elements of the CSO policy. In this annual update to the NMC Plan, the modifications incorporated in the Plan are shown in redline format.
- Provide annual NMC Plan Updates, which will now be submitted by March 31st each year.
- Maintain and implement a CSO OMM for the conveyance and collection systems, describing the Standard Operating Procedures (SOPs) and schedules for the remedial and routine operation, inspection, and maintenance activities it conducts in compliance with the NMCs. The subsequent OMM Updates were submitted to the regulatory agencies with the Chapter 94 Reports by March 31st each year, in accordance with the partial CD.
- Submit semi-annual reports that document the work completed within the preceding six months for NMC compliance, as well as a projection of work to be performed in the succeeding six month period.

Summary of the NMC Plan

CRW has prepared the following table summarizing this NMC Plan. It includes:

- A list of required actions under the NMC Plan, accompanied by the NMC Plan section addressing each action
- A reference to the section of EPA's NMC Guidance and/or the modified partial CD paragraph that more fully defines the required action (a more detailed table of these requirements is provided at the beginning of each NMC Plan section).
- A bulleted summary of the current level of implementation of the required action
- A bulleted summary, with anticipated compliance dates where known, for any additional actions necessary to achieve compliance
- Supporting documentation (e.g. the OMM section) documenting CRW's current level of implementation

CRW encourages EPA/PADEP to use this summary table as a checklist defining the current compliance status of CRW's NMCs and when full compliance will be reached (if known at this time).

Nine Minimum Control (NMC) Plan Summary Table for Capital Region Water's Combined Sewer System

Required Actions	Source of Requirement		Current Level of Implementation	Actions Necessary for Achieving Compliance		Supporting Documentation
	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
NMC-1: Proper Operation and Regular Maintenance Programs						
1.1: Regulatory Context						
1.2: Organization, Planning & Budget						
1.2.1: Organization and Responsible Staff	2.1	---	▪ Developed organizational structure ▪ Increased involvement of wastewater superintendent to provide comprehensive oversight in a single position ▪ Hired additional staff to support remedial work; refined field maintenance and operations structure, Headworks at AWTF	▪ Expand/refine the existing org chart	Annually every Mar 31st	
1.2.2: Resources Allocated to O&M Activities	2.1	C(10)(a)	▪ Wastewater Division completed level of effort analysis for remedial work and future preventative maintenance ▪ CRW budget defines O&M resources	▪ Assess human and equipment resources ▪ Develop O&M budget	Annually every Dec. 31st Annually every Dec. 31st	See OMM Section 4.12 See Appendix B
1.2.3: Remedial Work Prioritization	2.1	C(10)(a)	▪ Implemented priority remedial work system, including criticality criteria analysis	▪ Review, refine, apply prioritization criteria	Annually every Mar 31st	
1.2.4: Equipment Purchase Prioritization	2.1	C(10)(a)	▪ Implemented priority equipment purchase system	▪ Review, refine, apply prioritization criteria	Annually every Dec. 31st	
1.2.5: O&M Program Review and Revision	2.1	C(10)(a)	▪ Prepared O&M review, revision protocol ▪ Implemented revisions to O&M program to incorporate Cityworks and new SOPs	▪ Review, revise O&M program	Annually w/ submission on Mar. 31st w/ Ch. 94 Rpt.	
1.3: System Organization and Priorities						
1.3.1 Critical Facilities Definition	2.1	C(10)(a)	▪ CRW interceptors, CSO regulators, and pump stations within the conveyance system are defined as critical. ▪ Collection system manholes were inspected for use in determining critical sections of the collection system ▪ Critical collection system elements are represented in H/H model	▪ Review, refine, apply prioritization criteria	Annually every Mar 31st	See OMM Section 3.1 & 3.3
1.3.2: Critical Equipment Definition	2.1	C(10)(a)	▪ Current critical equipment list prepared; updated per recent purchases	▪ Update critical equipment list	Annually every Mar 31st	See OMM Section 3.2 & 3.4
1.3.3: Sewershed / Catchment Delineation	---	C(10)(a)	▪ Preliminary sewershed delineation complete; sewershed boundaries revised if necessary based on collection system manhole inspection	▪ Refine catchment delineation to reflect new information from systemwide CCTV inspection	Ongoing	
1.3.4: System Characterization and Mapping	---	C(10)(a)	▪ GIS of conveyance system complete ▪ Updated GIS of collection system based on manhole inspection data	▪ Continue to refine collection system GIS based from systemwide CCTV inspection	Ongoing	
1.4: O&M of CSO Regulator Structures						
1.4.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Each regulator inspected daily ▪ Prepared CAMP Study Plan ▪ Completed CAMP Study	▪ Continue existing daily regulator inspections ▪ Address CAMP recommendations during design of future regulator enhancement projects under LTCP implementation.	Ongoing Ongoing	See OMM Section 4.1.2 to 4.1.6 See CAMP Study Plan, CBH2OPP (LTCP)
1.4.2: Remedial Repair Procedures / Schedules	2.1	---	▪ Corrective maintenance performed per inspections	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM, Section 4.1.4
1.4.3: Maintenance Procedures / Schedules	2.1	---	▪ Preventive maintenance performed annually	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM, Section 4.1.7
1.4.4: Documentation Procedures	2.1	C(10)(a)	▪ Activities recorded in Interceptor Service Reports ▪ Cityworks O&M documentation for field work	▪ Continue to update Cityworks for future process changes & regulatory requirements	Ongoing	See OMM, Section 4.1.8
1.5: O&M of Outfalls / Backflow Prevention						
1.5.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Current inspections of diversion weirs/CSO outfalls ▪ Performed CD-required inspections of outfalls to assess structural condition / gate integrity ▪ Initiate gate inspections prior to predicted flood conditions	▪ Perform river intrusion inspections for key locations	Ongoing	See CD Par (G)(31)(c) for inspection requirements See OMM Section 4.2.3 to 4.2.6

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Required Actions	Source of Requirement		Current Level of Implementation	Actions Necessary for Achieving Compliance		Supporting Documentation
	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
1.5.2: Remedial Repair Procedures / Schedules	2.1	G(31)(c)	▪ Work done as identified by existing inspections ▪ Evaluated outfall/gate condition and susceptibility to river intrusion ▪ Defined near-term CSO outfall/regulator reconfiguration strategy for CSOs with <1-yr freeboard ▪ Incorporated river intrusion protection into Front St. PS rehab	▪ None: current approach complies with NMC requirements ▪ Address potential river intrusion during design of future regulator enhancement projects under baseline CBH2OPP implementation. ▪ Implement repairs/replacement for CSOs in critical condition ▪ Replace flap gates for identified outfalls	Ongoing Ongoing Ongoing Ongoing	See OMM Section 4.2.4 CBH2OPP (LTCP)
1.5.3: Maintenance Procedures / Schedules	2.1	---	▪ Preventive maintenance performed annually. ▪ Performed debris removal identified during inspections	▪ Semi-annual gate exercising and maintenance for all gates	Ongoing	See OMM Section 4.2.7
1.5.4: Documentation Procedures	2.1	C(10)(a)	▪ Activities recorded in Cityworks	▪ Continue to update Cityworks for future process changes & regulatory requirements	Ongoing	See OMM Section 4.2.8
1.6: O&M of Interceptors						
1.6.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Comprehensive inventory/inspection completed in 2014; post cleaning inspection completed in 2016	▪ Repeat inspections every 5 years following interceptor rehabilitation	Varies based on cleaning and rehab schedule	See OMM, Section 4.4.3
1.6.2: Remedial Repair Procedures / Schedules	2.1	C(10)(a)	▪ Asylum Run Interceptor rehabilitation completed ▪ Front Street Ph. 1 Interceptor completed	▪ Rehabilitate Paxton Creek Interceptor ▪ Rehabilitate Front Street Ph 2 Interceptor ▪ Rehabilitate Spring Creek Interceptor (in conjunction w/ Spring Creek PS project)	2032 2023 TBD	See OMM, Section 4.4.5
1.6.3: Maintenance Procedures / Schedules	2.1	C(10)(a)	▪ 33,500 ft sewer cleaning identified in 2014; completed cleaning in February 2017	▪ Monitor debris levels in interceptor manholes	Ongoing	See OMM, Section 4.4.4
1.6.4: Documentation Procedures	2.1	C(10)(a)	▪ Activities recorded in Cityworks	▪ Continue to update Cityworks for future process changes & regulatory requirements	Ongoing	See OMM, Section 4.4.6
1.7: O&M of Pump Stations						
1.7.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Inspected daily, seven days a week	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM Section 4.3.2
1.7.2: Remedial Repair Procedures / Schedules	2.1	C(10)(a)	▪ Remedial repairs done as needed and as identified by daily inspections ▪ Completed Front Street Pump Station upgrade	▪ Spring Creek Pump Station upgrade	TBD	
1.7.3: Maintenance Procedures / Schedules	2.1	C(10)(a)	▪ Routine, scheduled preventive maintenance	▪ Develop O&M program for rehabilitated Front Street PS	To Be Determined	See OMM Section 4.3.4.11, 4.3.5.11, 4.3.8
1.7.4: Documentation Procedures	2.1	C(10)(a)	▪ Activities recorded in Operations Log ▪ Enhanced tracking and reporting via Cityworks	▪ Continue to update Cityworks	Ongoing	See OMM Section 4.3
1.8: O&M of Force Mains						
1.8.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Periodic inspections by walking force main length ▪ Conducted internal inspection of all force mains	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM Section 4.5.3
1.8.2: Remedial Repair Procedures / Schedules	2.1	C(10)(a)	▪ Force main in good condition, no remedial repair required	▪ None: current approach complies with NMC requirements	Not Applicable	
1.8.3: Maintenance Procedures / Schedules	2.1	---	▪ Exercise air release valves semi-annually	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM Section 4.5.4
1.8.4: Documentation Procedures	2.1	C(10)(a)	▪ Commenced Cityworks O&M documentation for field work	▪ Expand reporting via Cityworks	Ongoing	See OMM Section 4.5.5
1.9: O&M of Collection System Sewers						
1.9.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Routine inspection of "hot spots" and at each regulator chamber ▪ Prioritized systemwide CCTV inspections underway ▪ Conducted rapid inspection of each manhole, sewer segment with pole camera; completed manhole inspection data review	▪ Perform systemwide CCTV inspection	June 30, 2025	See OMM Section 4.6.3
1.9.2: Remedial Repair Procedures / Schedules	2.1	C(10)(a)	▪ Limited reactive repairs as follow-up from customer complaints ▪ Schedule required remedial activities	▪ Develop rehabilitation project schedule from CCTV inspections	Ongoing	See OMM Sections 4.6.5, 4.6.6
1.9.3: Maintenance Procedures / Schedules	2.1	C(10)(a)	▪ As required and identified from inspections and customer complaints	▪ Refine and improve existing maintenance procedures and schedule via Cityworks	Ongoing	See OMM Section 4.6.4
1.9.4: Documentation Procedures	2.1	C(10)(a)	▪ Cityworks O&M documentation for field work	▪ Expand reporting via Cityworks	Ongoing	See OMM Section 4.6.7

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	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
1.10: O&M of Inlets / Catch Basins						
1.10.1: Inspection Procedures / Schedules	2.1	C(10)(a)	▪ Reactive inspections as follow-up from documented customer complaints ▪ Completed initial inlet cleaning and inspection	▪ Inlet inspections every three years	Complete; Ongoing	See OMM Section 4.7.4
1.10.2: Remedial Repair Procedures / Schedules	2.1	C(10)(a)	▪ Initial repairs performed from inspections	▪ Continued work done as needed as follow-up from inspections	Complete; Ongoing	
1.10.3: Maintenance Procedures / Schedules	2.1	C(10)(a)	▪ Inlet cleaning conducted as follow-up from documented customer complaints	▪ Current reactive maintenance program evolves to a scheduled preventive maintenance program	To Be Determined after remedial cleaning	See OMM Sections 4.7.5, 4.7.6
1.10.4: Documentation Procedures	2.1	C(10)(a)	▪ Cityworks O&M documentation for field work	▪ Expand reporting via Cityworks	Ongoing	See OMM Section 4.7.7
1.11: Source Investigations						
1.11.1: Food service grease traps	---	C(10)(a)	▪ See NMC-3	▪ See NMC-3	See NMC-3	
1.11.2: Non-Domestic waste streams	---	C(10)(a))	▪ See NMC-3	▪ See NMC-3	See NMC-3	
1.11.3: Floatables, Solids, Blockages	---	C(10)(a))	▪ See NMC-6	▪ See NMC-6	See NMC-6	
1.11.4: Sinkholes	---	C(10)(a)	▪ Reactive inspections as follow-up from customer complaints or public works reports ▪ Corrective measures implemented as follow-up from completed inspections and investigations ▪ Complete remediation of sinkholes known at CD Date of Lodging	▪ Continued reactive inspections from enhanced customer complaint tracking system	Ongoing	See Appendix C
1.12: Emergency Response Procedures						
1.12.1: Citizen Complaints / Service Requests	2.1	C(10)(a)	▪ Three methods of emergency response reporting available; existing protocols and procedures available ▪ Provided emergency protocol for typical emergencies ▪ Cityworks documentation	▪ Expand reporting via Cityworks	Ongoing	See OMM Section 4.10
1.12.2 Emergency Maintenance	2.1	C(10)(a)	▪ Emergency response protocol is in place with contact numbers	▪ None: current approach complies with NMC requirements	Not Applicable	See OMM Section 4.8 & 4.9
1.13: Training Policies and Procedures	2.1	C(10)(a)	▪ Existing training procedures and classes ▪ Implemented NMC training	▪ Consider enhancements to existing training	[1]Annually every Aug. 10th	See OMM Section 4.11
1.14: Periodic Review of O&M Plans	2.1	C(10)(a)	▪ NMC Plan & OMM preparation	▪ Annual updates to NMC Plan and OMM	Annually	OMM
NMC-2: Maximum Use of the Collection System for Storage						
2.1: Regulatory Context						
2.2: Combined Sewer System Inspection	3.1	C(10)(b)	▪ See NMC 1.4.1, 1.5.1, 1.6.1, 1.7.1, 1.8.1, 1.9.1, 1.10.1	▪ See NMC 1.4.1, 1.5.1, 1.6.1, 1.7.1, 1.8.1, 1.9.1, 1.10.1	See NMC 1.4.1, 1.5.1, 1.6.1, 1.7.1, 1.8.1, 1.9.1, 1.10.1	See OMM Sections 4.1, 4.2, 4.3, 4.4, and 4.9
2.3: Reduce River Intrusion	---	C(10)(b)	▪ See NMC 1.4, 1.5	▪ See NMC 1.4, 1.5	See NMC 1.4, 1.5	See OMM Sections 4.1, 4.2
2.4: Adjustment of Regulator Settings	3.1	C(10)(b)	▪ Developed H&H Model to assess settings; calibrated H&H model ▪ Confirmation inspections and enhanced documentation for existing regulator settings ▪ Characterized existing system performance ▪ Define initial cost-effective regulator adjustments ▪ Implemented Phase 1A regulator modifications	▪ Implement recommended regulator enhancement projects under baseline CBH2OPP implementation. Proceed with Phases 1B, 2, and 3 following completion of other system improvements.	Ongoing	CBH2OPP (LTCP)
2.5: Installation of In-System Controls	3.1	---	▪ Developed H&H Model to assess in-system controls; calibrated H&H model ▪ Characterized existing system performance ▪ Define cost-effective in-system controls, if any ▪ Implemented Phase 1A regulator modifications	▪ Implement decentralized green-grey stormwater controls within collection system as defined under CBH2OPP. Proceed with Phases 1B, 2, and 3 following completion of other system improvements.	Ongoing	CBH2OPP (LTCP)
2.6: Removal of Obstructions to Flow	3.1	C(10)(b)	▪ See NMC 1.6.3, 1.9.2, 1.10.2	▪ See NMC 1.6.3, 1.9.2, 1.10.2	See NMC 1.6.3, 1.9.2, 1.10.2	See OMM Sections 4.4.4, 4.6.5, 4.7.5
2.7: Effectiveness Evaluation	---	C(10)(b)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	[1]Annually every Aug. 10th	

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Required Actions	Source of Requirement		Current Level of Implementation	Actions Necessary for Achieving Compliance		Supporting Documentation
	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
NMC-3: Review and Modification of Pretreatment Requirements						
3.1: Regulatory Context						
3.2: Inventory Non-Domestic Dischargers						
3.2.1: Existing Pre-Treatment Program	4.1	---	▪ Regulate existing list of eight industrial dischargers ▪ Reviewed potential facilities for incorporation in pretreatment program	▪ Continue to identify specific facilities with high-risk of wet weather discharge to add to pre-treatment program	Ongoing	
3.2.2: Other Non-Domestic Dischargers	4.1	---	▪ Performed categorical risk assessment of non-domestic land uses, activities of concern in City of Harrisburg ▪ Expanded FOG program w/ informational website; developed FOG registry, applications, permits, and guidance; conducting facility inspections	▪ Continue to identify specific facilities, activities, and areas with moderate-risk of wet weather discharge for education, surveillance ▪ Continue to implement the new FOG program	Ongoing Ongoing	See Appendix D
3.3: Assess Impact of Non-Domestic Discharges	4.1	---	▪ CRW enforces pretreatment requirements at eight industrial dischargers ▪ Established protocol with City for inspections ▪ Establish legal authority to inspect and regulate high-risk facilities, activities, and areas	▪ Develop, implement inspections/enforcement in moderate-risk areas	To Be Determined	
3.4: Evaluate Feasible Modifications	4.1	---	▪ Not scheduled for implementation	▪ Evaluate Feasible Pretreatment Program Modifications ▪ Evaluate Feasible Modifications for Other Non-Domestic Dischargers	Ongoing Ongoing	
3.5: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	Annually every Mar 31st	
NMC-4: Maximization of Flow to POTW						
4.1: Regulatory Context						
4.2: Utilize Full Capacity of Conveyance System						
4.2.1: Restore Full Capacity via O&M	5.1	C(10)(c)	▪ Systemwide data collection (see NMC Sections 1.4.1, 1.5.1, 1.6.1, 1.7.1, 1.8.1, 1.9.1, and 1.10.1)	▪ Systemwide remedial cleaning and repair (see NMC Sections 1.4.2, 1.5.2, 1.6.2, 1.7.2, 1.8.2, 1.9.2, 1.10.2)	See NMC-1	See OMM Section 4
4.2.2: Adjust Conveyance System Operation	---	C(10)(c)	▪ Developed H&H Model to assess system capacity; calibrated H&H model; characterized existing system performance ▪ Analyzed contributing flows ▪ Define initial cost-effective regulator adjustments ▪ Completed Front Street Pump Station upgrade ▪ Implemented Phase 1A regulator modifications	▪ Implement recommended regulator enhancement projects Appendix B of modified partial CD. Proceed with Phases 1B, 2, and 3 following completion of other system improvements.	Complete/Ongoing	CBH2OPP (LTCP)
4.2.3: Reduce Infiltration / Inflow	---	C(10)(c)	▪ Conduct flow monitoring to characterize wet weather inflows from suburban communities ▪ Prepared Capacity Assessment Report; no significant I/I reductions recommended	▪ None: current approach complies with NMC requirements	See NMC 1.9.1	See Par. (E)(30)(c) of Partial CD
4.3: Optimize Wet Weather Performance of AWTF						
4.3.1: Analyze Existing AWTF Performance	5.1	C(11)	▪ Assessment performed in CBH2OPP	▪ Implement recommended AWTF enhancement projects under Appendix B of modified partial CD.	Ongoing	CBH2OPP (LTCP)
4.3.2: Assess Use of Unused Facilities	5.1	C(11)	▪ Assessment performed in CBH2OPP	▪ Implement recommended AWTF enhancement projects under Appendix B of modified partial CD.	Ongoing	CBH2OPP (LTCP)
4.4: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	Annually every Mar 31st	
NMC-5: Elimination of CSOs during Dry Weather						
5.1: Regulatory Context						
5.2: DWO Inspections / Assessment / Reporting	6.1	C(10)(d)	▪ See NMC 1.4.1, 1.4.4	▪ See NMC 1.4.1, 1.4.4	See NMC 1.4.1, 1.4.4	See OMM Section 4.1
5.3: DWO Corrective Actions						

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Required Actions	Source of Requirement		Current Level of Implementation	Actions Necessary for Achieving Compliance		Supporting Documentation
	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
5.3.1: Regulator / Gate Controls	6.1	C(10)(d)	▪ See NMC 1.4 and 1.5	▪ See NMC 1.4 and 1.5	See NMC 1.4, 1.5, 1.9, 2.4	See OMM Sections 4.1, 4.2, 4.6
5.3.2: Receiving Water Cleanup	6.1	C(10)(d)	▪ See NMC 6.4	▪ See NMC 6.4	Not Applicable	See OMM Section 4.2
5-3: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	[1]Annually every Aug 10th	
NMC-6: Control of Solid and Floatable Materials						
6.1: Regulatory Context						
6.2: O&M of Combined Sewer System	---	C(10)(e)	▪ See NMC-1.4, 1.5	▪ See NMC-1.4, 1.5	See NMC 1.4, 1.5	See OMM Sections 4.1, 4.2
6.3: Evaluate/Define/Implement Corrective Actions						
6.3.1: Pollution Prevention	7.5	C(10)(e)	▪ See NMC-7	▪ See NMC-7		
6.3.2: Collection System Controls	7.1	C(10)(e)	▪ Maintain existing sewer hoods in inlets and catch basins (see NMC 1.10)	▪ Incorporate decentralized green grey stormwater controls within collection system as defined under CBH2OPP ▪ Install hoods, baffles, or Type C inlet tops on inlets without existing floatables control	Ongoing Ongoing	See OMM Section 4.10, CBH2OPP (LTCP)
6.3.3: End-of-Pipe Controls	7.1	C(10)(e)	▪ None	▪ Address floatable control during design of future regulator enhancement projects under baseline CBH2OPP implementation.	Ongoing	CBH2OPP (LTCP)
6.4: Receiving Water Cleanup	7.3	C(10)(e)	▪ Removal of residual solid and floatable materials along shoreline	▪ None, current approach complies with NMC requirements	See NMC 5.2	See OMM Section 4.2
6.5: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	Annually every Mar 31st	
NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants						
7.1: Regulatory Context						
7.2: Street Cleaning	8.1.1	---	▪ Commenced new street sweeping program ▪ Reviewed cost effectiveness of street sweeping ▪ O&M Program for CRW Operations	▪ Update O&M program for CRW operations	Complete; Ongoing	Street/Pavement Management Fact Sheet (Appendix E) OMM
7.3: Public Education Programs	8.1.2	---	▪ Established mechanisms for distributing educational materials ▪ Established 6 targeted themes with audiences ▪ Conducted first public awareness survey ▪ Prepare Public Education / Outreach Program	▪ Implement Public Education / Outreach Program ▪ Continue conducting public awareness surveys	Ongoing	All Fact Sheets (Appendix E) Appendix F
7.4: Solid Waste Collection / Recycling	8.1.3	---	▪ Provided and publicized by City of Harrisburg ▪ Developed coordinated surveillance protocol with City	▪ Distribute public education material ▪ Enact CRW Rules and Regulations	August 1, 2024	Solid Waste Handling / Storage Fact Sheet (Appendix E)
7.5: Product Ban/Substitution	8.1.4	---	▪ None	▪ Provide education about product substitutions where product controls ineffective	To Be Determined	All Fact Sheets (Appendix E)
7.6: Product Use Control	8.1.5	---	▪ None	▪ Distribute public education material	August 1, 2024	Material Handling / Storage Fact Sheet (Appendix E)
7.7: Illegal Dumping	8.1.6	---	▪ Regulated by City of Harrisburg Code ▪ Citizen Complaints/Service Requests (NMC 1.12.1) ▪ Developed coordinated surveillance protocol with City	▪ Distribute public education material ▪ Enact CRW Rules and Regulations	August 1, 2024 Ongoing	Solid Waste Handling / Storage Fact Sheet (Appendix E)
7.8: Bulk Refuse Disposal	8.1.7	---	▪ Provided and publicized by City of Harrisburg ▪ Developed coordinated surveillance protocol with City	▪ Distribute public education material ▪ Enact CRW Rules and Regulations	August 1, 2024 Ongoing	Solid Waste Handling / Storage Fact Sheet (Appendix E)
7.9: Hazardous Waste Collection	8.1.8	---	▪ Provided and publicized by City of Harrisburg ▪ Developed coordinated surveillance protocol with City	▪ Distribute public education material ▪ Enact CRW Rules and Regulations	August 1, 2024 Ongoing	Material Handling / Storage Fact Sheet (Appendix E)
7.10: Water Conservation	8.1.9	---	▪ CRW provides education about water conservation	▪ None: current approach complies with NMC requirements	Not Applicable	
7.11: Non-Domestic Sources	8.1.10	---	▪ See NMC-3	▪ See NMC-3	See NMC-3	
7.12: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan	▪ Review, revise NMC Plan	Annually every Mar 31st	
NMC-8: Public Notification						

Nine Minimum Control (NMC) Plan Summary Table for Capital Region Water's Combined Sewer System

Required Actions	Source of Requirement		Current Level of Implementation	Actions Necessary for Achieving Compliance		Supporting Documentation
	NMC Guidance Section	Mod. Partial Consent Decree Paragraph		Description	Deadline	
8.1: Regulatory Context						
8.2: Warning Signs	9.1	C(10)(f)	▪ Inventoried existing signs/assessed optional sites ▪ Installed temporary warning signs ▪ Prepared CSO Signage Plan ▪ Installed 13 new warning signs	▪ Implement CSO Signage Plan	Ongoing	
8.3: Public Notification	9.1	C(10)(f)	▪ Established mechanisms for distributing educational materials ▪ Implemented hotline for CSO notification	▪ Revise written public notification procedures	Ongoing	
8.4: Public Education	9.1	C(10)(f)	▪ See NMC 7.3	▪ See NMC 7.3	See NMC 7.3	
8.5: Public Involvement	9.1	C(10)(f))	▪ Multiple public involvement options provided	▪ None: current approach complies with NMC requirements	Not Applicable	
8.6: Effectiveness Evaluation	---	C(11)	▪ Updated NMC Plan ▪ Cityworks utilized to generate work orders from public	▪ Review, revise NMC Plan	Annually every Mar 31st	
NMC-9: Monitoring to Characterize CSO Impacts / Control Efficacy						
9.1: Regulatory Context						
9.2: Characterize Combined Sewer System	10.1.1	C(10)(a)	▪ See NMC 1.3.4	▪ See NMC 1.3.4	NMC 1.3.4	See OMM Section 2
9.3: CSO Activation Monitoring						
9.3.1: Phase 1: Daily Visual Inspections	10.1.2	C(10)(g)	▪ Daily visual regulator inspections (See NMC 1-4) ▪ 13 Interceptor flow meters ▪ 13 flow meters at regulators to calibrate model (ends 4th quarter 2015) ▪ Calibrated H&H model	▪ Maintain Current Level of visual inspections ▪ Maintain 12 interceptor monitors	Ongoing Ongoing	See OMM Section 4.1
9.3.2: Phase 2: Semi-Automated Detection	10.1.2	C(10)(g)	▪ Prepared CSO Activation Monitoring Pilot (CAMP) Study Plan by 5/9/15 ▪ Completed CAMP Study	▪ Provide detailed Post-Construction Monitoring Plan according to the framework provided in the CBH2OPP	Ongoing	See CAMP Study Plan, CBH2OPP (LTCP)
9.3.3: Phase 3: Post-Construction Monitoring	10.1.2	C(10)(g)	▪ Develop draft post construction monitoring plan as part of the CBH2OPP	▪ Implement draft post construction monitoring plan as part of the CBH2OPP	Ongoing	CBH2OPP (LTCP)
9.4: Precipitation Monitoring	10.1.2	C(10)(g)	▪ Existing network of gauges as per IFMMPP ▪ Existing Gauge Adjusted Radar Rainfall system	▪ Continuation of gauge network to support post construction monitoring program ▪ Continuation of GARR system to support post construction monitoring program	Ongoing	
9.5: Document CSOs	10.1.2	C(10)(g)	▪ See NMC 1.3.1	▪ See NMC 1.3.1		
9.6: Use H/H Model to Characterize CSOs	10.1.2	C(10)(g)	▪ Developing H&H model and obtaining CSO monitoring data for future calibration	▪ Use calibrated model to quantify and characterize CSOs in semi-annual reports.	Semi-annually, starting Mar. 31, 2017	

Section 1
Minimum Control Number 1
Review of Operation and Maintenance Programs

1.1 Regulatory Context

1.1.1 Requirements of the National CSO Control Policy

The objective of this minimum control is to reduce the frequency, duration and volume of combined sewer overflow (CSO) discharges by having operating procedures and management practices in place and effectively implemented to enable the existing facilities to perform optimally and to assure that appropriate records are maintained. The steps involved in implementing this minimum control include the following:

- Define the extent of the existing established operation and maintenance (O&M) program.
- Determine whether or not it needs to be improved to satisfy the intent of the National CSO policy.
- Develop and implement the required improvements to address CSOs.
- Document the O&M actions and report them to Pennsylvania Department of Environmental Protection (PADEP) and United States Environmental Protection Agency (EPA) Region III.

Table 1-1 summarizes the requirements of the National CSO Control Policy, EPA guidance documents for NMC-1. The modified partial Consent Decree (CD) ~~required~~ requires Capital Region Water (CRW) to submit an updated Nine Minimum Controls (NMC) Plan ~~within 6 months of the date the decree was lodged (i.e., by August 10, 2015)~~annually by March 31. ~~Additionally, an annual update is required each year, for the first five years following submission of the NMC Plan.~~ The modified partial CD also ~~required~~ requires the submission of an updated CSO Operation and Maintenance Manual (OMM) ~~concurrently with the initial submission of the NMC Plan, which is also to be updated~~ each year and subsequently submitted to the regulatory agencies in conjunction with annual Chapter 94 submittals that are due each March 31st. The partial CD contains a list of required elements to be included in the OMM and the NMC-1 documentation, summarized in **Table 1-2**. **Tables 1-1** and **1-2** summarize where each required element of the NMC Guidance and modified partial CD are addressed in this section.

1.1.2 CRW Approach for NMC Planning Compliance

In late 2013 CRW assumed ownership, operation, and maintenance responsibilities for the conveyance and collection system within the City of Harrisburg. Due to long-term, well documented financial hardships, the City was not able to effectively operate and maintain this conveyance and collection system. As such, CRW is faced with extensive, long-term system investigation and remedial maintenance and repair needs that must first be addressed in order to develop a more routine, preventative operation and maintenance posture envisioned for the Nine Minimum Controls under the CSO Policy. As such, CRW's partial CD required CRW to prepare this NMC Plan, consisting of proposed actions to achieve the NMCs with an implementation schedule, as an alternative to

documentation of compliance with the NMCs called for in the CSO Policy. This 2019 submission is the fourth annual update to the NMC Plan.

Table 1-1: EPA Guidance Compliance Checklist for NMC-1

NMC-1 Requirement Description Proper Operation and Regular Maintenance Programs	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Organizational Structure: The O&M program should show the organizational structure for those responsible for implementing the program, including an organizational chart that establishes clear lines of communication, authority and responsibility. The chart should provide the names and telephone numbers of key personnel, the chain of command, and the relationship between various program components.	2.1.1	C (10)(a)	1.2.1 Figure 1-1 Figure 1-2 1.2.2.1	4.12
Budget: The O&M program should show the resources currently available for O&M and the procedures for preparing and approving the annual O&M budgets. The budget should provide sufficient funds and personnel for routine O&M and a reasonable contingency for emergencies.	2.1.2	C (10)(a)	1.2.2.3 Appendix B	4.12
Critical Facilities: The O&M program should include an agreed-upon list of the most critical elements of the combined sewer system and demonstrate that they receive an appropriate amount of attention.	2.1.3	C (10)(a)	1.3.1	3.1 thru 3.4
Procedure for Routine Maintenance: The O&M program should include documentation of procedures for routine maintenance of the major elements of the combined sewer system. The program should focus on preventative maintenance to avoid failures during critical times, such as periods of heavy rainfall.	See Below	See Below	See Below	See below
▪ O&M procedures for CSO Regulator Structures	2.1.4	N/A	1.4.2 1.4.3	4.1.7
▪ O&M Procedures for CSO Outfalls and Backflow Prevention Gates	2.1.4	N/A	1.5.2 1.5.3	4.2.6
▪ O&M Procedures for Interceptor Sewers	2.1.4	C (10)(a)	1.6.2 1.6.3	4.4.4
▪ O&M Procedures for Pump Stations	2.1.4	C (10)(a)	1.7.2 1.7.3	4.3.4, 4.3.5
▪ O&M Procedures for Force Mains	2.1.4	N/A	1.8.2 1.8.3	4.5.4
▪ O&M Procedures for Collection System Sewers	2.1.4	C (10)(a)	1.9.2 1.9.3	4.6.4
▪ O&M Procedures for Storm Inlets and Catch Basins	2.1.4	C (10)(a)	1.10.2 1.10.3	4.7.5

Table 1-1: EPA Guidance Compliance Checklist for NMC-1

NMC-1 Requirement Description Proper Operation and Regular Maintenance Programs	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Non-Routine Maintenance and Emergency Situations: The O&M program should describe response procedures for emergency situations, particularly those requiring funds outside the approved annual budget. The expectation is that response can be quick, without unnecessary processes and procedures, and that response protocols are in place for emergencies occurring at night, holidays and weekends.	2.1.5	C (10)(a)	1.12.2	4.8
Inspections: The O&M program should describe the procedures for inspecting the designated critical elements of the combined sewer system and have an established program for periodic inspections. The program should have an established process for review of the completed inspection forms by management personnel, and the retention of the forms.	See Below	See Below	See Below	See Below
▪ Inspection and Documentation Procedures for CSO Regulator Structures	2.1.6	C (10)(a)	1.4.1 1.4.4	4.1.3, 4.1.4, 4.1.5, 4.1.6
▪ Inspection and Documentation Procedures for CSO Outfalls and Backflow Prevention Gates	2.1.6	C (10)(a)	1.5.1 1.5.4	4.2.3, 4.2.4, 4.2.5
▪ Inspection and Documentation Procedures for Interceptor Sewers	2.1.6	C (10)(a)	1.6.1 1.6.4	4.4.2, 4.4.3
▪ Inspection and Documentation Procedures for Pump Stations	2.1.6	N/A	1.7.1 1.7.4	4.3.2, 4.3.3
Training: The O&M program should include an appropriate blend of classroom training and on-the-job training, including operation and safety procedures for new employees and re-training for long-time employees. The objective is to have well-trained employees who know their duties and how to report problems that require attention from managers.	2.1.7	C (10)(a)	1.13.1 1.13.2 1.13.3	4.11
Periodic Review of O&M Plans: O&M practices should be reviewed periodically and modified as necessary. It is a good practice to involve field O&M personnel in this process.	2.1.8	C (11)	1.14	4

Table 1-2: Consent Decree Compliance Checklist for NMC-1

Consent Decree Requirement Description Proper Operation & Regular Maintenance Programs	CD Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Annually submit a revised and updated **Nine Minimum Controls Plan** that documents the current level of NMC compliance and provides an implementation schedule for actions necessary to achieve NMC compliance with the National CSO Policy and the Consent Decree	C (11)	All sections	All sections	All sections
Continue to implement a CSO Operation and Maintenance Manual (OMM) describing standard operating procedures, inspection, maintenance, and training activities in compliance with the NMCs.	C (10)(a)	See Below	See Below	See Below

This NMC section largely focuses on the planning that is necessary to fully implement the NMC requirements. This section serves as a plan for the full implementation of NMC-1, supported by CRW's OMM documenting its current operation and maintenance practices. Each subsection in the NMC-1 documentation contains a paragraph labeled **"Documentation of Current Control Practices"** which provides descriptions for the activities currently implemented to comply with the EPA Guidance and partial CD requirements for NMC-1. Each subsection also contains a subsection labeled **"Plan for Completing Implementation of Minimum Control Practices"** which provides descriptions for the activities CRW still needs to implement to comply with EPA and partial CD requirements.

1.2 Organization, Planning, and Budget

The primary mission of CRW focuses on providing a reliable supply of high-quality drinking water for residential and community needs, as well as the effective management of wastewater and stormwater to enhance and sustain the region's watersheds and quality of life. To implement this mission, an organizational structure has been established, annual budgets are developed and approved, and plans are being developed and refined to meet future needs and opportunities. The partial CD requires CRW to implement a program of annual planning and budgeting procedures to define the organization, staffing, and resources needed to operate and maintain the conveyance and collection systems.

1.2.1 Organization and Responsible Staff

Documentation of Current Control Practices

CRW is a municipal authority that is governed by the Pennsylvania Municipal Authority's Act. CRW owns, maintains, and operates the water, wastewater, and stormwater facilities within the City of Harrisburg. An organization chart for CRW illustrating the chain of command and lines of communication is provided in **Figure 1-1**.

CRW is governed by a five-member Board of Directors. The board members are appointed by the Mayor of the City of Harrisburg and approved by City Council. The daily administration for CRW is provided by the Chief Executive Officer who is supported by a Chief Financial Officer, Chief Technical Officer, Chief Administrative Officer, Chief Strategy Officer, Chief Operations Officer Wastewater, Chief Operations Officer Drinking Water, and their designated staffs. The following key positions are related to the operation and maintenance of the wastewater facilities:

- The Chief Technical Officer is responsible for the inventory, inspection, and major repairs to the AWTF and the conveyance and collection systems. The Chief Technical Officer is supported by the following key positions:
  - A City Beautiful H_2O Program Manager responsible for overseeing the wet weather program and all compliance activities related to control of CSOs, SSOs, and stormwater.
  - A VP of Engineering responsible for the planning, engineering, design, and construction of projects.
  - An Asset Manager responsible for the development and maintenance of information about CRW's assets and further development of the Cityworks asset management program.
  - A GIS Manager responsible for the development and maintenance of CRW's GIS database.
- The Chief Operations Officer Wastewater, which reports directly to the CEO, is responsible for the operation and maintenance of CRW's wastewater and stormwater assets and is supported by a Wastewater Division responsible for the operation and maintenance of CRW's wastewater treatment, conveyance, and collection systems. An organization chart for the Wastewater Division, illustrating the chain of command and lines of communication, is provided in **Figure 1-2**. Key positions within the Wastewater Division are documented in Section 1.2.2.1.

At this time, CRW believes that its organizational structure is sufficient to carry out the various activities presented in the NMC Plan and OMM, particularly with the addition of new employees in the last several years.

Plan for Completing Implementation of Minimum Control Practices

Moving forward CRW will continually evaluate additional staffing requirements, as the investigations of the wastewater system continue, and prepare their annual budgets to support the additional staffing needs. Further refinements to the organizational structure and staff are anticipated as system-wide investigations are completed and the full breadth of priority remedial work is understood.

Figure 1-1: CRW Organizational Chart

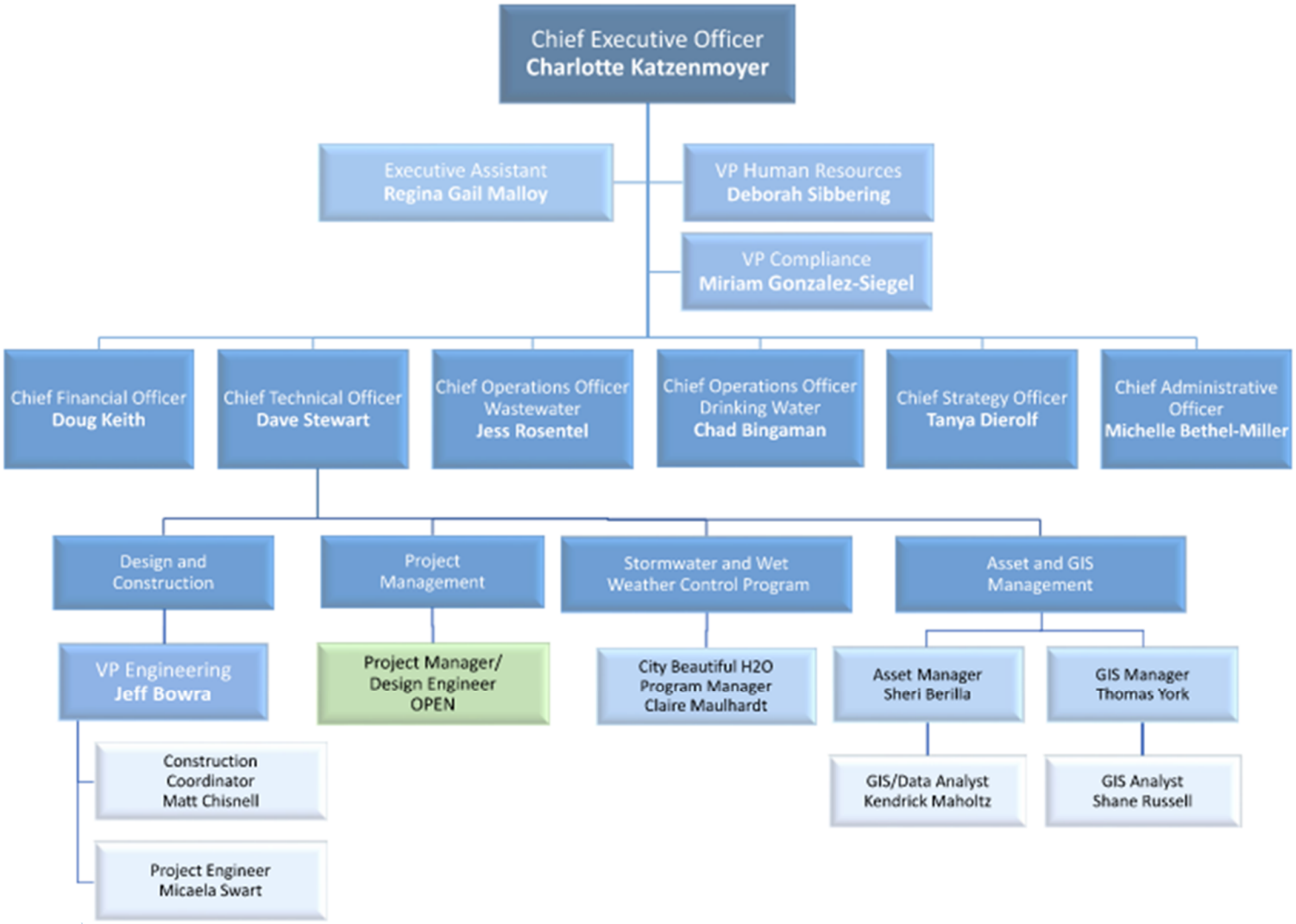
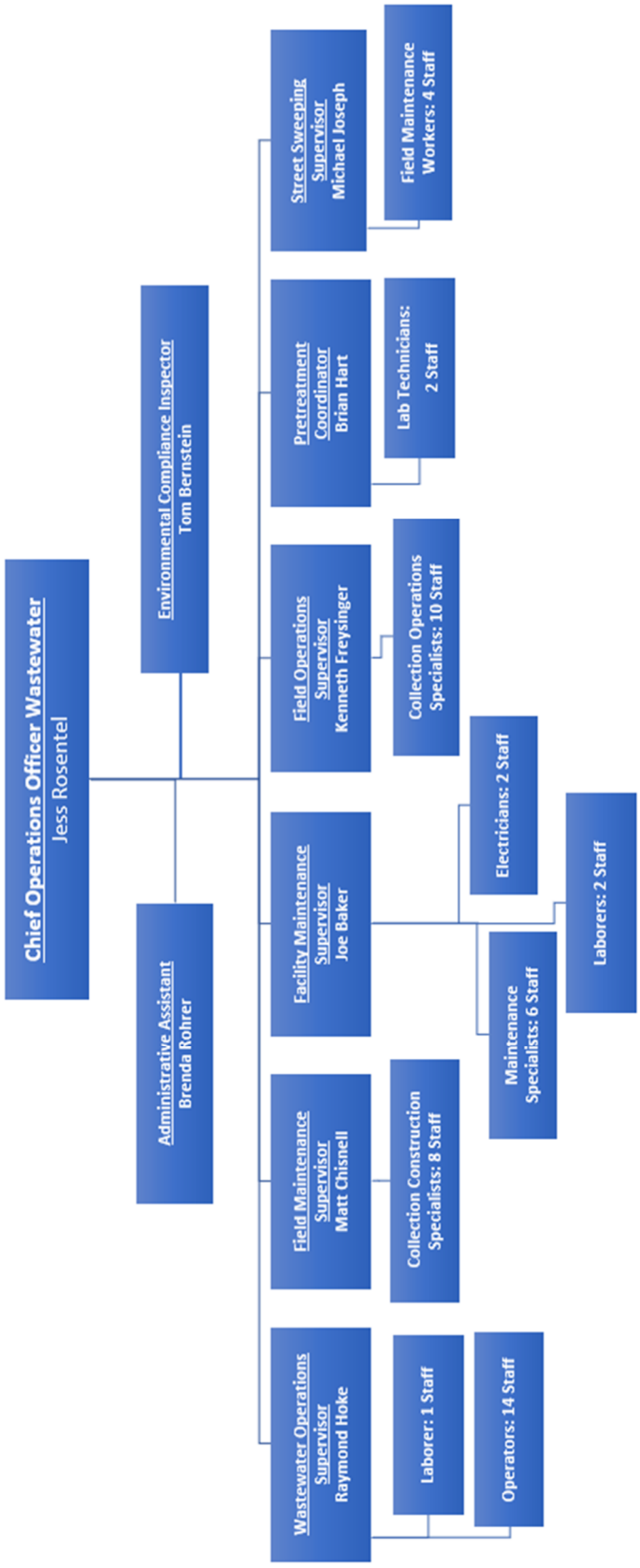


Figure 1-2: CRW Wastewater Division Organizational Chart



1.2.2 Resources Allocated to O&M Activities

1.2.2.1 Human Resources

Documentation of Current Control Practices

O&M activities for the CRW conveyance and collection systems are provided by the Wastewater Division, under the direction of the Chief Operations Officer Wastewater, which includes a management team and a staff work force. Descriptions of personnel dedicated to O&M activities and their associated responsibilities are provided below and the organization chart for the Wastewater Division illustrating the chain of command and lines of communication is provided in Figure 1-2.

Since August 2015, CRW has made several key personnel changes, which included cross-training staff within the organization, transferring staff from the AWTF to the field, and hiring a significant number of new employees for field operations and maintenance.

- **Chief Operations Officer Wastewater:** The operation and maintenance of the CRW collection and conveyance system, including the advanced wastewater treatment facility (AWTF) and pumping stations, is managed and coordinated through the Chief Operations Officer Wastewater who reports directly to the Chief Executive Officer. The Officer oversees and supervises inspection, operation, and maintenance activities performed on the CRW system and coordinates these activities through five supervisors: Wastewater Operations Supervisor, Facility Maintenance Supervisor, Field Construction Supervisor, Field Operations Supervisor, and Street Sweeping Supervisor. The Officer is responsible for the review and oversight of the required documentation for O&M activities and generating the associated summary reports. The Officer is also responsible for overseeing O&M activities during emergency situations. The Officer is responsible for notifying the regulatory agencies of all compliance-related items. The Officer manages the activities of the Pretreatment Coordinator and the two supporting laboratory technician positions.

- **Wastewater Operations Supervisor:** The operation of CRW's AWTF and the operation of the Front Street and Spring Creek Pump Stations are managed and coordinated by the Wastewater Operations Supervisor, who reports to the Chief Operations Officer Wastewater. The Operations Supervisor directs the activities of staff as detailed in Figure 1-2. Operation of the AWTF and the pump stations is implemented through a Supervisory Control and Data Acquisition (SCADA) system which provides real time system information to the operations staff. There are typically three operations positions during the daytime shifts. The Lower End Operator oversees the primary treatment facilities and processes. The Upper End Operator oversees the secondary treatment facilities and processes, and the Belt Filter Press Operator oversees the biosolids handing equipment and processes.

- **Facility Maintenance Supervisor:** Facility Maintenance Supervisor oversees Facility Maintenance (the CRW AWTF and pumping stations). The Facility Maintenance Supervisor reports to the Chief Operations Officer Wastewater. The Facility Maintenance Supervisor directs the activities of staff as detailed in Figure 1-2. Both reactive and preventive maintenance activities at the AWTF and pumping stations are provided by this maintenance team.

- **Field Construction Supervisor:** oversees all field maintenance activities to support the conveyance and collection system. The Field Construction Supervisor directs the activities of staff for field maintenance as detailed in Figure 1-2. The collection construction team is responsible for the repairs to the collection and conveyance system.

- **Field Operations Supervisor:** The Field Operations Supervisor oversees the daily operation of the collection and conveyance system, which reports directly to the Chief Operations Officer Wastewater. The Field Operations Supervisor oversees staff as detailed in Figure 1-2. The collection operations team is responsible for conducting the daily inspections of the CSO regulator structures and outfalls and providing their preventive maintenance, inspection and cleaning of the collection and conveyance system, and performing hot spot inspections. The field operations team is also responsible for responding to citizen complaints and service requests including sinkholes.
- **Pretreatment Coordinator/Laboratory Supervisor:** The Pretreatment Coordinator is responsible for administering the AWTF's pretreatment program for the CRW service area as well as the surrounding, contributing municipalities. Additionally, as the Laboratory Supervisor this position oversees two laboratory technicians for all sampling and analyses at the AWTF.
- **Street Sweeping Supervisor:** The Street Sweeping Supervisor is responsible for the daily operation of CRW's street sweeping program, which reports directly to the Chief Operations Officer Wastewater. The Street Sweeping Supervisor oversees four staff, which are responsible for operating and maintaining the street sweeping equipment.
- **Environmental Compliance Inspector:** The Environmental Compliance Inspector is responsible for inspecting potential illicit discharges, issuing violations, developing inspection documentation, and expanding the FOG program at CRW.
- **Administrative Assistant:** An Administrative Assistant provides clerical and administrative support to the Chief Operations Officer Wastewater and the entire Wastewater Division.

Improved organization and increased staffing levels have partially addressed the known remedial repair and maintenance needs of CRW's wastewater / stormwater assets, resulting in the maintenance levels listed in **Table 1-3**. This analysis indicates that CRW has completed remedial inspection and maintenance of all assets within its conveyance system, has identified and is in the process of addressing remedial repairs, and has achieved preventive maintenance levels. In CRW's collection system, however, a rapid assessment of trunk sewers and branch sewers, provided via a pole camera inspection from each known manhole, discovered evidence of remedial repair and maintenance needs, allowing initiation of critical repairs/maintenance and prioritizing remaining assets for comprehensive CCTV inspection and detailed assessment to further define remedial repair and maintenance needs / priorities. At the same time, CRW completed remedial cleaning of its inlets/catch basins, discovering that once cleaned, approximately 50 percent of these assets need to be rebuilt. As a result, limited preventive maintenance of collection system assets is performed at known "hot spots", allowing staff to focus on remedial maintenance and repairs.

Table 1-3: System Maintenance Levels

Asset Category	Remedial Inspections	Remedial Repair	Remedial Maintenance	Preventive Maintenance
Conveyance System:				
▪ Advanced Wastewater Treatment Facility	Complete	Ongoing	Completed	Achieved
▪ Pump Stations	Complete	Ongoing	Completed	Achieved
▪ Force Mains	Complete	Not Required	None	Achieved
▪ Interceptors	Complete	Ongoing	Completed	Achieved
▪ Regulators and Outfalls	Complete	Ongoing	Completed	Achieved
Collection System:				
▪ Trunk Sewers	Ongoing	Initiated	Initiated	Limited
▪ Branch Sewers	Ongoing	Assessment	Assessment	Limited
▪ Inlets/Catch Basins	Complete	Complete/Ongoing	Complete/Ongoing	Limited

~~At this time,~~ CRW believes that its organizational structure is sufficient to carry out the various activities presented in the NMC Plan and OMM, as summarized in the previous paragraph. In order to verify this, CRW compared the existing level of effort that is required to perform remedial maintenance with the projected future level of effort anticipated to perform routine, preventive operation and maintenance duties for the collection, conveyance, and treatment systems once remedial maintenance is completed:

- First, CRW utilized internal data from its Cityworks asset management system to define the level of effort expended in a one-year period to perform existing remedial and preventative maintenance activities. This data was also used to project the anticipated completion date for known remedial inspection and maintenance needs at the current level of effort.
- CRW also used benchmarking metrics for a Pennsylvania sewer system where the owner/operator has already submitted and successfully implemented a USEPA/PADEP-approved NMC Plan, to quantify the annual completion rates, required staff, necessary equipment, and budgetary requirements to provide routine preventive maintenance. These benchmark metrics were applied to CRW's existing wastewater assets to project the level of effort required to provide comprehensive preventive maintenance once remedial maintenance has been completed.
- Then, the level of effort currently expended for remedial and preventive maintenance activities was compared to the anticipated level of effort required to provide routine preventive maintenance of CRW's existing wastewater assets. Differences between the existing remedial and projected preventive maintenance level of effort were used as an indication of whether CRW has employed adequate resources to meet its NMC obligations.

The analysis confirmed that CRW is currently adequately staffed to provide NMC-compliant levels of preventive maintenance for each of its conveyance system assets. It also confirmed that the existing level of-effort to perform remedial collection system inspections and maintenance would generally meet the projected level of effort to perform preventive maintenance of collection system assets once remedial inspection and maintenance is complete:

- CRW completed the remedial inlet cleaning and repair activities by the end of 2021. As the remedial backlog is addressed, CRW staff will transition into routine preventative maintenance inlet inspection and cleaning of each inlet every three years.
- CRW has internal CCTV inspection capabilities with sufficient staff to support a systemwide collection system inspection by June 30, 2025, due to a delay in obtaining a second CCTV truck. This level of effort is adequate to perform preventive CCTV inspections and as-needed cleaning of approximately 10 percent of CRW's trunk and branch sewers annually, within the benchmark performance metrics for an NMC-compliant community. Existing staff levels are adequate to provide NMC-compliant levels of collection system maintenance.

Plan for Completing Implementation of Minimum Control Practices

At this time CRW believes that the Wastewater Division is appropriately staffed to handle the operation and maintenance of the AWTF, pumping stations, conveyance system, and collection system. Further refinements to the wastewater staff are anticipated as system-wide investigations are completed and the full breadth of priority remedial work is better understood. CRW will continue to assess its human resource needs annually, as part of the annual reviews of the NMC Plan and the budgeting process.

1.2.2.2 Equipment Resources

Documentation of Current Control Practices

CRW owns the following equipment for maintaining the AWTF, conveyance and collection systems:

AWTF Equipment

One Crane Truck
One Air Compressor
One Fork Lift
Four Pick-up Trucks
One Skid Steer Loader
Two 4-inch Trash Pumps
One 3-inch Trash Pump
One 10-inch Trash Pump

Field Operations Equipment

Two 5-Ton Dump Trucks
Three Pick-Up Trucks
One Wheel Front End Loader
Four Sets of Self-Contained Breathing Apparatus
Miscellaneous Cleaning Equipment
(Brooms, Brushes, Buckers, Hose, Etc.)

Personal Safety Apparel for Each Employee

Hard Hat
Uniform
Rain Gear
Boots
Fluorescent Vest
Gloves
Coveralls
Goggles

Maintenance Shop

Fully Equipped for Light Fabrication & Welding

Field Maintenance Equipment

Three Vactor Trucks
One Jet Trucks
Two Utility Trucks
Two Pickup Trucks
Four 5-Ton Dump Truck
Two 1-Ton Dump Trucks
One Backhoe
Two Mini Excavator
One Hydro Excavator
Two Black Top Roller
~~One~~ Two CCTV Trucks
One Spare CCTV Camera
One Pole Camera
Three Tripods
Three Fall Preventers
One Winch
Four Harness/Rope Assemblies
Four Manhole Hooks
One Spot Light
Ten Barricades
Ten Safety Cones
Two Manhole Ventilators
One Self Contained Breathing Apparatus
Five Portable Combustible Gas Analyzers
Shovels, picks, and digging irons
Two tool box sets
One Skid Steer Loader
Three Street Sweepers
One Lateral Launch CCTV Rover
One Manhole Cutter
Hydraulic Shoring

Plan for Completing Implementation of Minimum Control Practices

The partial CD requires CRW to provide a list that identifies and prioritizes equipment purchases for critical equipment. CRW is budgeting for the following prioritized purchases over the next few years:

- ~~Camera truck (replacement), new street sweeping supervisor vehicle, combination truck (replacement), field operations service truck (replacement)~~Mini-excavator, backhoe, hydro-excavator, and ~~three~~ multiple pickup trucks.

1.2.2.3 Budgetary Resources

Documentation of Current Control Practices

CRW prepares an annual budget for each fiscal year (January through December), in which the expenses are divided between Personnel, Operating, Professional Services, and Administrative. The 2023 O&M budget totals approximately $12.6 million dollars.

A copy of the 2023 CRW Wastewater Budget is included in **Appendix B**. Senior CRW field staff who are responsible for day-to-day O&M now have more opportunity to participate in the budget preparation process so the officials responsible for final budget preparation and approval are aware of O&M needs.

CRW believes that its O&M budget is adequate to implement all of the various activities presented in the Plan and OMM. This is supported by the analysis described above in Section 1.2.2.1 above, which looked at budgetary requirements for CRW staff to complete the remedial work and perform preventative maintenance. Annual refinements to the budget are anticipated as systemwide investigations are completed and the full breadth of priority remedial work is understood.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to formalize and refine its processes for preparing an annual budget. As CRW identifies additional projects the budget will be updated accordingly.

1.2.3 Remedial Work Prioritization

The modified partial CD requires CRW to develop and implement a program to prioritize remedial work, based upon findings from internal inspections, citizen complaints, hydrologic and hydraulic (H&H) model results, and other available information.

Documentation of Current Control Practices

CRW continues to investigate its conveyance and collection systems in order to identify and prioritize key items that require remedial work as detailed in the sections of this NMC Plan noted below. CRW's initial Strategic Asset Management Plan (SAMP), dated August 31, 2022 is the primary document providing the concise, overarching framework and guidance for administration of CRW's Asset Management Program. The strategic plan creates a consistent and repeatable approach to operating and maintaining CRW's facilities and systems to help CRW meet the established service level expectations and other operational objectives at the lowest life cycle cost including managing risk exposure. On July 14, 2023 CRW finalized the revision of the Collection System Asset Management Plan (CAMP) aligning the tactical plans with the overarching asset management strategy. The CAMP is the tactical asset class plan providing the short and long-term strategies to address the collection system's operational and maintenance requirements along with rehabilitation and replacement needs. All asset management plans are meant to be living documents that will require CRW to maintain with annual review and updates as needed. The SAMP and CAMP are included in **Appendix F**. ~~Prioritization criteria have been developed as part of CRW's asset management program (refer to Appendix F). The prioritization process utilizes both probability of failure and consequence of failure to determine the core risk. Probability of failure (POF) is defined according to the four failure modes listed in **Table 1-4.**~~

~~Table 1-4: Failure Modes~~

Failure Mode	Definition
Physical Mortality	Degradation of asset reduces performance below acceptable level
Capacity	Volume of demand exceeds design capacity
Financial Efficiency	Operations and maintenance costs exceed that of feasible alternatives
Levels of service	Functional requirements exceed design capacity (e.g., the treatment technology used for the removal of a pollutant does not remove enough of the pollutant to meet permit requirements)

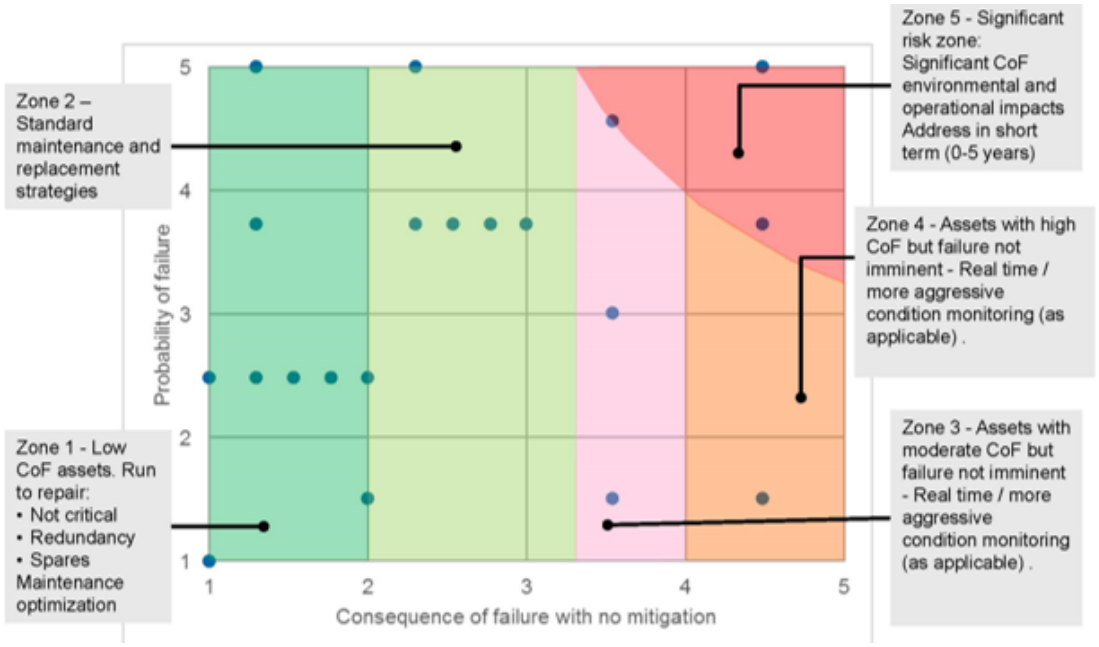
~~Physical mortality of the conveyance and collection systems is defined by the criteria and methodology of the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP), Manhole Assessment and Certification Program (MACP), and Lateral Assessment and Certification Program (LACP), while capacity and level of service are being defined through simulations of CRW's SWMM 5 H&H model. Financial efficiency evaluations are supported by the level of effort information currently being inventoried by CRW's Cityworks asset management system.~~

~~Consequence of failure (COF) is expressed in **Table 1-5** according to the following Triple Bottom Line (TBL) categories, with specific metrics used for each type of asset.~~

~~**Table 1-5: Triple Bottom Line & Consequence of Failure**~~

TBL Categories	Consequence of Failure Elements
Social / Community	Public Image, Customers Affected, Health and Safety
~~Financial~~	~~Financial Impact (total cost to fix and mitigate the failure~~ including indirect costs), Operational/Resource Impacts
Environment / Regulatory	Examples include overflows, basement backups, regulatory (permit) compliance considerations

~~POF and COF are integrated using the following figure in order to define Risk Management Zones for each asset, used to schedule remedial and (ultimately) preventive inspections, maintenance, and repair.~~



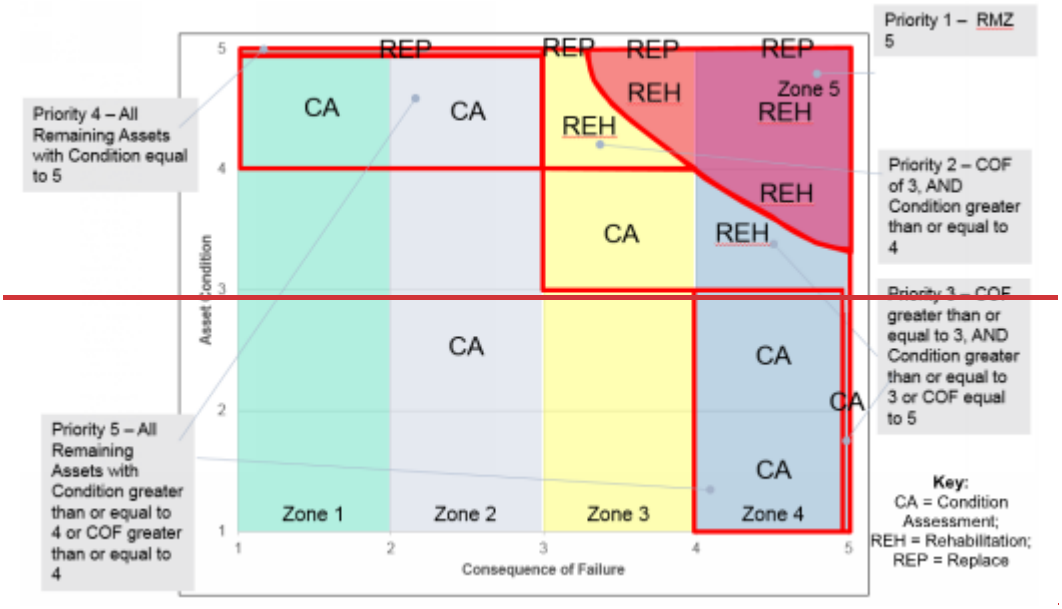
~~**Figure 1-3: Risk Management Zones**~~

~~Overall, the conveyance system remedial priorities for the interceptors and pumping stations have been identified and scheduled, a force main investigation was completed in 2016, and an outfall remedial schedule was developed based on recent investigations. Within the collection system, a comprehensive rapid assessment program based on pole camera inspections from manholes was completed in 2016, identifying obvious locations for critical system cleaning and repair and establishing priorities for CRW's ongoing comprehensive systemwide CCTV inspection/assessment.~~

~~In 2018, CRW completed a high-level investment planning exercise for the collection system assets. The asset investment prioritization analysis combined data from the rapid assessment, age-based condition, work orders and asset investment assumptions (treatment and cost). Collection system assets were assigned a priority level and a treatment option for consideration in future capital improvement projects, and a summary of the process is included herein. The asset investment prioritization process was established by organizing assets into five priority levels or "buckets" based on the risk management zone into which they fall and their condition ratings:~~

- ~~**Priority 1**: Assets falling in Risk Zone 5 (short-term renewal of infrastructure). Core risk is 16 or greater.~~
- ~~**Priority 2**: Assets with a COF of 3 AND Condition greater than or equal to 4 (or assets with imminent failure due to one of the non-physical mortality failure modes).~~
- ~~**Priority 3**: Assets with a COF of greater than or equal to 3, AND Condition greater than or equal to 3; OR COF equal to 5 and Condition less than 3.~~

- ~~**Priority 4**: Assets falling in Risk Zone 1 AND Condition equal to 5.~~
- ~~**Priority 5**: All remaining assets with Condition great than or equal to 4, or COF greater than or equal to 4.~~



~~**Figure 1-4: Priority Zones and Recommended Treatment Options**~~

~~Three intervention, or "treatment" options are considered:~~

- ~~Asset Condition Assessment (CA)~~
- ~~Asset Replacement (REP)~~
- ~~Asset Rehabilitation (REH)~~

~~Based on the risk management zone, COF, and condition, assets are assigned a priority level and treatment option as illustrated in Figure 1-4. Each treatment option has its own priority level from 1-5 and associated cost. Once assets have been assigned a priority level from 1-5, the next step is to determine the highest priority assets within each priority zone.~~

The approach for addressing remedial work for each type of infrastructure is discussed in further detail in the following subsections of this NMC Plan:

- Prioritization of outfall cleaning and rehabilitation – see Section 1.5.2
- Prioritization of interceptor system cleaning and rehabilitation – see Section 1.6.2
- Prioritization of pump station rehabilitation and upgrades – see Section 1.7.2
- Prioritization of force main rehabilitation – see Section 1.8.2
- Prioritization of collection system inspection and rehabilitation – see Section 1.9.2
- Prioritization of inlet and catch basin inspection and rehabilitation – see Section 1.10.2

Plan for Completing Implementation of Minimum Control Practices

~~CRW completed the asset investment prioritization analysis of the collection system in early 2018 and is utilizing the data to establish priorities for further evaluation and identify remedial work to be implemented. CRW plans to address the Priority 1 projects within the next five years. This approach aims to allocate the available funds where the greatest risk reduction and management can be achieved. Other criteria may be developed as necessary. In addition, the calibrated H&H model is being used to define any critical capacity constraints.~~ Collection system rehabilitation, catch basin rehabilitation, and rehabilitation resulting from sinkhole investigations will need to be conducted as customer complaints are recorded and as "hot spots" are identified. Prioritization findings will be reported in CRW's semi-annual reports as they are developed.

1.2.4 Equipment Purchase Prioritization

Documentation of Current Control Practices

CRW allocates funds for the purchase of additional equipment or replacement equipment each year. New equipment is purchased when the respective Supervisors identify equipment that has reached the end of its useful life or determine that additional equipment is necessary to properly operate and maintain the AWTF, pumping stations, conveyance system, and collection system. The Supervisors submit purchase requests to the Chief Operations Officer Wastewater through email or verbally for approval and processing. Typically, equipment is purchased in advance of each identified need on an ongoing basis. CRW is continuing to obtain additional equipment that will be required to support its operations and maintenance staff and replace aged equipment. ~~In 2015 the purchase of CCTV inspection equipment enabled CRW staff to conduct pipe inspections without relying on subcontractors. In 2020 CRW purchased the key pieces of equipment listed in Section 1.2.2.2 of this NMC Plan, including several other replacements for existing equipment.~~

Plan for Completing Implementation of Minimum Control Practices

Equipment purchases are addressed during each year's annual budgeting process, based on the findings of ongoing system inspections and evaluation of O&M performance. Equipment needs will be updated on an annual basis, as required by the partial CD and the NMC Plan.

1.2.5 O&M Program Review and Revision

Documentation of Current Control Practices

CRW prepared the OMM in August 2015, with annual updates for each calendar year starting in March 2017. CRW staff have thoroughly reviewed and applied the procedures in the OMM. During the OMM implementation in the field, clarifications, revisions, and additional practices have been noted for inclusion in future updates to the OMM.

Plan for Completing Implementation of Minimum Control Practices

The OMM is updated each calendar year, as required by the partial CD and the NMC Plan, to incorporate new procedures as they are developed. CRW will submit the ~~2020~~ annual update to the regulatory agencies with the Chapter 94 Report in March ~~2021~~each year, in accordance with the partial CD. This is an integral part of the rapidly evolving operations and maintenance of the CRW system, which will reflect the information gained through ongoing investigations and remedial work within the combined sewer system.

1.3 System Organization and Priorities

In Harrisburg, like many older cities, the collection of wastewater is mostly conveyed in the same conduits as stormwater. Within approximately 62 percent of the City, stormwater and wastewater are conveyed through combined sewers, shared conduits which are subject to overflows during periods of wet weather through a regulator structure connected to an outfall (within this 62% there are multiple instances where upstream separate sanitary and storm collection systems are ultimately discharged into a downstream combined sewer). The remaining 38 percent of the City areas are served by separate sanitary sewer (connected directly to an interceptor) and stormwater conveyance systems (discharges to a stormwater-only outfall) that are not connected to a downstream combined sewer regulator.

Combined Sewer System: Combined wastewater and stormwater flows are conveyed to the CRW AWTF through CRW's conveyance system and collection system. The ***conveyance system***, shown in **Figure 1-3**, consists of the following components:

- The ***Front Street Interceptor*** extends along the northeast shore of the Susquehanna River and receives combined flow from the City of Harrisburg and separate sanitary flow from Susquehanna Township.
- The ***Paxton Creek Interceptor*** receives combined flow from the City of Harrisburg and separate sanitary flow from the Borough of Penbrook, Lower Paxton Township, and Susquehanna Township.
- The ***Hemlock Street Interceptor*** receives combined flow from the City of Harrisburg and separate sanitary flow from the Borough of Paxtang, Lower Paxton Township, and Swatara Township.

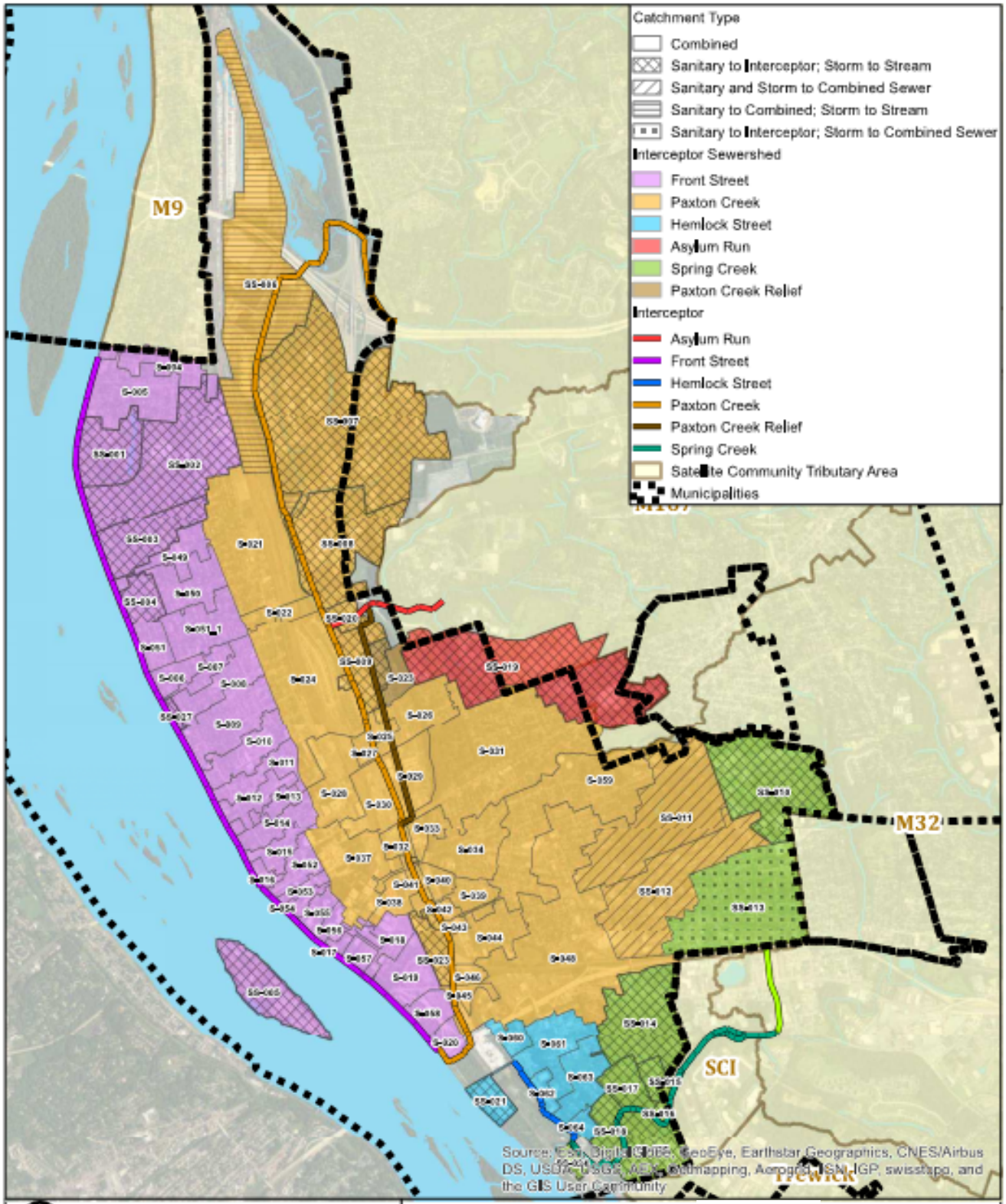


Figure 1-3
Map of Conveyance System

Capital Region Water
Dauphin County, Pennsylvania

- ***Two sewage pump stations*** within the CRW system. The Front Street and Spring Creek pump stations convey interceptor flow to the AWTF.
    - Note: The City of Harrisburg currently owns two pumping stations on City Island, which is a City park, that pump flow to the Front Street Interceptor. Although the City is responsible for the operation and maintenance of the City Island pumping stations, CRW is providing interim assistance with operations and maintenance until a permanent arrangement is established for City operation and maintenance of those facilities. As such these are not considered CRW facilities and are beyond the scope of the NMC documentation.
- ***59 CSO regulator structures***, located where the local combined sewer collection systems are connected to the interceptor sewers, control how much flow is directed to the AWTF, with the remainder discharged to the receiving water.CRW's ***combined collection system*** consists of the portions of CRW's collection system upstream of the CSO regulator structures. Previously, CRW personnel operated and maintained the conveyance system while personnel from the City Bureau of Sewerage and Bureau of Neighborhood Services operated and maintained the collection system. Beginning in December 2013, CRW was created and assumed O&M responsibilities, as well as ownership, for the collection system and pump stations.

Separate Sanitary Sewer System: Approximately 38 percent of the City area is served by separate sanitary and stormwater sewer systems. All of the satellite service communities are served by separate sanitary sewers except Steelton Borough which has a combined collection system and pumps its wastewater directly to CRW's AWTF. Wastewater flows from the satellite service communities are conveyed to the CRW AWTF through the following components of the conveyance system (**Figure 1-5**):

- The ***Asylum Interceptor*** conveys flow from Susquehanna Township to the Paxton Creek Relief Interceptor.
- The ***Paxton Creek Relief Interceptor*** receives flow from the separate sanitary collection sewers within the Borough of Penbrook and Susquehanna Township.
- The ***Spring Creek Interceptor*** conveys flow from Swatara Township to the Hemlock Street Interceptor.

1.3.1 Facilities Critical to the Performance of the Combined Sewer System

Documentation of Current Control Practices

A proper operation and maintenance program should identify and document facilities that are critical to the performance of the combined sewer system. CRW has determined that its entire conveyance system is critical to the performance of its combined sewer system. The critical facilities are comprised of the following conveyance system elements:

- CSO regulator structures
- CSO outfalls
- Backflow prevention gates
- Pump stations

- Interceptor sewers

However, at most outfall locations, CRW's backflow prevention flap gates are only critical when the receiving waters are above flood stage elevations.

From mid-2015 into early-2016 CRW conducted a rapid assessment of the collection system based on pole camera inspections of each known, accessible manhole. CRW used the rapid assessment findings to identify sewer segments exhibiting critical blockages and/or structural deficiencies for immediate attention (i.e., those with a rating of 4 or 5) as well as to prioritize sewer segments for comprehensive CCTV inspections to further assess their condition.

The NMC-1 Plan for these critical facilities is provided in Sections 1.4 through 1.9 below. CRW's current OMM outlines the protocols currently followed by CRW operations staff for these facilities.

Plan for Completing Implementation of Minimum Control Practices

CRW's asset management program will further define the Core Risk within the collection system based on the rapid assessment data and ongoing collection system investigations. Section 1.9 provides further discussion of the rapid assessment of CRW's collection system.

1.3.2 Critical Equipment Definition

Documentation of Current Control Practices

EPA Guidance for the NMCs suggests that proper O&M documentation should include a list of equipment critical to the performance of the collection and conveyance systems, as well as the AWTF. CRW considers all of the equipment listed in Section 1.2.2.2 to be critical to the operation and maintenance of its wastewater facilities.

Critical equipment for the AWTF includes the following items: vortex grit chambers, primary clarifiers, settled sewage pump station, high pure oxygenation activated sludge reactors, bioreactor, post aeration channel, final clarifiers, chlorine contact tanks, RAS regeneration tank, and chemical addition (for denitrification, CEPT, and CEST). Further details are provided in CRW OMM Section 3.4.

Plan for Completing Implementation of Minimum Control Practices

The list of critical equipment will be updated annually as part of the annual update to this NMC Plan and the OMM.

1.3.3 Sewershed and Catchment Delineation

The partial CD requires CRW to implement a program to divide the conveyance and collection systems into different sewershed and catchment areas for the purposes of organizing the systems. CRW completed this delineation while concurrently implementing its field inspection programs and developing its H&H model, both of which require systemized naming conventions and sewer system organizational structure.

Documentation of Current Control Practices

CRW has been actively updating the sewershed and catchment boundaries through ongoing investigations and data review. Available historical sewer maps, engineering drawings, and other archived documents have been reviewed, and the pertinent information has been loaded into a geographic information system (GIS) relational database. In 2014, a comprehensive field inspection program of its conveyance system was completed to assess and document existing conditions. In 2015

and the first half of 2016, a rapid assessment of CRW's collection system was performed to further characterize the combined sewer system, assess its condition, and refine sewershed and catchment delineation. Critical to this process was the identification and characterization of number flow diversion and/or splitting structures within the collection system. Manhole inspection results were reviewed for trunk sewers and manholes along sewershed boundaries to further define the sewershed delineations. Additional findings through further CCTV investigation are continually updated in the GIS database. The latest delineation of sewershed and catchment areas are depicted in **Figure 1-3**.

Plan for Completing Implementation of Minimum Control Practices

Sewershed and catchment boundaries will be checked and revised as needed based upon any additional sewer system investigations recommended by the ongoing field investigation program.

1.3.4 System Characterization and Mapping

The partial CD requires CRW to locate, characterize and map the diameter, length, elevation, construction material and age of CRW's conveyance and collection system. The partial CD requires a program to evaluate the structural integrity and maintenance needs of the conveyance and collection systems through internal inspections (CCTV).

Documentation of Current Control Practices

A GIS database has been successfully created and is utilized to delineate the tributary sewershed areas that convey combined and separate wastewater flow to each of the CRW regulator structures and other points of connection to the interceptor sewer system. The conveyance and collection systems are organized by the various interceptor sewers that comprise the CRW system.

CRW has been incorporating the information that is being collected from the ongoing field investigations to refine the GIS database information, fill gaps and holes in the existing attribute information tables, refine the existing configuration of the conveyance and collection system, and refine the current watershed and sewershed delineations. Additional findings through further CCTV investigation are continually updated in the GIS database. The GIS data was used to provide the required input data for the development of the refined H&H simulation models of the CRW conveyance and collection systems.

Plan for Completing Implementation of Minimum Control Practices

The GIS of the accessible portions of the collection system has been completed and will continue to be updated periodically as new information becomes available.

1.4 O&M of CSO Regulator Structures

The CSO regulator structures are considered to be critical to the performance of CRW's combined sewer system. The partial CD requires CRW staff to conduct regularly scheduled regulator and outfall inspections with procedures that can detect and document wet and dry weather CSO discharges and identify the most likely cause(s) of the discharges. When functioning properly, the regulator structures ensure that all the wastewater flow is diverted to the interceptor sewers and the AWTF during dry weather, and they control the frequency, duration and volume of overflow discharges to the Susquehanna River and Paxton Creek during wet weather. Therefore, these structures are inspected daily, observed conditions are carefully documented, any observed problems are promptly addressed, and both preventative and corrective maintenance activities are scheduled and conducted.

1.4.1 Inspection Procedures/Schedules

Documentation of Current Control Practices

There are 59 CSO regulators in the CRW conveyance system, each of which is critical to performance of the system during both wet and dry weather operation. Each CSO regulator in the CRW system is inspected on a daily basis, as detailed the CRW OMM Sections 4.1.3 through 4.1.6. Inspections of the CSO regulator structures are completed once per day, seven days a week, by CRW staff to check and verify they are operating properly, identify combined sewer overflows, identify river intrusion into the interceptor system, identify and correct operational problems, and to identify and schedule required maintenance. Inspections are generally conducted from the surface and entry into the structures is not required unless correctable problems are identified. A pole mounted sewer inspection camera is available and could be utilized if better visibility is required to conduct the inspection.

Daily inspection activities at CSO regulator structures are intended to promptly detect when CSO discharges into the Susquehanna River and Paxton Creek are occurring. CSO discharges should only occur as a result of wet weather (rainfall or snowmelt). Dry weather overflows must be promptly corrected and must be promptly reported to PADEP. The duration and volume of wet weather overflows are estimated, recorded, and reported to PADEP on a monthly basis.

In response to EPA review comments on the regulator inspections, CRW provided further explanation of the inspection protocols and timing. Regulator inspections typically follow within one of these three timeframes: (1) two hours during ideal conditions with minimal traffic (weekends), (2) up to four hours during dry weather, and (3) up to five hours during active CSO events or post-storm activities. The following clarifications further explain the timing of the inspection process, and inspection checklists in the OMM have been updated to clarify the procedures as follows:

- The Diversion Chamber is checked first, and only if there are abnormal conditions are the Regulator Chamber and Float Chamber inspected.
- The observations for flow, water level, debris, etc. are conducted simultaneously. During wet weather, closer inspection is performed to ensure proper flow.
- The documentation procedures are very efficient through the use of codes on the Interceptor Service Report (now handled through Cityworks).
- The 14 tasks under the *Active Combined Sewer Overflow Activity Checklist* are not in addition to the *Standard Daily* CSO *Regulator Inspection Activity Checklist.* These "active" tasks primarily replace the "standard" tasks (with the exception of traffic protection), and of the "active" tasks there is one of three potential subsets of tasks that are actually performed (not a full 14 tasks).
- For the most part, the five tasks under *CSO Post-Storm Activity Checklist* are not in addition to the tasks in the other checklists but rather in place of those tasks, with the exception of resetting the blocks. Block resetting is an efficient process that is performed from above grade.

Additionally, a comprehensive inspection of the regulator structures was conducted in 2014. This provided CRW with detailed sketches of each regulator structure, detailed measurements of the

configuration of each structure for input into the H&H models, as well as photos to document the current condition of each structure.

CRW conducted the CSO Activation Monitoring Pilot (CAMP) Study from November 2015 through November 2016 ~~according to the requirements of Paragraph G(31)(d) of CRW's partial CD~~ and the CAMP Study Plan was submitted to EPA/PADEP on May 10, 2015. The CAMP Study Evaluation Report was submitted on December 1, 2016. In general, the report found that it was premature to proceed with the installation of CSO activation and monitoring equipment. CRW will maintain the standard daily regulator inspections, which have proven to be effective and economical.

Plan for Completing Implementation of Minimum Control Practices

In accordance with the recommendations of the CAMP Study Evaluation Report, CRW will consider CSO activation monitoring capabilities during implementation of the updated ~~as the baseline regulator improvement projects identified in the~~ City Beautiful H_2O Program Plan (CBH2OPP) ~~are implemented~~.

1.4.2 Remedial Repair Procedures/Schedules

The partial CD requires CRW to implement a program, including standard operating procedures, for remedial, routine, and preventive maintenance of their conveyance and collection systems to preserve their hydraulic capacity, minimize gate blockages, minimize the discharge of floatables and solids, and maintain operation of the sewer system.

Documentation of Current Control Practices

Remedial or corrective maintenance and repair of regulator structures are implemented to correct a problem that was identified during the daily inspections and performed as needed when it is identified during the daily inspections or following a CSO discharge event. Common reactive maintenance activities include clearing sewer debris from regulator structure control openings and float chambers after storms. After storm events are over, and the collection system has returned to normal dry weather flow conditions, the flow conditions within the CSO regulator should have also returned to "normal." If not, there could be problems with accumulated debris, partially obstructed or blocked orifice openings between the chambers, or problems with the Brown and Brown mechanical system that caused the control gate to get stuck in the smaller opening or wet weather set point position.

Depending on the nature of the observed problem or condition, corrective maintenance may be implemented immediately before leaving the structure, or may be reported, logged, prioritized, and placed on a maintenance schedule for future implementation. If dry weather CSOs are identified, the remedial measures required to determine the cause and stop the CSO are implemented immediately. Detailed descriptions of these procedures, including checklists of specific maintenance activities conducted by CRW crews, are provided in CRW OMM Sections 4.1.5 and 4.1.6.

Plan for Completing Implementation of Minimum Control Practices

The EPA Guidance requirements for this aspect of NMC-1 have been fully met by completed and ongoing CRW activities. No additional control measure is anticipated at this time.

1.4.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

CRW staff performs preventive maintenance on CSO regulator structures on a scheduled basis to ensure proper operation during dry and wet weather conditions, to limit the likelihood of dry-weather

overflows to the receiving waters, and to limit the frequency, duration and volume of CSO discharges during wet weather. Preventative maintenance for each regulator structure is performed semi-annually, as detailed in CRW OMM Section 4.1.7. Additionally, some routine maintenance activities are completed more frequently and completed during the daily inspections (i.e. those activities not requiring confined space entry). Maintenance activities are also scheduled based on items identified during daily inspections. Currently, all maintenance activities are documented in Cityworks the computerized maintenance management system.

Plan for Completing Implementation of Minimum Control Practices

No additional control measure is anticipated at this time.

1.4.4 Documentation Procedures

The CRW NPDES Permit and the National CSO Policy *Nine Minimum Controls* require that complete and consistent record keeping, and procedures for report development and archiving, are properly developed and implemented.

Documentation of Current Control Practices

Interceptor service reports, work orders, and managerial summary reports have been developed, implemented and archived by CRW personnel to document observed conditions and completed maintenance activities within CSO regulator structures. CRW utilizes the Cityworks Asset Management System for service requests, work orders, and inspections. Further details are documented in CRW OMM Section 4.1.8, which was updated to reflect the Cityworks system. The findings from each CSO regulator structure inspection are recorded on the appropriate interceptor service report**.** Recorded information includes confirmation that the inspection was completed; start/stop times, duration, and volume of CSOs; overflow detection device (ODD) codes; backflow codes, and the crew members who performed the inspections. Any required maintenance identified during inspections is noted in the comments section. A representative copy of service report is included in OMM Appendix A; for reference, the OMM Appendix A Table of Contents is included in **Appendix A** (of this document)

An example preventive maintenance report is included in OMM Appendix A. Preventive maintenance schedule forms (for each CSO type) through Cityworks are included in OMM Appendix A.

Plan for Completing Implementation of Minimum Control Practices

CRW has completed development of Cityworks, capturing and reporting all relevant process data. CRW will continue to reflect future process changes and regulatory requirements.

1.5 O&M of Outfalls/Backflow Prevention Gates

Both the CSO outfalls and the backflow prevention gates are considered to be critical to the performance of CRW's combined sewer system. River intrusion may occur when river stages exceed the elevation of the CSO diversion weir, reducing the available capacity of the interceptor sewers and the AWTF. Backflow prevention gates, commonly called flap gates, are designed to prevent river intrusion from entering the CSO regulator structures. The proper operation and maintenance (O&M) of outfall flap gates prevents or reduces river intrusion.

1.5.1 Inspection Procedures/Schedules

The Partial Consent Decree requires CRW staff to conduct regularly scheduled regulator and outfall inspections with procedures that can accurately detect and document wet and dry weather CSO

discharges. These inspections also meet the partial Consent Decree requirement to identify the cause(s) of the discharge and if river intrusion was a contributing cause.

Documentation of Current Control Practices

The CRW conveyance system contains 60 CSO outfalls that discharge combined wastewater to the Susquehanna River or Paxton Creek. (Of the 59 regulators structures in the CRW system, each has a dedicated outfall except for two which share a common outfall. In addition to the 58 permitted outfalls, the Front Street and Spring Creek pump stations each have an overflow structure, for a total of 60.) Inspections of the CSO outfalls are completed daily by CRW staff to identify combined sewer overflows, identify potential for river intrusion into the interceptor system, and remove debris from the outfalls. Some of these items may be observable during the CSO regulator structure inspection, but outfall inspections allow for direct observations of what occurs at the discharge point (i.e. how much debris accumulates at the outfall or how close a CSO regulator may be to experiencing river intrusion). The inspection of outfalls is conducted concurrently with each daily round of CSO regulator structure inspections.

A February 10, 2016 memorandum prepared under partial Consent Decree paragraph V(G)(31)(c) includes an assessment of the inundation potential of each backflow prevention gate, demonstrating that daily inspections of the flap gates is not required because the flap gates only prevent river intrusion during flooding conditions along Paxton Creek and the Susquehanna River, with the exception of three outfalls along Paxton Creek where the diversion weir elevation is comparable with seasonal high water conditions. Nearly all of the CSO outfalls along Paxton Creek are not submerged and the flap gates are only needed to provide protection against river intrusion during flood-stage conditions along the creek. CRW monitoring data also indicates that flood stages along Paxton Creek typically coincide in magnitude and timing with CSO discharges, further limiting river intrusion. In contrast, the CSO outfalls along the Susquehanna River are submerged. However, the Susquehanna flap gates are not located at the outfalls, but rather in concrete flood chamber structures, generally located away from the shoreline, near the CSO regulator structures. The outfall pipes have sufficient slope so even though the outfalls are submerged by river water, the flood chambers and flap gates are not. Therefore, river water can only enter and flood the outfall pipe and cannot intrude into the interceptor system during normal non-flood river stages. For all the Susquehanna River CSO outfalls, for river intrusion into the interceptor system to occur, river flood stages would need to exceed the crest of the diversion weir, allowing river water to travel up the entire length of the outfall pipe into the flood chamber, pass through the regulating chamber and diversion chamber in the CSO regulator structure, and pass over the crest of diversion weir. Similarly, for nearly all the Paxton Creek CSO outfalls (excluding three), for creek intrusion into the interceptor system to occur, creek water would need to pass over the crest of diversion weir.

Therefore, the incidence of river intrusion is checked on a daily basis by inspecting the diversion weirs in the CSO regulator structures. If no flow is observed over the weir, neither river intrusion nor CSO discharges are occurring. If flow is observed over the diversion weir in the direction from the trunk sewer toward the river, CSO discharge activity would be occurring, and if flow is observed over the weir from the river toward the regulating chamber, river intrusion would be occurring. Detailed procedures for the outfall and backflow prevention gate inspections are documented in CRW OMM Section 4.2.3 through 4.2.5.

CRW performed a complete inspection of the structural condition of each CSO outfall and gate in late 2015, as detailed in CRW OMM Section 4.6.3.

Plan for Completing Implementation of Minimum Control Practices

CRW crews will conduct inspections of the flap gates as described in the OMM Section 4.2.2, particularly at locations identified to be more prone to flooding in anticipation of predicted flooding conditions with the potential to cause river intrusion. The inspections will be conducted with a pole camera to speed the process and prevent the need to conduct a confined space entry into the flood chamber. In anticipation of a predicted flooding event, the inspections will verify that the flap gates are in their closed positions and are free of debris that would prevent the gates from sealing.

1.5.2 Remedial Repair Procedures/Schedules

Documentation of Current Control Practices

Remedial repair for outfalls and backflow prevention gates is performed as needed when it is identified during the daily inspections. Due to the relatively simple nature of outfalls and flap gates, extensive corrective maintenance is not required to ensure proper operation. Detailed descriptions of corrective maintenance activities are provided in the *Daily Outfall and Backflow Prevention Gate Inspection Checklist*, located in Section 4.2.4 of the OMM. The outfall pipes generally do not accumulate sediment because it is flushed out during wet weather overflows, so they usually remain fairly clean with minimal maintenance.

The CSO outfall inspections enabled CRW to define an outfall early action project schedule for remedial repairs of the outfalls/gates for the February 10, 2016 ~~partial CD~~ deliverable, which was updated on April 20, 2017 in response to EPA comments. ~~CRW incorporated potential outfall relocation/consolidation/abandonment into the CSO LTCP presented in the CBH2OPP.~~ On February 13, 2024 CRW updated the Outfall Early Action Project Schedule.

Plan for Completing Implementation of Minimum Control Practices

Table~~s~~ 1-~~6 4 and 1-7~~ provide~~s~~ the schedule outlined in the CSO Outfall Early Action Project Schedule.

Table 1-~~6~~4. CSO Outfall Repair Early Action Project Schedule

Time Period	Recommended Actions
February 2024	▪ Repair outfall 013 regulator chamber - **COMPLETE**
March 2024 (Annually)	▪ Outfall assessments during routine annual CSO cleaning
March 2024 – September 2024	▪ Conduct details assessments (under bypass pumping) of the structures at the following outfalls and develop repair strategies with schedules: - Outfalls 042 & 042 - Outfall 039 - Outfall 008 ▪ Implement repairs at outfall 019
CSO Long-Term Control Plan Development: October 2024 – December 2024	▪ Schedule outfall repairs or reconfiguration strategy for the following critical outfalls: - Outfall 007 (replace with 27-in pipe; utility conflicts) - Outfall 029 (replace with 36-in pipe; further coordination required) - Outfall 038 (possible sewer separation) ▪ Schedule flap gate replacement at outfalls 006, 008, 020, 021, 022, 024, 051, and 058 as part of a future LTCP project or IDIQ contract
2025-2026	▪ Implement sewer separation projects at the following critical outfalls: 027 & 041 ▪ Finalize scope of near-term (5-yr) outfall improvements in conjunction with LTCP, AMP, and near-term 20-Yr CIP project areas

2027-2028	▪ Incorporate river intrusion protection into Spring Creek PS rehabilitation (outfall 003)
2029-2030	▪ Implement Paxton Creek outfall and regulator improvements
Ongoing	▪ Condition of outfalls and related structures is monitored during daily CSO checks; minor repairs are made as needed.

~~Time Period~~	~~Recommended Actions~~
~~Through April 1, 2017 (System Characterization)~~	~~▪ Define near-term CSO outfall / regulator strategy for CSOs with <1-year freeboard and/or not in good condition (memorandum submitted February 2017).~~
~~2019-2021~~	~~▪ Implement repairs for four CSO outfalls in critical condition, completed.~~ ~~▪ Incorporate river intrusion protection into Front St. PS (CSO 002) rehabilitation design (completed).~~ ~~▪ Evaluate flap gate repair viability for outfalls 006, 008, 021, 022, 024, 032, and 051 (completed).~~
~~Ongoing (CSO LTCP Implementation)~~	~~▪ Evaluate/implement repairs at outfall 027.~~ ~~▪ Implement flap gate replacement at outfalls 006, 008, 021, 022, 024, 032, and 051 as part of a future LTCP project or IDIQ contract; schedule to be determined.~~ ~~▪ Incorporate river intrusion protection into Spring Creek PS rehabilitation (CSO 003), to be included in future design projects.~~ ~~▪ Implement repairs for CSOs in critical/poor condition.~~ ~~▪ Implement Year 2 CSO outfall / regulator reconfiguration per strategy.~~ ~~▪ Incorporate remaining CSO outfall/regulator reconfiguration into CSO LTCP schedule.~~

~~**Table 1-7. CSO Outfall Structural Repairs**~~

~~CSO~~	~~Height [in]~~	~~Width [in]~~	~~Shape~~	~~Defect Location~~	~~Recommended Structural Repair & Timing~~	~~Qty. (Units)~~
~~*CSO-007*~~	~~*25*~~	~~*25*~~	~~*Circ.*~~	~~*CSO Pipe (between Diversion Chamber & Flood Chamber)*~~	~~***Defer repair** - Replace with 27" Pipe – utility conflicts*~~	~~*32 LF*~~
~~CSO-027~~	~~30~~	~~30~~	~~Circ.~~	~~Outfall Pipe (Downstream of Flood Chamber)~~	~~***Defer repair** - include with sewer separation/PCI rehab/replacement*~~	~~39 LF~~
~~*CSO-029*~~	~~*20*~~	~~*20*~~	~~*Circ.*~~	~~*CSO Pipe/Outfall*~~	~~***Defer repair** - Replace with 36" Pipe – further coordination required*~~	~~*38 LF*~~
~~*CSO-038*~~	~~*20*~~	~~*20*~~	~~*Circ.*~~	~~*Outfall Pipe*~~	~~***Defer repair** - evaluate abandoning outfall/ regulator*~~	~~-~~
~~*CSO-041*~~	~~*20*~~	~~*20*~~	~~*Circ.*~~	~~*Outfall Pipe (Downstream of Flood Chamber)*~~	~~***Defer repair** - include with sewer separation/PCI rehab/replacement*~~	~~-~~

1.5.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

Preventative maintenance for the backflow prevention gates is performed annually to ensure they continue to operate properly. Visible flap gates without flood chambers are maintained during periods of low flow along the creek and river to maximize accessibility. Flap gates with flood chambers and flood gates can be maintained at any time. Detailed descriptions of preventive maintenance activities, and associated checklists used by the CRW crews, are provided in CRW OMM Section 4.2.6. CRW removed the debris from the outfall pipes that was discovered during the outfall inspections.

Plan for Completing Implementation of Minimum Control Practices

Annual gate maintenance will continue to be performed.

1.5.4 Documentation Procedures

Documentation of Current Control Practices

Interceptor service reports, work orders, and managerial summary reports have been developed, implemented and archived by CRW personnel to document observed conditions and completed maintenance activities with respect to outfalls and backflow prevention gates. The findings from CSO outfall inspections and maintenance activities are recorded on the appropriate forms in Cityworks. The interceptor service report also includes the findings from CSO regulator inspections since they are done concurrently. An illustrative example of an interceptor service report is provided in OMM Appendix A. Further details are documented in CRW OMM Section 4.2.7.

Plan for Completing Implementation of Minimum Control Practices

CRW has completed development of Cityworks, capturing and reporting all relevant process data. CRW will continue to reflect future process changes and regulatory requirements.

1.6 O&M of Interceptors

The partial CD requires CRW to implement a program for the inspection, cleaning, and maintenance of sewers and manholes to remove solids and debris and maintain operation of the interceptor sewer system.

1.6.1 Inspection Procedures/Schedules

Documentation of Current Control Practices

The water level (percent full) in each interceptor is inspected and recorded daily at designated manholes, one for each of the Asylum Run, Front Street, Hemlock Street, Paxton Creek, Spring Creek interceptor sewers. This information is recorded on the *Daily CSO Inspection Work Order (previously referred to as Interceptor Service Report)*, a copy of which is provided in Appendix A of the OMM. The daily CSO regulator inspections also provide key information on the condition of the interceptors.

CRW completed an interceptor inspection program in 2014. CRW contracted Redzone Robotics to inspect all interceptor sewers using the "Cleanflow" sewer inspection system, which included CCTV video, NASSCO PACP data, sonar, and laser profiling. Summary descriptions of the inspections, the observed findings, and the corresponding recommendations in CRW OMM Section 4.4.3.

CRW cleaned 33,500 linear feet of the interceptors, and after each segment was cleaned it was re-inspected via CCTV and sonar. The cleaning project involved portions of the Paxton Creek Interceptor, Front Street Interceptor, Hemlock Interceptor, Spring Creek Interceptor, and Paxton Creek Relief Interceptor. This information is being utilized for the interceptor rehabilitation designs discussed in Section 1.6.2 below.

Plan for Completing Implementation of Minimum Control Practices

CRW is ~~developing~~ developed a routine inspection program for its interceptors ~~that will likely be~~ on a 5-year rotation, after remedial interceptor repairs have been completed, as described in the ~~next section~~Section 1.6.3.

1.6.2 Remedial Repair Procedures/Schedules

The Partial Consent Decree requires CRW to implement a program, including standard operating procedures, for remedial, routine, and preventive maintenance of their conveyance and collection systems to preserve their hydraulic capacity, minimize the discharge of floatables and solids, and maintain operation of the sewer system.

Documentation of Current Control Practices

The post-cleaning inspection results were reviewed to finalize identification of the portions of each interceptor that will require rehabilitation. The Asylum Run Interceptor and Front Street ~~Phase 1~~ Interceptor rehabilitation projects are complete.

Plan for Completing Implementation of Minimum Control Practices

Interceptor repairs identified in the recent inspection program are outlined in CRW OMM Section 4.4.3. A summary of proposed schedule for interceptor remedial construction is provided below.

- FY 2032: Paxton Creek Rehabilitation
- ~~FY 2022-2023: Front St. Phase 2 Rehabilitation~~
- ~~TBD~~FY 2028: Spring Creek Rehabilitation (schedule tied to pumping station project)

1.6.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

As part of the Front Street Interceptor Rehabilitation project, CRW is comprehensively cleaning 20,850 linear feet, as listed in Table 1-8.

Plan for Completing Implementation of Minimum Control Practices

CRW is developing a CCTV inspection and cleaning program on a 5-year schedule for each interceptor, following rehabilitation construction completion, which is summarized below in **Table 1-5**.

Table 1-~~7~~5: 5-Year Interceptor Cleaning Program

Interceptor	Approximate Length (LF)	5-Yr Cycles
Front Street	20,850	2023, 2028, 2033
Spring Creek	10,620	2024 2029, 2034
Asylum Run & Hemlock	5,980	2025, 2030, 2035
Paxton Creek – Phase 1	18,680	2026 2031, 2036
Paxton Creek – Phase 2	15,940	2027, 2032, 2037

1.6.4 Documentation Procedures

Documentation of Current Control Practices

Interceptor inspection documentation is tied closely to the daily CSO regulator inspections. Additional details on this documentation are provided in CRW OMM Section 4.4.6, and examples of the associated interceptor service reports, which are now handled through Cityworks, are included in OMM

Appendix A. In mid-2017, CRW completed development and implementation of a project module within Cityworks to record project related and contracted work orders.

Plan for Completing Implementation of Minimum Control Practices

CRW has completed development of Cityworks, capturing and reporting all relevant process data. CRW will continue to reflect future process changes and regulatory requirements.

1.7 O&M of Pump Stations

The pump stations are considered to be critical to the performance of CRW's combined sewer system. When functioning properly, the primary pump stations (Front Street and Spring Creek) receive wastewater from the interceptors; provide preliminary treatment of wastewater; and direct flow to the AWTF. The proper operation and maintenance of the pump stations is critical to protecting water quality in the river and creek and maintaining the proper operation of the treatment plant. Therefore, inspections are conducted daily, observed conditions are carefully documented, any observed problems are promptly addressed, and both preventative and corrective maintenance activities are scheduled and conducted. The partial CD requires CRW to implement a program for the inspection, operation and maintenance of pump stations to maintain operation of the interceptor sewer system.

1.7.1 Inspection Procedures/Schedules

Documentation of Current Control Practices

Pump stations are inspected every day, seven days per week. Front Street and Spring Creek Pump Stations are inspected and maintained twice per shift for a total of four inspections per day. Inspections are typically completed around 10:30-11:30 and 17:00-18:00 during the first shift ("A" shift), and around 22:30-23:30 and 05:00-6:00 during the second shift ("B" shift). During heavy rain and/or heavy flows, inspection frequency for Front Street and Spring Creek Pump Stations is increased to three times per shift for a total of six inspections per day. The Market Street Pump Station is inspected twice a day during dry weather and six times per day in wet weather. The City Island Pump Stations are inspected once a day during dry weather and twice a day during events on City Island. There are four rotating crews that perform the inspections, providing 24 hours a day, 7 days a week, year-round coverage. The CRW OMM contains checklists and detailed procedures for routine inspection activities conducted at the pump stations, located in Section 4.3.2, 4.3.3, 4.3.4 and 4.3.5.

1.7.2 Remedial Repair Procedures/Schedules

Documentation of Current Control Practices

The partial CD requires CRW to implement a program, including standard operating procedures, for the inspection and maintenance of pump stations along the conveyance system to preserve their hydraulic capacity and maintain operation of the conveyance sewer system. Remedial repairs are made on an as needed basis to maintain pumping station operation. The OMM has a series of written procedures and checklists describing remedial actions including the following:

- Procedures for lost communication with the AWTF computer
- Procedures for repairs to the screening equipment
- Procedures for repairs to the sewage pumps
- Pump down procedures

CRW completed the Front Steet pump station upgrade in 2021.

Plan for Completing Implementation of Minimum Control Practices

CRW is planning to upgrade the Spring Creek pump station.

1.7.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

CRW staff implement a routine preventative maintenance program on the pump stations. Depending on the specific task, preventative maintenance activities are performed on a weekly, monthly, quarterly, semi-annual, or annual basis, and schedules are outlined in CRW OMM Section 4.3.8.

Plan for Completing Implementation of Minimum Control Practices

CRW will update the Front Street pump station, maintenance procedures and documentation based on the recent upgrades. CRW will continue to review and assess its maintenance procedures on an annual basis.

1.7.4 Documentation Procedures

Documentation of Current Control Practices

A series of field reports and managerial summary reports have been developed, implemented and archived by CRW personnel to document observed conditions and completed maintenance activities with respect to pump stations. CRW documents all pumping station maintenance on the *Operations Log* for each station, as detailed in CRW OMM Section 4.3.9. OMM Appendix A contains examples of the pump station documentation forms and checklists. In early 2019 CRW completed the implementation of Cityworks for operations and maintenance of the AWTF and pumping stations.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue updating Cityworks for operations and maintenance of AWTF and pumping stations, as needed.

1.8 O&M of Force Mains

1.8.1 Inspection Procedures/Schedules

The partial CD requires a program to inventory and inspect all force mains, indicating the diameter, length, construction material, typical flow rates, and special corrosion protection measures.

Documentation of Current Control Practices

CRW operates and maintains two force mains: the 6,000 feet long force main from the Front Street pump station to the AWTF, and the 65 feet long force main connecting the Spring Creek pump station to the Front Street force main. The entire length of the Front Street Pump Station force main is walked annually to look for any indication of leaks. Any wet spots or other changes in surface conditions that could be related to a leak is documented on the *Collection System Work Order*. In addition to the periodic inspections, flow discrepancies observed at the AWTF may prompt force main inspections. Inspection procedures for the two force mains are detailed in CRW OMM Section 4.5.3, and a copy of the inspection form is provided in OMM Appendix A.

CRW completed a detailed force main condition assessment, utilizing an internal acoustic inspection tool that identifies leaks, gas pockets, pipe anomalies, and pipe stresses. No remedial maintenance or repair needs were identified during this inspection.

Plan for Completing Implementation of Minimum Control Practices

All envisioned minimum controls have been implemented at this time.

1.8.2 Remedial Repair Procedures/Schedules

Subsequent to the force main inspection activities, the partial CD requires CRW to develop a schedule to periodically evaluate the structural integrity, maintenance needs, and remaining service life of each force main, including provisions for internal inspection.

Documentation of Current Control Practices

Force main repairs are currently conducted on an as needed basis. The condition assessment, described previously in Section 1.8.1, indicated that there are not any rehabilitation efforts required.

Plan for Completing Implementation of Minimum Control Practices

All envisioned minimum controls have been implemented at this time.

1.8.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

The maintenance required for the force mains is relatively minimal, as detailed in CRW OMM Section 4.5.4. Air release valves are exercised and inspected annually, and excess water is pumped out of the blow-off chamber, if necessary.

Plan for Completing Implementation of Minimum Control Practices

All envisioned minimum controls have been implemented at this time.

1.8.4 Documentation Procedures

Documentation of Current Control Practices

Force main maintenance and remedial work is documented on the CRW *Collection System Work Order* form, through Cityworks as detailed in CRW OMM Section 4.5.5 and included in OMM Appendix A.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to advance the implementation of Cityworks.

1.9 O&M of Collection System Sewers

The partial CD requires CRW to implement a program for the inspection, cleaning, and maintenance of sewers and manholes to remove solids and debris. The partial CD also requires CRW to develop and implement a program to investigate and minimize sources of floatable materials, solids, and other substances that cause blockages or reduce hydraulic capacity.

1.9.1 Inspection Procedures/Schedules

Documentation of Current Control Practices

Maintenance responsibility for the collection system was transferred in December 2013 from the City of Harrisburg to CRW. CRW's collection system consists of approximately 117 miles of sewer and approximately 3,000 manholes. Key areas of the collection system, referred to as "hot spots", are inspected on a daily basis for identifying potential problems with debris, sediment or FOG accumulations. There is a specific list of locations in the collection system that have historically proven to be problem areas, which CRW staff inspect routinely (at a minimum monthly and more frequently

for particular areas of historical concern). The list of "hot spot" locations is provided in OMM Appendix A3.3. Trunk sewers are inspected daily at their discharge to each regulator structure to verify proper flow conditions and identify any potential upstream problems. A pole mounted sewer inspection camera can be used to look up the trunk sewer from the surface of a regulator structure or manhole. Details on the daily inspection of trunk sewers are provided in CRW OMM Section 4.6.3. Additionally, CCTV inspections are performed within the collection system when there is a suspected blockage, etc., and CRW has initiated a comprehensive systemwide CCTV inspection and assessment of the collection system.

A hot spot is added to the list based on whenever there is an SSO or unauthorized discharge from the occurrence of a line blockage. A hot spot is delisted once there has been a period of no activity for at least 16 months (depending on the inspection frequency requirements outlined in the OMM). The hot spot inspection cleaning and inspection intervals are generated via Cityworks.

CRW used pole cameras to complete a rapid assessment of the collection system from (accessible) collection system manholes. Details on the scope of inspection and documentation activities are provided in CRW OMM Section 4.6.3. GPS equipment was used to confirm or update location coordinates, structure configurations and field measurements will be confirmed/obtained, and dual zoom cameras provided video documentation of each sewer segment to characterize observed conditions.

~~CRW completed two CCTV inspection projects that total approximately 13 miles, which were the initial focus of further investigative efforts. The projects were selected in order to evaluate critical structural deficiencies, support key multi-modal projects, better define critical sewers, and assist with LTCP development.~~CRW continues to conduct a comprehensive CCTV investigation of the collection system sewers.

Plan for Completing Implementation of Minimum Control Practices

~~CRW is utilizing the rapid assessment data in conjunction with their asset management prioritization procedures outlined in Section 1.2.3 to identify critical cleaning / repair needs, establish the high priority areas for comprehensive CCTV inspections to more fully assess system condition, and prioritize cleaning/repair needs.~~ CRW intends to complete the inspection and cleaning of the entire collection system by June 30, 2025.

CRW will not be able to define a long-term preventive collection system inspection and cleaning program until the remedial cleaning work is identified and completed.

1.9.2 Remedial Repair Procedures/Schedules

The partial CD requires CRW to implement a program, including standard operating procedures, for remedial, routine, and preventive maintenance of their conveyance and collection systems to preserve their hydraulic capacity, minimize obstructions or blockages, minimize the discharge of floatables and solids, and maintain operation of the sewer system.

Documentation of Current Control Practices

Currently, specific repairs are ~~primarily~~ performed on an as needed basis in response to citizen complaints, CCTV inspections revealing critical structural deterioration, identification of blockages, etc. In-house capabilities for sewer maintenance requiring excavation is limited to shallow sewers. Construction on sewers greater than ten feet deep is typically done by contractors.

~~CRW continues to perform collection system inspection, rehabilitation, and replacement projects as detailed in the semi-annual reports and prioritized in the asset management plan.~~CRW is also implementing the Collection System Asset Management Plan (CAMP), which involves prioritizing project areas for rehabilitation and replacement each year.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to prioritize areas of the collection system for remedial repair based on an overall schedule for cleaning, rehabilitation, replacement, etc. as part of the ~~core risk analysis in the asset management program and LTCP plan implementation~~CAMP implementation.

1.9.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

Routine maintenance for the collection system, primarily consists of removing debris identified during the "hot spot" inspections described in Section 1.9.1 above; further details are provided in CRW OMM Section 4.6.4.

Plan for Completing Implementation of Minimum Control Practices

Procedures for additional preventative maintenance will be developed once the initial system-wide inspection and prioritization is completed. CRW will prioritize areas that require remedial cleaning, which can be followed up with further inspection and remedial work where required. Once this work is completed CRW will be able to develop a schedule for the comprehensive collection system cleaning and re-cleaning.

1.9.4 Documentation Procedures

Documentation of Current Control Practices

CRW staff record all maintenance activities on the Collection System Work Order forms through Cityworks, as detailed in CRW OMM Sections 4.4.7 and 4.6.7. Copies of the forms used to document collection system activities are provided in OMM Appendix A. There are numerous templates in Cityworks to address different collection system work orders.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to advance the implementation of Cityworks, including the addition of reporting capabilities.

1.10 O&M of Inlets / Catch Basins

The partial CD requires CRW to implement a program, including standard operating procedures, for the inspection, cleaning, and maintenance of inlets and catch basins to remove solids and debris, minimize obstructions or blockages, minimize the discharge of floatables and solids, and maintain operation of the sewer system.

1.10.1 Inspection Procedures/Schedules

Maintenance responsibility for inlets and catch basins was transferred in December 2013 from the City of Harrisburg to CRW. CRW maintains approximately 3,900 stormwater inlets as part of its combined sewer system.

Documentation of Current Control Practices

Remedial systemwide inspection and cleaning of inlets and catch basins to restore function and capacity is nearly complete. In addition, inlets and catch basins may be inspected and cleaned in response to citizen complaints. Complaints may be received by the 24-hour call center or directly by staff at the AWTF. High priority inlets and catch basins receive maintenance first. After a high priority catch basin is successfully cleaned and repaired, the adjacent inlets are inspected and cleaned while the crews are in the vicinity. Inspections and subsequent maintenance activities are tracked for all stormwater inlets.

Initial inspection and maintenance activities revealed that up to 50 percent of the inlets and catch basins were partially to completely blocked with debris. When cleaned, many of these storm inlets were discovered to have significant structural deficiencies that require immediate repair. Consequently, CRW completed a multi-year program of initial remedial inlet inspection, cleaning and repair.

CRW inlet cleaning and inspection procedures are outlined in CRW OMM Section 4.7.4, including a detailed *Inlet and Catch Basin Inspection Activities Checklist.* OMM Appendix A also contains Field Maintenance Information summary tables that document the work.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to clean and inspect inlets every three years now that the initial round of inspections is completed.

1.10.2 Remedial Repair Procedures/Schedules

Documentation of Current Control Practices

Currently, CRW performs remedial work on specific inlets as needed. When storm inlets are cleaned in response to documented citizen complaints, as described in Section 1.10.1 above, the structural integrity of the inlet is assessed. If remedial repair or reconstruction is required, the work is generally done the same day. A checklist for the reconstruction of inlets and catch basins is provided in OMM section 4.7.5. Rebuilding a stormwater inlet typically requires a 2-person crew approximately 8 hours to complete. CRW completed the multi-year program of initial remedial inlet cleaning and repair.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to repair, rebuild, and incorporate floatables control (where needed) for inlets.

1.10.3 Maintenance Procedures/Schedules

Documentation of Current Control Practices

Maintenance activities for inlets and catch basins include remedial cleaning and reconstruction. The current remedial maintenance activities for inlets and catch basins are documented in CRW OMM Section 4.7.5, including an *Inlets and Catch Basins Cleaning Checklist*. At this time, clearing an inlet blockage without having to do any reconstruction requires a two-person crew approximately 1 to 3 hours to complete, depending on the amount of material to be removed.

Plan for Completing Implementation of Minimum Control Practices

Now that CRW completed its multi-year program of remedial cleaning and repair, based upon citizen complaints and inspection of adjacent inlets, it will embark on a more preventative cleaning and maintenance program. Beginning in 2022 CRW plans to start a preventative maintenance program

based upon similar benchmarking metrics. This would involve inspecting 120% of the inlets each year and assuming approximately 50% of the inspected inlets would require cleaning each year.

1.10.4 Documentation Procedures

Documentation of Current Control Practices

Maintenance for inlets and catch basins is documented as outlined in CRW OMM Section 4.7.7. Documentation for inlet and catch basin service requests, work orders and inspections are recorded in Cityworks. Copies of these forms are provided in OMM Appendix A.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to update Cityworks to fulfill all future documentation needs and reflect process updates.

1.11 Source Investigations

The partial CD requires CRW to implement a program, including standard operating procedures, for the inspection of grease traps from restaurants, schools, and other facilities.

1.11.1 Food Service Grease Traps

CRW outlines their approach for regulating food service grease traps in NMC-3. The Environmental Compliance Inspector is tasked with advancing the FOG program for CRW.

1.11.2 Non-Domestic Waste Streams

CRW has detailed documentation for their procedures for regulating non-domestic waste streams in NMC-3.

1.11.3 Floatables, Solids, and Blockages

CRW has detailed documentation for their procedures for preventing floatables, solids, and blockages in NMC-6.

1.11.4 Sinkholes

Documentation of Current Control Practices

Sinkholes are currently inspected in response to citizen complaints received by the 24-hour call center. CRW maintains a detailed database of each sinkhole that has been discovered and remediated related to CRW infrastructure beginning in September 2012. Further details are provided in CRW OMM Section 4.9. Once a potential sinkhole is identified via customer complaints or other means, a visual inspection is implemented, often using listening devices to check for an indication of water flow. A pole camera is often used to conduct further investigations below the ground surface. If necessary, a CCTV inspection will be conducted of the gravity sewer and storm mains in the vicinity of the sinkhole. Sinkholes are repaired using CRW crews and equipment if the depth is shallow enough (generally up to 8 feet deep), or CRW may employ an outside contractor to perform the repair. A database summarizing the sinkholes that CRW has addressed in recent years is included in **Appendix C**.

CRW completed the first phase of its Sinkhole Impact Assessment and Mitigation Program. This program was developed to evaluate the inter-related nature of aging CRW infrastructure and sinkhole formation. The program developed a criticality assessment and rating system to prioritize infrastructure and specific areas that should be the focus of further sinkhole investigation or

infrastructure rehabilitation. Although the program does not specifically focus on the combined/sanitary sewer system, this is a critical component of the CRW infrastructure that was evaluated.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to investigate sinkholes and address sinkholes related to CRW utilities.

1.12 Emergency Response Procedures

1.12.1 Citizen Complaints/Service Requests

Documentation of Current Control Practices

Citizens may currently utilize one of two methods to report problems or request service:

- Call 1-888-510-0606; Extensions 2 or 3
- Complete the form available under Report a Problem on www.capitalregionwater.com

All service requests are directed to the Customer Service Center. Customer Service Representatives are responsible for creating the request in Cityworks. The service request will automatically populate in the responsible Field Maintenance Supervisor's inbox, and field staff are subsequently dispatched to each location. Additional details are provided in CRW OMM Section 4.10.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to advance the implementation of Cityworks.

1.12.2 Emergency Maintenance

Documentation of Current Control Practices

An emergency may be identified by CRW maintenance staff or reported to CRW by customers or other concerned citizens. Complaints received by CRW during regular business hours are relayed to the Customer Service Center. A Customer Service Representative will create the service request in Cityworks and immediately call the appropriate maintenance management staff. If CRW maintenance staff identifies the emergency a call is made directly to the appropriate Field Maintenance Supervisor. It is the responsibility of the responsible Supervisor and staff to record the incident in Cityworks. If the nature of the complaint is an emergency, it will be investigated immediately by maintenance crews. Once the situation is investigated, a preliminary determination is made of the criticality and the equipment/personnel required, and supervisory/management staff are contacted for further direction. Management will allocate additional resources as necessary, including equipment and materials, emergency contractors, and additional staff. Detailed communication procedures and the chain of command are documented in CRW OMM Section 4.8.

Through Cityworks CRW is able to elevate the status of emergency work orders as extremely critical, high priority work orders.

For emergencies that may occur during evening, weekends, and holidays, the emergency response generally does not change. While management staff typically work during normal business hours, the chain of command remains the same. The CRW call center is operational 24 hours per day. Additionally, the AWTF is staffed 24 hours per day, and operators may receive emergency notifications outside normal business hours.

Emergency maintenance may require the use of outside contractors to make repairs beyond CRW capabilities, or to accelerate repairs. CRW maintains a pool of emergency contractors that may be contracted to complete emergency maintenance.

CRW typically responds to four primary types of emergencies that are listed below. For each emergency, the OMM contains an SOP(s) that should be referenced to resolve the issue.

- SSO or Line Blockage: refer to the line blockage SOP.
- Dry Weather Overflow: refer to the active overflow SOP.
- Pump Station Failure: refer to the Emergency Action Plan and Emergency Shutdown Procedures.
- Large Sinkhole or Line Collapse: refer to SOP in the OMM.

1.13 Training Policies and Procedures

1.13.1 New Employees

A proper O&M program includes an appropriate blend of classroom training and on-the-job training. New employees should be trained in operation and safety procedures as soon as they begin duty, and opportunities for training and re-training of long-term employees should be available. The objective is to have well-trained employees who know their duties and how to report problems that require attention from O&M managers. The partial CD requires that CRW develop and implement a training program for personnel conducting O&M activities.

Documentation of Current Control Practices

All new CRW employees undergo a formalized training program which includes both classroom and on-the-job training. A series of safety training sessions are conducted over a period of several days and include topics such as confined space entries, traffic control, and chemical safety. New employees are also given facility tours so they are familiar with the "within the fence" treatment plant facilities and the "outside the fence" pump station and CSO structure facilities. New employees go through a mandatory six-month probationary period when they are teamed with one of the experienced Field Maintenance Specialists who provide on-the-job training for all aspects of the employee's job description. CRW developed the following 4-week training schedule for new staff in Field Maintenance:

Week 1

Day 1

- 7:00 am – 8:30 am new employees meet with Human Resources
- Field Maintenance Supervisor meets with employees
- General overview of job
- Hand out personal protective equipment
- Introduction of CSO's field work with Supervisor

Day 2-5

- Checking CSOs
  - New employees out in the field will be with experienced personnel
- Things to look at:
  - CSO Resource Book

- Confined space entry procedures
  - View video
  - Calibration of meters
- Work zone traffic safety
- Cityworks
- Sewer maps
- O&M Manuals
- Basic Vactor operation

Week 2

- Checking CSOs
- Vactor Operation
  - CSO cleaning
  - Flushing & cleaning lines
  - Washing down chambers

Week 3

- Checking CSOs
- Hot spot checking

Week 4

- Checking CSO's
- Assisting with camera truck

CRW also implements a formalized process for ongoing training for the staff who provide O&M services. On a monthly basis, the designated members of the Safety Committee meet to discuss all aspects of safety, proactively review ongoing trends and/or potential concerns, and to make decisions on what topics should be presented and discussed with the staff at the quarterly meetings. The quarterly meetings are conducted with all the O&M staff, and the presented topics are those selected by the Safety Committee at the monthly meetings. CRW also conducts an ongoing series of Tool Box Talks. These monthly meetings involve all the O&M staff and focus on operational topics and issues. Written handout materials are obtained from an outside training vendor and are distributed to all the O&M staff and presented by the senior field managers. CRW also maintains a collection of training videos that are available to O&M staff on DVD, which includes topics such as traffic safety and proper chemical handling. Written meeting minutes are prepared to document all the continuing safety and operational training sessions.

In early 2017, CRW developed and implemented a one-day training module on "Implementing CRW's NMC Plan".

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to implement its formalized training programs for new employees and will continue to implement its ongoing monthly and quarterly continuing training programs. The programs including existing mechanisms to evaluate potential ways to enhance and improve its employee training programs.

1.13.2 Employee Advancement

Documentation of Current Control Practices

Each CRW employee must successfully demonstrate certain skills and handle specific responsibilities at their current grade level prior to being considered for a promotion within the CRW organization. New employees must successfully complete the formalized six-month probationary period which

includes both classroom and on-the-job training and must demonstrate they have the necessary skills to effectively fulfill their job responsibilities and provide the required O&M support services.

1.13.3 Operator Licensing Requirements

Documentation of Current Control Practices

For all CRW positions that require a PADEP operator's license, staff are required to pass the respective licensing/certification exams and maintain the necessary CEUs. Field employees providing O&M support are encouraged to obtain a Commercial Driver's license and continue on to obtain a PADEP Wastewater E-4 license for satellite collection systems. CRW reimburses employees for the successful completion of the training requirements and to obtain the 15 Continuing Education Units that are required on a three-year cycle to renew their certification. Operations staff at the AWTF and the pump stations have obtained PA-DEP A-1,4 certification licenses. Again, CRW reimburses the employees to obtain the 30 Continuing Education Units that are required on a three year cycle to renew their certification.

1.14 Periodic Review of O&M Programs

Documentation of Current Control Practices

Through the development of this NMC Plan and the CRW OMM, CRW thoroughly examined their current O&M program. These two documents serve as the groundwork for future improvements to their O&M program. CRW updated the OMM to include Cityworks asset management protocol.

Plan for Completing Implementation of Minimum Control Practices

CRW will be formally updating this NMC Plan and the OMM on an annual basis. As additional procedures are developed from the ongoing investigations and remedial repairs they will be implemented.

Section 2
Minimum Control Number 2
Maximum Use of the Collection System for Storage

2.1 Regulatory Context

The United States Environmental Protection Agency (EPA) guidance for Nine Minimum Control (NMC) No. 2 indicates that, "maximum use of the collection system for storage means making relatively *simple* modifications to your combined sewer system to enable it to store wet weather flows until downstream sewers and treatment facilities can handle them." Use of the collection system for storage, referred to herein as "in-system storage," has long been recognized as a potentially cost-effective means to mitigate the occurrence and impacts of CSOs.

The policy and guidance documents require the evaluation and documentation of the current level of implementation of the NMCs within the combined collection system. Capital Region Water's (CRW's) modified partial Consent Decree (CD) requires CRW to prepare this NMC Plan, consisting of proposed actions to achieve the NMCs with an implementation schedule, as an alternative to documentation of compliance with the NMCs called for in the Combined Sewer Overflow (CSO) Policy. **Table 2-1** summarizes the major requirements for NMC-2 based upon EPA's Guidance for Nine Minimum Controls, while **Table 2-2** summarizes the major requirements of CRW's modified partial CD. Each table identifies the specific subsection of this NMC-2 Plan that addresses each requirement.

Table 2-1: EPA Guidance Compliance Checklist for NMC-2

NMC-2 Requirement Description Maximization of Storage in the Collection System	EPA Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Conveyance and Collection System Inspection: This control measure would enable identification of deficiencies, such as accumulations of sediment or river intrusion through leaking flap gates, which restrict the use of the system's available storage capacity.	3.1	C (11)(b)(i)	2.2	4.1 4.4
Flap Gate and Outfall Pipe Maintenance and Repair: This control measure would promptly identify and correct leaking flap gates and/or outfall pipes that could admit significant volumes of water into the sewer system, occupying system storage and conveyance capacity that would otherwise be available.	3.1	C (11)(b)(i)	2.3	4.2
Adjustment of CSO Regulator Structures: This control measure would raise the crest of the diversion weirs, with simple modifications, to increase in-system storage of wet weather flows.	3.1	C(11)(b)(ii)	2.4	Not Applicable
Retard Flows: This control measure would modify catch basin inlets, using available commercial devices such as Hydrobrakes, to restrict the rate at which surface runoff is allowed to enter the system.	3.1	Not Applicable	2.5	Not Applicable

Table 2-1: EPA Guidance Compliance Checklist for NMC-2

NMC-2 Requirement Description Maximization of Storage in the Collection System	EPA Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Localized Upstream Detention: This control measure would use localized detention in appropriate upstream areas, such as upstream parking areas, to provide effective short-term storage.	3.1	Not Applicable	2.5	Not Applicable
Upgrade/Adjustment of Pump Operations: This control measure would increase pumping rates, and available capacities in upstream portions of the collection system, through repair or modification of pump stations, but require available capacity in downstream sewers and at the AWTF.	3.1	Not Applicable	2.5	Not Applicable
Removal of Obstructions to Flow: This control measure would include maintenance activities to remove and prevent accumulations of debris and sediment that restrict flow and reduce available storage volume.	3.1	C(10)(b)(iii)	2.6	Not Applicable

Table 2-2: Consent Decree Compliance Checklist for NMC-2

NMC-2 Consent Decree Requirement Description Maximize Use of Storage in the Collection system	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Investigate the condition and effectiveness of currently installed measures to prevent river intrusion into the combined sewer system (e.g., gaskets on river gates.)	C (10)(b)(i)	3.1	2.2 2.3 2.4	4.1 4.2
Utilizing the results of the investigation and, taking into account observed intrusion occurrences, perform necessary repairs, replacements, and maintenance to prevent river intrusion into the combined sewer system	C (10)(b)(i)	3.1	2.2 2.3	4.1 4.2
Conduct internal investigations and hydraulic modeling, to identify work that can be conducted to maximize in-pipe storage (e.g., adjustment of weir heights, prevention of river intrusion into the combined sewer system.)	C (10)(b)(ii)	Not Applicable	2.4	Not Applicable
Identify portions of the combined sewer system that accumulate debris, grit and sediment, and identify appropriate frequencies for routine removal of these accumulations.	C (10)(b)(iii)	3.1	2.2	Not Applicable
Repair locations where river intrusion occurs through cracked and damaged CSO outfall pipes, and develop a priority list and repair schedule for the necessary remedial activities.	C (10)(b)(iv)	3.1	2.3	4.2

2.2 Combined Sewer System Inspection

A key component of maximizing storage within the conveyance and collection system is ensuring that the combined sewers are in good condition and free of debris and blockages. CRW's conveyance system contains approximately 45,000 linear feet of combined sewer interceptors ranging in cross section from 2-ft diameter to 5-ft by 6-ft. The collection system consists of an additional 117 miles of pipe. Both the conveyance and collection system sewers could potentially be utilized for in system storage. CRW completed a rigorous interceptor system inspection and cleaning program, restoring the full hydraulic capacity of the interceptor and identifying 33,700 LF of critical interceptor sewer repair

over the next few years. CRW completed a rapid assessment of its collection system, identifying high priority cleaning and repair needs and establishing priorities for a comprehensive system-wide CCTV inspection to more accurately identify and define remedial cleaning/repairs. Routine daily regulator inspections are also critical in ensuring that the combined sewer system is functioning properly.

Documentation of Current Control Practices

The modified partial CD requires CRW to identify portions of the combined sewer system that accumulate debris, grit, and sediment. In 2014 CRW conducted an inspection of each of the interceptors in the conveyance system in order to identify areas that require cleaning, rehabilitation, and/or repair. This involved the inspection of 71,000 linear feet of interceptor within both the combined and separate sanitary systems. The inspections involved CCTV video, NASSCO PACP data, sonar and laser profiling. In early 2017 CRW completed cleaning 33,500 linear feet of interceptors discovered through this inspection with debris levels greater than 15% of pipe depth. The scope of the cleaning project also included post-cleaning CCTV and sonar inspection. Further details on the inspection are provided in Section 1.6 of this NMC Plan and CRW OMM Section 4.4.3. Since this represents the first time the interceptor has been cleaned in recent memory, subsequent inspections associated with scheduled interceptor repairs are being performed to better identify chronic locations of debris, grit, and sediment accumulation.

Since proper CSO regulator performance is crucial to utilizing the conveyance and collection systems for storage, each CSO regulator is inspected daily, as detailed in Section 1.4 of this NMC Plan and CRW OMM Section 4.1. Corrective maintenance measures are implemented as the inspections identify problems. CRW also conducted a comprehensive inspection of the outfall pipes and backflow prevention devices with rapid video inspection during the second half of 2015 and early 2016, as detailed in Section 1.5 of this NMC Plan.

Additionally, key locations in the collection system are also inspected frequently, as detailed in Section 1.9 of this NMC Plan. These are known problem areas that have a history of obstructions, which CRW staff routinely check to ensure that flow is being conveyed properly, thereby maximizing storage.

CRW also completed the inspection of the collection system manholes with rapid video inspection in early 2016, as detailed in Section 1.9 of this NMC Plan. The rapid assessment of CRW's collection system preliminarily identified approximately 4,260 LF of sewer in critical need of cleaning and/or rehabilitation. On-going CCTV inspections are further characterizing sewer condition and identifying priority cleaning and repair needs. CRW is projecting that the CCTV investigation of the entire collection system will be completed by June 30, 2025~~, due to a delay in obtaining a second CCTV truck~~. CRW has completed inspection of the majority of pipes that require specialty equipment, heavy cleaning, and have the highest consequence and probability of failure (large diameter and brick sewers). CRW's Cityworks system is being used to track this work, identify long-term trends of debris, grit, and sediment accumulation, and define appropriate preventive maintenance programs as trends are defined.

Plan for Completing Implementation of Minimum Control Practices

Collection System Conveyance and Maintenance: CRW is using the findings of the rapid assessment of the collection system to implement a prioritized schedule for a comprehensive CCTV inspection of the entire collection system. CCTV findings, in turn, are being used to define priorities for additional remedial collection system cleaning or rehabilitation. After these remedial needs are addressed, CRW

will develop a more routine preventative cleaning and televising program within the collection system. Further details are provided in Section 1.9 of this NMC Plan and CRW OMM Section 4.6.3.

***Conveyance System Inspection and Maintenance**:* The modified partial CD requires CRW to utilize the results of the field investigations and perform the necessary repairs, replacements and maintenance necessary to prevent river intrusion into the combined sewer system. CRW will be implementing the recommendations of the February ~~10~~13, ~~2016~~ 2024 ~~and April 20, 2017~~ submittal~~s~~ on ~~initial~~ outfall and backflow prevention gate remedial repairs, summarized in Section 1.5 of this NMC Plan. In addition, the NMC-2 goal of maximizing collection system storage will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates) ~~recommended as a baseline control under CRW's LTCP.~~that will be implemented with the Appendix B projects of the modified partial CD.

The modified partial CD also requires CRW to use the results of the field investigations to identify appropriate frequencies for schedules for removal of solids and debris accumulations. CRW developed a remedial cleaning and repair schedule for its interceptor system based upon the findings of the interceptor inspections completed in 2015, as documented in Section 1.6 of this NMC Plan and CRW OMM Section 4.3. Following interceptor repair projects, CRW also plans to routinely televise its interceptors every 5 years to determine if conditions have changed. Key interceptor manholes are also inspected annually to monitor debris levels. CRW will evaluate the impact of debris levels on the interceptor capacity and develop cleaning schedules for localized reaches identified with problematic debris accumulations, as deemed appropriate.

These formal inspection programs will ensure that CRW has a firm understanding of the condition of the interceptors and collection system in order to optimize storage within the system.

2.3 Reduce River Intrusion

CRW's system includes backflow prevention gates and CSO diversion weirs within the regulating structures to prevent river intrusion, which would have the potential to decrease the capacity of the combined sewer system. While the CSO outfalls along the Susquehanna River are submerged, river intrusion is controlled by the height of the diversion weir crest within each regulator structure, which typically is significantly higher than normal river stage and only reached during flood stage conditions along the Susquehanna. Most Paxton Creek outfalls are above the creek surface, and again creek intrusion into the interceptor can typically only occur when flood stage conditions exceed the diversion weir crest elevation within each regulator structure. As such, the proper operation of these backflow prevention devices is only a high priority item for CRW if relatively frequent flooding conditions (e.g., more frequently than a 1- to 2-year flood stage recurrence interval) exceed the height of the diversion weir crest.

Documentation of Current Control Practices

The February 10, 2016 memorandum to EPA/DEP provides an assessment of the frequency of river/creek stages exceeding diversion weir crest elevations, which is further detailed in Section 1.5.2, as well as follow-up responses to EPA comments in an April 20, 2017 deliverable.

CRW crews check for river intrusion as part of the daily inspections conducted at the CSO regulator structures. CRW inspects and maintains the backflow prevention gates, where they exist, at each applicable outfall in anticipation of flood stage events along the Susquehanna River or Paxton Creek, as detailed in Section 1.5 of this NMC Plan and CRW OMM Section 4.2. These inspections are used to

determine the condition of the gates and seals, verify the gates are in their fully closed and sealed positions, and remove any sticks or debris that may prevent a flap gate from sealing. For all the CSO regulator structures located along the Susquehanna River, the outfalls are submerged. However, it is important to note that these outfall pipes were designed and constructed with sufficient slope so that the CSO regulating structure is above the normal non-flood elevation of the river surface, and the CSO diversion weir provides an additional layer of protection against river intrusion. Even when a flap gate seal is compromised and/or an outfall pipe is leaking, and river water intrudes into and fills the outfall pipe, the river water does not top the diversion weir and enter the interceptor system during dry weather non-flooding conditions. Therefore, proper flap gate operation is not critical to preventing river intrusion for the Susquehanna River outfalls during non-flood conditions. The primary purpose of the flap gates is to prevent river intrusion during major flood events. Conversely, most of the Paxton Creek outfalls are elevated above the water surface and intrusion into the interceptor can only occur during high water conditions, when creek levels exceed the crest elevations of the CSO diversion weirs. In addition, H&H modeling of the CRW sewer system, flow monitoring at CSO regulators and river stage monitoring at four sites along Paxton Creek demonstrate that peak Paxton Creek stages occur at roughly the same time but at slightly lower elevations than peak CSO discharges, creating a net positive flow out the CSO outfall and mitigating the effect of river intrusion along Paxton Creek.

River intrusion into the interceptor system generally can only occur if the river elevation is above the crest elevation of a diversion weir. Therefore, if river water is not observed to flow over a weir crest, it can be concluded that river intrusion is not occurring at that CSO regulator structure or outfall location. If flow is observed over the diversion weir in the direction from the trunk sewer toward the river, CSO discharge activity would be occurring, and if flow is observed over the weir from the river toward the Regulating Chamber, river intrusion would be occurring. If the diversion weir is submerged, CRW will then perform a follow-up inspection of the backflow prevention gate.

Initial flap gate repairs are limited to regulator structures where river intrusion is projected to occur more frequently than once per year. CRW identified the following outfalls for early action flap gate repair or replacement: 006, 008, 021, 022, 024, 032, and 051. CRW's field staff determined that repairs were not feasible.~~,~~

~~CRW prepared an early action outfall repair schedule in the April 20, 2017 deliverable.~~ On February 13, 2024, CRW submitted an updated CSO Outfall Repair Early Action Project Schedule.

Plan for Completing Implementation of Minimum Control Practices

CRW will be implementing the recommendations of the February ~~10~~13, ~~2016~~ 2024 and April 20, 2017 submittal~~s~~ on initial outfall and backflow prevention gate remedial repairs. ~~Initial repairs are limited to regulator structures where river intrusion is projected to occur more frequently than once per year. CRW identified the following outfalls for early action flap gate repair or replacement: 006, 008, 021, 022, 024, 032, and 051. CRW's field staff determined that repairs were not feasible, and the f~~Flap gate replacements will be significant projects that will be incorporated as part of a future capital project during ~~LTCP~~ updated CBH_2OPP implementation or as a separate IDIQ contract. In addition, the NMC-2 goal of maximizing collection system storage will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates) ~~recommended as a baseline control under~~in CRW's updated CBH_2OPP~~LTCP~~. Again, it is important to note that in most cases the backflow prevention gates are not needed to prevent river intrusion during normal dry weather non-flood conditions along the Susquehanna River and Paxton Creek.

2.4 Adjustment of Regulator Settings

The regulator structures are critical in controlling the amount of flow that is conveyed to the interceptor, stored within the collection system, or conveyed to the receiving water. CRW's system utilizes regulators with variable control orifices, fixed orifices with elevated discharge pipes, and fixed control orifices with diversion weirs. The orifice size, outfall pipe elevation, and weir crest elevation are each key parameters to controlling the amount of the storage that is utilized within the combined sewer.

Documentation of Current Control Practices

The modified partial CD requires CRW to conduct an engineering study, through internal investigations and hydrologic and hydraulic (H&H) modeling, to identify work items that can be conducted to minimize river intrusion into the combined sewer system. An internal inspection of each regulator structure was performed in 2013. CRW crews conduct daily inspections of each regulator structure for proper operation, as documented in NMC Section 1.4 and CRW OMM Section 4.1. These inspections provide detailed documentation of the components within each structure and the configuration of each structure. The inspection information included the surveyed elevations of the crests of each of the CSO diversion weirs, which were compared to the normal non-flood elevations of the Susquehanna River and Paxton Creek. This provided the amount of freeboard against river intrusion provided at each regulator structure. Under current practice, the majority of the regulators are currently set to close completely during an overflow event to protect the interceptor system against excessive surcharge conditions and to protect the Advanced Wastewater Treatment Facility (AWTF) against excessive influent flow. While this current practice, in effect, maximizes the quantity of available storage in the interceptor system, it does not maximize the more important goal of wet weather capture. Modifications to regulator settings are not recommended until scheduled interceptor repairs are completed, as frequent surcharging of the interceptors could further compromise their structural integrity.

The modified partial CD requires CRW to conduct an engineering study, through internal investigations and H&H modeling, to identify work items that can be conducted to maximize in-pipe storage. CRW utilized its H&H model to identify possible modifications to the regulator settings and the weir crest elevations to improve storage in the conveyance system. Proposed modifications include adjustment of weir crest elevations or orifice settings. Raising weir crest elevations would potentially provide triple benefits. The level of protection against river intrusion would be increased, the volume of available storage in the upstream trunk sewer could potentially be increased, and wastewater capture during wet weather conditions would be increased. CRW identified modifications to the weir crest elevations and regulator settings for the ~~baseline level of control under CRW's LTCP~~Appendix B projects of the modified partial CD.

CRW developed a phased approach to regulator modifications based on the timing of other system improvements. With the rehabilitated and expanded Front Street Pump Station online, CRW completed Phase 1A of the regulator modifications. These modifications involved raising diversion weir crest elevations, disconnecting B&B gates, and/or enlarging control orifice openings for specifically selected regulator structures.

Plan for Completing Implementation of Minimum Control Practices

The NMC-2 goal of maximizing collection system storage will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates) ~~recommended as a baseline control under CRW's LTCP~~throught the implementation

of Appendix B projects and the updated CBH$_2$OPP. CRW will proceed with Phase 1B regulator modifications. Phase 2 regulator modifications will be completed following Front Stret Interceptor rehab. Phase 3 regulator modifications will be completed following Paxton Creek Interceptor rehab.

2.5 Installation of In-System Controls

A wide variety of in-system controls are available for increasing the storage of CRW's combined sewer system:

- A variety of devices for throttling flows at combined sewer inlets / catch basins.
- Localized, upstream detention facilities.
- Green infrastructure designed to capture, retain, and/or detain stormwater before discharge to the combined sewer system.
- Upgrading / adjusting pump station operation.

~~In general, CRW evaluated these in-system control options during preparation of its CSO LTCP.~~ This section documents CRW's current control practice and plan for completing implementation of this minimum control practice.

Documentation of Current Control Practices

An effective NMC-2 program would include an investigation into opportunities to modify catch basin inlets, using commercially available devices, to restrict the rate at which surface runoff is allowed to enter the combined sewer system. The program would also include an investigation into opportunities to use localized detention in appropriate upstream areas (such as upstream parking areas) to provide effective short-term storage. By delaying the rate at which stormwater enters the combined sewer, CRW could increase storage in the collection system, and potentially increase available storage in the interceptor system.

When CRW assumed ownership, operation, and maintenance responsibilities for the collection system within the City of Harrisburg, it commenced a program to inspect, clean, and maintain storm inlets and catch basins throughout the City. CRW completed the initial remedial phase, which involved the inspection, cleaning, and repair/rebuilding (where necessary) of each inlet. This program is documented in Section 1.10 of this NMC Plan and in CRW OMM Section 4.7. Modifications to inlets to provide storage are not recommended until remedial cleaning and repair are complete, a comprehensive CCTV inspection of the collection system is performed, and H&H modeling can be refined as needed to evaluate the effectiveness of this storage and to check that it does not result in surface flooding or basement backups. When new inlets are installed or existing inlets are reconstructed options for storage will be evaluated.

CRW is in the process of inventorying, assessing the condition, and conducting remedial repairs on its collection system, including its combined sewers, storm inlets, and catch basins, as documented in Sections 1.9 and 1.10 of this NMC Plan, and CRW OMM Sections 4.6 and 4.7. While system condition assessments proceed, the potential for using existing and / or new collection system sewers will be evaluated in detail ~~under the decentralized green/grey local control strategy recommended in CRW's LTCP~~.

CRW upgraded its Front Street Pumping Station because the facility was beyond its useful life. The scope of work included expanding the peak hydraulic capacity of the station as well as rehabilitation of the equipment.

With the Front Street Pumping Station online, Phase 1A regulator modifications were completed, which included raising diversion weir elevations that will provide additional storage and protection against river intrusion.

Plan for Completing Implementation of Minimum Control Practices

CRW is utilizing its H&H Model to, among other things, identify in-system storage options (e.g., throttling flows at inlets / catch basins, providing upstream detention).

In addition, most components of the Spring Creek pump station are beyond their functional life span, and ~~the CSO LTCP includes~~ a major upgrade or replacement project is included as an Appendix B project. Once the stations are upgraded, CRW will be applying its H&H model to assess current pumping station performance and identify alternative operational rules for proposed pump stations that might increase in-system storage.

While the future phases of regulator modifications are focused on taking advantage of the increased hydraulic capacity along the interceptors to provide additional CSO capture, raising the crests of the diversion weirs will also provide additional storage and protection against river intrusion.

CRW intends to use a decentralized green/grey local control strategy during the implementation of the ~~LTCP~~ updated CBH_2OPP to provide storage to reduce CSOs and unauthorized releases (e.g., basement backups) within the collection system. CRW is presently assessing and repairing the collection and conveyance system to better identify opportunities and constraints to implementing this decentralized green/grey strategy.

2.6 Removal of Obstructions to Flow

An effective NMC-2 program would include maintenance activities to remove and prevent accumulations of debris and sediments that would restrict flow and consume available storage volume. In order to ensure wet weather flows can be conveyed and stored within the combined sewer system, it is paramount that the interceptors and collection system are periodically cleaned. CRW is undertaking a comprehensive systemwide inspection and cleaning program of its collection and conveyance systems to remove decades of accumulated sediment and debris and identify critical sewer rehabilitation projects necessary to increase system reliability and allow system surcharging as needed to maximize storage.

Documentation of Current Control Practices

Significant quantities of sediment and debris were removed from portions of the interceptors to facilitate the recent inspection process (see Section 1.6 of this NMC Plan for details). Based on the findings of the inspection it was determined that additional sediment and debris must be removed from the CRW interceptors. A total of 33,500 linear feet of interceptor were cleaned by early 2017 to remove accumulated sediment. Additional details are provided in Section 1.6 of this NMC Plan.

CRW also performed a rapid assessment if its collection system via a pole-camera inspection of each collection system manhole. Rapid inspection findings identified critical remedial maintenance and repair needs and are being used to prioritize systemwide CCTV inspections and/or cleaning. CRW

continues to advance a comprehensive cleaning and inspection program for the entire collection system. Refer to Section 1.9 of this NMC Plan. CRW is also actively cleaning out inlets, as described in Section 1.10 of this NMC Plan, to remove blockages.

Plan for Completing Implementation of Minimum Control Practices

Since the initial phase of interceptor cleaning was completed, CRW will continue with routine cleaning as it is identified through CCTV inspections every 5 years following completion of the interceptor rehabilitation projects. These inspections are expected to further quantify the rate at which sediment accumulates and identify "hot spots" that require routine cleaning.

CRW has initiated a remedial inspection and cleaning program for the collection system based on the rapid assessment manhole inspections (see Section 1.9 of this NMC Plan for details). ~~The rapid assessment findings are being used to assist CRW in prioritizing the areas in the system that require the most cleaning and provide the best opportunities for in-system storage.~~ CRW plans to complete the collection system cleaning and inspection program in June 2025.

2.7 Effectiveness Evaluation

The modified Partial Consent Decree requires CRW to investigate both the condition and effectiveness of currently installed measures to prevent river intrusion into the combined sewer system.

Documentation of Current Control Practices

Through the development of their inspection and cleaning program, CRW is continually working towards improving their ability to provide in system storage.

Plan for Completing Implementation of Minimum Control Practices

CRW will evaluate the effectiveness of their control practices for NMC-2 on an annual basis and update the NMC Plan accordingly.

Section 3

Minimum Control Number 3 - Review and Modification of Industrial Pretreatment Programs

3.1 Regulatory Context

3.1.1 Requirements of the National CSO Control Policy

Under Nine Minimum Control (NMC) No. 3, Capital Region Water (CRW) is determining whether industrial sources contribute to Combined Sewer Overflow (CSO) impacts, and if so, investigate ways to control them. The United States Environmental Protection Agency (EPA) guidance indicates that implementation of this minimum control would be achieved through the imposition of controls on non-domestic discharges during storm flow and CSO occurrences and where necessary, modifications to inspection, reporting, and oversight procedures. Through the implementation of NMC-3, EPA anticipates the control of "non-domestic discharges" to combined sewer systems during storm flow.

EPA guidance prescribes the process by which the implementation of these controls should be accomplished, and in general, consists of four suggested components, shown in **Table 3-1. Table 3-1** also lists the applicable references in CRW's modified partial Consent Decree (CD), NMC Plan, and CSO Operation and Maintenance Manual (OMM). There are no specific requirements for NMC-3 in CRW's partial CD. EPA guidance further suggests that once implemented, this minimum control should not require additional effort unless combined sewer system (CSS) characterization and modeling indicate a pollutant from an industrial source is causing a specific health, water quality, or environmental problem. CRW's CSS Characterization (submitted April 1, 2017) did not reveal any such issues.

Table 3-1 EPA Guidance Checklist for NMC-3

NMC-3 Requirement Description Review and Modification of Pretreatment Requirements	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Inventory Nondomestic Discharges: Prepare an inventory of all nondomestic discharges, including the map location, the volume of flow, and the pollutant types and concentrations in the discharge.	4.1.1	Not Applicable	3.2	Not Applicable
Assess the Impacts: Assess the impact of nondomestic discharges in CSOs by comparing the total quantity of nondomestic flow to the total flow from all sources.	4.1.2	Not Applicable	3.3	Not Applicable
Evaluate Feasible Modifications: If the assessment indicates that nondomestic sources might contribute significantly to CSOs, evaluate feasible modifications to the pretreatment program, including the prohibition of batch discharges and adding detention to prevent discharges during wet weather.	4.1.3	Not Applicable	3.4	Not Applicable
Documentation: Provide documentation demonstrating a diligent effort to evaluate this control. If modification of the pretreatment program is appropriate, provide descriptions of the modifications, a schedule for implementing the modifications, and an estimate of the expected loading reduction.	4.4	Not Applicable	3.2 – 3.4	Not Applicable

Table 3-2 Regulated Industrial Users

ID Number on GIS Map	Industrial User	Class[1]	SIC[2] Code	Category	CRW Permit No.	Receiving CSO Regulator ID	Receiving River or Stream
2	Harrisburg Dairies, Inc. 20th and Herr Streets, Harrisburg, PA 17103	NC	2020	High Load Conv.	082119-13	002[3]	Susquehanna River
3	Hershey Creamery Company 301 S. Cameron St, Harrisburg, PA 17101	NC	2024	High Load Conv.	072319-8	043[4]	Paxton Creek
4	LCSWMA[5] 1670 S. 19th St, Harrisburg, PA 17104	NC	4953	High Load Metals	122017-9	003	Paxton Creek
5	Norfolk Southern Railway Company 3322 Industrial Rd, Harrisburg, PA 17110	NC	4011	High Load Conv.	081918-11	002	Susquehanna River
6	Public Realty Capital 909 Elmerton Ave, Harrisburg, PA 17110	NC	4953	High Load Metals	040615-21	002	Susquehanna River
7	Robert E. Young Water Services Center 100 Pine Dr, Harrisburg, PA 17104	NC	4941	High Load Conv.	042918-22	002	Susquehanna River
8	Swatara Township Landfill 599 Eisenhower Blvd, Harrisburg, PA 17111	NC	4953	High Load Metals	031618-17	003	Paxton Creek
~~9~~	~~The AMES Companies, Inc.[6] 1500 S. Cameron St, Harrisburg, PA 17104~~	~~C~~	~~3799~~	~~Metal Finishing~~	~~062519-6~~	~~003~~	~~Paxton Creek~~

1) C – Categorical, NC - Noncategorical
2) Standard Industrial Classification (SIC)
3) CSO 002 is the emergency outfall for the Front Street Pump Station. CSO 003 is the emergency outfall Spring Creek Pump Station.
4) Stormwater from the facility's property could also potentially discharge to CSOs 059, 042, and 002.
5) Lancaster County Solid Waste Management Authority/Susquehanna Resource Management Complex
~~6) Part of this facility's property is designated as direct discharge.~~

3.1.2 CRW Approach for NMC Planning Compliance

CRW's modified partial CD requires CRW to prepare this NMC Plan, consisting of proposed actions to achieve the NMCs with an implementation schedule, as an alternative to documentation of compliance with the NMCs called for in the CSO Policy. This section serves as a plan for the full implementation of NMC-3.

3.2 Inventory of Non-Domestic Dischargers

Documentation of Current Control Practices

Existing Regulated Industrial Users

There are presently ~~eight~~ seven significant industrial users within the CRW service area that are regulated by CRW's Pretreatment Program, including industries in the City of Harrisburg and outlying communities. **Table 3-2** lists the permitted industrial users, the user's Standard Industrial Classification (SIC) code, the CRW permit number, the receiving CSO diversion structure (or none if

served by separate sewers), and the receiving river or stream. Of the eight permitted industrial users, one is classified as categorical and seven as noncategorical industrial users. The AMES Corporation stopped manufacturing on October 31. 2023, and the permit has been vacated. CRW maintains a computerized database that includes the inventory of the permitted industrial users, their discharge limits, and the results from compliance monitoring and sampling.

CRW identifies potential industrial users starting with the review of planning modules to determine if there is the potential for discharge quantities or pollutants that would qualify for the Pretreatment Program.

Figure 3-1 presents a GIS map of the locations of each of the regulated industrial users and their corresponding sewershed areas. Although only one of the users discharges wastewater to a CSO Regulator (CSO-043), the other seven discharge to interceptors that flow to the Front Street and Spring Creek pump stations. There are permitted bypass CSOs at both pump stations (CSOs 002 and 003); therefore, these regulated industrial users are upstream of permitted CSOs.

In addition, the contributing municipalities reported the following industrial users in their Chapter 94 Reports:

- Lower Paxton Township – none
- Paxtang Borough – none
- Penbrook Borough - one car wash of negligible impact with intermittent flow of 1,400 gpd
- Steelton Borough – none
- Susquehanna Township – TJ's = 216,750 gal/quarter, Triangle Car Wash = 854,250 gal/quarter
- Swatara Township – none

Risk Assessment of Other Non-Domestic Dischargers

CRW completed an assessment of the risk of pollutant discharges associated with a range of activities of concern under CRW's NMC-3 compliance plan. The purpose of this risk assessment is to establish priorities for its pollution prevention programs, including those targeted at non-domestic dischargers. CRW did not identify other high-risk non-domestic dischargers that should be included in CRW's industrial pretreatment program at this time based on the findings of this risk assessment and the H&H modeling conducted for the CSS characterization. Similarly, CRW will use the findings of this risk assessment to identify decentralized and/or low to medium risk activities of concern and risk-appropriate pollution prevention regulations, surveillance, and education for these activities (See NMC-7 for more details).

Risk is an uncertain event that, if it occurs, has a positive or negative consequence on an objective. Risk can be expressed in terms of the consequence and likelihood of occurrence. The risk assessment involves the assignment of a consequence and likelihood of occurrence rating to each identified risk. Because it is difficult to assign an actual value to the percent likelihood or the environmental consequence of a risk, a qualitative assessment may be assigned.

Table 3-3 lists the activities of concern (AOCs) evaluated by this risk assessment. **Appendix D** correlates the AOCs to associated land uses. For example, the activity of Vehicle / Equipment Service is

associated primarily with gas stations, garages, auto dealers, truck terminals, and car washes; whereas, the activity of Yard / Landscape Management is associated with many different land uses. Based on the associated land uses and parcel data from the Dauphin County GIS, Table 3-3 presents the total private property parcels and land area associated with each AOC.

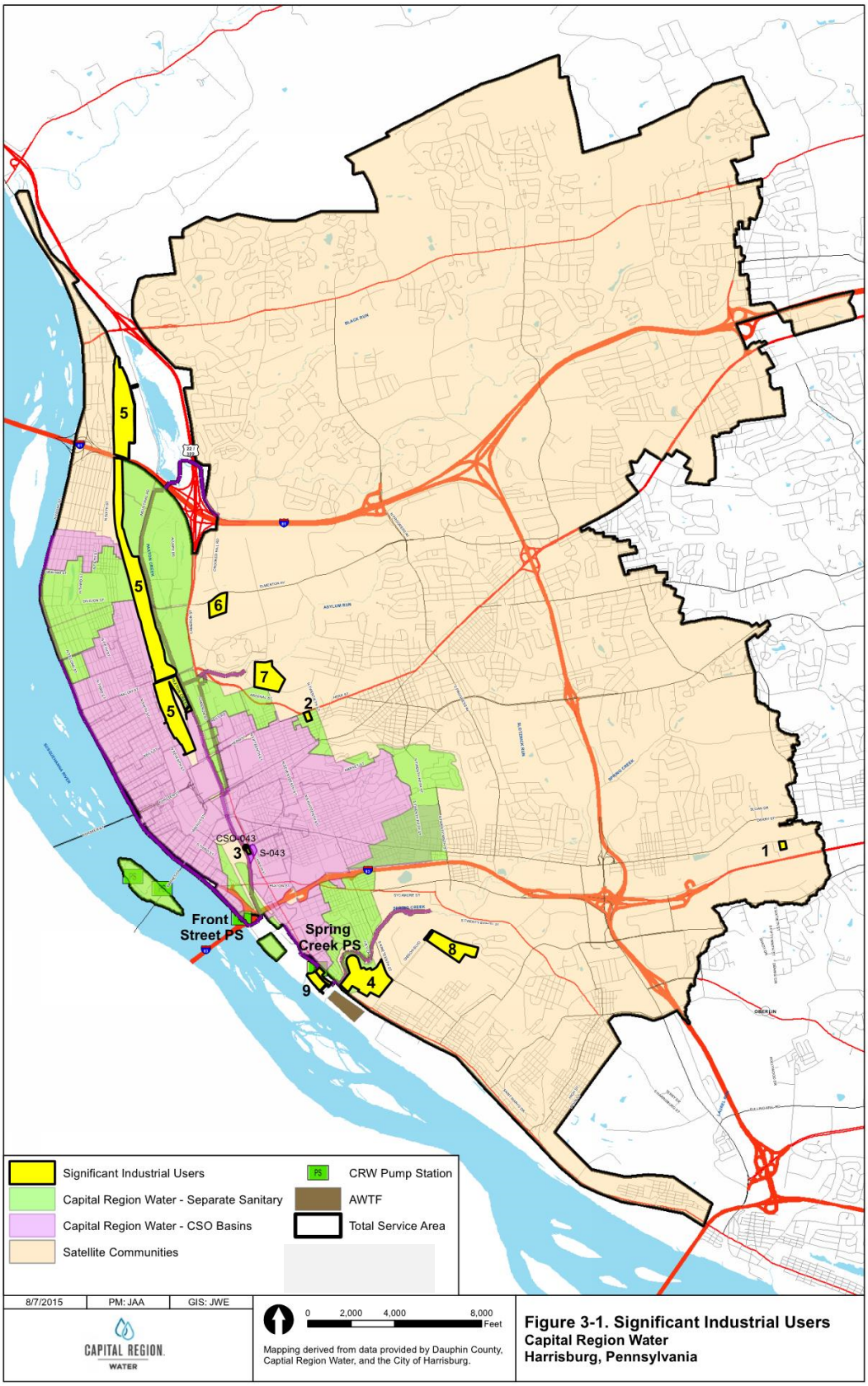


Figure 3-1. Significant Industrial Users
Capital Region Water
Harrisburg, Pennsylvania

Table 3-3 Activities of Concern

Activity Type	Total Associated Private Property Parcels	Total Associated Private Property Area (ac)
Yard / Landscape Management	18,203	2,307
Building Maintenance / Renovation	16,998	1,903
Lateral Maintenance / Repair	16,424	1,834
Street / Pavement Management	2,375	1,064
Development / Construction	1,720	383
Solid Waste Handling / Storage	1,489	832
Material Handling / Storage	561	902
Hazardous Material Handling / Storage	608	928
Spill Prevention / Response / Cleanup	561	902
Liquid Waste Handling / Storage	499	508
Food Service	190	113
Vehicle / Equipment Service	91	54

Table 3-4 presents a semi-quantitative rating of the likelihood of occurrence for each AOC. The rating is semi-quantitative in that it incorporates the associated private property area as a percentage of the total area. The notes below the table explain the qualitative ratings for the other likelihood criteria. The criteria weightings give the greatest weight to those criteria that CRW deems most impactful to the likelihood of a stormwater pollutant discharge: whether there is outdoor material handling and the approximate frequency of discharge without treatment or control. The overall likelihood rating is the sum of each rating times its weight. The likelihood rating is normalized to a scale of 0 to 5 relative to the maximum possible rating of 23.

Table 3-4 Likelihood of Occurrence Rating

Land Use / Activity Type	Type of Discharge	Total Private Property Area Where Activity Occurs (ac)	Likelihood Criteria				Likelihood Rating (Weighting x Score)	Normalized Likelihood Rating (Scale of 0 to 5)
			% of Total Parcel Area (3,912.67 ac)	Outdoor Material Handling or Exposure[1]	Activity Frequency[2]	Discharge Frequency Without Treatment / Control[3]		
CRITERIA WEIGHTING			**2**	**3**	**1**	**3**		
Yard / Landscape Management	Runoff, spill	2,307	59%	3	3	3	22.2	4.8
Building Maintenance / Renovation	Illicit discharge, spill	1,903	49%	2	2	1	12.0	2.6
Lateral Maintenance / Repair	Illicit discharge	1,834	47%	3	1	1	13.9	3.0
Street / Pavement Management	Runoff	1,064	27%	3	2	3	20.5	4.5
Development / Construction	Runoff, spill	383	10%	3	3	2	18.2	4.0
Solid Waste Handling / Storage	Illicit discharge, spill	832	21%	2	3	1	12.4	2.7
Material Handling / Storage	Illicit discharge, spill	902	23%	2	3	1	12.5	2.7
Hazardous Material Handling / Storage	Spill	928	24%	2	3	1	12.5	2.7
Spill Prevention / Response / Cleanup	Spill	902	23%	3	1	1	13.5	2.9
Liquid Waste Handling / Storage	Illicit discharge, spill	508	13%	1	3	1	9.3	2.0
Food Service	Illicit discharge, spill	113	3%	1	3	1	9.1	2.0
Vehicle / Equipment Service	Illicit discharge, spill	54	1%	1	3	1	9.0	2.0

[1] Usually = 3, Sometimes = 2, Rarely = 1

[2] Continuous over at least 6 months = 3, Periodic or at least once /month = 2, Random / Occasional = 1

[3] Continuous or during most precipitation events = 3, Periodic or at least once/month = 2, Random / Occasional = 1

Table 3-5 presents a qualitative consequence rating for each AOC based on the relative quantity of the constituents of concern that are handled or discharged. The notes below the table explain the qualitative ratings for each criteria. The criteria weightings give the highest weight to pollutants with potential human health risk, medium weight to pollutants associated with illicit discharge, and lowest weights to those typically considered non-point source pollutants. The overall consequence rating is the sum of each rating times its weight. The likelihood rating is normalized to a scale of 0 to 5 relative to the maximum consequence rating: 27.

Table 3-5 Consequence Rating

Land Use / Activity Type	Constituents of Concern: Relative Quantity Handled or Discharged[1]												Consequence Rating (Weighting x Score)	Normalized Consequence Rating (Scale of 0 to 5)
	Sediment	Deicers	Solid Waste	Leachate	Food Waste	Oil & Grease	Vegetation Waste	Fertilizer	Herbicide/Pesticide	Process Waste	Sewage	Hazardous Materials		
CRITERIA WEIGHTING	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**5**		
Yard / Landscape Management	M	M	I	N	N	I	H	H	M	N	N	N	14.0	2.6
Building Maintenance / Renovation	M	N	M	I	N	I	N	N	N	N	M	I	10.0	1.9
Lateral Maintenance / Repair	I	N	N	N	N	L	N	N	N	N	M	N	8.0	1.5
Street / Pavement Management	M	H	M	I	N	M	L	N	N	N	N	N	12.0	2.2
Development / Construction	H	N	L	I	N	I	M	N	N	N	N	N	6.0	1.1
Solid Waste Handling / Storage	I	N	H	M	L	L	M	N	N	N	N	L	17.0	3.1
Material Handling / Storage	M	M	M	M	N	M	N	L	L	N	N	M	27.0	5.0
Hazardous Material Handling / Storage	I	N	I	I	N	I	N	N	I	N	N	H	15.0	2.8
Spill Prevention / Response / Cleanup	N	N	N	N	N	N	N	N	N	L	M	M	19.0	3.5
Liquid Waste Handling / Storage	I	N	N	N	N	I	N	N	N	M	H	M	25.0	4.6
Food Service	N	N	M	N	H	H	N	N	N	N	M	N	17.0	3.1
Vehicle / Equipment Service	M	N	I	N	N	H	N	N	N	L	N	M	21.0	3.9

[1] Definitions and Scores: High (3) = H, Medium (2) = M, Low (1) = L, Insignificant (0) = I, Not Applicable (0) = N

The risk score is then determined by the consequence and likelihood ratings. **Table 3-6** explains the risk score classifications. In general, activities with a higher likelihood and consequence are a higher risk. The differentiation between high (4) and medium (3) risks is based on reasoning that a high consequence activity with medium likelihood is a higher risk than a medium consequence activity with high likelihood.

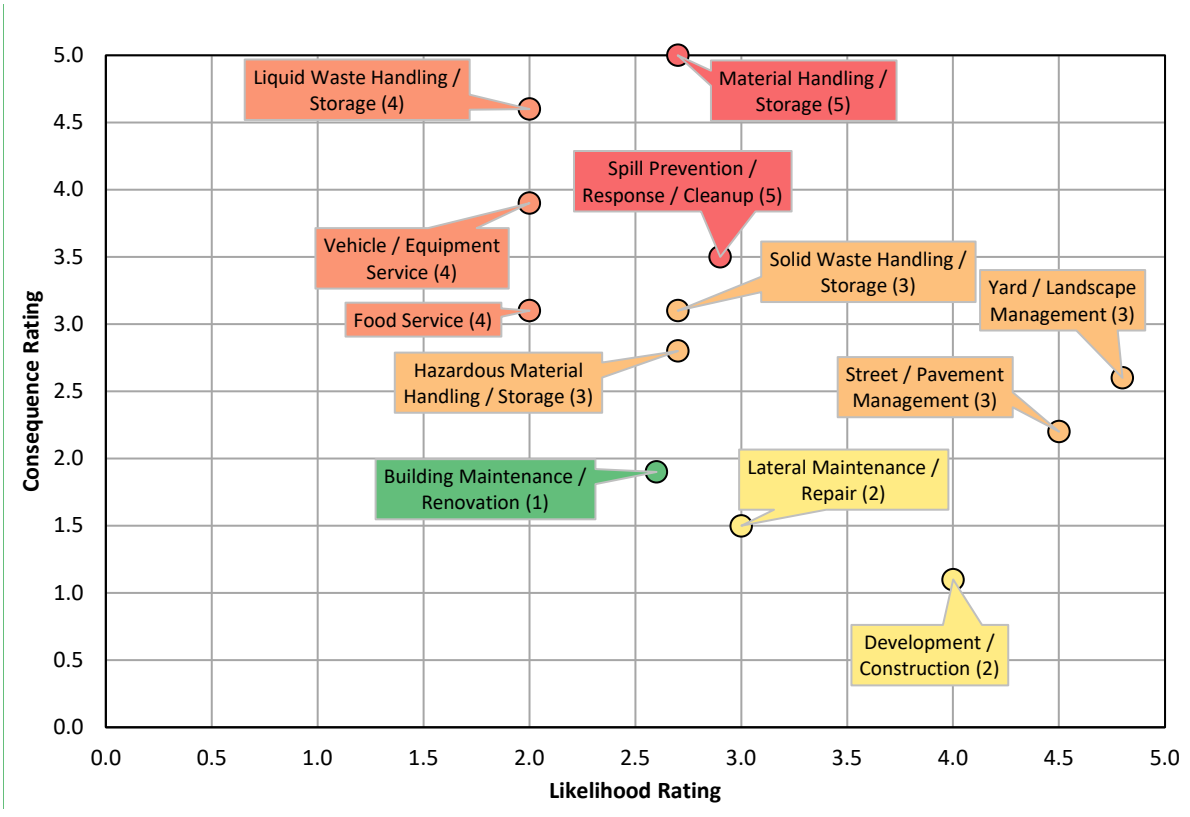
Table 3-6 Risk Score Classifications

Consequence Rating	Likelihood Rating 0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
5	2	2	2	4	4	5	5	5	5	5	
4.5	2	2	2	4	4	5	5	5	5	5	
4	2	2	2	4	4	5	5	5	5	5	
3.5	2	2	2	4	4	3	3	3	3	3	
3	2	2	2	2	2	3	3	3	3	3	
2.5	2	2	2	2	2	3	3	3	3	3	
2	1	1	1	1	1	1	2	2	2	2	
1.5	1	1	1	1	1	1	2	2	2	2	
1	1	1	1	1	1	1	2	2	2	2	
0.5	1	1	1	1	1	1	2	2	2	2	

Key	
Very High	5
High	4
Medium	3
Low	2
Very Low	1

Figure 3-2 presents the resulting risk scores for each AOC. Based on this assessment, the highest risk activities are Material Handling / Storage and Spill Prevention / Response / Cleanup; both are high consequence activities with a medium-high likelihood. **Figure 3-3** presents the same results geographically based on the total risk score (sum of all associated activities) for each land use. **Appendix D** presents the land use risk scores in tabular format. The total risk score is normalized to a scale of 0 to 5 relative to the minimum and maximum scores.

Figure 3-2 Risk Score Results



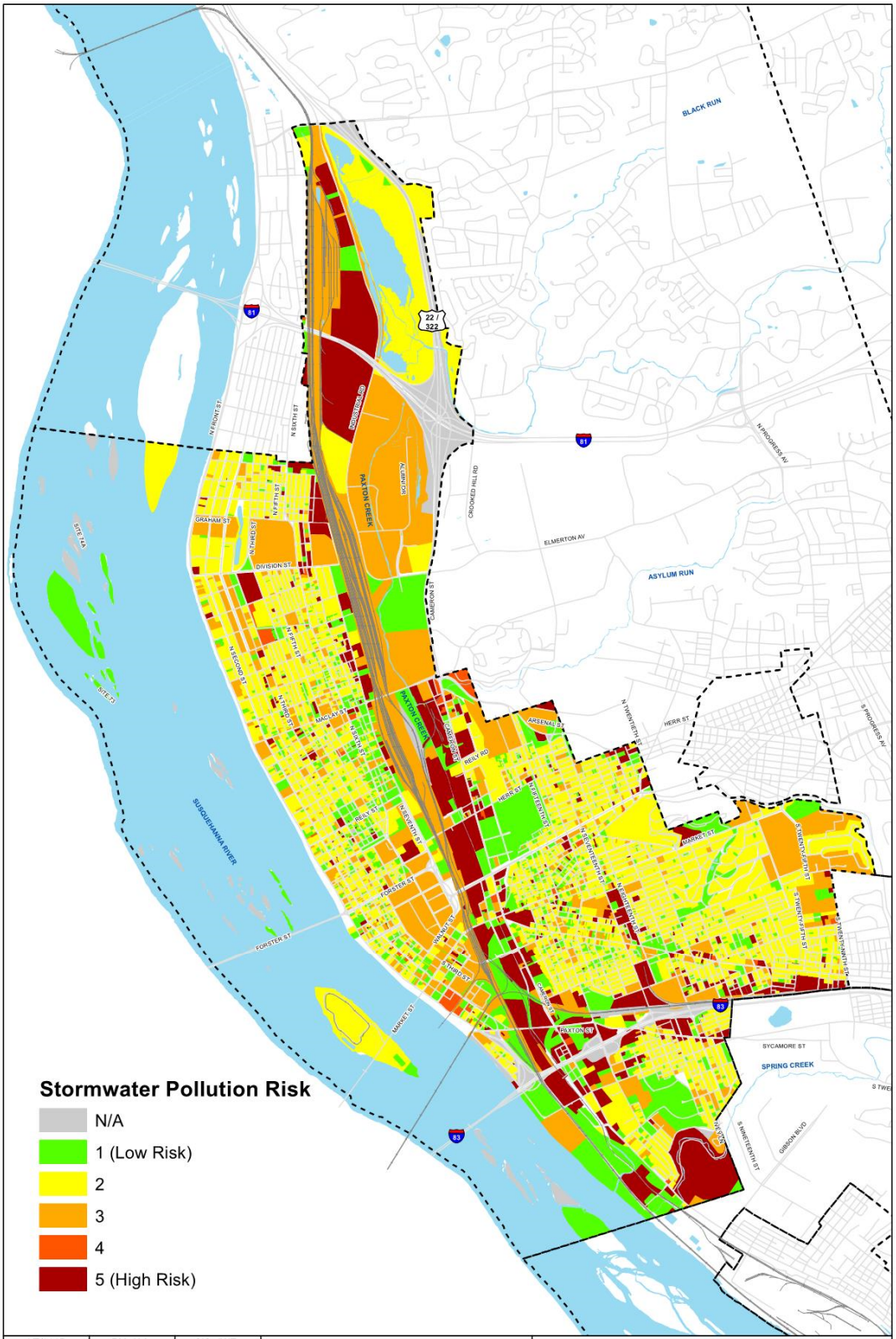


Figure 3-3 Stormwater Pollution Risk
Capital Region Water
Harrisburg, Pennsylvania

As **Figure 3-3** shows, many of the highest risk land uses are clustered along Paxton Creek and the railroad corridors and include gas stations, garages, car dealers, truck terminals, warehouses, and industries. These high priority areas and land uses pose a potentially significant risk to both CSO discharges and Municipal Separate Storm Sewer System (MS4) discharges and are candidates for inclusion in CRW pollution prevention activities.

CRW's approach to regulating industrial process water as a CSO issue started by determining which, if any, users should be added to the CRW Pretreatment Program. CRW reviewed high priority businesses and determined that there were not any specific businesses should be added to the Pretreatment Program as significant industrial users (SIUs). As defined by Capital Region Water's Rules and Regulations, SIUs means all categorical industrial users (based on SIC codes) or any noncategorical industrial users that:

- Have a discharge flow of 25,000 gpd or more per average workday of process wastewater; or
- Have an average process flow which makes up five percent or more of the average dry weather hydraulic or organic capacity of the treatment plant; or
- Have a reasonable potential in the opinion of the Control or Approval Authority to adversely affect the treatment plant through inhibition, pass through of pollutants, sludge contamination, or endangerment of AWTF workers, or to violate any pretreatment standard or requirement.

CRW reviewed businesses associated with certain high consequence pollutants (e.g., oil and grease, hazardous materials), prior history of downstream sewer system operational concerns, and information about the facilities' operations, and determined that no specific businesses should be added to the Pretreatment Program at this time, CRW will annually update this industrial user inventory to identify new industrial users within the service area and remove users that are no longer contributing to the service area. If subsequent evaluations reveal activities subject to CRW Rules, CRW will inform the business to submit an Industrial Wastewater Discharge Application.

FOG-Contributing Non-Domestic Dischargers

In May of 2019 Capital Region Water hired an Environmental Compliance Inspector to develop and implement a Fats, Oils, and Grease (FOG) program within the City of Harrisburg. The first step was to establish guidelines that would govern the program. This was completed in November of 2019 and incorporated into CRW's Wastewater and Stormwater Rules and Regulations which were revised and approved by the Board on January 22, 2020 and went into effect on February 1, 2020.

CRW also developed a FOG Program Implementation Plan for a three-year phased approach. Key documents were developed to support the program including a FOG Best Management Practices Manual, a FOG Discharge Permit, a FOG Discharge Permit Application, and a Cleaning Log Sheet.

A registry was created to identify all potential FOG dischargers within the City. This registry is part of CRW's GIS and asset management software and is used to track inspections of grease control equipment. Over 200 FOG contributors including, but not limited to, restaurants, car washes, automotive businesses, and schools have been identified and logged in the system. Update of this registry takes place weekly as more contributors are identified. Letters were issued to all identified potential FOG discharges to inform them of the new regulations, FOG Program, and permit requirements.

FOG inspections began in February of 2020 but were suspended at the beginning of March due to the pandemic and didn't resume until July of 2020. These initial inspections consist of educating business owners about CRW's new FOG program and FOG best management practices. The inspector also confirms that each contributor has the proper grease control equipment during these initial inspections. CRW completed the initial inspections of all currently open food service establishments in 2020. Inspection and permitting efforts are currently focused on car washes and automotive maintenance garages.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to evaluate whether additional businesses should be added to the Pretreatment Program. If it is determined that specific businesses should be added to the Pretreatment Program, CRW will inform the business to submit an Industrial Wastewater Discharge Application. CRW will annually update this industrial user inventory to identify new industrial users within the service area and remove users that are no longer contributing to the service area. CRW will further evaluate the best approach for regulating the discharges from the Harrisburg Hospital.

CRW will also continue to evaluate additional facilities that may be FOG contributors, and the entity will be added to the FOG registry. Inspections will be conducted, and FOG permits will be issued, if warranted for the facility.

3.3 Assess Impact of Non-Domestic Discharges

Documentation of Current Control Practices

Current Regulations / Inspection Results

CRW administers a Pretreatment Program designed to achieve industrial user compliance with applicable federal, state and local effluent discharge limitations. The objective of the program is to prevent the introduction of pollutants into the public sewer system that would:

- Interfere with the operation of either the collection pipes or the treatment plant, or adversely affect the resulting treated sludge;
- Compromise the welfare and safety of workers at the treatment plant or in the collection sewer pipes; or
- Pass through the sewage treatment plant, inadequately treated, into the receiving waters or into the atmosphere.

CRW's and local jurisdiction wastewater regulations prohibit these types of discharges to the sewer system and establish an industrial pretreatment program. CRW Wastewater and Stormwater Rules and Regulations Sections 7 and 8, and City Code Chapters 9-501 to 9-511, define prohibited discharges to the sewer system and specific discharge limitations; require certain users to install pretreatment facilities, perform sampling, and submit compliance reports; require industrial users to obtain discharge permits; and establish enforcement and penalties. Although there are no requirements specific to wet-weather conditions, the regulations state that industrial permits may contain "limits on rate and time of discharge or requirements for flow regulations and equalization."

For the regulated industrial users in its Pretreatment Program, CRW maintains a monthly record of flows from these dischargers and the discharges are periodically sampled for 19 different parameters to ensure program compliance. Inspection and sampling activities performed during the year include

facility inspections, self-monitoring inspections, and compliance sampling. Compliance sampling schedules are twice annually for three consecutive days with each day providing a separate sample. Self-monitoring sampling and reporting activities are quarterly for conventional pollutant dischargers and monthly for a metal and organic priority. Additional monitoring is performed when necessary.

Details of inspection results and any violations may be found in the Municipal Wasteload Management Report submitted to the Pennsylvania Department of Environmental Protection (PADEP) on an annual basis.

Flow Assessment

In accordance with EPA's CSO guidance, a preliminary assessment was performed to ascertain whether the industrial discharges are concentrated in certain areas, thereby having the potential to impact specific overflow points. As shown in **Table 3-1** and **Figure 3-1**, only one of the regulated industrial users is located in a CSO area: CSO-043. However, the other seven discharge wastewater to interceptors that flow to the Front Street and Spring Creek pump stations. There are permitted bypass CSOs at both pump stations (CSOs 002 and 003); therefore, these regulated industrial users are upstream of permitted CSOs. CRW's CSS Characterization, completed April 1, 2017, indicates that the CSOs at the two pump stations do not activate during typical year rainfall events, minimizing the impact of industrial waste on CSOs.

CRW evaluated the industrial process flows relative to the CRW service area land use information from the Dauphin County GIS to determine the percent of total service area that is industrial, heavy industrial, and commercial land uses.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to monitor industrial flow contributions ~~while developing the LTCP~~, but at this time there are not any entities with significant impacts.

3.4 Evaluate Feasible Modifications

Documentation of Current Control Practices

CRW continues to evaluate feasible modifications to its industrial pre-treatment program, as described in the previous sections. CRW's Environmental Compliance Inspector is continuing to advance CRW's FOG program, which includes adding facilities to the FOG registry and issuing permits, as described in Section 3.2.

Plan for Completing Implementation of Minimum Control Practices

CRW recognizes that the National CSO Policy requirements are intended to control discharges upstream of CSO structures during wet weather, should the discharges have the potential to adversely impact water quality. Industrial dischargers to combined sewer systems are exempted from stormwater permitting requirements under the national and state industrial stormwater permitting programs. As a result, the CSO discharge permit holder is responsible for controlling storm water discharges from industrial users served by combined sewer systems.

Based on the information provided in the EPA guidance on the CSO Policy, CRW's approach to NMC-3 addresses two issues regarding those dischargers with the greatest potential impact to CSOs:

- ***Evaluate Feasible Pretreatment Program Modifications*** for users who pose the greatest threat to receiving water quality, based upon the volume and pollutant concentrations of process or waste water discharged during wet weather.

- ***Evaluate Feasible Modifications for Other Non-Domestic Dischargers*** who pose the greatest threat to water quality based on activities with the potential to contaminate stormwater.

Section 3.2 described CRW's ongoing program to identify high priority private property maintenance and management activities, land uses, and areas that are candidates for addition to CRW's Pretreatment Program or modification of pollution prevention activities due a higher likelihood and consequence of discharging stormwater pollutants of concern. The following sections describe how CRW is evaluating and implementing these modifications.

Evaluate Feasible Pretreatment Program Modifications

CRW developed a H&H model and used it to evaluate the relationship between CSO and businesses in the industrial pretreatment program. This evaluation did not reveal significant effects to receiving water quality. ~~CRW's LTCP provides a strategy for implementing CSO controls to optimize existing system performance.~~ Because the relative contribution of industrial process flows to the total flow to the CRW system is insignificant, the effect of changes in discharge timing or increasing pollutant controls is minimal.

Evaluate Feasible Modifications for Other Non-Domestic Dischargers

For other non-domestic dischargers that are NOT added to the Pretreatment Program, CRW will prioritize the dischargers according to the risk assessment presented in Section 3.2.1 and implement pollution prevention activities based on the associated activities of concern (AOCs). **Appendix E** presents CRW's pollution prevention framework that defines CRW's plan for developing education programs, regulations, and surveillance/inspection programs to address the AOCs. The purpose of the framework is to coordinate these programs for compliance with overlapping regulatory requirements among the CSO NMCs and MS4 Minimum Control Measures. **Appendix E** is organized as a series of "Pollution Prevention Fact Sheets," each one targeted to control strategies and objectives for specific AOC(s). The control strategies fall into three categories:

- ***Education/ Involvement*** – Section 7 of this NMC Plan, NMC-7 Pollution Prevention Programs, describes CRW's overall plan to develop public education and information mechanisms. The **Appendix E** fact sheets list pollution prevention themes and practices that will be targeted for each AOC.

- ***Inspection/Surveillance*** – Starting from the protocol for coordinated City/CRW surveillance, inspection, and enforcement, CRW will continue to develop inspection and surveillance programs as described in the **Appendix E** fact sheets (e.g., on-site inspections, "windshield surveys," sewer system inspections, and hotline reporting). The purpose of inspection/surveillance activities is to identify potential storm water pollutant sources and determining if controls are in-place and effective. As necessary, CRW will modify existing or develop new inspection forms for use by CRW inspectors in pollution prevention-related inspections. CRW's new Environmental Compliance Inspector is heading up these efforts.

It is important to note that implementation of these control strategies is designed to reduce the stormwater pollution risk associated with AOCs, but many of the risks that are being managed by CRW

cannot be entirely eliminated. There will still be some likelihood of occurrence and consequence that is retained even after the risk has been managed.

3.5 Effectiveness Evaluation

Documentation of Current Control Practices

CRW's documentation of the effectiveness of its industrial pre-treatment program is described in the previous sections.

Plan for Completing Implementation of Minimum Control Practices

CRW shall, on at least an annual basis, evaluate the effectiveness of the measures implemented under NMC-3, as progress is made. ~~Based on that evaluation, for the first five (5) years following initial submission of the NMC Plan,~~ CRW will submit to PADEP for review and approval a proposed revised plan including an implementation schedule of any additional actions necessary to comply with the NMCs.

Section 4
Minimum Control Number 4
Maximize Flow to the POTWs

4.1 Regulatory Context

Nine Minimum Control (NMC) No. 4 is described in the United States Environmental Protection Agency (EPA) guidance manual as follows. "Maximizing flow to the publicly owned treatment works (POTW) entails simple modifications to the combined sewer system (CSS) and treatment plant to enable as much wet weather flow as possible to reach the treatment plant and receive treatment." The guidance goes on to explain that more complex CSS and POTW modifications would be identified and evaluated as part of the development of a Long-Term Control Plan (LTCP). **Table 4-1** summarizes the major requirements of EPA's Guidance for Nine Minimum Controls, while **Table 4-2** summarizes the major requirements of Capital Region Water's modified partial Consent Decree (CD). Each table indicates the specific subsection of this NMC-4 Plan that addresses each requirement.

Table 4-1: EPA Guidance Compliance Checklist for NMC-4

NMC-4 Requirement Description Maximization of Flow to the AWTF for Treatment	EPA Guidance Reference	Consent Decree Reference	NMC Plan Section
Capacity Determination: This control measure would determine the capacity of the major interceptors and pump stations that deliver flow to the AWTF, and ensure the full capacity is available through a proper O&M program.	5.1	C (10)(c)	4.2.1
Record Analysis: This control measure would analyze existing records to compare flows processed by the AWTF during wet weather events and dry weather periods and determine the relationships between performance and flow.	5.1	C (10)(c)	4.2.1
Capacity Comparisons: This control measure compares the current flows with the design capacities of the AWTF and of individual process units, and identify locations of available excess capacity.	5.1	C (10)(c)	4.2.1
Unused Treatment Facilities: This control measure would determine if any inoperative or unused treatment facilities on the AWTF site could be used to store or treat wet weather flows.	5.1	C (10)(c)	4.3.2
Cost Estimates: This control measure would develop cost estimates for any planned physical modifications and any additional O&M costs at the AWTF due to increased wet weather flows.	5.1	C (10)(c)	4.3.2

Table 4-2: Consent Decree Compliance Checklist for NMC-4

NMC-4 Consent Decree Requirement Description Maximization of Flow to the AWTF for Treatment	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section
Maximize flow in the combined sewer system to the AWTF	C (10)(c)	Not Applicable	4.2 4.3 4.4

4.2 Utilize Full Capacity of Conveyance System

In order to maximize wet weather flow conveyance to the Advanced Wastewater Treatment Facility (AWTF), the full hydraulic capacity of the interceptors must be available. Additionally, the pumping stations must be fully operational and sized to deliver the maximum amount of flow to the AWTF.

4.2.1 Assess and Restore Full Capacity via O&M

CRW is in the process of assessing and restoring the full capacity of its collection and conveyance system, with a goal of maximizing flow to its AWTF. CRW's current and planned control practices have already been described in detail in other sections of this NMC Plan:

- Conducting a system-wide data collection effort to build a geographic information system (GIS) of its conveyance and collection systems (see NMC Section 1.3.4), coupled with investigations into the structural integrity and potential obstructions within this system (see NMC Sections 1.4.1, 1.5.1, 1.6.1, 1.7.1, 1.8.1, 1.9.1, and 1.10.1),
- Developing a hydrologic and hydraulic (H&H) model of its conveyance and major trunk sewer systems, supported by an extensive flow monitoring program to provide the data necessary to calibrate this model (see NMC Section 9.6). Findings of H&H modeling of the existing system are described in the April 1, 2017 CSS Characterization.
- Performing remedial maintenance on this system to remove significant obstructions and repair critical structural / operational deficiencies (See NMC Sections 1.4.2, 1.5.2, 1.6.2, 1.7.2, 1.8.2, 1.9.2, 1.10.2)

A brief summary of these initiatives, as they relate to compliance with the requirements of NMC-4, follows.

Documentation of Current Control Practices

CRW completed an inspection of the interceptors that identified over 40,000 cubic feet of accumulated sediment, which has accumulated over the last several decades. CRW completed the cleaning of this accumulated sediment from its interceptor in early 2017, as described in Section 1.6.2 of this NMC Plan. This restored the hydraulic capacity of the interceptors. H&H modeling indicates that interceptor cleaning must be accompanied by a comprehensive rehabilitation of the interceptor pipes to restore structural integrity and allow interceptor operations under somewhat surcharged conditions. In addition, ~~ongoing~~ improvements to the Front St. Pump Station ~~(scheduled to be completed in 2020) must be~~ were completed in order to achieve additional CSO reductions.

CRW performed a flow monitoring program to support calibration of its H&H model, in accordance with its approved *Initial Flow Metering and Monitoring Program Plan (IFMMPP).* Thirteen flow monitors were installed at key locations along the interceptor system. Interceptor monitoring commenced August 2014 and completed during 2015. Review of the monitoring data collected to date provides an understanding of the current operation and capacity of the existing system with the existing sediment accumulations. Flow monitoring is continuing at twelve interceptor locations, and the eight rain gauges are also still operational~~, allowing further evaluation of flow monitoring data as CSO LTCP development proceeds~~.

CRW periodically compares the flow received at its pumping stations and its AWTF and compares these flows with the current rated capacity of these facilities. The current rated pumping station capacities for Front Street and Spring Creek are ~~43.2~~60 mgd and 28.9 mgd, respectively. These capacities are maintained through ongoing maintenance and frequent inspections to ensure the facilities are operating properly, as described in Section 1.7 of this NMC Plan and CRW OMM Section 4.3.

Plan for Completing Implementation of Minimum Control Practices

CRW is proceeding with the rehabilitation of its interceptors and pumping stations. The existing structural and operating conditions of these interceptors / pumping stations limits opportunities to increase flows to the AWTF until repairs are completed. In addition, the NMC-4 goal of maximizing conveyance to the AWTF will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates), including Appendix B projects. ~~recommended as a baseline control under CRW's LTCP.~~

4.2.2 Adjust Conveyance System Operation

Documentation of Current Control Practices

CRW routinely maintains its regulators to operate as designed, as described in Section 1.4.3 of this NMC Plan, maintaining the full capacity of the regulator to divert small to moderate storm flows to the interceptor system. CRW also completed calibration of an H&H model of the CRW combined sewer system, as described in Section 1.3 of this NMC Plan. Under CRW's modified partial CD, the H&H model was utilized to support the existing system characterization. CRW's H&H model of the CRW combined sewer system was utilized to assess opportunities to maximize flows to the AWTF by adjusting the regulator settings, raising the crest elevations of the CSO diversion weirs, cleaning the interceptor sewers, and modifying operations of the pumping stations, which will be implemented under the ~~LTCP~~Appendix B projects of the modified partial CD.

Significant upgrades to the Front Street Pumping were completed in 2021, which include significant increases to the rated design capacity of the station. The construction of upgrades to the Front Street Pumping Station provides increased reliability, improved performance, and additional hydraulic capacity, as described in more detail in Section 1.7 of this NMC Plan.

H&H modeling determined that the completed interceptor sewer cleaning program has the potential to increase the quantities of wet weather flow conveyed through the interceptor system, but only if coupled with projected hydraulic design capacities of the pumping station and the structural rehabilitation of the interceptor pipes. CRW developed a phased regulator modification plan based on the timing of these other system improvements. Phase 1A of the regulator modifications were completed, now that the Front Street Pumping Station is online, and involved raising diversion weir

crest elevations, disconnecting B&B gates, and/or enlarging control orifice openings for specifically selected regulator structures.

Plan for Completing Implementation of Minimum Control Practices

The NMC-4 goal of maximizing conveyance to the AWTF will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates) ~~recommended as a baseline control under CRW's LTCP~~. CRW will implement future Phases 1B, 2, and 3 of the regulator modifications following completion of other system improvements. Phase 2 regulator modifications will be completed following Front Street Interceptor rehab. Phase 3 regulator modifications will be completed following Paxton Creek Interceptor rehab.

4.2.3 Reduce Infiltration/Inflow

Documentation of Current Control Practices

CRW completed rapid inspections of all the manholes in the separate sanitary collection system, which will assist in identifying infiltration/inflow (I/I) sources. CRW is proceeding with a systematic inspection of the separate sanitary collection system to identify key I/I sources. CRW also completed the second phase of flow monitoring at an additional seven monitoring sites in the separate sanitary sewer system and further assessed monitored flows entering CRW's interceptors from the separate satellite sewer systems of other jurisdictions. This was utilized to identify areas more prevalent towards I/I. CRW evaluated the monitored rainfall and flow data to characterize typical I/I to the separate sanitary sewer system. As documented in the System Characterization Report and Separate Sanitary Sewer Evaluation, I/I was not determined to be a significant contributor to flows within the separate sanitary sewer system.

Plan for Completing Implementation of Minimum Control Practices

As CRW continues with the inspection (via CCTV and cleaning) of the separate sanitary collection system, the data will be reviewed to develop rehabilitation projects that will reduce I/I.

4.3 Optimize Wet Weather Performance of AWTF

CRW completed a significant upgrade to their AWTF in 2016.

4.3.1 Analyze Existing AWTF Performance

Documentation of Current Control Practices

~~During development of CRW's LTCP,~~ CRW conducted stress testing of the primary clarifiers to confirm their hydraulic capacity and identify potential improvements to improve operation during high flow events. CRW also completed a hydraulic analysis of the AWTF to confirm the wet weather flow capacity ~~in conjunction with secondary treatment capacity as part of the LTCP~~. This evaluation recommended potential enhancements to the primary clarifiers to increase their hydraulic capacity and improve settling at peak wet weather flow rates. The construction of the new headworks screening facility is complete. Primary clarifier mechanical improvements were completed in 2022.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to improve AWTF performance with key Appendix B projects ~~during the Immediate Implementation Phase of the LTCP~~.

4.3.2 Assess Use of Unused Facilities

Documentation of Current Control Practices

As part of the design of the recent upgrade to the AWTF, CRW evaluated opportunities to re-use existing AWTF facilities wherever possible.

Plan for Completing Implementation of Minimum Control Practices

The NMC-4 goal of maximizing capacity of the AWTF will be furthered through a variety of enhancements (e.g., new headworks, enhanced primary clarification) ~~recommended as a baseline control under CRW's LTCP~~included in Appendix B projects.

4.4 Effectiveness Evaluation

Documentation of Current Control Practices

As part of this NMC Plan, CRW is reviewing its current practices and developing schedules and priorities for improvements to maximize flow to the AWTF.

Plan for Completing Implementation of Minimum Control Practices

The NMC-4 goal of maximizing conveyance to the AWTF will be furthered through the comprehensive CSO regulator/outfall enhancements (raising weirs, modifying regulator controls and repairing river intrusion gates), interceptor rehabilitation, pump station enhancements, and AWTF enhancements ~~recommended as baseline controls under CRW's LTCP~~included in Appendix B projects.

Section 5
Minimum Control Number 5
Prohibiting CSO Discharges during Dry Weather

5.1 Regulatory Context

The objective of this minimum control is to assure that combined sewer system regulator structures overflow only during wet weather conditions, when there is a direct or immediate precipitation, snow-melt or flood condition influence. This minimum control includes actions taken to assure that there are no overflows from the combined sewer systems during dry weather flow conditions. **Table 5-1** summarizes the major requirements of United States Environmental Protection Agency's (EPA) Guidance for Nine Minimum Controls (NMCs), while **Table 5-2** summarizes the major requirements of Capital Region Water's (CRW) modified partial Consent Decree (CD). Each table indicates the specific subsection of this NMC-5 Plan that addresses each requirement.

Table 5-1: EPA Guidance Compliance Checklist for NMC-5

NMC-5 Requirement Description Elimination of CSOs during Dry Weather	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Visual Inspection: This control measure would provide a visual inspection program of sufficient scope and frequency to provide reasonable assurance that any DWO occurrences will be detected.	6.1	C (10)(d)	5.2	4.1
Adjustment of Regulator Settings: This control measure would seek opportunities to provide additional freeboard against DWOs by simple means such as adjusting a gate setting or raising a weir crest.	6.1	Not Applicable	5.3.1	Not Applicable
Repair/Rehabilitation of Regulators: This control measure would provide simple repairs to prevent regulators with hydraulically or mechanically activated gates from becoming stuck in the bypassing position because of damage, deterioration, or inadequate maintenance.	6.1	Not Applicable	5.3.1	4.1
Maintenance of Flap Gates: This control measure would provide routine inspections, the removal of obstructing debris, and the replacement of warped gates or deteriorated gaskets to prevent river intrusion into the combined sewer system through a flap gate that failed to close properly.	6.1	Not Applicable	5.2, 5.3.1	4.2
Trunk Sewer Cleaning: This control measure would remove obstructions such as sediment accumulations and tree roots from interceptors that can restrict flow and result in DWOs at upstream locations.	6.1	Not Applicable	5.2 5.3.1	4.4
Sewer Repair: This localized control measure would repair specific sewer segments to reduce ground water infiltration that, when combined with peak sanitary sewage flow, can exceed the capacity of the regulator and result in DWOs.	6.1	Not Applicable	5.3.1	4.6

Table 5-2: Consent Decree Compliance Checklist for NMC-5

NMC-5 Consent Decree Requirement Description Elimination of CSOs During Dry Weather	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Take measures to eliminate and/or address CSOs during dry weather.	C (10)(d)	6.1	5.2 5.3 5.4	4.1.1 4.1.4 4.1.5

Dry weather discharges at combined sewer overflow (CSO) outfalls can occur in any combined sewer system. CRW implements procedures to ensure that dry weather CSO discharges do not occur due to deficiencies in CRW's system (e.g, under-sized regulator settings, inadequate hydraulic capacity, or lack of maintenance) but only as a result of random and infrequent actions by a third party not under the direct control of CRW. Examples of these third-party actions or conditions that can produce an uncharacteristic peak flow to a CSO regulator structure and cause a random DWO include a water main break, water used to extinguish a fire or flush a hydrant, water used on a construction site for dust control that is incorrectly applied or improperly controlled, and the draining of a public swimming pool. Other examples of these third-party actions or conditions include unpreventable acts of vandalism and contractor or municipal negligence in servicing or repairing a component of the regional collection system. The random discharges induced by these third-party actions cannot be prevented but can and must be promptly identified and corrected by inspection, cleaning, repair, and/or removal of the cause of the excessive flow and/or debris sources.

5.2 DWO Inspections/Assessment/Reporting

Documentation of Current Control Practices

CRW has a comprehensive inspection program to verify that CSO regulator structures and pump stations are operating properly, and to ensure DWOs are promptly identified and corrected. CRW's inspection activities, operation and maintenance activities, and the crews and equipment used to implement them are documented in greater detail in Section 1.4 of this NMC Plan, as well a CRW OMM Section 4.1. Additionally, the interceptors were inspected and cleaned, during 2015-2017, and either have been or will be rehabilitated to address structural deficiencies. These inspection activities are described in Section 1.6 of this NMC Plan.

As was previously explained in the documentation for NMC-1 and NMC-2, river intrusion into the interceptor sewers can only occur during flood stage conditions along Paxton Creek and the Susquehanna River, and flap gate inspections are therefore not typically critical components to preventing DWOs.

In compliance with the requirements of the CRW National Pollutant Discharge Elimination System (NPDES) permit and the modified partial CD, should a DWO be observed or detected during these visual inspections, the inspector has the authority and responsibility to immediately notify the Pennsylvania Department of Environmental Protection (PADEP) by telephone to report the incidence of a DWO. Following the telephone notification, the CRW Wastewater Superintendent prepares and submits written notification to PADEP within five days of detection.

In compliance with the requirements of the modified partial CD, CRW includes with its semiannual reports to the regulatory agencies information on DWOs. The semiannual report describes the existing methods used by CRW staff for detecting DWOs, the number of DWOs observed directly during the reporting period, and the number of DWOs detected via inspection aids such as wooden blocks placed on the crests of the diversion weirs. The report narrative describes the apparent cause(s) for each DWO, including if the DWO was the result of a third-party action. The semiannual report also documents the environmental impacts of the DWO events, the remedial measures taken to remove any DWO deposits along the shoreline and the measures CRW staff take to prevent future DWO incidents.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to consider refinement of its CSO activation and monitoring procedures ~~during the LTCP implementation as~~with implementation of the updated CBH$_2$OPP detailed in Section 1.4 of this NMC Plan.

5.3 DWO Corrective Actions

5.3.1 Regulator Gate Controls

Documentation of Current Control Practices

As described in Sections 1.4 and 1.5 of this NMC Plan, CRW inspected each regulator structure, including the dimensions of the control orifice openings during dry weather conditions and the crest elevations of the CSO diversion weirs. CRW also verified the regulator control settings and the set points on the Brown and Brown float mechanisms.

As described and documented in NMC-1.4, and OMM-4.1.5, upon detection of a DWO, CRW crews immediately determine the cause and implement any required corrective maintenance measures. These measures could include the removal of obstructing debris or the reopening of a Brown and Brown control orifice opening to its fully open dry weather condition. An example of corrective measures that have been implemented are documented in **Appendix A**.

CRW completed a rapid assessment if its collection system via a pole camera inspection of manholes to identify large accumulations of sediment, debris, grease, and/or other materials that could increase the risk of causing a DWO if transported to the regulator chamber. The rapid assessment and flow monitoring programs have not identified any sewer segments that would allow excessive ground water infiltration to a point that, when combined with peak sanitary sewage flow, can exceed the capacity of a regulator structure or result in DWOs. CRW also inspected each outfall and its backflow prevention gates to identify potential conditions that could create a DWO. CRW cleaned 33,500 linear feet of its interceptors to restore capacity and eliminate potential blockages that could lead to a DWO.

CRW completed H&H model evaluations to determine how the existing diversion weir heights could be raised without inducing unacceptable surcharge conditions. ~~The LTCP details the weir height modifications that will be incorporated in the Baseline Level of Control, as further defined in Section 2.4 of this NMC Plan.~~Appendix B included diversion weir modifications in a phased approach.

As described and documented in NMC 2.5, with the Front Street Pump Station is online, the diversion dam crest elevations for certain specifically selected regulator structures were elevated, Brown and Brown regulators were chained open, or control orifice openings enlarged. While these activities are focused on providing additional CSO capture, raising the crests of the diversion dams, chaining open

the Brown and Brown regulators, or enlarging the control orifice sizes also provides additional protection against dry weather overflows.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue with cleaning and/or further assessment of the collection system, as further defined in Section 1.9.1 of this NMC Plan and CRW OMM Section 4.6.3. CRW will implement the weir height adjustments for the Baseline Level of Control. CRW will implement future Phases 1B, 2, and 3 of the regulator modifications following completion of other system improvements.

5.3.2 Receiving Water Cleanup

Documentation of Current Control Practices

CRW currently removes residual solid and floatable materials along the shoreline of the Susquehanna River and Paxton Creek following significant storm events, as further defined in Section 6.4 of this NMC Plan and CRW OMM Section 4.2.4.

Plan for Completing Implementation of Minimum Control Practices

CRW plans to continue this practice in the future.

5.4 Effectiveness Evaluation

Documentation of Current Control Practices

CRW has maintained an effective process for preventing and addressing DWOs.

Plan for Completing Implementation of Minimum Control Practices

CRW will evaluate the effectiveness of their control practices for NMC-5 on an annual basis and update the NMC Plan accordingly.

Section 6
Minimum Control Number 6
Control of Solids and Floatable Material in CSO Discharges

6.1 Regulatory Context

The sixth minimum control is intended to control visible floatables and solids. Under the United States Environmental Protection Agency (EPA) guidance document, control of visible floatables and solids are to be accomplished using relatively simple measures such as pollution prevention through Best Management Practices (BMPs); simple devices including baffles, screens, and racks to remove coarse solids and floatables from combined sewage. **Table 6-1** summarizes the major requirements of EPA's Guidance for Nine Minimum Controls (NMCs), while **Table 6-2** summarizes the major requirements of Capital Region Water's (CRW) modified partial Consent Decree (CD). Each table indicates the specific subsection of this NMC-6 Plan that addresses each requirement.

Table 6.1: EPA Guidance Compliance Checklist for NMC-6

NMC-6 Requirement Description Control of Solid and Floatable Materials in CSOs	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Baffles: This control measure would place baffles within regulator structures to remove neutral buoyancy floatables from combined sewage before they reach the receiving stream.	7.1.1	C (10)(e)	6.3.2	Not Applicable
Trash Racks and Static Screens: This control measure would place manually cleaned vertical bars within regulator structures to control coarse solids and floatables.	7.1.2 7.1.3	C (10)(e)	6.3.2	Not Applicable
Catch Basin Modifications: This control measure would include installation of horizontal grating restrictions, hanging traps, sewer hoods, or vertical throat restrictions to reduce the amount of street litter that enters the combined sewer system.	7.1.4	C (10)(e)	6.3.2	4.7
End of Pipe Nets: This control measure would retain floatables in a set of netted bags installed at the end of a CSO outfall for subsequent removal and disposal.	7.1.5	C (10)(e)	6.3.3	Not Applicable
Outfall Booms: This control measure would contain materials with positive buoyancy with specially fabricated floatation structures and suspended curtains placed in the water around outfalls.	7.3.1	C (10)(e)	6.3.3	Not Applicable
Skimmer Boat: This localized control measure would use skimmer boats to remove floating materials within a few inches of the water surface.	7.3.2	C (10)(e)	6.4	Not Applicable

Table 6-2: Consent Decree Compliance Checklist for NMC-6

NMC-6 Consent Decree Requirement Description Control of Solid and Floatable Materials in CSOs	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Operate and maintain the existing combined sewer system in accordance with the OMM to control solid and floatable materials (SFMs) discharged from COS outfalls.	C (10)(e)	7.1	6.2, 6.2.1	4.1 4.2
Should a visible accumulation of SFMs be deposited into the receiving water or onto the stream bank, remove these materials.	C (10)(e)	Not Applicable	6.4	4.2
As set forth in the OMM, conduct annual evaluations of past performance and implement corrective actions to reduce the presence of SFMs in CSO discharges and receiving waters.	C (10)(e)	Not Applicable	6.5	4.2
Report actions taken by CRW to control SFMs in the semi-annual reports required by CD Section VII.	C (10)(e)	Not Applicable	6.5	Not Applicable
Consider for implementation at least the SFMs control technologies set forth in the NMC Guidance.	C (10)(e)	7.1	6.3.2 6.3.3 6.4	Not Applicable

6.2 O&M of Combined Sewer System

Documentation of Current Control Practices

CRW has a comprehensive inspection and maintenance program for its combined sewer overflow (CSO) regulator structures, outfalls, and backflow prevention gates as detailed in Sections 1.4 and 1.5 of this NMC Plan, and CRW OMM Sections 4.1 and 4.2. CRW currently removes residual solid and floatable materials along the shoreline of the Paxton Creek following significant storm events, as detailed in Section 5.3.2 of this NMC Plan and CRW OMM Section 6.4. With the submerged CSO outfalls along the Susquehanna River, and the speed of the current along the shoreline, visible accumulations of solid or floatable materials are rare, but are removed when found.

As discussed in NMC-1 with further details in CRW OMM Section 4, CRW completed additional inspections of the outfalls and a collection system manhole inspection. As a result of the outfall inspections, a few outfalls were cleaned in which significant debris was observed.

CRW also removes accumulated debris within the regulator structures and diversion chambers on a routine basis. 80-85% of the existing collection system inlets contain hoods, sumps, and/or baffles to trap solid and floatable debris, which is cleaned out as part of the ongoing inlet cleaning program. CRW also performs street sweeping throughout the City to prevent debris from entering the collection system.

Plan for Completing Implementation of Minimum Control Practices

The findings of the collection system inspections are being utilized to prioritize and schedule comprehensive CCTV inspections and cleaning of significant debris accumulations that could cause releases of floatable and solid debris.

6.3 Evaluate/Define/Implement Corrective Actions

6.3.1 Pollution Prevention

Documentation of Current Control Practices

CRW's pollution prevention practices are summarized in NMC-7. CRW's ongoing pollution prevention practices include an improved citywide street cleaning program to prevent debris and sediment from entering inlets, and participation in internet and social media to promote stormwater pollution prevention within the community.

CRW also completed an assessment of the risk of pollutant discharges associated with a range of activities of concern as described in Section 3.2.1 in this NMC Plan. The purpose of this risk assessment is to establish priorities for its pollution prevention programs. CRW worked with the City to develop protocol for integrated City/CRW surveillance/inspection/enforcement to leverage existing City legal authority. CRW adopted updated rules and regulations with adequate legal authority for CRW to regulate and enforce potential sources of solid and floatable materials.

Plan for Completing Implementation of Minimum Control Practices

CRW's pollution prevention activities that are planned for the future are discussed in NMC-7. A key component of CRW's plan for pollution prevention is to develop a strong public education program with specific themes and target audience groups.

6.3.2 Collection System Controls

Documentation of Current Control Practices

CRW's existing inlets are equipped with a variety of hood and sump configurations to control solids and floatables. As part of the ongoing inlet cleaning program CRW is removing blockages and reactivating clogged inlets on a continual basis. Further details are provided in Section 1.10 of this NMC Plan and CRW OMM Section 4.10. 80-85% of the inlets contain a brick wall trap that performs like a hood. If an inlet/catch basin is rebuilt that does not include a trap, CRW will incorporate Type C inlet tops for floatable debris controls.

The use of sewer traps/hoods/baffles, Type C inlet tops, and/or sumps at the catch basins is CRW's approach to solids and floatables control. These controls keep solids and floatable debris trapped within the catch basins or at the surface until they are removed as part of CRW's O&M program. These controls prevent floatable debris from being conveyed through the collection system and reaching the regulator structures and outfalls, thus eliminating the need for netting facilities.

As required in Section VII of the modified partial CD, CRW prepares and submits to the regulatory agencies a series of semi-annual reports documenting their progress in implementing the modified partial CD. As part of that reporting, CRW describes actions taken by its staff to control solid and floatable materials.

Plan for Completing Implementation of Minimum Control Practices

The effectiveness of the various existing sewer hood and sump technologies was evaluated during long term control plan development. Now that the remedial inlet cleaning is complete and CRW collected documentation on specific inlet features, CRW is proceeding with the installation of hoods, baffles, Type C inlet tops, or other appropriate floatable debris controls for all inlets that do not currently have controls in place.

The modified partial CD requires CRW to consider for implementation at least the solid and floatable materials control technologies set forth in the NMC Guidance. During the implementation of CRW's long term control plan, CRW will evaluate the potential applicability, effectiveness, and safety of using NMC-6-suggested collection system controls such as the installation of baffles, and/or trash racks within the CSO regulator structures for specific projects in conjunction with changes proposed for regulators and weirs to address NMC-2 and NMC-4.

6.3.3 End-of-Pipe Controls

Documentation of Current Control Practices

CRW does not currently have end-of-pipe solids/floatable removal devices installed on their outfalls.

Plan for Completing Implementation of Minimum Control Practices

The ~~Partial Consent Decree~~modified partial CD requires CRW to consider for implementation at least the solid and floatable materials control technologies set forth in the NMC Guidance. During the implementation of CRW's long term control plan, end-of-pipe controls such as nets and outfall booms will be incorporated in specific projects where they are determined to be feasible.

6.4 Receiving Water Cleanup

Documentation of Current Control Practices

CRW's current receiving water inspection and cleanup efforts are discussed in Section 1.5.1 of this NMCD Plan and CRW OMM-4.2. Unlike the Susquehanna River, the outfalls along the Paxton Creek are elevated above the normal water surface elevation. As part of the daily inspection procedures CRW crews conduct at the CSO outfalls, residual solid or floatable materials under the outfalls are promptly removed and disposed of.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue its current practices of inspecting each of the CSO outfalls and removing any residual solid and floatable materials under the elevated outfalls along the Paxton Creek.

The modified partial CD requires CRW to consider for implementation at least the solid and floatable materials control technologies set forth in the NMC Guidance during the development of the long-term control plan. However, skimmer boats are not a feasible option due to the shallow depths of the receiving waters.

6.5 Effectiveness Evaluation

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to evaluate the effectiveness of their control practices for NMC-6 on an annual basis and update the NMC Plan accordingly.

Section 7
Minimum Control Number 7
Pollution Prevention Programs

7.1 Regulatory Context

7.1.1 Requirements of the National CSO Control Policy

Pollution prevention programs can help to reduce the amount of contaminants and floatable materials that enter the combined sewer system receiving waters via combined sewer overflow (CSO) discharges. **Table 7-1** outlines the key components for a pollution prevention program and applicable references in the Nine Minimum Controls (NMC) guidance, NMC Plan, and CSO Operation and Maintenance Manual (OMM). Capital Region Water's (CRW) modified partial Consent Decree (CD) requires CRW to prepare this Plan, consisting of proposed actions to achieve the NMCs with an implementation schedule, as an alternative to documentation of compliance with the NMCs called for in the CSO Policy. There are no requirements for NMC-7 Pollution Prevention in CRW's modified partial CD.

7.1.2 CRW Approach for NMC Planning Compliance

CRW recently completed an assessment of the risk of pollutant discharges associated with a range of activities of concern (Section 3.2.1). The purpose of this risk assessment is to establish priorities for its pollution prevention programs. **Appendix E** presents CRW's pollution prevention framework that defines a plan for developing education programs, regulations, and surveillance/inspection programs to address activities of concern (AOCs). The purpose of the framework is to coordinate these programs for compliance with overlapping regulatory requirements among the CSO Nine Minimum Controls (NMCs), Municipal Separate Storm Sewer System (MS4) Minimum Control Measures, Paxton Creek Total Maximum Daily Load (TMDL) Strategy, and Chesapeake Bay Program. **Table 7-2** lists the corresponding NMCs for each fact sheet. The pollution prevention responsibilities of NMC-7 are similar to the MS4 permit's requirements for public education / involvement (MCMs 1 and 2), prevention of illicit discharges / illegal dumping (MCM 3), and good housekeeping practices for municipal operations (MCM 6). **Appendix E** is organized as a series of "Pollution Prevention Fact Sheets," each one targeted to control strategies and objectives for specific AOC(s).

Many of the activities suggested by the United States Environmental Protection Agency (EPA) document, *Combined Sewer Overflows: Guidance for Nine Minimum Controls* are not currently within the purview of CRW's existing responsibilities or legal authorities. CRW has no responsibility for the operation of streets, recycling programs, or many other activities commonly regarded as opportunities for stormwater pollution prevention. An important step in the regulatory process is therefore to obtain the cooperation of the City of Harrisburg (City) in regard to their responsibilities in the area of pollution prevention, for the City to delegate the necessary legal authority to CRW to require pollution prevention activities of property owners draining to CRW's combined sewer system, and/or to educate property owners with regard to their pollution prevention responsibilities. The fact sheets outline CRW regulatory initiatives, which may require coordination with and/or modification to City Code, which will be addressed under the NMC Plan.

Table 7-1 Nine Minimum Control 7 Compliance Checklist from EPA Guidance

NMC-7 Requirement Description Pollution Prevention Programs	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Street Cleaning: Remove street litter during dry weather periods.	8.1.1	Not Applicable	7.2	Not Applicable
Public Education Programs: Implement anti-litter campaigns and public education programs to reduce the amount of street litter and household items that enter CSOs, encourage the proper disposal of sanitary and personal hygiene items, and encourage the proper application of fertilizers, pesticides and herbicides.	8.1.2	Not Applicable	7.3	Not Applicable
Solid Waste Collection and Recycling: Reduce the amount of litter on streets with the proper placement, maintenance and emptying of trash receptacles along City streets, and the use of recycling programs.	8.1.3	Not Applicable	7.4	Not Applicable
Product Ban / Substitution: Eliminate the production and sale of products that do not degrade in the environment.	8.1.4	Not Applicable	7.5	Not Applicable
Control of Product Use: Public agencies should control the use of problem materials, such as fertilizer and pesticides in public parks, and application of de-icing salt on public roads and parking areas.	8.1.5	Not Applicable	7.6	Not Applicable
Illegal Dumping: Utilize public education, notices, and enforcement programs to control illegal dumping into waterways, storm inlets, on onto the ground.	8.1.6	Not Applicable	7.7	Not Applicable
Bulk Refuse Disposal: Consider providing municipal disposal facilities to accept materials such as home renovation debris that are not accepted by normal curbside garbage collection.	8.1.7	Not Applicable	7.8	Not Applicable
Hazardous Waste Collection: Designate areas where any type of household hazardous waste can be brought for collection and environmentally safe disposal.	8.1.8	Not Applicable	7.9	Not Applicable
Water Conservation: Reduce dry weather sanitary flow and increase the volume of combined sewage that can be retained and treated by reducing water consumption.	8.1.9	Not Applicable	7.10	Not Applicable
Commercial / Industrial Pollution Prevention: Use local ordinances to require establishments with waste oil or hazardous waste storage to develop and implement a pollution prevention plan or apply best management practices to minimize pollutant discharges.	8.1.10	Not Applicable	7.11	Not Applicable
Documentation: Provide documentation demonstrating a diligent effort to evaluate this control, including the following: ▪ A summary of the alternatives considered ▪ A list and description of the measures planned for implementation and the responsible parties ▪ A cost estimate and implementation schedule ▪ An estimate of the expected benefits ▪ Samples of the public educational materials planned for use	8.5	Not Applicable	7.2 – 7.11 Appendix E	Not Applicable

Table 7-2 Pollution Prevention Fact Sheet Applicability

Pollution Prevention Fact Sheets	NMC-1: Review of Operation & Maintenance Programs	NMC-5: Prohibiting CSO Discharges during Dry Weather	NMC-6: Control of Solids and Floatable Material in CSO Discharges	NMC-7: Pollution Prevention
Building Maintenance /	•		•	•
Development / Construction			•	•
Food Service		•	•	•
Lateral Maintenance / Repair	•	•		•
Liquid Waste Handling / Storage	•			•
Material Handling / Storage	•			•
Solid Waste Handling / Storage	•		•	•
Spill Prevention / Response /	•			•
Street / Pavement Management	•		•	•
Vehicle / Equipment Service	•		•	•
Yard/Landscape Maintenance	•		•	•

7.2 Street Cleaning

Documentation of Current Control Practices

In 2015 and 2016, CRW participated in funding City of Harrisburg street sweeping operations. In 2017, CRW publicly bid the street cleaning contract to obtain the most cost-effective annual street sweeping activities for improved pollution control during 2017. The street cleaning contractor commenced work in Spring 2017 and continued through 2019, utilizing regenerative air technology and cleaning each street 26 times a year. Starting in Summer 2020, CRW began performing the street cleaning.

CRW developed and implemented a written operation and maintenance (O&M) program for CRW operations and facilities that contribute to the discharge of pollutants to CRW's CSOs and MS4s. This includes street cleaning and inlet cleaning procedures. The Appendix E fact sheet for Pollution Prevention for Street / Pavement Management defines CRW's approach to street sweeping and other pavement management practices to control the discharge of sediment, deicers, solid waste, oil and grease, and vegetation waste from streets and parking lots.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to improve the O&M program to stress pollution prevention and good housekeeping measures, contain site-specific information, and include controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, CRW parking lots, maintenance and storage yards, and procedures for the proper disposal of sediment and debris removed.

7.3 Public Education Programs

Documentation of Current Control Practices

An informed and knowledgeable community is crucial to the success of CRW's Pollution Prevention Programs because it will inspire greater support and participation. CRW currently uses the following mechanisms to distribute educational materials:

- Social media: Capital Region Water currently uses Twitter, Facebook, Instagram, and Nextdoor.com to provide education, encourage public participation, send alerts, and respond to customer communications.
- Website: Capital Region Water's educational materials, information about ongoing projects, and public documents are published on its website (www.capitalregionwater.com). This includes an informational page about the Fats, Oils, and Grease Program, including permitting resources and best management practices.
- Media Relations: Capital Region Water regularly sends press releases and communicates with local media outlets to distribute information.
- Outreach & Volunteer Events: Capital Region Water regularly engages its community through educational and volunteer events and activities. Community litter cleanups are a priority outreach event.
- Community Ambassador Committee: Capital Region Water meets monthly with a community stakeholder committee comprised of local community leaders, providing feedback to Capital Region Water on projects and disseminates information throughout the community.
- Email: Capital Region Water sends regular emails to its email list of over 4,000 customers and community leaders.
- Published Materials: Capital Region Water produces brochures, door hangers, and flyers to provide educational information and advertise events.
- ~~Specific public education materials, as well as public involvement events, are described in the semi-annual reports.~~Specific public education materials and public involvement events are described in the semi-annual reports.
- Facility Tours & Open Houses: Capital Region Water hosts public tours and open houses at facilities and completed project sites.

CRW has identified the six targeted themes and potential audiences shown in **Table 7-3**. The audiences and themes for the area served by the combined sewer system should be consistent with those for the MS4 to achieve a consistent public education program. Up to five target audiences have been identified: students / teachers, residents, businesses, institutions (e.g., state agencies), and development / construction.

Initially, the public education targeted theme focused on system awareness. Using CRW's "City Beautiful H_2O" wet weather campaign, CRW delivered a variety of messages necessary to "reach" its diverse target audiences. Key educational events included community events that provided interactive stations for community members to learn about stormwater and wastewater while offering

opportunities to solicit their input through surveys and activities. Targeted outreach has continued with an emphasis on stormwater education and local solutions. Public input is continually considered during project implementation.

~~CRW hired a professional research firm to conduct a phone and online survey with a representative sample of its customer base in Harrisburg. The survey measured customer satisfaction and evaluated customer preferred communication methods. Capital Region Water continues to collect informal feedback regarding communication and notification preferences.~~

Table 7-3 Target Audience Groups and Themes

Targeted Theme	Targeted Audience	Justification	Appendix E Fact Sheets
CSO / MS4 / Stream / Watershed Awareness	All	Increase knowledge of how a combined sewer system and stormwater system function, promotes watershed-wide awareness of stormwater impacts and management practices	▪ Not Applicable
Industrial and commercial wastes/spills	Businesses	Discourages the discharge of illegal substances to the City's combined sewer system and MS4 and reduces the likelihood of spilled pollutants from entering the systems	▪ Building Maintenance / Renovation ▪ Food Service ▪ Liquid Waste Handling / Storage ▪ Material Handling / Storage ▪ Solid Waste Handling / Storage ▪ Spill Prevention / Response / Cleanup
Property Management (e.g., pesticide, herbicide and nutrient use, waste management / disposal)	Residents, Businesses, Institutions	Encourages proper storage, use, and disposal of materials involved with maintenance of exterior grounds and buildings	▪ Building Maintenance / Renovation ▪ Yard/Landscape Maintenance ▪ Lateral Maintenance / Repair ▪ Street / Pavement Management
Vehicle and Equipment Management	Residents, Businesses, Institutions	Encourages proper exterior storage, maintenance, and operation of vehicles / equipment.	▪ Material Handling / Storage ▪ Spill Prevention / Response / Cleanup ▪ Vehicle / Equipment Service
School-Based Science Curriculum	Students / Teachers	Education of children is often more effective, helps educate parents; helps satisfy State science education goals.	▪ Material Handling / Storage ▪ Solid Waste Handling / Storage
Construction / Post-Construction Management Practices	Development / Construction	Orients development and construction industry to new stormwater requirements	▪ Development / Construction

~~CRW completed a Stakeholder Engagement and External Affairs Strategy Report, which included developing a public engagement strategy.~~ CRW's External Affairs Manager, with support and assistance from the Community Relations Managers, implements ~~the recommendations of its Stakeholder Engagement and External Affairs Strategy Report~~a stakeholder engagement strategy to address multiple regulatory requirements for CSO, MS4, stream, and watershed awareness, and steps that the public can take to reduce pollutants in stormwater runoff. As part of this effort, CRW prepared a summary of public outreach, participation, and notification required to meet regulatory compliance for the NMCs, modified partial consent decree, MS4 permit, TMDL Plan, and miscellaneous commitments. In addition, CRW prepared a tracking spreadsheet for the action items associated with fulfilling these measures.

CRW implements its ~~Stakeholder Engagement and External Affairs Strategy Report~~stakeholder engagement strategy in coordination with the public education and outreach practices of its Stormwater Management Program and requirements of its NPDES Municipal Separate Sewer System (MS4) permit. The MS4 permit requires CRW to implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and the steps that the public can take to reduce pollutants in stormwater runoff.

Plan for Completing Implementation of Minimum Control Practices

CRW will annually publish at least one (1) issue of a newsletter, pamphlet, flyer, or website that provides a general description of its programs and addresses one or more of the targeted themes. The list of publications, including websites, and the content of the publications will be reviewed and updated at least once during each year. Publications may include a list of references (or links) to refer the reader to additional information (e.g., PADEP and EPA stormwater website) and notify the public of opportunities provided by other agencies and groups such as upcoming household hazardous waste collection events or entities who receive and dispose used tires and motor oil.

Themes will focus on pollution prevention for targeted activities of concern. Section 3.2.1 of this NMC Plan presents a risk assessment to establish priorities for CRW's pollution prevention programs. CRW will use the findings of this risk assessment to identify high-risk non-domestic dischargers that should be included in CRW's industrial pretreatment program, and low to medium risk activities of concern that CRW will address with risk-appropriate regulations, surveillance, and education. In selecting future public educational materials for each targeted theme, CRW intends to relate the topics to something that the public is invested in and, wherever possible, address both the MCMs and the NMCs required for the combined sewer system.

Specific distribution methods will be further refined based on the effectiveness of education and outreach. Distribution methods that will be considered include: displays, posters, signs, pamphlets, booklets, brochures, radio, local cable TV, newspaper articles, other advertisements (e.g., at bus and train stops/stations), bill stuffers, posters, presentations, conferences, meetings, fact sheets, giveaways, storm drain stenciling, internet websites and social media, or mechanisms to reach schools. CRW will select and utilize at least two (2) distribution methods each year. These are in addition to the newsletter, pamphlet, flyer, or website.

7.4 Solid Waste Collection / Recycling

Documentation of Current Control Practices

Solid waste collection / recycling is the responsibility of the contributing municipalities and townships. The City of Harrisburg provides trash and recycling services in CRW's CSO area and existing city code regulates the storage and disposal of solid wastes. The City publicizes on its website what items can be disposed of in the trash and recycling and provides a phone number for more information on proper disposal of non-recyclable items and household hazardous wastes. Glass bottles and jars are no longer collected with recycling, except in bulk quantities.

CRW adopted updated rules and regulations that provide CRW with adequate legal authority to regulate improperly managed solid waste that may discharge into CRW sewers.

Plan for Completing Implementation of Minimum Control Practices

The Appendix E fact sheet for Pollution Prevention for Solid Waste Handling / Storage defines CRW's approach for this element of NMC-7:

- CRW will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial, industrial, and residential property owners and practices to control pollutants associated with solid waste.
- To the extent allowed under current legal authority, CRW will conduct inspections of solid waste receptacles, storage areas, and/or dump sites that may discharge into CRW sewers.

7.5 Product Ban/Substitution

Documentation of Current Control Practices

There are currently no product bans or required substitutions. CRW promotes product substitution through its public education programs and reports on progress in its semi-annual compliance reports. Since the service area of CRW's combined collection system (i.e., the City of Harrisburg) is small, and CRW has no authority to enact such bans in surrounding jurisdictions where many City residents shop. CRW does not believe that product bans enacted solely by CRW would be effective. CRW is willing to work with EPA and/or DEP on broader national or state-level product bans.

Plan for Completing Implementation of Minimum Control Practices

As shown in the Appendix E fact sheets, potential product substitutions apply to several AOCs: building maintenance/renovation, yard/landscape maintenance, material handling/storage, street/pavement management, and vehicle/equipment service. CRW will continue to encourage product substitutions for these AOCs using education and involvement, if the product control measures described below in Section 7.6 require further restriction

7.6 Product Use Control

Documentation of Current Control Practices

CRW currently has no control practices for the use of fertilizers and pesticides or application of de-icing materials. CRW promotes proper use of fertilizers, pesticides, and deicing materials through its public education programs, and reports on progress in its semi-annual compliance reports. CRW also has hired an Environmental Compliance Inspector to spearhead its source control efforts. CRW is prepared to discuss with EPA/DEP collaborative methods to improve the effectiveness of such programs.

Plan for Completing Implementation of Minimum Control Practices

As shown in the Appendix E fact sheets, proper material handling and usage applies to several AOCs: building maintenance/renovation, yard/landscape maintenance, material handling/storage, street/pavement management, and vehicle/equipment service. CRW will continue to encourage proper handling for these AOCs using education and involvement. Beginning in the second year of the public education program, CRW will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial/industrial property owners and residential property owners with messages encouraging these audiences to minimize the amount and exposure of hazardous materials, follow manufacturer directions, and properly store and dispose of excess materials.

7.7 Illegal Dumping

Documentation of Current Control Practices

Existing City of Harrisburg code regulates the storage and disposal of solid wastes, prohibits disposal with stormwater, and prohibits the deposit of hazardous wastes and materials. CRW Operations Department, External Affairs Manager, and Environmental Compliance Inspector are responsible for implementing the following practices:

- **Provide Mechanism to Report Illicit Discharges/Illegal Dumping.** To report a problem or provide feedback, such as reporting illegal dumping in storm drains, the CRW website (www.capitalregionwater.com) publicizes two methods that are monitored continuously: a telephone number and online form. Problems may also be reported via email, Twitter, Facebook, and Nextdoor. This is part of the Cityworks program, as described in NMC-1.
- **Respond to Reports of Illicit Discharge/Illegal Dumping.** CRW and the City are implementing protocol to address illicit discharges/illegal dumping, which is a key responsibility of CRW's Environmental Compliance Inspector.
- **Document Illicit Discharge/Illegal Dumping.** CRW has developed an incident report to document investigations of illicit discharge/illegal dumping.
- **Respond to Reports of Illicit Discharge/Illegal Dumping.** CRW adopted updated rules and regulations that provide CRW with adequate legal authority to regulate illicit discharges and illegal dumping that may discharge into CRW sewers. CRW's Environmental Compliance Inspector responds to all applicable complaints in a timely and appropriate manner, and documents all responses, including the action taken, the time required to take the action, and whether the complaint was resolved successfully.
- **Standard Operating Procedure.** CRW developed a standard operating procedure for illicit discharge detection in particular areas known for regular unpermitted discharges.

Plan for Completing Implementation of Minimum Control Practices

The Appendix E fact sheet for Pollution Prevention for Solid Waste Handling / Storage defines CRW's approach for this element of NMC-7. CRW Operations Department, External Affairs Manager, and Environmental Compliance Inspector are responsible for implementing the following practices:

- **Provide Educational Outreach about Illicit Discharges and Illegal Dumping.** CRW will finalize the draft educational outreach to public employees, business owners and employees, property owners, the general public and elected officials about its program to detect and eliminate illicit discharges. CRW will provide this education as part of its public education program, public involvement program, and municipal employee training program. Specific educational outreach messages and mechanisms will be defined in the PEOP discussed in Section 7.2.1, and may include:
    - Programs to encourage and facilitate public reporting of illicit discharges;
    - Organizing volunteers to locate and visually inspect outfalls and to stencil storm drains; and

- Implement and encourage recycling programs for common wastes such as motor oil, antifreeze and pesticides.

7.8 Bulk Refuse Disposal

Documentation of Current Control Practices

Solid waste collection / recycling is the responsibility of the contributing municipalities and townships. The City of Harrisburg provides trash and recycling services in CRW's CSO area and existing city code regulates the storage and disposal of solid wastes. The City publicizes on its website what items can be disposed of in the trash and recycling. Bulk trash items can be placed with trash (one item per week) for collection. CRW has also implemented protocol in conjunction with City to address issues with solid waste collection.

CRW adopted updated rules and regulations that provide CRW with adequate legal authority to regulate improperly managed solid waste that may discharge into CRW sewers.

Plan for Completing Implementation of Minimum Control Practices

The Appendix E fact sheet for Pollution Prevention for Solid Waste Handling / Storage defines CRW's approach for this element of NMC-7:

- CRW will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial, industrial, and residential property owners and practices to control pollutants associated with solid waste.
- To the extent allowed under current legal authority, conduct inspections of solid waste receptacles, storage areas, and/or dump sites that may discharge into CRW sewers.

7.9 Hazardous Waste Collection

Documentation of Current Control Practices

Household Hazardous Wastes (HHW) are not regulated as hazardous waste under federal and state laws. However, City code prohibits certain discharges that would include HHW and other materials. The City of Harrisburg provides trash and recycling services in CRW's CSO area and publicizes on its website what items can be disposed of in the trash and recycling. For hazardous material, the City's website notes that proper disposal depends on the quantities; residents are advised to call the Harrisburg Department of Public Works Recycling Office for information. Dauphin County also offers free curbside HHW collection to each household, by request, one time per year.

CRW adopted updated rules and regulations that provide CRW with adequate legal authority to regulate improperly managed hazardous materials that may discharge into CRW sewers.

Plan for Completing Implementation of Minimum Control Practices

The Appendix E fact sheet for Pollution Prevention for Material Handling / Storage defines CRW's approach for this element of NMC-7:

- Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial/industrial property owners and residential property owners and proper handling and disposal of hazardous materials.

- CRW will maintain and promote a hot line for the public and/or other government agencies to report improper management of hazardous materials.

7.10 Water Conservation

Documentation of Current Control Practices

As discussed in Section 7.3.1, CRW currently uses social media and its website to provide public education messages, including water conservation messages.

Plan for Completing Implementation of Minimum Control Practices

CRW will continue to promote water conservation measures through public education. CRW will also identify key water conservation practices and specific audience groups to develop a program that will promote the reduction of CSO discharges.

7.11 Non-Domestic Sources

Documentation of Current Control Practices

CRW continues to implement its industrial pre-treatment program and evaluate feasible program modifications for other non-domestic sources, as described in Section 3.

Plan for Completing Implementation of Minimum Control Practices

Section 3.3.2 of this NMC Plan describes CRW's plan for implementing controls for NMC-3, including pollution prevention controls for non-domestic sources.

7.12 Effectiveness Evaluation

Documentation of Current Control Practices

CRW continues to evaluate the effectiveness of its pollution prevention program, as described in the previous sections.

Plan for Completing Implementation of Minimum Control Practices

CRW shall, on at least an annual basis, evaluate the effectiveness of the measures implemented under NMC-7, as progress is made. Based on that evaluation, CRW will submit to PADEP for review and approval a proposed revised plan including an implementation schedule of any additional actions necessary to comply with the NMCs.

Section 8
Minimum Control Number 8
Public Notification

8.1 Regulatory Context

Public notification programs are intended to ensure that the public receives adequate information about combined sewer overflows, the locations of the outfalls, the actual occurrence of combined sewer overflows (CSOs), potential health and environmental effects of CSOs, and precautions concerning recreational or commercial activities (such as swimming) during and immediately after CSOs. The key intent of the program is to inform persons using CSO receiving waters about the existence of potential health risks associated with the use of the affected water body. A second objective of Capital Region Water's (CRW) public notification program is to raise public consciousness concerning the effect of CSO discharges on the uses of the receiving water bodies and to encourage public support for control programs.

The National CSO Control Policy, United Stated Environmental Protection Agency (EPA) guidance documents for the Nine Minimum Controls (NMC) suggest that the selected public notification program should be the most cost-effective measure that provides reasonable assurance that the affected public is informed in a timely manner. The appropriate mechanism will also depend on the size of the use area and means of public access. **Table 8-1** outlines the key program components in the NMC guidance, while **Table 8-2** outlines the specific requirements for public notification contained in Paragraph C.10(f) of CRW's modified partial Consent Decree (CD). Both tables provide the applicable references in the NMC guidance, NMC Plan, and CRW Operations and Maintenance Manual (OMM). On September 22, 2023, CRW submitted a Public Notification Plan, which is included in **Appendix G.**

8.2 Warning Signs

Documentation of Current Control Practices

To be in compliance with the partial CD's public notification requirements outlined at the beginning of Section 8, CRW must install and continuously maintain signs at each combined sewer system (CSS) outfall that notify and alert the public to avoid contact with waters near or downstream of discharging CSS outfalls. CRW shall also install warning signs at public stream access points (e.g. boat launches, beaches) that notify and alert the public to avoid recreational contact with waters during or just after any wet weather event.

Since 2015, CRW has inventoried existing outfall signage, installed temporary signage, and developed new signage with input from the public and regulatory agencies. ~~In 2015, CRW's Community Outreach staff visited every CSO outfall and inventoried existing signage and identified locations for new signage. Using a map of CSO locations, CRW visited each known outfall and completed a worksheet documenting the street nearest each outfall, its receiving waters, and information pertaining to signage. Photographs of existing signs, if any, were taken along with photos of possible placements for new signs. Photos from a previous discharge survey were used to assess the location of new signage for outfalls that were not accessible. This process was repeated for all CSO outfalls located along the~~

~~Susquehanna River, Paxton Creek, and three public access points (Dock Street Dam Boat Launch, City Island Boat Launch, and the currently closed City Island Beach).~~

~~In 2021, CRW staff inventoried and inspected signage at each CSO outfall location. Inspection and inventory information was catalogued in the maintenance management system. This information along with existing public feedback, including the community input gathered in 2016 and 2017, informed a CSO signage implementation strategy for 2022.~~The Public Notification Plan (PNP) documents the design, location, and planned installation date of any signs and placards. Photographs of each standardized type of sign are included in the PNP. The PNP also includes a current, comprehensive inventory of signage at each outfall. CRW completed the installation of all the required signage by the December 31, 2023 deadline.

~~**Figure 8-1** shows examples of previous signs, while **Figure 8-2** shows the recently developed WARNING placards and signs. **Table 8-3** provides an inventory of the existing signs (as of August 1, 2023).~~

Table 8-1 EPA Guidance Compliance Checklist for NMC-8

NMC-8 Requirement Description Public Notification	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
Posting at Affected Use Areas: Post at the effected use areas (e.g. along the riverfront) when use restrictions are temporary	9.1	Not Applicable	8.2	Not Applicable
Posting at Selected Public Places: Post at places like an information center at a park or a boat launch ramp where a narrower segment of the public is likely to be effected.	9.1	C (10)(f)(iii)	8.2	Not Applicable
Posting at CSO Outfalls: Post at CSO outfalls where they are visible and the affected shoreline areas are accessible to the public.	9.1	C (11)(f)(i)	8.2	Not Applicable
Telephone Hot Line: Consider implementing a telephone hotline where restrictions on a use occur relatively frequently, affect a large number of people, and might change daily.	9.1	Not Applicable	8.3	Not Applicable
Documentation: Provide documentation demonstrating a diligent effort to evaluate this control, including the following: ▪ A list and description of the measures planned for implementation and the responsible parties ▪ The procedures or protocol for issuing notices ▪ Samples of the public education materials used or proposed, and a photograph of a typical sign. ▪ A list of the locations where signs are posted, or will be posted.	8.5	C (11)(f)(iii) C (11)(f)(iii) Not Applicable Not Applicable	8.2 - 8.6 8.3 8.2, 8.4 8.2	Not Applicable

Table 8-2 Consent Decree Compliance Checklist for NMC-8

NMC-8 Consent Decree Requirement Description Public Notification	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Submit a Public Notification Plan	C (10)(f)(i)	9.1	8.3	Not Applicable
Install and maintain signs at each CSO outfall to notify and alert the public to avoid contact with waters near discharging CSO outfalls	C (10)(f)(ii)	9.1	8.2	Not Applicable
Install CSO discharge warning signs at public stream access points (e.g. boast launches) that notify and alert the public to avoid recreational contact with waters during or just after any wet weather event.	C (10)(f)(iii)	9.1	8.2	Not Applicable
Develop written procedures to provide the public with information concerning CSO discharge occurrences and their impacts on water quality (e.g. website notifications) and the locations of the discharges.	C (10)(f)(v)	9.1	8.3	Not Applicable
Distribute CSO pamphlets for education of the general public	C (10)(f)(vi)	Not Applicable	8.4	Not Applicable
Evaluate/document CSO public education programs, the community's response, and any follow-through plans based on public response.	C (10)(f)(vii)	Not Applicable	8.4	Not Applicable
Investigate and document public involvement, including concerns expressed, and comments and suggestions made by the public concerning CSOs, and take any corrective measures warranted.	C(10)(f)(viii)	Not Applicable	8.5	Not Applicable
Consider implementation of email and/or text message public notification systems for CSO, DWO, and unauthorized release events.	C(10)(f)(ix)	Not Applicable	8.3	Not Applicable

Table 8-~~4~~ 3 summarizes the number of each type of sign installed as of ~~August~~ December 31, 2023.

Table 8-~~4~~ 3 Signage Inventory Summary

Sign Type	Number of Signs Installed
ID/CSO Number Tag (9"x6")	58
Warning Placard (9"x6")	~~54~~58
Temporary Warning Sign	0
Public Notice Signs	~~TBD~~5
Access/Interpretive Sign (60"x36")	~~1~~2
Warning Sign (36"x36")	~~9~~13
Warning Sign (18"x24")	~~22~~24

~~The community input process was an integral part of the development of the Signage Implementation Plan. CRW partnered with other local organizations to host three "Community Greening Parties" – as a part of these community events, CRW shared information about the existing warning and educational signs and asked for feedback on 1) the graphic style used to communicate information on an educational sign and 2) feedback on the type of structure used to display the sign. The public process has attracted community interest and engaged a number of residents in three neighborhoods in Harrisburg. The public events were followed by an online survey to gather additional community input. The results were used to help refine the graphics and communication guidelines for the sign types, as well as to help educate the public about the potential public health and environmental risks.~~

~~CRW developed a 36"x36" warning sign, which incorporated comments from the regulatory agencies. This warning sign is installed at ten (10) locations, as detailed in **Table 8-3**.~~

In 2023 CRW also developed an annual signage inspection and maintenance process within the asset management system.

Plan for Completing Implementation of Minimum Control Practices

~~To be in compliance with the partial CD's public notification requirements outlined at the beginning of Section 8, CRW must install and continuously maintain signs at each combined sewer system (CSS) outfall that notify and alert the public to avoid contact with waters near or downstream of discharging CSS outfalls. CRW shall also install warning signs at public stream access points (e.g. boat launches, beaches) that notify and alert the public to avoid recreational contact with waters during or just after any wet weather event.~~

~~Capital Region Water is actively updating and standardizing signage. New signage templates were designed to ensure placement at each outfall location. Physical site limitations and visibility restrictions were considered for design and installation. A three-digit outfall (i.e., asset) identification number was produced specifically for each outfall location. One of at least two redesigned warning signs will also be installed at each outfall location. This includes a permanent warning placard and/or a mounted warning sign. Warning placards and signs include a QR code, a two-dimensional or matrix barcode, containing data that points a user to a website or application. In this case, the user is directed to Capital Region Water's website (https://capitalregionwater.com/resources/cso/) for further information on CSOs and related activity. Users can cross-reference the CSO asset ID with data on our interactive map to learn more about relevant CSO activity within a 48-hour period at any location throughout our system. A screenshot of this map is included as Figure 8.4.~~

~~Damaged or dated signage that does not include public notification of the outfall, direction to avoid contact with water during and following discharge, and appropriate CRW contact information is removed. The recently developed 36"x36" warning signage, which incorporated comments from the regulatory agencies, will continue to be maintained where currently installed. Of the 13 original locations, eight (8) locations have well maintained signage. Unfortunately, vandalism and theft are a challenge with sign maintenance. Formalization of an annual signage inspection and maintenance process is underway to address any signage deficiencies in a timely manner. All new signage is within ten (10) feet of the CSO outfall location. Spanish text appears as appropriate.~~

~~In 2023 Capital Region Water updated new signage for each outfall and has developed an annual signage inspection and maintenance process within our asset management system. All signs are equipped with a QR code that will point users to the Capital Region Water website landing page for Combined Sewer Outfall resource information. (https://capitalregionwater.com/resources/cso)~~

~~In addition to the scheduled replacement of all outdated, or damaged/missing signs, Capital Region Water designed new 18"x24" Public Notice signs to be installed at six (6) locations along the Susquehanna Riverfront lower walkway. An example of this sign is included in Figure 8-2.~~

All planned installation will be completed in accordance with the Public Notification Plan as required per the Modification to the Partial Consent Decree. All installation plans outlined in the Public Notification Plan will supersede any details included with the NMC Plan v.8.0.

As part of CRW's ongoing public notification efforts, notice of new signage and installation details was provided directly to the City of Harrisburg and to the public via a press release, bill stuffer, social media, and website announcement. Capital Region Water remains committed to quick, reliable access to public notification of CSO events as well as site-specific educational materials.

8.3 Public Notification

Documentation of Current Control Practices

CRW currently uses multiple means of communicating with the public: the CRW website (www.capitalregionwater.com), a telephone number, an email mailing list, social media (e.g., Twitter, Facebook), ~~a Reverse 911 emergency notification system,~~ and an Everbridge emergency notification system.

CRW utilizes the Everbridge Emergency Alert System to provide a daily update/alert on CSO activity. This includes active CSOs and activity within the last 24 hours. Customer and stakeholders are provided a direct number to the CSO Hotline or can call CS/888-510-0606 and listen for the prompt to hear the daily message. ~~Protocols, templates, and samples messages are available.~~

Warning placards and signs include a QR code, a two-dimensional or matrix barcode, containing data that points a user to a website or application. In this case, the user is directed to Capital Region Water's website (https://capitalregionwater.com/resources/cso/) for further information on CSOs and related activity. Users can cross-reference the CSO asset ID with data on our interactive map to learn more about relevant CSO activity within a 48-hour period at any location throughout our system.~~CRW is currently redesigning its website and exploring possible integration.~~

CRW installed ten ADS ECHO monitors at selected sites in advance of the March 20, 2024 deadline.

~~As part of an online survey, CRW asked members of the public what is their preferred method for receiving water and sewer service information: phone, email, text message, or social media. CRW implemented a toll-free hotline that can be called to check on the status of CSO discharges. New signage includes the toll-free phone number. Further notification will be provided through CRW's website and social media platforms. CRW also completed a Stakeholder Engagement and External Affairs Strategy Report, which included public communication and notification strategies.~~

Further details on notification procedures are provided in the PNP. CRW also notifies the regulatory agencies in accordance with the CSO reporting policies outlined in the modified partial CD and the NPDES permit.

Plan for Completing Implementation of Minimum Control Practices

To be in compliance with the public notification requirements outlined in paragraphs C(10)(f)(i, ix) of the modified partial CD, CRW will continue to implement the notification procedures to provide the public with information concerning CSO discharge occurrences, locations of the discharges, and their

impacts on water quality in the Receiving Water(s) ~~along with its signage implementation plan~~in accordance with the PNP.

8.4 Public Education

Documentation of Current Control Practices

Section 7.3 of this NMC Plan documents CRW's current public education practices.

Plan for Completing Implementation of Minimum Control Practices

To be in compliance with the consent decree's public education requirements outlined in paragraph C(10)(f)(vi) of the modified partial CD, CRW must distribute CSO pamphlets for education of the general public and evaluate and document any CSO public education programs and the community's response to such programs and any follow-up plans addressing public education based on public response.

Section 7.3 of this NMC Plan describes CRW's plan for completing implementation of its public education and involvement programs for pollution prevention.

8.5 Public Involvement

Documentation of Current Control Practices

The following existing CRW programs are designed to provide opportunities for public involvement and participation:

- CRW publicizes the date and location of its Board Meetings and welcomes the public to attend and provide input.
- To report problems or provide feedback, the CRW website (www.capitalregionwater.com) publicizes two methods that are continuously monitored: a telephone number and an email account (info@capitalregionwater.com). An online form is also provided to report a problem.
- CRW also engages with the public through their website, email, Twitter, Facebook, Instagram, and Nextdoor.com.
- CRW co-sponsors the Great Harrisburg Clean Up, a public event to clean city streets, encourage proper waste disposal and recycling, and help keep local waterways clean. CRW also has monthly litter cleanups, volunteer work days at CRW's rain garden, and volunteer opportunities during events, and developed a Community Ambassador Committee.
- CRW conducts public outreach events that are focused on providing interactive stations for community members to learn about and offer input on approaches to manage stormwater and wastewater within the City.
- CRW identified key mechanisms to solicit public involvement and participation: public events, social media, and door-to-door interactions.

Plan for Completing Implementation of Minimum Control Practices

To be in compliance with the consent decree's public involvement requirements outlined in paragraph C(10)(f)(viii) of the modified partial CD, CRW must investigate and document any public involvement

including any concerns expressed, and comments or suggestions made by the public concerning CSOs, and take any corrective measures warranted.

As documented in Minimum Control Measure #2 of CRW's Stormwater Management Plan, during the first year of coverage under the MS4 permit, CRW will identify mechanisms to regularly solicit public involvement and participation. Mechanisms will include conducting and documenting comments received at public meetings, as well as maintaining and service request system through Cityworks (as detailed in NMC-1) for the public and/or other government agencies to report concerns and information. CRW will track and follow up on reports of dry-weather discharges from CSOs and other concerns. CRW will continue with the public involvement mechanisms noted above.

CRW completed a Stakeholder Engagement and External Affairs Strategy Report, which included developing a public engagement strategy.

8.6 Effectiveness Evaluation

Documentation of Current Control Practices

CRW continues to evaluate the effectiveness of its public notification program, as described in the previous sections.

Plan for Completing Implementation of Minimum Control Practices

~~As required in paragraph C(11)(f)(vi) of the partial CD,~~ CRW shall, on at least an annual basis, evaluate the effectiveness of the measures implemented under NMC-8, as progress is made. Based on that evaluation, CRW will submit to PADEP for review and approval a proposed revised plan including an implementation schedule of any additional actions necessary to comply with the NMCs.

Section 9
Minimum Control Number 9
Inspection, Monitoring, and Reporting

9.1 Regulatory Context

United States Environmental Protection Agency (EPA) Guidance suggests that the ninth minimum control involve visual inspections and other simple methods to determine the occurrence and apparent impacts of combined sewer overflow (CSO) discharges. This minimum control is an initial characterization of the combined sewer system to collect and document information on overflow occurrences and any known water quality problems that may be caused by these CSO discharges. This minimum control is the precursor to the more extensive characterization and monitoring efforts to be conducted as part of the development of the long-term control plan. The modified partial Consent Decree (CD) includes requirements associated with this minimum control that are more extensive and incorporate long term control plan (LTCP) monitoring requirements. **Table 9-1** summarizes the major requirements of EPA's Guidance for Nine Minimum Controls (NMCs), while **Table 9-2** summarizes the major requirements of Capital Region Water's (CRW) modified partial CD. Each table indicates the specific subsection of this NMC-9 Plan that addresses each requirement.

Table 9.1: EPA Guidance Compliance Checklist for NMC-9

NMC-9 Requirement Description Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls	EPA NMC Guidance Reference	Consent Decree Reference	NMC Plan Section	OMM Section
General Characteristics: This measure would involve obtaining maps, record drawings, tables and other general information on the combined sewer system, such as the service population, configuration of the collection and interceptor systems, locations of CSO outfalls, and designated uses to provide a spatial reference for records of overflows.	10.1.1	Not Applicable to NMC-9	9.2	Not Applicable
Overflow Frequency Occurrence: This measure would involve recording the number, date, and time of CSOs at as many outfalls as feasible, through simple visual observation or use of visual inspection aids such as chalking or wooden blocks.	10.1.2	C (10)(g)(i)	9.3	4.1
Automatic Measurement: For systems with few CSO outfalls, and where electrical service exists at the regulator structures, automatic monitoring equipment such as level recorders can be placed at the diversion weirs to provide information on overflow frequency, duration and depth.	10.1.2	C (10)(g)(ii)	9.3	Not Applicable

Table 9.2 Consent Decree Compliance Checklist for NMC-9

NMC-9 Consent Decree Requirement Description Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls	Consent Decree Reference	EPA NMC Guidance Reference	NMC Plan Section	OMM Section
Conduct visual inspections of each CSO regulator chamber and CSO outfall once per day, seven days per week. Continue to use tethered blocks and/or chalk to detect overflow activity.	C (10)(g)(i)	10.1	9.3.1	4.1
Record observations made by the inspectors in a consistent manner on pre-printed forms or bound log-books, and include the following information: ○ Name of the inspector ○ Date and time of the inspection ○ Status of the regulator (e.g., no sign of overflow, overflowing, block displacement since last inspection) ○ Weather conditions, including amount of rainfall ○ Any observed maintenance issues	C (10)(g)(i)	10.1	9.3.1	4.1
Utilize the calibrated H&H model and rainfall data to characterize CSO discharges and report them in Semi-Annual Reports.	C (10)(g)(v)	10.2	9.3.2	4.1
Implement the Post-Construction Monitoring Program.	C (10)(g)(il)	10.2	9.3.2	Not Applicable
The regional gauge network will record rainfall amounts in 5-minute increments. Maintain any new gauges installed under the IFMMPP.	C (10)(g)(iii)	Not Applicable	9.4	Not Applicable
Document the procedures used to collect and summarize the number of CSO events and the frequency and duration of CSOs.	C (10)(g)(iv)	10.2	9.5	4.1
Monitor and maintain a record of all CSO activity including occurrence, duration and volume, including the associated rainfall data.	C (11)(g)(v)	10.2	9.5	4.1
Submit the flow monitoring and rainfall data to the regulatory agencies as part of the Semi-Annual Reports required by CD section VII.	C (10)(g)(v)	Not Applicable	9.5	Not Applicable

9.2 Characterize Combined Sewer System

EPA NMC-9 guidance suggests that a proper CSO characterization program should begin with obtaining the necessary information to understand the configuration of the combined sewer system, the associated sewershed areas and service populations, and the locations of all the CSO regulator structures and outfalls.

Documentation of Current Control Practices

As defined in Section 1.3.4 of this NMC Plan and CRW OMM Section 4.4.3, CRW has an existing GIS database of the conveyance and collection systems that includes the configuration of all the interceptor sewers, the locations of all the CSO regulator structures, and the locations of all the CSO

outfalls. Sewershed delineations have been developed for each of the sewershed areas tributary to the regulator structures, along with the associated service populations.

CRW also completed the rapid assessment of the collection system via pole camera inspection of each manhole, in part to define system connectivity and collect data on physical attributes (e.g., pipe diameter, material, invert elevation). Additionally, CRW completed the first phase of municipal separate sanitary sewer systems (MS4) manhole surveys in the CRW service area. CRW has been updating the GIS database as new data is acquired.

CRW completed a comprehensive inspection program of its conveyance system. In 2014, CRW conducted an inspection of each of the interceptors, totaling 71,000 lineal feet. The inspections involved CCTV video, NASSCO PACP data, and sonar and laser profiling. Inspection data was used to support an interceptor cleaning program, including a re-inspection of the interceptor after it was cleaned. Major sections of the interceptors are currently being rehabilitated, with additional inspections performed to support the rehabilitation contractor. Further details are provided in CRW OMM Section 4.4.3.

CRW also completed a comprehensive inspection program for its CSO regulator structures. A database has been developed for the critical configurations of the structures, the dimensions of the control weirs and orifices, the diameters of the pipes, and surveyed elevations of critical features. CRW performed inspections of its flap gates and outfall pipes in 2015. CRW also used pole cameras to perform collection system inspections at each manhole and support a rapid assessment of collection system pipes to identify immediate cleaning and repair needs and prioritize CCTV inspections to support a comprehensive condition assessment of the collection system.

CRW is ~~projecting that~~continuing with the CCTV investigation of the entire collection system, which will be completed by June 30, 2025~~, due to a delay in obtaining a second CCTV truck~~. CRW has completed inspection of the majority of pipes that require specialty equipment, heavy cleaning and have the highest consequence and probability of failure (large diameter and brick sewers).

CRW completed the System Characterization Report on April 1, 2017. ~~with further details in the LTCP submitted on April 1, 2018.~~

Plan for Completing Implementation of Minimum Control Practices

CRW will document additional findings from further investigations in the combined sewer system.

9.3 CSO Activation Monitoring

9.3.1 ~~Phase 1:~~ Daily Visual Observations

Documentation of Current Control Practices

There are 59 CSO regulator structures in the CRW system, and each regulator is inspected on a daily basis seven days a week. The visual inspection procedures include the documentation of any observed CSO discharges and any CSO activity detected though wooden blocks that are placed on the crests of the diversion weirs to detect CSO activity that may have occurred between visual inspections. If CSO activity is in progress during an inspection, the depth of the flow over the weir is measured and the CSO discharge rate is estimated using a flow table that is based on the measured length of the weir crest and the application of a broad crested weir equation. CRW's inspection activities, CSO activation activities, and the associated documentation are described in greater details in Section 1.4 of this NMC Plan and CRW OMM Sections 4.1.4 through 4.1.6.

From September 2014 through September 2015, CRW utilized a network of 8 rainfall gages, 8 interceptor flow monitors, 5 monitors at the major points of connection of the suburban community systems, and 13 CSO regulator structure monitors. These monitors were placed at critical locations identified in CRW's approved Initial Metering and Monitoring Plan (IFMMPP). The equipment at the monitoring sites continuously monitored wastewater flow depth and velocity to quantify precipitation and flow in five-minute increments.

- Data collected at the rainfall gages is used to generate gage-adjusted radar rainfall (GARR) at a 1 square kilometer level of detail throughout CRW's service area and the service area of the six suburban systems flowing into CRW's system.
- Data from the eight interceptor monitoring sites were used to quantify and characterize dry and wet weather flow through the CRW conveyance system.
- Data from the meters at the five significant points of connection between the separate sanitary sewer collection systems of the satellite customer communities and the CRW interceptor sewers were used to quantify and characterize dry and wet weather flow from the satellite systems.
- Data from the 13 CSO monitoring sites were used to quantify and characterize the total influent flow from the tributary collection systems and the frequency and duration of CSO discharges.
- Monitoring data was used to calibrate the H&H model of CRW's conveyance and major trunk sewer systems.
- CRW continues to maintain the seven of the eight interceptor flow meters to document storage and flow maximization efforts and also maintains the flow meters at the five points of connection with the satellite systems.

In accordance with the modified partial CD, the CSO flow monitoring data and rainfall data are to be submitted to the regulatory agencies as part of the semi-annual reports. CRW submitted this data with the September 2015 through March ~~2023~~ 2024 reports. In accordance with the requirements of the modified partial CD, the monitoring data was used to quantify and characterize dry and wet weather flow generated from the collection system, conveyed through the interceptor system, and conveyed to the CSO regulator structures. The monitoring data was used to calibrate the hydrologic and hydraulic (H&H) model. Starting with the March 31, 2017 semi-annual report, CRW's calibrated H&H model is used to simulate measured rainfall and estimate CSO volumes, durations, and frequencies.

Plan for Completing Implementation of Minimum Control Practices

The EPA guidance requirements for this aspect of NMC-9 have been fully met by completed and ongoing CRW activities. Equipment will continue to be maintained and data will continue to be collected at the eight rainfall gaging stations, five point of connection monitoring sites, and seven interceptor monitoring sites to quantify and characterize changes induced by the removal of accumulated sediment and debris.

9.3.2 ~~Phase 2:~~ Semi-Automated Detection

~~The partial CD requires that~~ CRW assessed the cost-effectiveness of its current visual approach to CSO activation through the CSO Activation Monitoring Pilot (CAMP) Study, as described in the following section.

Documentation of Current Control Practices

CRW conducted the CSO Activation Monitoring Pilot (CAMP) Study from November 2015 through November 2016. The CAMP Study Evaluation Report was submitted on December 1, 2016. In general, the report found that it was premature to proceed with the installation of CSO activation and monitoring equipment in advance of implementing regulator modifications recommended under the LTCP, which includes modifications that will eliminate certain regulators and outfalls.

Plan for Completing Implementation of Minimum Control Practices

CRW has implemented ~~the Phase II monitoring approach,~~ a cost-effective and reliable combination of visual inspections and H&H modeling to determine the frequency, volume, and stop/start times of CSO discharges, to be reported in each semi-annual compliance report. The ~~Phase III~~ monitoring approach will be further developed during CRW's Post-Construction Monitoring P~~lan~~rogram in the updated CBH_2OPP ~~after the Immediate Implementation Phase (0-10 years)~~.

9.4 Precipitation Monitoring

Documentation of Current Control Practices

In August 2014, CRW also established a network of eight precipitation monitoring sites, in accordance with the approved IFMMPP, to support a gauge adjusted radar rainfall (GARR) system. The system uses the gauge data, monitoring rain and snow in 5-minute increments, to adjust NEXRAD reflectivity data obtained from the National Weather Service. The result is high resolution (1 km by 1 km pixel resolution), spatially distributed precipitation data over the entire CRW service area, including the satellite customer community sewershed areas. The precipitation data was used in conjunction with the flow monitoring data to calibrate and validate the H&H model by the April 1, 2016 ~~partial CD deadline~~, and to support H&H model estimates of CSO discharges, reported in semi-annual compliance reports to EPA/DEP.

Plan for Completing Implementation of Minimum Control Practices

The EPA guidance requirements for this aspect of NMC-9 have been fully met by completed and ongoing CRW activities. As required by the IFMMPP and the modified partial CD, precipitation monitoring and data collection will continue for the duration of the modified partial CD. The precipitation data will continue to be used in conjunction with the flow monitoring data to support semi-annual reports of CSO discharges.

9.5 Document CSOs

Documentation of Current Control Practices

CRW inspection crews document any directly observed or detected CSO activity in a consistent manner through Cityworks. The documentation includes all the items required in the modified partial CD, including the name of the inspector, the data and time of the inspection, the CSO activity status of the regulator, weather conditions – including the amount of rainfall, and any observed maintenance issues. The documentation is currently recorded through Cityworks. Examples of completed CSO activity documentation is provided in Appendix A of this NMC documentation.

Plan for Completing Implementation of Minimum Control Practices

The EPA guidance requirements for this aspect of NMC-9 have been fully met by completed and ongoing CRW activities. CRW inspection crews will continue to document any directly observed or

detected CSO activity, providing the information required by the modified partial CD through the Cityworks asset management system.

9.6 Use H&H Model to Characterize CSOs

The volume of CSO discharges is determined using CRW's calibrated / validated H&H model.

Documentation of Current Control Practices

As was previously described in NMC Sections 9.3 and 9.4 above, CRW successfully completed the flow and precipitation monitoring programs to provide the necessary data to calibrate and verify the H&H models. The H&H model was calibrated for the April 1, 2016 ~~partial CD~~ deadline. ~~CRW also completed the following deliverables, which address the potential impacts of CSO discharges on the receiving waters.~~

- ~~Long Term Control Plan Approach memorandum dated December 23, 2014~~
- ~~Water Quality Modeling Plan memorandum dated July 27, 2015~~
- ~~Sensitive Areas/Priority Areas in the Harrisburg Receiving Waters memorandum dated April 1, 2016~~

The calibrated H&H model has been utilized for recent semi-annual compliance reports to estimate the frequency, duration and volume of CSO discharges from each of the 59 CSO regulator structures in the CRW conveyance system.

Plan for Completing Implementation of Minimum Control Practices

The model will be re-applied to support development of subsequent semi-annual reports. The H&H model also was applied to support the existing system characterization. H&H model results will be checked against the results of the daily visual inspections. Implementation of the updated ~~LTCP~~ CBH_2OPP will include further evaluation of the impacts of CSO discharges on the receiving waters.

Appendix A

CRW Operation and Maintenance Documents

Please note that this document list is only included for reference in the NMC Plan, please refer to the OMM for the actual documents and data CD.

Table A-1 Summary of Operation and Maintenance Documents

Code	Document	Completed By	Reviewed By	Frequency
1. CSO Regulator Structures / Overflows - Field Forms				
A1-0	**CSO Inspection Forms** Document CSO regulator conditions; record overflows.	Field Operations	Management	Daily
A1-1	**Front Street Interceptor Service Report** Document CSO regulator conditions; record overflows.	Field Operations	Management	Daily
A1-2	**Paxton Street Interceptor Service Report** Document CSO regulator conditions; record overflows.	Field Maintenance	Management	Daily
A1-3	**Combined Sewer Overflow Discharge Estimates** Estimate overflow volumes for each CSO regulator structure.	-	Field Maintenance	During overflows
A1-4	**CSO Semi-Annual Inspection and Preventative Maintenance Schedule Form (Type A)** Inspection/maintenance checklist for Type A regulators.	Field Operations	Management	Twice annually
A1-5	**CSO Semi-Annual Inspection and Preventative Maintenance Schedule Form (Type B)** Inspection/maintenance checklist for Type B regulators.	Field Operations	Management	Twice annually
A1-6	**CSO Semi-Annual Inspection and Preventative Maintenance Schedule Form (Type C)** Inspection/maintenance checklist for Type C regulators.	Field Operations	Management	Twice annually
A1-7	**CSO Semi-Annual Inspection and Preventative Maintenance Schedule Form (Type D)** Inspection/maintenance checklist for Type D regulators.	Field Operations	Management	Twice annually
2. CSO Regulator Structures / Overflows - Managerial Reports				
**A2-1	**Discharge Monitoring Reports** Monthly DMRs submitted to PADEP.	Management	PADEP	Monthly
A2-2	**Combined Sewer Overflow Summary Report (All CSOs)** Totals flow, duration, and rainfall for all CSOs (for each day in a month). Supplemental report submitted with monthly DMR.	Management	PADEP	Monthly
*A2-3	**Combined Sewer Overflow Summary Report (Individual CSOs)** Totals flow, duration, and rainfall for all CSOs (for each day in a month). Supplemental report submitted with monthly DMR.	Management	PADEP	Monthly

Code	Document	Completed By	Reviewed By	Frequency
*A2-4	**Combined Sewer Overflow Report by Outfalls** Report summarizing overflow volumes, durations, and causes for each CSO regulator for the entire year. Submitted with Chapter 94 Report.	Management	PADEP	Annually
*A2-5	**Dry Weather Combined Sewer Overflow Report** Report summarizing dry weather overflow volumes, durations, and causes for each CSO regulator for the entire year. Submitted with Chapter 94 Report.	Management	PADEP	Annually
*A2-6	**Preventative Maintenance Report** Report summarizing preventative maintenance performed for each CSO regulator for the entire year. Submitted with Chapter 94 Report.	Management	PADEP	Annually
**A2-7	**Precipitation Report** Report summarizing daily precipitation for the entire year. Submitted with Chapter 94 Report.	Management	PADEP	Annually
A2-8	**Weir Rehabilitation Report** Report summarizing the history of weir rehabilitation. Submitted with Chapter 94 Report.	Management	PADEP	Annually
3. Collection System - Field Forms				
A3-1	**Customer Service Requests** Provides a series of questions and Cityworks forms to document complaints regarding the collection system and create service requests.	Admin.	Maintenance/ Management	Variable
A3-2	**Collection System Work Order** Documents the reported problem and actions taken to correct the problem.	Field Maintenance	Management	Variable
A3-3	**Collection System Inspection ("Hot Spot Checklist")** List of known "hot spots" to document flow conditions.	Field Operations	Management	Weekly
A3-4	**Inlet/Catch Basin Inspection** Documents inlet condition, configuration, and features.	Field Maintenance	Management	Variable
A3-5	**Fats, Oils, and Grease (FOG) Inspection** Documents FOG inspection findings, including type of facility, facility procedures, grease traps, etc.	Environmental Compliance Inspector	Management	Variable
4. Collection System - Managerial Reports / Tracking Spreadsheets[1]				
A4-1	**Work Report** Documents labor, materials, and equipment costs for work performed.	Management	Management	Daily
*A4-2	**Collection System Activity Report** Report summarizing collection system activities (including inlet cleaning/rebuilding and “hot spot” inspections) for the entire year. Submitted with Chapter 94 Report.	Management	PADEP	Annually
A4-3	**Collection System Tracking Spreadsheets**	Management	Management	Tracked Continuously

Code	Document	Completed By	Reviewed By	Frequency
	Spreadsheet tracking inlets cleaned, inlets repaired, sewer problems, and sinkholes			
5. Pump Stations – Field Forms[2]				
A5-1	**Front Street Pump Station Checklist** Documents walkthrough inspections for Front Street Pump Station.	Facility Maintenance	Management	4 Times Daily
A5-2	**Spring Creek Pump Station Checklist** Documents walkthrough inspections for Spring Creek Pump Station.	Facility Maintenance	Management	4 Times Daily
A5-3	**City Island Pump Station Checklist** Documents walkthrough inspections for City Island Pump Station.	Facility Maintenance	Management	2 Times Daily
A5-4	**AWTF Preventative Maintenance Chart – Weekly Inspection** Inspection/maintenance checklist for pump stations (also includes AWTF facilities).	Facility Maintenance	Management	Weekly
A5-5	**AWTF Preventative Maintenance Chart - Monthly Inspection** Inspection/maintenance checklist for pump stations (also includes AWTF facilities).	Facility Maintenance	Management	Monthly
A5-6	**AWTF Preventative Maintenance Chart – 3 Month Inspection** Inspection/maintenance checklist for pump stations (also includes AWTF facilities).	Facility Maintenance	Management	3 Months
A5-7	**AWTF Preventative Maintenance Chart – 6 Month Inspection** Inspection/maintenance checklist for pump stations (also includes AWTF facilities).	Facility Maintenance	Management	6 Months
A5-8	**AWTF Preventative Maintenance Chart – Yearly Inspection** Inspection/maintenance checklist for pump stations (also includes AWTF facilities).	Facility Maintenance	Management	Annually
6. Confined Space Entry – Field Forms[3]				
A6-1	**Confined Space Permit** Documents confined spacy entries for CRW staff.	Field/Facility Maintenance	Management	As necessary
A6-2	**SCBA User Inspection Form** Documents inspection of SCBA equipment whenever it is used.	Field/Facility Maintenance	Management	As necessary

* An abbreviated version is included as a hardcopy in this manual. The full version is included on the CD attached with this manual.

**A hardcopy version of this document is not included, but is available on the CD attached with this manual.

1. The Sinkhole Master Spreadsheet is included in **Appendix D**.

2. CRW also utilizes a bi-monthly AWTF preventative maintenance inspection checklist, but is not included here as it does not pertain to pump station maintenance.

3. Additional safety guidelines for confined space entry are included in **Appendix C**.

Appendix B

CRW Wastewater Budget

Capital Region Water
Wastewater Fund
Income Statement - Consolidated
2023 Budget
Adopted - November 30, 2022

OPERATING BUDGET		2023
OPERATING INCOME		
City Rate Revenue	$	12,927,000
Public Authority Revenue		10,570,000
Miscellaneous Income		529,215
Operations Income		879,200
Operating Income	**$**	**24,905,415**
OPERATING EXPENSE		
Compensation & Benefits	$	4,248,886
General & Administration		135,700
Chemicals/Laboratory		526,000
Utilities		2,030,246
Business Insurance		465,798
Information Technology		79,670
Maintenance & Repair		396,000
Contract Services		280,000
Water Meters		90,571
Professional Services		1,452,250
Other Indirect Fees		2,874,687
Office Equipment and Furniture		2,400
Operations Equipment		5,000
Other Operating Expenses		-
Operating Expense	**$**	**12,587,208**
NET POSITION FROM OPERATIONS	**$**	**12,318,207**
Other Operating Income		60,000
Other Operating Expense		475,000
Net Other Operating Expense	$	(415,000)
Net Position Before Debt Service	**$**	**11,903,207**
Debt Service Reserve Fund Income	$	30,000
Debt Service Expense		5,250,524
Net Debt Service Expense	**$**	**5,220,524**
NET OPERATING POSITION	**$**	**6,682,682**
Appropriated to Capital Budget as Rate Financing	$	3,803,650
Appropriated to Cash Reserves	$	2,879,032

CAPITAL BUDGET		2023
Funding from Rates	$	3,803,650
Funding from Financing and Cash Reserves		33,312,669
Capital Funding Total	**$**	**37,116,319**
Capital Expenditures		37,116,319
NET CAPITAL POSITION	**$**	**-**

Appendix C

Sinkhole Master Database

Capital Region Water
Sinkhole List
As of 12-31-2023

ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000001	Repaired	Locust St & River Aly	CRW	10/29/14 2 Repairs completed, 2 plates removed.	Storm - 2 Pipes
SH-000002	Repaired	12 N Third St	CRW	08/24/15 Repaired.	Sewer - SSP-002000
SH-000003	Repaired	Cranberry St, #204	Abel Recon	W.O. 5695, 5687 two holes for point repair. Abel Const. Project.	Sewer - SSP-004840
SH-000004	Repaired	Shanklin Aly, #403	CRW	06/10/15 Replaced 10 ft section	Sewer - SSP-006787
SH-000005	Patched	River Aly & Market St		No known city sewer down River Aly. 06/03/15 Repaired not by CRW, NE Corner patched.	Unknown
SH-000006	Patched	River St, #144 N.		W.O. 5761, Inspect MH no noted structural damage.	Unknown
SH-000007	Patched	Court St, #3 S.	CRW	W.O. 3734, 1986.	Storm - Buried Inlet
SH-000008	Repaired	South St, #203	CRW	W.O. 8453, 2779	Water - WP-001013
SH-000009	Repaired	Buttonwood St, #646	CRW & Abel Reco	W.O. 12077, 5934, 5933, 5772. Surface repair complete, Lining Project complete 05/19/2019	Sewer, SSP-004814
SH-000010	Patched	Prince Aly, #729	COH	05/30/14 CCTV, no issues. 04/08/16 Leak Detection - No leaks	Unknown
SH-000011	Repaired	Shanklin Aly & Academy Aly	CRW	06/10/15 Repaired by CRW, 10' section collapsed.	Sewer - SSP-006787
SH-000012	Repaired	115 South St	CRW	W.O. 8454, 04/11/16 2 leaks, both mains. 06/01/15 CCTV no issues.	Water - WP-000910
SH-000013	Repaired	Susquehanna St & Dubbs Aly	CRW	11/10/2014 Repaired 3 inlets, removed 3 plates, final street restoration.	Storm - 3 Inlets
SH-000014	Patched	93 Disbrow St		W.O. 11154 confirmed patch. 06/01/15 CCTV, no compromise.	Unknown
SH-000015	Patched	1736 Ethel St		No sewer or water pipes in location.	Unknown
SH-000016	Patched	209 N Fourteenth St	COH	W.O. 11147, 5655, 989.	Unknown
SH-000017	Repaired	N Thirteenth St & Cumberland St	CRW	W.O. 5770 Repair Hydrant 07/02/15 water main break, 1330 Cumberland.	Water - WP-002528 & WH-001408
SH-000018	Patched	1712 Regina St		W.O. 11155 - Patched. 06/26/14 CCTV - no issues. 03/06/2015 leak detection - neg.	Unknown
SH-000019	Repaired	N Seventeenth St & Arsenal Blvd	CRW	Completed final Water St Restoration Project. 07/02/15 N 17th & Parkway main break. 06/26/15 CCTV line, no structural issues.	Unknown

Capital Region Water
Sinkhole List
As of 12-31-2023

ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000020	Patched	S Fifteenth St & Drummond St		W.O. 11148. SR 1619 sinkhole. Reponsbility of other utility.	Unknown
SH-000021	Repaired	311 Evergreen St	CRW	W.O. 5669, 5783, 5970.	Storm - SWP-006795
SH-000022	Repaired	S Twenty-Seventh St & Greenwood St	CRW	W.O. 5784 Manhole repair. 04/13/15 CRW excavated & repaired street.	Sewer - SSMH-002295
SH-000023	Repaired	S Fourteenth St & Kittatinny St	CRW	W.O. 11908 Rework, 11906, 3891 Replaced 18" with 8ft of SDR. 05/06/15 CCTV.	Sewer - SSP-005410
SH-000024	Repaired	S Twenty-Sixth St & Duke St	CRW	W.O. 5785, 1788 Nov 2014 - CRW completed repair.	Unknown
SH-000025	Repaired	1525 Sycamore St	Abel Recon	W.O. 7969 & 10971 Lining project completed 05/09/2019, 7946 06/24/15 On-site inv, surface repair complete.	Sewer - SSP-000821
SH-000026	Patched	S Fourteenth St & Howard St		04/13/15 cleaned and CCTV, no sewer related issues in area.	Unknown
SH-000027	Repaired	126 Evergreen St	CRW	07/22/14 CCTV - no compromise, Excavate to rule out lateral, found no cause. Restored street. 01/2014 Evergreen & Thompson main break.	Unknown
SH-000028	Repaired	1245 Thompson St	CRW	01/2014 Evergreen & Thompson, main break	Unknown
SH-000029	Rough Area	211 S Twentieth St		Sinkhole in Eugene Alley where 211 S 20th St downspout directed to street. No Sewer line in Eugene Alley. Street falure	Strom Leader
SH-000030	Rough Area	2248 Berryhill St		W.O. 5799 CRW clear with sewer.	Unknown
SH-000031	Repaired	Harris St & Fulton St	CRW	W.O. 8478, 2881. Dec 2015 main break at 418 Harris.	Water - WP-000652
SH-000032	Repaired	122 Muench St	CRW & Rogele	W.O. 10698 CRW, WO 3892 Rogele.	Sewer - SSP-001919 & SSMH-004000
SH-000033	Repaired	Verbeke St & Bartine St	CRW	W.O. 8414, 7338, 2705.	Sewer - SSMH-001009
SH-000034	Repaired	Reily St & Susquehanna St	CRW	W.O. 5807, 7999.	Sewer - SSMH-000922
SH-000035	Repaired	107 Reily St	CRW & Property*	W.O. 5815. 10/07/16 Roots in lateral at 258 ft. 08/25/14 Repaired bad utility excavations and removed plate.	Sewer - SSP000027

Capital Region Water
Sinkhole List
As of 12-31-2023

ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000036	Repaired	N Second St & Hamilton St	CRW	W.O. 5817. 07/22/14 Sinkhole near inlet lateral, excavated found no compromise. Backfilled & restored.	Unknown
SH-000037	Repaired	James St & Herr St	Rogele	30224, 70979	Sewer - SSP-001364 - Replaced
SH-000038	Repaired	James St, #1020	CRW	W.O. 8415, 3883, 2887.	Sewer - SSP-002006
SH-000039	Repaired	1300 Marion St	CRW	W.O. 6089, 3210 Main Break Repaired	Water - WP-005053
SH-000040	Lining Project	1320 N Third St	COH	Id for 2020 Sewer Replacement project. W.O. 11264, 11146, 10673, repair verified. City repaired these taps.	2 Sewer Service Laterals, SSP-006784
SH-000041	Repaired	Penn St & Calder St	CRW	W.O. 1772 effective repairs . 01/2016 Main Break. 09/02/14 WO Repaired storm pipe, inlet on SE corner.	Storm - SWP-001662
SH-000042	Repaired	Schuylkill St & Reel St	CRW	W.O. 6173, 2796 , 2795, 2782. 2 Storm pipe repairs.	Storm - SWP-000056 & SWP-006463
SH-000043	Repaired	N Fifth St & Alricks St	CRW	W.O. 8497, 5733, No compromise in sewer line.	Water - WP-000096
SH-000044	Repaired	2102 N Fourth St	Rogele	01/2013 Repaired. 12/31/2012 Main Break with multiple issue, a sewer service lateral connection, 2 seperated joints and broken storm pipe.	Water - WP-000511
SH-000045	Repaired	Woodbine St & N Third St	CRW	W.O. 7951 included in 3rd st project, 5667 & 5668.	Sewer - SSP-002110
SH-000046	Repaired	Geary St & Agate St	CRW	W.O. 11490, 10977, 10970, 7952	Sewer - SSP-000446
SH-000047	Hole in Street	2308 N Second St		04/24/13 CCTV - CRW clear with sewer.	House Leader
SH-000048	Hole in grass area	2424 N Fifth St		05/30/2014 CRW CCTV - Clear, no sewer issues in this area.	Unknown
SH-000049	Repaired	2245 Elizabeth Aly	CRW	W.O. 10678, 6433, 5732. No Water Pipes in area.	Sewer - SSMH-005046
SH-000050	Repaired	2910 Parkside Ln	CRW	W.O. 3178 Main Repair. No Sewers in Parkside.	Water - WP-003862
SH-000051	Repaired	Mulberry St	CRW	04/14/15 CCTV - no issue. 08/12/14 Excavated and backfilled with stone. 12/2008 Main Break	Unknown

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SH-000052	Repaired	S Eighteenth St and Cloverly Ter		01/02/15 No leaks. 05/20/14 CCTV - no issues. Lines under the chemical building at swimming pool are owner responsibility.	Unknown
SH-000053	Patched	1321 S Twelfth St		W.O. 5659,no sewer issue.	Unknown
SH-000054	Repaired	1414 Sycamore St	Abel Recon	W.O. 11938 & 10971 repair, 8166 Lining project completed 04/30/2019, surface repair complete	Sewer - SSP-004020
SH-000055	Repaired	1713 Sycamore St	Abel Recon	W.O. 9814. 6770, 5718, 5670 Lining project	Sewer - SSP-001070
SH-000056	Repaired	1508 S Twelfth St	Abel Recon	W.O. 5702, 5660 Lining project	Sewer - SSP-000721
SH-000057	Repaired	1940 Caledonia St	Abel Recon	W.O. 6360, 6320, 3730, 3771 Lining project. SR 514,	Sewer - SSP-000891 & SSP-000886
SH-000058	Repaired	1440 S Fourteenth St	CRW & Rogele	03/2014 8 Sinkholes total, 2 main breaks, entire 1400 Block of S 14 th St.	Water - WP-006009
SH-000059	Repaired	147 Balm St	Abel Recon	W.O. 10006 Water St. Restoration, 6768 - Lining project, SR#2161. Main Breaks in area 12/2014 & 01/2015.	Water - WP-007482 & Sewer SSP-004237
SH-000060	Plated	204 Locust St		SR3578, WO 16930,16997, 18531, 18592. 08/29/14 All lines CCTV'd are good or water line leakage. 06/2018 sinkhole open in patch	Sewer, SSP-001946
SH-000061	Repaired	2034 N Fourth St	HRI	W.O. 6772	Sewer - SSP-000477
SH-000062	Repaired	1209 Bailey St	CRW & HRI	W.O. 9944, 3711-Repair Sewer Pipe 04/20/2015 Main Break	Sewer - SSP-001821 & Water - WP-006861
SH-000063	Repaired	N Third St & Seneca St	CRW	W.O. 7977, 5979, 5676	Strom - SWP-000049
SH-000064	Repaired	N Fifth & Strawberry St	CRW	W.O. 6583, 5679	Sewer - SSMH-003401
SH-000065	Repaired	1437 S Fourteenth St	CRW & Rogele	03/2014 8 Sinkholes total, 2 main breaks, entire 1400 Block of S 14 th St.	Water - WP-006009
SH-000066	Repaired	1614 Green St	HRI	W.O. 6773, 5686	Sewer - SSP-000057
SH-000067	Repaired	Capital St & Verbeke St	CRW	10/21/14 Repaired with 100 lbs stone/80 lbs cold patch. History - 06/25/2012 main break	Water Main Break
SH-000068	Repaired	246 Schuylkill St	CRW	W.O. 4711, 07/11/14 Filled with stone and patched.	Unknown

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SH-000069	Patched	N Third St & Calder St	Property Owner	Confirmed no sewer issues. 2014 Property owner issue.	Sewer Service Lateral.
SH-000070	Repaired	113 S Thirteenth St	Property Owner	W.O. 11149, 3894, 5665, 8203, 8216 6798 (Service leak @115 S 13th). Sewer pipes no structural issues.	Water - WLAT-007740
SH-000071	Repaired	Green St & Woodbine St	CRW	W.O. 6529, 5673 repair storm pipe, 1550 repair main.	WP-008474 & SWP-000108
SH-000072	Repaired	S Cameron St & Kittatinny St	CRW & Abel Rec*	W.O. 9210, 9030, 6793, 6789, 6790. CRW grouted and Abel did point repair.	Sewer - SSP-001983
SH-000073	Patched	Liberty St & Adams Aly	COH	W.O. 5638, 5745 CCTV - no sewer compromise.	Unknown
SH-000074	Repaired	1338 Penn St	CRW	W.O. 1779. 09/16/14 Excavation proved no casue, applied stone/blacktop.	Unknown
SH-000075	Repaired	N Third St & Shamokin St	CRW & Abel Rec*	W.O. 6767, 6577, 5731. Abel lined and CRW capped abandoned line.	Sewer - SSP-001289 & SSP-005123
SH-000076	Repaired	S Sixteenth St & Chestnut St	CRW & Abel Rec*	W.O. 8556, 8555, 6362, 5654 Abel lined, CRW replaced SWP	Sewer, SSP-000995 & SWP-002622
SH-000077	Patched	312 Graham St		W.O. 5677 no structural compromise.	Unknown
SH-000078	Repaired	9 S Thirteenth St	Wexcon	W.O. 13683, 11150, 8586, 8554, 8550, 8346, 5743. Prior Hydrant leak..	Sewer - SSP-002048
SH-000079	Patched	1504 North St	COH	W.O. 11156, 4636. Repair done by COH. Main in good structural condition.	Unknown
SH-000080	Repaired	2410 Logan St	Property Owner	10/20/16 W.O. 5972, 5675. CCTV verified laterals repaired. 2011 & 2014 Main Break repairs at 2417 Logan.	2 Sewer Service Laterals
SH-000081	Repaired	650 S Twenty-Seventh St	CRW	Same as SH-000022. W.O. 5784. 04/13/15 CRW excavated & repaired street.	Sewer - SSMH-002295
SH-000082	Repaired	57 N Eighteenth St	Property Owner	06/24/15 On-site inv., new lateral cleanouts and patch visible.	Sewer Service Lateral
SH-000083	No sinkhole located	2544 N Second St		09/30/16 W.O. 5672 Sinkhole, no SH located. History - service leak at 2538/2540 N 2nd.	Unknown

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SH-000084	Repaired	2939 Croyden Rd	Abel Recon	TRENCHLESS LINING. W.O. 8247 completed 04/23/2019, 5658 Patched.	Sewer - SSP-001758
SH-000085	Repaired	1400 Regina St	CRW	W.O. 9874 & 9875, for 1443 & 1445 Regina water service line repairs.	Water - WP-002253
SH-000086	Repaired	2800 Barbara St, #244	CRW	W.O. 5950, 5944, 5682	Sewer - SSP-001412
SH-000087	Patched	Calder St & Wyeth St		07/14/15 CCTV not CRW issue. 06/03/15 Site Inv. Patched, from inlet to MH.	Unknown
SH-000088	Repaired	272 Briggs St	Abel Recon	W.O. 9813, 7182, 5728, 4640. Pipe was lined.	SSP-004568
SH-000089	Repaired	Green St & Hamilton St	CRW	W.O. 10811, 10772, 10770, 61620 07/22/15 Inlet rebuilt.	Sewer - SSP-000534
SH-000090	Patched	1222 Derry St		W.O.5666, no sewer line in area. 06/24/15 On-site inv., patch middle of street.	Unknown
SH-000091	Repaired	Liberty St & Susquehanna St	CRW	W.O. 15223, 4166, 2623. Capped abandoned service lateral.	Sewer - SSP-001935
SH-000092	Repaired	444 Delaware St	CRW	W.O. 2870, 2871	Storm - SWINLT-000488
SH-000093	Repaired	N Second St & Strawberry St	CRW	04/22/15 Sealed pipe at bell. 04/08/15 Broken storm pipe from inlet.	Storm Pipe
SH-000094	Repaired	James St & Snipe Aly	CRW	W.O. 8415, 3883, 2886, 2774, 2727 SR#2031.	Sewer - SSP-002006
SH-000095	Repaired	Wallace St & Muench St	CRW	06/03/15 CRW Repaired.	Sewer Main
SH-000096	Repaired	2005 Lenox St	Ed Chambers	W.O. 13733 sewer lateral repair done for 2004 Lenox. WO 8317, 5671 no issues found.	Sewer Service Lateral
SH-000097	Repaired	N Fifth St & Seneca St	CRW	Street Cut Permit Dtd Nov 2014, 02/06/14 water main break	Water Main
SH-000098	Repaired	918 James St	CRW	W.O. 13757, 10694, 1769.	Sewer - SSP-004795
SH-000099	Repaired	Sayford St & Bartine St	CRW	W.O. 2862, 2508, 2507 & #2506. 07/16/14 Sinkhole excavated and backfilled with stone.	Water - WH-000433
SH-000100	Repaired	123 Hancock St	CRW	W.O. 2996, 1770.	Sewer - SSP-004381
SH-000101	Repaired	Parkway Dr & Briggs St	HRI	W.O. 5730, 1795.	Storm - SWP-001336
SH-000102	Repaired	N Second St & Delaware St	CRW	W.O. 11876, 10761, 5674	Storm - SWP-000249

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SH-000103	Repaired	21 N Eighteenth St	Property Owner	W.O. 14554, 1771. 48' from SSMH-002239 dirt in lateral. 09/26/14 Sewer Street Cut Permit. 12/05/14 Main break at 43 N 18th	Sewer Service Lateral
SH-000104	Plated	1619 Regina St		04/07/16 W.O. 1773, no compromise, pipe is lined.	Unknown
SH-000105	Repaired	N Second St & Granite St	CRW	07/29/14 W.O. Excavated, backfilled and removed plate	Unknown
SH-000106	Repaired	Strawberry St & Cowden St	CRW	08/14/14 Filled in with stone and compacted.	Unknown
SH-000107	Repaired	N Third St & Vaughn St	CRW	WO28367 Replaced Storm Pipe. 08/18/14 Excavated and repaired broken 10" TCP with wrap around clamp.	Storm, SWP-006344
SH-000108	Repaired	1604 N Second St	CRW	S.R. 1549, prior CCTV & leak detection, no issue. 2014 Filled with cold patch.	Unkown
SH-000109	Repaired	1010 Susquehanna St	CRW	S.R. 2622, Verizon vault issue. 08/21/14 Filled with cold patch.	Verizon Vault
SH-000110	Repaired	N Second St & Harris St	CRW	W.O. 5726, 3782, 3825	Sewer - SSP-000065
SH-000111	Repaired	217 Calder St	CRW	W.O. 9795, 9826,3074, 2841, 1468 SR#3054.	Water - WP-004677
SH-000112	Repaired	Schuylkill St & Susquehanna St	CRW	08/12/16 W.O. 4711 Sewer line in good condition. 06/24/14 Repaired, stone and 200 lbs cold patch	Unkown
SH-000113	Repaired	Kittatinny St & Fishel Aly	CRW	W.O. 11136, 9986, 5669 SR#3067	Storm, SWP-006795
SH-000114	Repaired	452 Crescent St	Mac Mor & CRW	W.O. 10104 Mac Mor Repair, 10005. 10029, 3336, 1791 & 2791 SR#3070 sinkhole.	Sewer - SSP-005876
SH-000115	Repaired	N Eighteenth St & North St	CRW	01/15/2020 repair WO29436. W.O. 1973, 3101, 4917, 4918.	Storm - SWP-002638
SH-000116	Rough Area	Lewis St & Susquehanna St		09/30/16 W.O. 5678 could not locate an area with sinkhole.	Unknown
SH-000117	Patched	1362 Mayflower St		W.O. 11157, 11841, 11961.	Unknown
SH-000118	Repaired	N Fifth St & Schuylkill St	CRW	W.O. 10106, 9709	Sewer - SSP-001478
SH-000119	Depression	2407 Turner St		04/13/15 CCTV line, lat. at Turner & Saul is broken, soil visible, CRW issue. Flushed line.	Sewer Service Lateral

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SH-000120	Sinking Patch & hole in yard	1 S Eighteenth St		W.O. 14554, 16406, 1771, 4276. 04/15/16 SR#1126 Reopen issue no resolution from SR#150	Sewer Service Lateral
SH-000121	Repaired	919 Green St	HRI	W.O. 1996, 3818, 5727.	Sewer - SSP-001931
SH-000122	Repaired	Division St & Waldo St	Pipe Data	W.O. 3146, 3895	Sewer - SSP-000380
SH-000123	Sinkhole	2218 Susquehanna St		W.O. 1761, 1768, 1919	2 Sewer Service Laterals
SH-000124	Repaired	S Seventeenth St & Sycamore St	CRW	W.O. 10953, 10988, 11241. 04/29/15 Hole opened up.	SWP-000690
SH-000125	Repaired	Seneca St & Turner St		W.O.11158, 11739. 04/2015 MH structurally good. Bell telephone vault has 1'x1' hole in the side	Verizon Vault
SH-000126	Repaired	S Eighteenth St & Rudy Rd	CRW	W.O. 13814, 13082-repair, 13215, 15272 -extended prior repair, 15271-lining project 06/30/15 video Rudy broken pipe from 6/116 to Holly	Sewer - SSP-001572
SH-000127	Sinkhole in yard	1025 S Seventeenth St		12/01/15 Joe B. said he will serve the notice. 06/24/15 On-site inv, sinkhole located. 04/14/15 CCTV to homeowner's lateral - pipe is good, MH is not	Unknown
SH-000128	Repaired	N Front St & State St	CR Powers	W.O. 3244, 3216, 3085, at 106 State St. SR#1549	Water - WLAT005063
SH-000129	Patched	1111 N Second St		05/06/15 Pic provided by A. Bliss	Other Utility Patch
SH-000130	Repaired	1508 Briggs St	Big Brother	W.O. 2475, 8798, 11646, 10539, 11673 - home owner repaired.	Water - Service Line
SH-000131	Repaired	Taylor Blvd & Market St	Wexcon	W.O. 12924, 13011	Sewer - SSP-001180
SH-000132	Repaired	Sixteenth St & North St	CRW	06/04/15 Repaired, replaced damage pipe. 05/29/15 JB recd call from D. West 8pm Cnty called to inform of sinkhole, C*	Storm Pipe
SH-000133	Repaired	Christian St & Sylvan Ter	CRW	08/2016 Water's St. Restoration Project. 05/06/15 EML A. Bliss EML Reappearing sinkhole hear*	Water
SH-000134	Sinkhole	319 Lewis St		W.O. 2878, 11915. CCTV clears CRW.	Undetermined
SH-000135	Patched	S Twenty-Sixth St & Greenwood St		06/26/15 CRW cold patched earlier patch that is sinking. 06/02/15 EML LG, CCTV clears CRW	Undetermined

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SH-000136	Sinkhole	Hillside Avenue		06/24/15 On-site inv., could not locate sinkhole. 06/09/15 EML softball size hole, middle of st.	Unknown
SH-000137	Repaired	Darlington Aly & Nineteenth St	UGI	06/24/15 On-site inv., UGI working on repair to backfill 06/25/15. Exposed collapsed Y lateral pipe and SE inlet hole in pipe.	Unknown
SH-000138	Repaired	Fifteenth St & Swatara St	Rogele	06/24/15 Pipe slipped with SDR 35, CCTV repair and connections.	Brick Sewer Main
SH-000139	Repaired	Evergreen St & Kittatiny St	CRW	W.O. 5669, 11136	Storm - SWP-006795
SH-000140	Patched	1418 Liberty St	COH	07/01/15 Per Joe, updated city 2 COH vacant properties have compromised laterals at the main.	2 Sewer Service Laterals
SH-000141	Sinkhole	1714 Walnut St		W.O. 4310, 4297 void in pipe at 1736 Walnut die test confirmed.	Sewer Service Lateral
SH-000142	Repaired	1911 Susquehanna St	Construxx	W.O. 13742, leak repair at 1907.	Water - WLAT-019291
SH-000143	Repaired	1800 Logan St	CRW	W.O. 2686	Storm - SWINLT-000619
SH-000144	Repaired	Evergreen St & Haehnlen St	CRW	W.O. 1991, 985	Water - WP-001692
SH-000145	Repaired	1220 Walnut St	CRW	W.O. 3876 Water St Restoration.	Water - WP-002234
SH-000146	Sinkhole	241 Seneca St		09/30/15 EML to DE Area Sinking. 07/15/15 Cleaned, CRW cleared. 01/20/2010 Main Break at 243 Seneca	Unknown
SH-000147	Patched	1734 State St		07/27/15 EML AB with pics	Other Utility Patch
SH-000148	Repaired	1115 S Eighteenth St	CRW	W.O. 10952 St. Restor completed 08/15/17, 2471 Repair completed 04/20/16, 2370 S.R. 857	Storm - SWP-001079
SH-000149	Patched	1739 Susquehanna St	COH Patched	08/06/15 CCTV not CRW issue, 12" pipe has no compromise 07/21/15 WO to inv. - lines up with UGI cut	Unknown
SH-000150	Repaired	Fourth St & Chestnut St	CRW	8/17/15 CRW concrete over Storm Pipe joint.	Storm Pipe
SH-000151	Repaired	215 Market St	CRW, Abel Recon	W.O. 18465 - 2019 repair, 8092 - 2017 repair, 8090, 4100	Sewer - SSP-004935, SSP-001999
SH-000152	Repaired	1232 Rolleston St	CRW	W.O. 12672, 10517, 3865	Sewer - SSP-000878

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SH-000153	Patched	Fifteenth St & Walnut St	Unknown	08/25/15 Site Inv - Patched. 07/21/14 Plate Tracking List - "Undetermined. One call made"	Unknown
SH-000154	Patched	Penn St & Woodbine St	Verizon	10/07/15 W.O. Verizon vault responsible for sinkhole. 08/25/15 Site Inv - Patched. 07/25/14 Plate Tracking list "Not addressed yet. Vicinity of CSO"	Verizon Vault
SH-000155	Repaired	Logan St & Clinton St	CRW	W.O. 3917, S.R. 1546	Sewer - MH
SH-000156	Repaired	Third St & Walnut St	CRW	09/24/14 Repaired broken water main sheared at steam vault. Removed 4' section of 10" pipe.	Water Main Break
SH-000157	Repaired	Division St & Agate St	CRW	10/28/14 Repaired & filled void around chimney & reset manhole casing. Restored street.	Sewer - MH & SWP
SH-000158	Repaired	Green St & Edward St	CRW	Manhole repair WO#22653, Sanitary Pipe Repair WO#19600, 04/28/16 W.O. 2879, CCTV Sewer Pipe, Closed. 9/15/2015 EML CCTV'd and CRW clear.	Sewer, SSMH-000076 and SSP-000339
SH-000159	Repaired	Twentieth St & Paxton St	CRW	W.O. 708	Storm - SWP-002104
SH-000160	Sinkhole	Twelvth St & Cumberland St		08/12/15 CCTV Sanitary Pipe and Storm Lateral, CRW Clear	Unknown
SH-000161	Repaired	125 N Summit St	CRW	W.O. 3156, 4510	Water - WLAT-014918
SH-000162	Repaired	Susquehanna St & Union St	CRW	W.O. 7745 Repaired failed clamp on water line in verizon vault.	Water - WP-004885
SH-000163	Sinkhole	River St		10/09/15 Per Joe B. Hole by previous utility patch.	Bad compaction, other utility
SH-000164	Repaired	River St & Pine St	CRW	W.O.1696 ST Restoration, water.	Water - WVH-000325
SH-000165	Sinkhole	1004 N Eighteenth		Two factory taps blown out. W.O. 3403 lining project, 2971, 631 S.R. 150, 158	Sewer - SSP-001232
SH-000166	Repaired	Fifth & Boyd	CRW	W.O. 1190, 1144 S.R. 920, 439, 294	Water - WP000649
SH-000167	Repaired	2704 N Fifth St	CRW	W.O. 2972, 8418, 8649, 8734 SR532	Sewer - SSP-001497
SH-000168	Sinkhole	3004 Market St		Closed W.O. 3282, dated 05/10/16 Leak Detection - negative, out of CRW sewer service area	Unknown
SH-000169	Repaired	Pentwater & Briarcliff	CRW	W.O. 10355, 2116 S.R. 846	Water - WP-008827
SH-000170	Repaired	23 & Derry	CRW	W.O. 3295, S.R. 1223	Sewer - SSMH-005519

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SH-000171	Repaired	Fulton & Hamilton	Wexcon	W.O. 8160, Lining contract work, W.O. 11445 08/28/17 plated, 09/22/17 patched, unkown to patch work	Storm - SWP-006535
SH-000172	Repaired	Front & Chestnut	CRW & NRG	10/19/16, W.O. 5947 - NRG to repair steam manhole. W.O. 3474 3449	Steam Manhole
SH-000173	Repaired	2313 Logan	CRW	2017 St Restoration WO#8962, 8963 11/18/16, Repair W.O. 6597, 6553 S.R. 2431	Water - WP-004044
SH-000174	Patched	1706 Berryhill St		WO18049 temp st restor completed 06/08/18, Repair 8658 S.R. 2863.	Sewer SSP-001023
SH-000175	Repaired	751 Seventh St	CRW	W.O. 8315 repair valve box, S.R. 2923	Water - WV-001417
SH-000176	Repaired	232 State St	CRW	Repair WO 8390 completed 04/13/17, 8591 St Restor completed 06/23/17 S.R. 2982	Sewer - SSP-001404
SH-000177	Repaired	Twentieth St & Greenwood St	CRW	W.O. 8669, 8679, S.R. 3001	Storm, SWP-000748
SH-000178	Repaired	Penn St & Kelker St	CRW	WO9436 repair completed 06/05/17, 9438 St Restor completed 06/23/17, S.R. 3030	Storm, SWP-006616
SH-000179	Repaired	Sixteenth St & Paxton St	Rogele	W.O. 10032, 9751, 9758, S.R. 3058	Storm, SWP-000669
SH-000180	Sinkhole	3016 N Third St		W.O. 10135, 10136, 10178, 11668, S.R. 3074, 3147	Sewer, SSP-000343
SH-000181	Repaired	2043 Chestnut St		WO 11835 review of CCTV no evidence to cause for sinkhole, St Rest WO29725or	Unknown
SH-000182	Sinkhole	Twenty-Third St & Luce St		W.O. 11840, 11839 - Repair, 11881 Lining project candidate S.R. 3153	Storm, SWP-000899
SH-000183	Repaired	Market and Evergreen	Rogele & Abel	W.O. 12249 exceeds depth, 12611, S.R. 3161	Sewer, SSP-000937
SH-000184	Repaired	2949 Front St	CRW	W.O. 13133, 12519, 12540, 12466, S.R. 3166, in rear of building	Sewer, SSP-001908
SH-000185	Repaired	Seventeenth and Market	TBD	WO 12992, 8769 - Repair, S.R. 3179 &2981 on 03/2017	Sewer, SSP-001009
SH-000186	Repaired	353 Fifteenth St	Rogele - Sewer	W.O. 13737, 13920, S.R. 3208	Sewer, SSP-000900
SH-000187	Repaired	1220 Thompson St	CRW	W.O. 14467, 14474, 14477 - Repair, S.R. 3232	Storm, SWP-006846
SH-000188	Repaired	Twelvth St & Walnut St	CRW	See also SH-000210. W.O. 16259, 16306, 16314, 20501 SR 3277	Sewer, SSP-000928

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SH-000189	Repaired	7TH & Schulkill	CRW	W.O. 17837, 17957, 17964, 17965, 18042, 18205, 18552 SR 3413	Storm, SWP-001985
SH-000190	Repaired	209 HUMMEL ST	CRW & Rogele	W.O. 16759, 16769, 16782, 17819 S.R. 3325	Sewer, SSP-006057
SH-000191	Repaired	1400 Block Scott St	CRW	W.O. 17589,17616, 17595, 17596, S.R. 3386	Sewer, SSP-001624
SH-000192	Repaired	SECOND ST & CUMBERLAND ST	CRW	WO 17706, 17713, 17728, 17790,18032, 18313 S.R. 3393	Storm, SWP-003048
SH-000193	Repaired	SEVENTEENTH ST & ELM ST	CRW	W.O. 19966, 20001, 5361, 17702, S.R. 3397	Sewer, SSP-000950
SH-000194	Repaired	1245 MULBERRY ST	Construxx	W.O. 17302, S.R. 3576	Water Service, WLAT-007041
SH-000195	Repaired	400 MARKET ST	CRW	W.O. 18716, S.R. 3631	Storm, SWINLT-005050
SH-000196	Repaired	1839 Spencer	Rogele	W.O. 19159, 19251, 19170, 19229, 19252, 24320 SR 3774	Sewer, SSP-002074
SH-000197	Repaired	Geiger	Rogele	W.O. 19273, 19281, 19290, 19329	SSP-001794
SH-000198	Repaired	James St & Calder	CRW	W.O. 19611, 19612, 20021, 20613, 20024, 20071, 20173 S.R. 3924, 4039	STORM - SWP-000319
SH-000199	Repaired	3RD AND SAYFORD	CRW	W.O. 20028, 20029, 20030, 20034, 20188, 20202 20520, SR 4064	STORM - SWMH-000037
SH-000200	Repaired	Park St near 19th St	CRW	W.O. 20307, 20308, 20309, 21459, SR4158	Storm - SWP-003081
SH-000201	Repaired	Susquehanna St near Dubbs Aly	Rogele	W.O. 20026,19987, 19986, 19985, 19895, 19894. SR 4007	Sewer, SSP-007136
SH-000202	Repaired	Holly & Carlisle	CRW	W.O. 21877, 21848, 21876, 21877, 21879, 23928. SR4585	Sewer, SSP-001004
SH-000203	Repaired	CRESCENT & BERRYHILL	Rogele	W.O. 23647, 23652, 23651, 23641, 17827, 17830, 17843. SR 3407, 3408, 3534.	Sewer, SSP-005876
SH-000204	Repaired	6th & Muench	Rogele	W.O. 24380, 24407, 24386, 24490, 25907 SR5238	Sewer, SSP-003543
SH-000205	Repaired	SUSQUEHANNA ST & CUMBERLAND ST	Rogele	W.O. 21332, 21341, 21379, 21405, 24585, 25733. SR4437	Sewer, SSP-000655
SH-000206	Repaired	THIRD ST & BLACKBERRY ST	BLD	W.O. 21907, 22384 - Repair,24588 SR4612	Sewer, SSP-002001
SH-000207	Repaired	2716 REEL ST	CRW	W.O. 10004, 10047, 10387, 10184, 11907, 13815, 24589. SR3069	Water Service, WLAT-000526

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Sinkhole List
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ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000208	Repaired	CAMERON ST & MARKET ST	CRW	W.O. 18064, 24598. SR3457	Abandoned Brick Sewer Pipe
SH-000209	Repaired	2459 DERRY ST	CRW	W.O. 19168, 19257, 19826, 24599 SR3772	Storm - SWINLT-003939
SH-000210	Repaired	1198 WALNUT ST	Rogele	See also SH-000188. W.O. 16314, 19240, 24600, 20501 SR3806	Sewer, SSP-000928
SH-000211	Repaired	Front St. & Riley St.	Standard Pipe S	W.O. 24876, 24978, 24976- 03/18/18 Pending, 25474-Repair	Sewer - SSP-003030
SH-000212	Repaired	10th & Market	CRW	W.O. 26210, 26193, 26209, 26214	Sewer - SSP-000701
SH-000213	Repaired	1648 4th St	Rogele	W.O. 26012, 26006, 26211, 26212, 26213, SR 5689	Sewer - SSP-003430
SH-000214	Repaired	620 Geary St.	CRW	W.O. 26586, 26621, 26645, 26648 30749 SR 5849	Water - WP-010999
SH-000215	Replaced Pipe	Meunch & Susquehanna	Rogele	WO 25452, 25457, 25458, 25464, 27921, 41671 SR 5488	Sewer, SSP-000081
SH-000216	Replaced Pipe	Evergreen & Mulberry	Rogele	WO 26805, 26811, 26812, 26826, 26889 SR 5920	Sewer, SSP-006057
SH-000217	Repaired	423 Crescent St.	CRW	WO27636 SR6158	Water - Failed Patch
SH-000218	Repaired	159 Royal Terrace	CRW	WO 27813, 27806, 27810, 28993, 30895, 30912 SR6219	Storm, SWP-003023
SH-000219	Repaired	17th & Elm	Rogele	WO 27711, 27678, 27680, 27681, 27710, 31335, 35377 SR6188	Sewer, SSP-004438 & Storm, SWP-000579
SH-000220	Repaired	Second & Strawberry	CRW & Abel Reco	WO 27629, 27630, 27631, 27632, 28056, 28216, 28217 SR6166	Sewer Manhole, SSMH-001198
SH-000221	Repaired	Woodbine & Susquehanna	CRW	WO 26805, 26811, 26812, 26826 SR5920, SR8810	Storm, SWP-000080
SH-000222	Repaired	Williams to Verbeke	CRW	WO 27036, 27037, 27038, 27039, 28069, 28071, 28279, 28280, 29676	Sewer - SSP-002013
SH-000223	Repaired	4th & Sayford	CRW	WO 29333, 29339, 29530, 29578, 29724	Sewer, SSP-000508
SH-000224	Repaired	15th and North	CRW	WO 28661, 29551, 29552, 29564, 29565, 29854 SR 6420, 6545	Storm, SWP-000587
SH-000225	Repaired	4th st near Sayford	CRW	WO29530 TAY 10/2/19. Possible duplicate of SH-000223 tyork, 02/18/2020.	SSP-000503
SH-000226	Repaired	21st & Chestnut	TBD	WO31255, 34243 SR6994, tyork, 02/18/2020.	SSMH-002278

Capital Region Water
Sinkhole List
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ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000227	Repaired	441 S 15th Street		05/08/2020 SR: WO35653, WO35641, SR7823	water, WP-010647
SH-000228	Repaired	N 7th & Seneca St	CRW	SR7859, WO36506, WO36253, WO36866	SWP-000064
SH-000229	Repaired, CIPP	North St & N 18th St		Same area as SH-000115, WO36695, 32792, 32795.	Sewer, SSP-001195
SH-000230	Repaired	1527 Catherine St	CRW	SR7777, WO35115, 35225. Two prior repairs done by CRW on contractor workWO25044, 34171, 35225 (Third), 45607 (Fourth)	Water Service, WLAT-009901.
SH-000231	Repaired	703 N 17TH ST	CRW	WO35312, 35484 SR7798	Water, WP-002565
SH-000232	Repaired	Wiconisco and Agate	CRW	SR 7920, WO 36850, 37199, 37201.	SSMH-000152
SH-000233	Patched	701 N Front St	CRW	WO37313 tyork 7/15/2020.	Water Service, WLAT-021029
SH-000234	Plated	2nd & Locust	Rogele	SR 7973, WO 37385, 37424, 37885. tyork 7/17/2020.	SSP-001946
SH-000235	Repaired	385 HALE rear	Verizon	tyork 7/31/2020 Verizon dug through our line. WO38656	SWP-007865
SH-000236	Repaired	James & Boas	CRW	SR 8054, WO 38640, 38658, 39328, 39578	SWP-007951
SH-000237	Repaired	1726 Market St	TBD	SR8064, WO 6895, 15496, 38712, 40415. WO40416 TAY 9/29/2020.	SSP-000966
SH-000238	Repaired	Thompson & Summit	TBD	WO40721, 37238, 26875 TAY 10/14/2020.	SSP-005272
SH-000239	Repaired	Penn & Basin	CRW	SR8333, WO41601, 41611, 41649. WO41714 TAY 11/30/2020.	SWINLT-000892
SH-000240	Repaired	1000 Blk Susquehanna St	Rogele	SR8354, WO41814, 41809, 42007, 41897 Open Repair. WO42879 TAY 2/2/2021.	SSP-000656
SH-000241	Repaired	1830 Green St	CRW	See SH-000255	WLAT-003644
SH-000242	Repaired	Green & Cumberland	CRW	SR8621, WO 44748, 44664, 44903, 44904, 44916	SSP-000634
SH-000243	Repaired	Green & Cumberland	CRW	SR8621, WO 44748, 44664, 44903, 44904, 44916	SSP-000634
SH-000244	Repaired	Broad St Market	CRW	SR8651, WO 44954, 45001, 45002, 45003, 45028, 45081	SSP-004748
SH-000245	Repaired	Central St	CRW	SR8789, WO45814, 45820 45897, 45925 45927, 46182	SSP-001675
SH-000246	Repaired	Liberty & Buttonwood	Rogele	SR8837 WO46302 46300, 46301, 48932, 47652	SSP-001399
SH-000247	Repaired	Balm st	Rogele	SR9040 SR8700, WO45231 45333	SSP-007191
SH-000248	Repaired	2229 Logan St.	CRW	SR8912 WO47579, 47578, 48489, 47572	SSP-000487

Capital Region Water
Sinkhole List
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ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000249	Repaired	River & Barbara	Rogele	SR8920, WO47621, 47630, 47631, 47632	SSP-001415
SH-000250	Repaired	737 & 739 S 26th St	CRW	SR9004, WO48629, WO48685, 48691, 49126, 48620 | REPAIRED IN FRONT OF CURB	SSLAT-000181
SH-000251	Repaired	Brensinger & Emerald	Rogele	SR8960, WO48631, 48810, 48947, 49127, 49144	SSP-005257
SH-000252	Repaired	1768 Market St	Rogele	SR8542 WO43380 43427, 43417	SSP-000966
SH-000253	Repaired	12th & Cumberland St	CRW	SR8820, WO46391 46392, 47562,	SSMH-001443, SSP-000688
SH-000254	Repaired	Penn & Sayford	CRW	SR8873, WO46488, 46487, 46489, 47613, 46491, 47613	SSP-4482, SSMH-000985
SH-000255	Repaired	Green & Muench	CRW/Rogele	SR9140 WO4905, 49057, 49058, 49212	SSP-000082
SH-000256	Repaired	Walnut & Linden	CRW	SR8907 WO49246, 47564, 47649, 47650, 47651	WP-007123
SH-000257	Repaired	321 Hamilton St	CRW	SR8695 WO45200, 45200, 45885	WP-005029
SH-000258	Repaired	Cameron & Sycamore	CRW	SR8583 WO43920, 45885, 43926	WP-001491
SH-000259	Patched	Flinton St, rear of 1220 Rolleston	CRW	WO52160 | Not a pipe issue	Previous CRW repair
SH-000260	Repaired	2020 Market St	CRW	SR9358, WOs 51789, 50802, 13010	SSP-001179
SH-000261	Repaired	701 N 2nd St	CRW	WO's 51083, 51084, 50972, 52394 SR9419	SSP-004595
SH-000262	Repaired	18th & North	CRW	SR9439, WOs 52008, 51203, 51189, NOTE THIS IS THE SAME LOCATION AS SH-274	Tap at SWP2639
SH-000263	Repaired	Cumberland and Monroe	CRW	SR9446, WOs 51230,51234, 51233, 52381	SSP-001376 laterals broken off of CRW main
SH-000264	Repaired	24 N Summit St	Rogele	SR9467, WOs 51476, 51748	SSP-001820
SH-000265	Repaired	Front and Chestnut Sts.	Rogele	SR9697, WOs 52712, 53298, 52740, 52786, 52787	SWP-000454
SH-000266	Repaired	2350 Green St	CRW	SR9815 WOs 53398, 53451, 53961, 54905	SSP-005230
SH-000267	Repaired	19 S Summit St	CRW	SR9939, WOs 54454, 54486, 54887, 54897, 54903, 55052	SSP-000938
SH-000268	Repaired	Third and Klemm	CRW	WOs 55031, 55036, 55123, 55122	SSMH-000066
SH-000269	Repaired	1625 Briggs St	CRW	SR9985, WOs 54548, 58578, 54588	Goose neck from WLAT15826

Capital Region Water
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ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000270	Repaired	1408 THOMPSON ST	CRW	SR10471, WOs 56438, 56509, 56532, 56510	WLAT-007828 gooseneck
SH-000271	Patched	Susquehanna & Hamilton	CRW	SR10396 10609, 10610, WOs 56135, 57289, 56142	WP-004527
SH-000272	Replaced	Front & Peffer	Rogele	04/06/2022 SR: CRW responsibility, added per WO57861	SSP-003012 Replaced w/ 24' PVC
SH-000273	Repaired	431 Amity Rd	Rogele	SR11006, WOs 58675, 58845, 59002, 58703, 58955, 59062, 58675	SSP-006569
SH-000274	Repaired	1803 North St	Mr Rehab / CRW	SR11035, WOs 58832, 59842, 58841, 58842	Tap break-in from SWP2638
SH-000276	Repaired	S 18th St & Bellevue Rd	CRW	SR11007 WOs 58691, 58735, 58750	WP-002345
SH-000277	Patched	2206 Logan St	CRW	SR11079 WOs 58994, 59036, 60174	Leaking gooseneck
SH-000278	Repaired	2540 N 2nd St	CRW	SR11034, WOs 58852, 58873, 59063, 58874	WP-3933 break
SH-000279	Install Manhole	1816 STATE ST	Rogele	WOs 60200, 60179, 61159	Party Line
SH-000280	Repaired	N 13th St & Walnut St	CRW	SR11120, WOs 57422, 60157, 61074, 61158	Abandoned Leaking Service - WO57422
SH-000281	Repaired	227 Chestnut St	CRW	SR10601, WOs 57289,	old lateral main break
SH-000282	Patched	2123 Jefferson St	CRW	SR10328, WOs 55860, 62005	WLAT-019771
SH-000283	Repaired	121 Conoy St	CRW/Rogele	SR11256, WOs 61070, 62019	SSP-004538
SH-000284	Repaired	Front & Manor	CRW	SR11262, WOs 62065. 62415,	Junction of SWP8457, SWP8458 and SSP1907
SH-000285	Patched	William & Verbeke	CRW	WO64211	SSP-007396
SH-000286	Repaired	2229 Logan St.	CRW/Lech	SR8912 WOs 47572, 47578, 48489 | SR 11914 WOs, 74156 (TVI 10, 147) 74181, 75136	SSP-000487
SH-000287	Patched	2112 Susquehanna St	CRW	WO65124	Settlement
SH-000288	Repaired	2nd and Charles (Alley)	CRW	WOs 28984, 32837, 32921	SWP348
SH-000289	Repaired	2229 LOGAN ST	Lech Bros.	WOs 58994, 65482, 65489, 65490, 65583	SSLAT305 inproper repair by contractor
SH-000290	Active	Melrose and Greenwood		WOs 68224, 68189	SWP8599 repair failure
SH-000291	Repaired	1619 Compass	Construxx	SR12745, WOs	lateral connection

Capital Region Water
Sinkhole List
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ASSETID	STATUS	LOCATION	REPAIREDBY	NOTES	POSSCAUSE
SH-000292	Repaired	1422 N 4TH	CRW	SR13447, CCTV 72816, Repair Stornwater Pipe 73025. St Resto 73412	SWP8962
SH-000293	Plated	214 LOCUST ST	TBD	SR 13974, WOs 74788, (TVI 68), 75017	SSP-001948
SH-000294	Repaired	1593 Logan St	CRW	SR 14252, WOs 75431, 75428, 75430	SWP-001907
SH-000295	Repaired	1918 York St	TBD	SR 13017, WOs 71015, 71245, 75916	SSP-001244
SH-000296	Repaired	1601 Green Street	East Coast	SR 13492, WOs 72973, 73030, 73031	Lateral
SH-000297	Repaired	135 Summit St	CRW	SR 14443, WOs 76067(CCTV),76173 (Repair Sewer Pipe)	SSP-007326
SH-000298	Repaired	1667 Wayne St	CRW	trenchless repair	SSP-000876
SH-000299	Patched	Verbeke St	CRW	SR14524 WOs 76378 (CCTV), 76237(Plate), 77216 (Update)	SSP-007396
SH-000300	Patched	Division and Waldo St	Pending	SR15310 WOs 79349 (CCTV), 79353 (Plate), 79352 (Repair MH)	SSP-000380/SSMH-000159

Appendix D

Associated Land Uses and Risk Scores for Activities of Concern

Appendix D Associated Land Uses and Risk Scores for Activities of Concern

Activity Type	Associated Land Uses and Risk Scores																									
	OFFICE	STORE/RETAIL	SHOPPING CENTER	STORE/OFFICE WITH APTS	MEDICAL OFFICE	FINANCIAL INSTITUTION	CONDOMINIUM OFFICE	RESTAURANT/TAVERN	FAST FOOD RESTAURANT	GAS STATION	COMM GARAGE/AUTO DEALER	LODGING FACILITY	PRIVATE EDUC FACILITY	PARKING LOT/GARAGE	COMMUNICATIONS FACILITY	PVT CARE/NURSING HOME	FUNERAL HOME	THEATRE	TRUCK TERMINAL	WHSE/IND TO 10000 SQ FT	WHSE/IND TO 10-50000 SQ FT	WHSE/IND TO 50000-UP SQ FT	COMMERCIAL/INDUST MISC	DINER	CARWASH	LAUNDROMAT	UNUSABLE COMMERCIAL
Yard / Landscape Management	3	3	3	3	3	3	3	3	3		3	3	3			3	3	3		3	3	3	3	3	3	3	3
Building Maintenance / Renovation	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	
Lateral Maintenance / Repair	2	2	2	2	2	2	2	2	2	2	2	2	2			2	2	2	2	2	2	2	2	2	2	2	
Street / Pavement Management	3	3	3	3	3	3		3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3	
Development / Construction																											
Solid Waste Handling / Storage		3	3	3	3			3	3	3	3	3	3			3	3	3	3	3	3	3	3	3			
Material Handling / Storage										5	5								5	5	5	5	5				
Hazardous Material Handling / Storage					3					3	3						3		3	3	3	3	3				
Spill Prevention / Response / Cleanup										5	5								5	5	5	5	5				
Liquid Waste Handling / Storage								4	4											4	4	4	4	4	4	4	
Food Service		4	4					4	4	4		4				4		4						4			
Vehicle / Equipment Service										4	4								4						4		
TOTAL RISK SCORE	**9**	**16**	**16**	**12**	**15**	**9**	**6**	**20**	**20**	**30**	**29**	**16**	**12**	**4**	**1**	**16**	**15**	**16**	**26**	**29**	**29**	**29**	**29**	**20**	**17**	**13**	**3**
NORMALIZED TOTAL RISK SCORE	**2**	**3**	**3**	**2**	**3**	**2**	**1**	**4**	**4**	**5**	**5**	**3**	**3**	**1**	**1**	**3**	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**4**	**3**	**3**	**1**

Note: The risk score is blank for activities not associated with land use.

Appendix D Associated Land Uses and Risk Scores for Activities of Concern

Activity Type	Associated Land Uses and Risk Scores																										
	TAX INCREMENT FINANCING OFFICE	CHURCH EXEMPT	HOSPITAL/CLINIC EXEMPT	EDUCATIONAL EXEMPT	VACANT EXEMPT	PARKING LOT EXEMPT	FIRE HOUSE EXEMPT	LEGION/VFW/CLUB EXEMPT	MUNICIPAL EXEMPT	EXTENED CARE EXEMPT	MISC EXEMPT	LIBRARY EXEMPT	PARK/RECREATION EXEMPT	RESIDENTIAL EXEMPT	FAIRGROUND/HALL EXEMPT	POST OFFICE EXEMPT	WASTE TREATMENT EXEMPT	STATE/GOVT BLDGS EXEMPT	DWELLING DISABLE VET	CEMETARY	REDEVELOPMENT AUTHORITY	GROUP RESIDENCE	EMERGENCY MEDICAL	HISTORIC SITE	COMMUNITY CENTER	MUNICIPAL WATER	RAILROAD RIGHT OF WAY
Yard / Landscape Management	3	3	3	3	3		3	3	3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Building Maintenance / Renovation	1	1	1	1			1	1	1	1		1		1	1	1	1	1	1		1	1	1	1	1	1	
Lateral Maintenance / Repair		2	2	2			2	2	2	2		2	2	2	2	2	2	2	2		2	2	2	2	2	2	
Street / Pavement Management		3	3	3		3	3	3	3	3		3	3	3	3	3	3	3					3	3	3	3	
Development / Construction					2																2						
Solid Waste Handling / Storage		3	3	3			3	3	3	3					3		3						3		3		
Material Handling / Storage									5								5	5								5	5
Hazardous Material Handling / Storage			3				3										3						3			3	3
Spill Prevention / Response / Cleanup							5										5									5	5
Liquid Waste Handling / Storage			4														4									4	
Food Service			4	4				4		4					4												
Vehicle / Equipment Service							4																				
TOTAL RISK SCORE	**4**	**12**	**23**	**16**	**5**	**3**	**24**	**16**	**17**	**16**	**1**	**9**	**8**	**9**	**16**	**9**	**29**	**14**	**6**	**3**	**8**	**6**	**15**	**9**	**12**	**26**	**16**
NORMALIZED TOTAL RISK SCORE	**1**	**3**	**4**	**3**	**1**	**1**	**5**	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**3**	**2**	**5**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**5**	**3**

Note: The risk score is blank for activities not associated with land use.

Appendix D Associated Land Uses and Risk Scores for Activities of Concern

Activity Type	Associated Land Uses and Risk Scores																								
	BLDG LOT UNDER 1 ACRE	BLDG LOT 1 TO 5 ACRES	COMMERCIAL LAND	INDUSTRIAL LAND	MISCELLANEOUS LAND	UNBUILDABLE LOT	PRD COMMON AREA	MISC RECREATIONAL	1 STORY RESIDENCE	1.5 STORY STORY RESIDENCE	2 STORY RESIDENCE	3 STORY RESIDENCE	SPLIT LEVEL RESIDENCE	BI LEVEL RESIDENCE	CONDOMINIUM	APTS 4 OR LESS UNITS	APTS 4 TO 10 UNITS	APTS OVER 10 UNITS	MISC RESIDENTIAL	MULTIPLE DWELLINGS	UNHABITABLE DWELLING	ELECTRIC COMPANY	TELEPHONE/TELEGRAPH COMPANY	RAILROAD	MISC PUBLIC UTILITY
Yard / Landscape Management	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		3
Building Maintenance / Renovation									1	1	1	1	1	1	1	1	1	1	1	1	1				
Lateral Maintenance / Repair									2	2	2	2	2	2	2	2	2	2	2	2	2				2
Street / Pavement Management																	3	3							3
Development / Construction	2	2	2	2	2																				
Solid Waste Handling / Storage																	3	3							3
Material Handling / Storage																						5		5	5
Hazardous Material Handling / Storage																						3		3	3
Spill Prevention / Response / Cleanup																						5		5	5
Liquid Waste Handling / Storage																									4
Food Service																									
Vehicle / Equipment Service																									
TOTAL RISK SCORE	**5**	**5**	**5**	**5**	**5**	**3**	**3**	**3**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**12**	**12**	**6**	**6**	**6**	**16**	**3**	**13**	**28**
NORMALIZED TOTAL RISK SCORE	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**5**

Note: The risk score is blank for activities not associated with land use.

Appendix E

Pollution Prevention for Building Maintenance / Renovation

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Indoor facility cleaning ▪ Outdoor pressure washing ▪ Building repair, painting and remodeling ▪ Fire sprinkler line flushing	▪ Sediment ▪ Solid waste ▪ Sewage (including detergents) ▪ Hazardous materials (metals, solvents)	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney - Engineering/Wet Weather
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Discharges to CRW sewers from building maintenance / renovation activities such as cleaning, washing, flushing, scraping and painting can be contaminated with toxic hydrocarbons in solvents, heavy metals, suspended solids, and abnormal pH.

Purpose

Utilizing the following protocols will prevent or reduce the discharge of pollutants from building and grounds maintenance activities by washing and cleaning up with as little water as possible, preventing and cleaning up spills immediately, keeping debris from entering CRW sewers, and maintaining CRW sewers.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at property owners and building maintenance and renovation businesses. These mechanisms will target the following practices in order to control associated pollutants.

- Indoor Facility Cleaning
    - Use dry cleaning methods when practical.
    - Switch to non-toxic cleaning chemicals when possible.
    - Mix/handle cleaning solutions indoors and away from storm sewer inlets.
    - Properly dispose of wash waters and excess cleaning solutions into the sanitary sewer except during rainfall events.
- Outdoor Pressure Washing/Spraying
    - Collect and properly dispose of wash waters and associated solids.

- Building Repair, Painting and Remodeling
    - Properly store and dispose of solid wastes, paints, solvents and other unused materials.
    - Collect and properly dispose of wastes from outdoor painting, scraping, and sandblasting.
    - Recycle residual paints, solvents, lumber, and other material as much as possible.
- Fire Sprinkler Line Flushing
    - Dispose of fire sprinkler line flush water into the sanitary sewer except during rainfall events.

Rules, Regulations, and Incentives

City code 9-913.1 prohibits any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the City of Harrisburg's separate storm sewer system or waters of the commonwealth.

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate the handling and disposal of building maintenance/renovation wastes, excess cleaning solutions, wash waters with soaps/detergents, and fire sprinkler line flush water.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- CRW will maintain and promote a hot line for the public and/or other government agencies to report concerns and will respond to citizen reports of illegal dumping and improper use or disposal of materials and wash waters from building maintenance and renovation.
- To the extent allowed under current legal authority, conduct inspections of building maintenance activities that may discharge into CRW sewers.
- Support the City of Harrisburg Sanitation Division to collect and properly dispose of solid wastes, paints, and solvents.
- CRW staff will report any dumped waste observed during routine field activities.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDDE): Illegal Dumping Control
- MS4 MCM-6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Development / Construction

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Earth disturbance ▪ Material handling and storage ▪ Waste management ▪ Spill prevention and response	▪ Sediment ▪ Solid Waste ▪ Vegetation Waste ▪ Oil & grease	▪ Education/ Involvement	Dauphin Co. Conservation District CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney CRW – Engineering
		▪ Inspection/Surveillance	Dauphin Co. Conservation District CRW – Operations / PFI

Rationale

The primary pollutant associated with development and construction is sediment from earth disturbing activities such as clearing, grubbing, grading and excavation. As stormwater flows over a construction site, it can also pick up pollutants like solid waste, vegetation wastes and spills (e.g., oil, grease, and other chemicals) and transport these to a CRW sewer.

Purpose

To promote clean water in greater Harrisburg, construction businesses should prevent sediment, wastes, and spills from entering the storm drain system by designing, installing, and maintaining erosion and sediment controls and implementing waste management and spill prevention and response measures that constitute a Storm Water Pollution Prevention Plan (SWPPP).

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will support the efforts of the Dauphin Co. Conservation District to educate developers, contractors, and engineers about sediment and erosion controls during construction.

Rules, Regulations, and Incentives

By August 10, 2016, CRW intends to:

- Develop a working agreement with the Dauphin County Conservation District (DCCD) and the City of Harrisburg to utilize DCCD's written program for construction site stormwater runoff control. The Pennsylvania Department of Environmental Protection (DEP) implements a statewide program for issuing National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges associated with construction. In Dauphin County, DEP has delegated a significant portion of this program to DCCD through a written delegation agreement.
- Adopt rules and regulations (within its legal authority as a municipal authority) to require sediment and erosion controls and ensure compliance.

- Enter into an agreement with the City of Harrisburg to:
    - Require CRW review and approval of development and construction plans prior to City issuance of zoning approvals, building permits, or other mechanisms to allow the developer / contractor to start construction.
    - Allow CRW and DCCD to inspect construction sites for proper installation and maintenance of erosion / sediment controls and construction material / waste handling operations, and to issue / recognize "stop work" orders if such controls are not effective.
    - Require CRW to inspect and approve the installation of sewers and stormwater control facilities within development / construction projects.
- Work with DCCD and the City of Harrisburg to establish requirements for construction site waste management and utilize the existing DCCD program to implement these requirements.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- CRW will maintain and promote a hot line for the public and/or other government agencies to report concerns and information regarding local construction activities. CRW will inform DCCD of any public inquiries, concerns, and information they receive regarding construction site stormwater runoff.
- CRW staff will report any construction site stormwater runoff concerns observed during routine field activities.
- To the extent allowed under current legal authority, conduct inspections of construction sites that may discharge into existing / proposed CRW sewers.

Regulatory Requirements Addressed

- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCM-4: Construction Site Stormwater Runoff Control

Appendix E

Pollution Prevention for Food Service

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Wash water disposal ▪ Fats, oil & grease disposal ▪ Solid waste disposal ▪ Outdoor washing	▪ Oil & grease ▪ Solid waste ▪ Food waste ▪ Sewage	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney COH – Bureau of Codes
		▪ Inspection/Surveillance	COH – Bureau of Codes COH – Sanitation CRW – Operations / PFI

Rationale

Food service activities at commercial eating establishments / restaurants include indoor and outdoor cleaning and washing and storage and disposal of fats, oil, grease, and solid waste. All of these activities have the potential to contribute pollutants to the stormwater drainage system or cause blockages of sanitary and/or combined sewer systems that contribute to sewer overflows.

Purpose

To promote clean water in greater Harrisburg, food service owners and managers should prevent wash waters and wastes from entering CRW's separate stormwater system, and install / maintain traps and cleanouts to prevent oil, grease, and other constituents harmful to CRW's operations from entering its sanitary sewer system.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at owners, managers, employees, and customers of food service establishments. These mechanisms will target the following practices in order to control associated pollutants:

- Proper disposal of indoor wash waters to the sanitary sewer system.
- Collection and proper storage and disposal or recycling of fats, oil & grease.
- Proper storage and disposal of solid wastes and food wastes.
- For outdoor cleaning, using dry cleaning methods when practical and collection and proper disposal of wash waters and associated solids.

Rules, Regulations, and Incentives

City code 6-501 Food Inspection requires installation, inspection, maintenance and record keeping for oil, grease, and grit interceptors, traps, or other such removal devices at commercial eating establishments, and prohibits discharging the contents to the sanitary sewer system.

City code 9-913.1 prohibits any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the City of Harrisburg's separate storm sewer system or waters of the commonwealth.

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate food service operations that may discharge into CRW sewers.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- To the extent allowed under current legal authority, conduct inspections of food service establishments that may discharge into CRW sewers.
- Support the City of Harrisburg Bureau of Codes in their enforcement of code for food service establishments that affect discharges to CRW sewers.
- CRW staff will report any deposits of fats, oil and grease found during sewer inspection to the City of Harrisburg Bureau of Codes.
- Support efforts of the City of Harrisburg Sanitation Division to collect and properly dispose of solid wastes and food wastes.
- Maintain and promote a hot line for the public and/or other government agencies to report illegal dumping.

Regulatory Requirements Addressed

- CSO NMC-5: Elimination of CSOs During Dry Weather: Interceptor Cleaning
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDDE): Illegal Dumping Control

Appendix E

Pollution Prevention for Yard/Landscape Maintenance

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Fertilizer/pesticide/herbicide use ▪ Mowing, trimming, and weeding ▪ Waste management ▪ Sustainable planting practices	▪ Sediment ▪ Vegetation waste ▪ Fertilizer ▪ Herbicide/pesticide	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney - Engineering/Wet Weather
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Yard and landscape maintenance activities include grass cutting; trimming; yard waste disposal; planting trees and shrubs; fertilizer, pesticide and herbicide application; and other landscaping practices. All of these practices have the potential to contribute pollutants to the stormwater drainage system.

Purpose

To promote clean water in greater Harrisburg, property owners and yard / landscape maintenance businesses should prevent landscape waste from entering the storm drain system by collecting and properly disposing of clippings, cuttings, and leaves. They should also apply fertilizers, pesticides, and herbicides in a manner that minimizes runoff into the storm drain system and receiving waters.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at property owners and yard/ landscape maintenance businesses. These mechanisms will target the following practices in order to control pollutants associated with yard and landscape maintenance:

- Fertilizer, Pesticide, and Herbicide Use
    - Minimize use and over application.
    - Follow manufacturer's recommendations.
    - Properly store and dispose of waste and unused materials.
- Mowing, Trimming, and Weeding
    - Check vehicles and equipment for leaks.
    - Use mechanical or hand methods of weeding in lieu of herbicides.
    - Cover exposed soil to prevent erosion.

- Waste Management
    - Properly dispose of yard waste.
    - Prevent stockpiled material from entering a CRW sewer.
- Sustainable Planting Practices
    - Choose native vegetation with low maintenance and other beneficial features.
    - Avoid plants that require high nitrogen fertilizers or frequent mowing or trimming.

Rules, Regulations, and Incentives

By August 10, 2016, CRW will enact rules, regulations, and policies implementing the following controls:

- Require public employees and commercial applicators to hold proper state and federal certification for fertilizer, pesticide, and herbicide use.
- Prohibit dumping of fertilizers, pesticides, herbicides, and vegetative waste into storm sewers, water bodies, streets, and/or vacant properties.
- Develop requirements and/or incentives to utilize green infrastructure for managing stormwater and sustainable vegetation for landscaping.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- Respond to citizen reports of improper use of pesticides, herbicides, and fertilizers.
- Support the City of Harrisburg Sanitation Division's efforts to collect and properly dispose of unused fertilizer, pesticide, herbicide, and vegetative waste.
- CRW staff will report any dumped vegetative waste observed during routine field activities.
- To the extent allowed under current legal authority, conduct inspections of commercial yard/landscape maintenance activities for proper certifications and waste disposal practices.
- CRW will maintain and promote a hot line for the public and/or other government agencies to report illegal dumping.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Involvement / Participation
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDD&E): Illegal Dumping Control

- MS4 MCM-6: Pollution Prevention / Good Housekeeping for Municipal Operations: Government Facility Controls

Appendix E

Pollution Prevention for Lateral Maintenance / Repair

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Lateral cleaning ▪ Lateral repair & replacement ▪ Roof & foundation drainage ▪ Fats, oil & grease disposal	▪ Sewage ▪ Oil & grease	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney - Engineering/Wet Weather COH – Bureau of Codes
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Bureau of Codes

Rationale

Roots, cracks, and joint defects cause sewer laterals to plug and/or collapse, often causing sinkholes to form. Roof, footer, and yard drain connections to sanitary sewer laterals contribute to wet weather CSOs, SSOs, and/or sewer backups. Likewise, illicit connections of sanitary laterals to the stormwater collection system contribute pollutants. Improper disposal of fats, oil and grease to CRW sewers creates deposits that can lead to blockages and sewer overflows.

Purpose

To promote clean water in greater Harrisburg, commercial, industrial, and residential property owners must keep their lateral connections in good working order to control sewer clogging / backups, wet weather flows, and/or sinkholes. During lateral installation and repair, property owners should obtain required permits to ensure that connections are plumbed to the correct sewer system.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial, industrial, and residential property owners. These mechanisms will target the following practices:

- Owner responsibilities for private sanitary lateral maintenance, repair, and replacement.
- Collection and proper storage and disposal or recycling of fats, oil and grease.

Rules, Regulations, and Incentives

The City of Harrisburg Department of Building and Housing Development, Bureau of Codes Enforcement administers and enforces the residential and plumbing codes.

The City of Harrisburg, Bureau of Codes Health Officer administers and enforces food inspection. Existing City code 6-501 requires installation, inspection, maintenance and record keeping for oil, grease, and grit interceptors, traps, or other such removal devices at commercial eating establishments, and prohibits discharging the contents to the sanitary sewer system.

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate the maintenance, repair, and replacement of sewer laterals and control discharges of fats, oils, and food service operations that may discharge into CRW sewers.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- To the extent allowed under current legal authority, conduct inspections of sewer laterals that may discharge into CRW sewers, and commercial/residential connections to these sewer laterals.
- Support the City of Harrisburg Bureau of Codes in their enforcement of code for food service establishments that affect discharges to CRW sewers.
- Notify residential property owners of significant deposits of fats, oil and grease downstream of residential areas.
- Maintain and promote a hot line for the public and/or other government agencies to report concerns.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Routine Maintenance and Inspections
- CSO NMC-5: Elimination of CSOs During Dry Weather: Cleaning and Sewer Repair
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDD&E)

Appendix E

Pollution Prevention for Liquid Waste Handling / Storage

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Individual and on-lot sewage systems ▪ Industrial waste processing ▪ Sewer breaks / blockages ▪ Waste transport	▪ Sewage ▪ Process waste ▪ Hazardous materials	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney - Engineering/Wet Weather
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Bureau of Codes

Rationale

Industrial facilities may produce wastes that cannot be effectively treated by CRW's AWTF and are subject to pretreatment standards. Stormwater discharges from industrial facilities may also overwhelm the combined sewer system, causing CSOs containing their industrial waste, or may be significant sources of stormwater pollutants due to the nature of the activities and materials handled on-site. In addition, sewers may leak or overflow if blocked, and certain wastes transported on highways or rail may enter CRW's sewer system if a leak or spill occurs.

Purpose

To promote clean water in greater Harrisburg, certain industrial facilities are subject to pretreatment standards and/or other controls to prevent discharge of industrial waste to CRW's sewer system. Liquid waste transported through Harrisburg via sewers, vehicles, trains, or other facilities may enter CRW's sewers if leaks or spills occur.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at industries / businesses that generate liquid waste, and at transporters of liquid wastes. These mechanisms will target the following practices:

- Businesses and Industries
    - Industrial pretreatment requirements
    - Development and implement of stormwater pollution prevention plans.
    - Spill prevention and containment plans for liquid wastes
- Transporters of Liquid Waste
    - Spill prevention and containment plan requirements.

Rules, Regulations, and Incentives

City of Harrisburg code Chapter 6-303 requires approval of the City's Health Officer for septic systems (on-lot sewage systems) and that such systems be maintained in a sanitary condition. Pennsylvania Code Chapter 73 specifies site requirements and design standards for individual and on-lot sewage systems.

By August 10, 2016, CRW will enact rules, regulations, and policies implementing the following control strategies:

- Require industrial facilities that discharge to CRW sewers to develop and implement a stormwater pollution prevention plan and, for select facilities, comply with industrial pretreatment rules.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- Regular sewer system inspections, including illicit discharge detection.
- To the extent allowed under current legal authority, conduct inspections of outdoor areas at industrial facilities that have a potential to contaminate stormwater, concurrent with the wet weather inspection related to process flow control.
- CRW will maintain and promote a hot line for the public and/or other government agencies to report concerns.
- CRW staff will report any illicit discharges observed during routine field activities.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDD&E)
- MS4 MCM-6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Material Handling / Storage

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Spill prevention & response ▪ Waste management	▪ Sediment ▪ Deicers ▪ Solid waste ▪ Leachate ▪ Oil & grease ▪ Fertilizer ▪ Herbicide/pesticide ▪ Hazardous materials	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney COH – Fire Other agencies
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Raw materials, by-products, finished products, containers, and material storage areas exposed to rain and/or runoff can pollute stormwater when materials spill, leak, wash off or dissolve into water and reach the stormwater collection system or water bodies. The potential impacts to water quality are wide ranging, depending on the specific materials.

Purpose

To promote clean water in greater Harrisburg, commercial, industrial, and residential property owners should handle and store materials in a way that prevents them from entering the CRW sewers unless authorized.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial/industrial property owners and residential property owners. These mechanisms will target the following practices:

- Commercial/industrial property owners
    - Develop and implement a Spill Prevention Control and Response Plan.
    - Minimize the amount and exposure of hazardous materials.
    - Contain, report and clean up spills and leaks in accordance with applicable laws and regulations.
- Residential property owners
    - Minimize the amount and use less toxic materials when practical.
    - Properly store and dispose of household hazardous wastes.

- Sweep and use absorbents to properly clean up spills and leaks.

Rules, Regulations, and Incentives

For commercial/industrial property owners, hazardous material rules and regulations are administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), U.S. Nuclear Regulatory Commission (NRC), and Pennsylvania Department of Environmental Protection. Household Hazardous Wastes (HHW) are not regulated as hazardous waste under federal and state laws. However, City code prohibits certain discharges that would include HHW and other materials:

- City code 6-307.9 prohibits the deposit of hazardous wastes and materials.
- City code 9-913.1 prohibits any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the City of Harrisburg's separate storm sewer system or waters of the commonwealth.
- City code 9-501.7 prohibits discharges to the sanitary sewer containing wax, grease or oils of petroleum origin in excess of 100 mg/L, or petroleum products in amounts that will cause interference or pass-through at the Advanced Wastewater Treatment Facility (AWTF).

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate improperly managed materials that may discharge into CRW sewers.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- CRW staff will report any concerns observed during routine field activities.
- Maintain and promote a hot line for the public and/or other government agencies to report illegal dumping and respond to reports of improper storage or disposal of materials.
- To the extent allowed under current legal authority, conduct inspections of material storage and handling areas that may discharge into CRW sewers.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDDE): Illegal Dumping Control and Proper Waste Disposal
- MS4 MCM-6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Solid Waste Handling / Storage

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Littering ▪ Illegal dumping ▪ Waste storage and collection ▪ Waste disposal and recycling	▪ Solid waste ▪ Leachate ▪ Food waste ▪ Oil & grease ▪ Vegetation waste ▪ Hazardous materials	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney COH – Bureau of Codes
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Improper storage and handling of solid wastes can allow debris, toxic compounds, oils and greases, heavy metals, nutrients, sediment, and other pollutants to enter CRW sewers. The discharge of pollutants from waste handling and disposal activities can be prevented and reduced by reducing waste generation and through proper storage and disposal.

Purpose

To promote clean water in greater Harrisburg, commercial, industrial, and residential property owners should reduce solid wastes and properly store and dispose of solid wastes to prevent the discharge of pollutants to CRW's sewers.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial, industrial, and residential property owners. These mechanisms will target the following practices in order to control pollutants associated with solid waste:

- Reuse and recycle wastes when possible.
- Use watertight, covered solid waste containers.
- Provide retail customers covered recycling and trash receptacles in high traffic areas.
- Collect, transport, and dispose of solid waste at appropriate disposal facilities in accordance with applicable federal, state, and local laws and regulations.
- Cover and/or contain runoff from, and prevent runon to, waste storage areas.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer.
- Collect and dispose of hazardous wastes according to applicable laws and regulations.

Rules, Regulations, and Incentives

Existing City of Harrisburg code regulates the storage and disposal of solid wastes:

- 3-365 requires exterior of all property to be free of accumulated refuse.
- 6-307 prohibits the deposit of litter.
- 6-309 regulates types, location, use of receptacles (no leaks, proper use).
- 9-301 to 309 regulates refuse collection and prohibits disposal with stormwater.

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate improperly managed solid waste that may discharge into CRW sewers.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- CRW staff will report any concerns observed during routine field activities.
- Maintain and promote a hot line for the public and/or other government agencies to report illegal dumping and respond to reports of improper storage or disposal of solid wastes.
- To the extent allowed under current legal authority, conduct inspections of solid waste receptacles, storage areas, and/or dump sites that may discharge into CRW sewers.
- Support the City of Harrisburg Sanitation Division's programs to collect and properly dispose of household hazardous wastes.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Control of Illicit Discharges: Illegal Dumping Control
- MS4 MCM-6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Spill Prevention / Response / Cleanup

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Spill/leak prevention, response, and cleanup measures ▪ Reporting ▪ Waste Disposal	▪ Process Waste ▪ Sewage ▪ HazMat	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney Other agencies
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Spills and leaks of chemicals, oils, automotive fluids and other materials, if not properly controlled, can adversely impact the storm drain system and receiving waters. Proper spill response planning and preparation can enable commercial and industrial facility employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Purpose

To promote clean water in greater Harrisburg, commercial, industrial, and residential property owners should prevent materials from entering the storm drain system by preventing spills and containing and properly disposing of wastes and clean up materials.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at commercial/industrial property owners and residential property owners. These mechanisms will target the following practices:

- Commercial/industrial property owners
    - Develop and implement a spill prevention, control and response plan.
    - Minimize the amount and exposure of hazardous materials.
    - Contain, report and clean up spills and leaks in accordance with applicable laws and regulations.
- Residential property owners
    - Minimize the amount and use less toxic materials when practical.
    - Properly store and dispose of household hazardous wastes.
    - Properly clean up spills and leaks.

Rules, Regulations, and Incentives

Federal regulations 40 CFR 122.26 identify specific classes of industrial facilities that must apply for NPDES permit coverage or No Exposure certification from the Pennsylvania Department of Environmental Protection (DEP). DEP's NPDES industrial general permit requires best management practices such as a Preparedness, Prevention and Contingency (PPC) Plan. Facilities subject to Spill Prevention Control and Countermeasure (SPCC) must also maintain plans with spill prevention / response / and cleanup measures. In addition, City code prohibits certain discharges that would include spills or cleanup of chemical, oils, and other materials:

- City code 9-913.1 prohibits any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the City of Harrisburg's separate storm sewer system or waters of the commonwealth.
- City code 9-501.7 prohibits discharges to the sanitary sewer containing wax, grease or oils of petroleum origin in excess of 100 mg/L, or petroleum products in amounts that will cause interference or pass-through at the Advanced Wastewater Treatment Facility (AWTF).

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- Annual inspection of Significant Industrial Users by CRW's Pretreatment Program will include inspection of management practices called for in the industry's PPC Plan and ensure that facilities are in compliance with their NPDES industrial stormwater permits, if applicable.
- Maintain and promote a hot line for the public and/or other government agencies to report illegal dumping and respond to reports of improper storage or disposal of hazardous materials.
- Work with the City of Harrisburg Sanitation Division to collect and properly dispose of wastes and excess materials.
- Regularly inspect municipal maintenance facilities and equipment for leaks, control and repair immediately.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC -7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM3: Control of Illicit Discharges: Proper Waste Disposal
- MS4 MCM6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Street / Pavement Management

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Deicing / snow removal ▪ Pavement repair / replacement ▪ Bridge painting / repair ▪ Pavement marking ▪ Street sweeping ▪ Waste management	▪ Sediment ▪ Deicers ▪ Solid Waste ▪ Oil and Grease ▪ Vegetation Waste	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney COH – Engineering
		▪ Pavement Management ▪ Inspection/Surveillance	CRW – Operations / PFI COH – Highway & Traffic

Rationale

Roadways and parking lots can contribute significant pollutants to the stormwater collection system and receiving waters. Grit, dust, spills, hydrocarbons, litter, and vegetative waste that are washed off streets and parking lots can be managed through pavement cleaning and waste management activities. When ice melts, the salt and other deicing chemicals flow into storm drains and receiving waters. Street, bridge, and parking lot maintenance activities can also contribute suspended solids, hydrocarbons, oil and grease.

Purpose

To promote pollution prevention for street / pavement management activities in greater Harrisburg, The City of Harrisburg, parking facility owners, snow removal businesses, and pavement contractors should properly use street / pavement maintenance chemicals, prevent and clean up spills, and properly dispose of wastes.

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at parking facility owners, snow removal businesses, and pavement contractors. These mechanisms will target the following practices in order to control pollutants associated with street / pavement management.

- Deicing
    - Make efficient use of road salt and other deicing chemicals through proactive, variable and controlled application.
    - Consider using alternative deicing agents (less toxic, biodegradable, etc.)
- Pavement repair / replacement
    - Schedule activities for dry weather.
    - Protect stormwater inlets and nearby waterways.

  - Prevent and clean up spills and leaks.
  - Sweep, vacuum, or shovel to remove and properly dispose of wastes and excess materials.
  - Clean vehicles and equipment in designated wash areas.

- Bridge painting / pavement marking
  - Prevent and clean up spills and leaks.
  - Collect and properly dispose of waters and wastes from pressure washing and sand blasting.

- Parking Facility Maintenance
  - Pavement cleaning, waste disposal, vehicle leak detection, facility repair, and other pollution prevention activities appropriate for parking facilities in the City.

Rules, Regulations, and Incentives

By August 10, 2016, CRW will enact rules, regulations, and policies implementing the following control strategies:

- Deicing applicator certification for completion of training / education and use of best practices.

For pavement repair / replacement, the Office of the City Engineer issues the Standard Specifications for Street Cut Permits that require protection of stormwater inlets and proper pavement repair techniques.

Pavement Management

- In 2015, CRW participated in funding City of Harrisburg street sweeping operations and is assessing the cost-effectiveness of annual street sweeping activities.
- Based on this annual assessment, CRW will determine a cost-effective level of street sweeping services for pollution control, and will establish an equitable level of funding with the City.
- CRW will coordinate main / lateral replacements / repairs with City pavement resurfacing / road reconstruction projects to minimize pavement deterioration and construction-related pollution.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- CRW staff will report any street and bridge maintenance-related concerns observed during routine field activities to the City of Harrisburg Department of Public Works.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC -7: Pollution Prevention Programs to Reduce CSO Contaminants

- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM3: Control of Illicit Discharges: Illegal Dumping Control
- MS4 MCM6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix E

Pollution Prevention for Vehicle / Equipment Service

Summary

Activities of Concern	Targeted Constituents	Control Strategies and Objectives	Responsible Parties
▪ Fueling operations ▪ Fluid leaks / spills / disposal ▪ Solvent/wash water use/disposal ▪ Storage yards ▪ Maintenance activities	▪ Sediment ▪ Oil & grease ▪ Process waste ▪ Hazardous materials	▪ Education/ Involvement	CRW – Community Outreach
		▪ Rules, Regulations, & Incentives	CRW – Attorney - Engineering/Wet Weather
		▪ Inspection/Surveillance	CRW – Operations / PFI COH – Sanitation

Rationale

Vehicle or equipment maintenance and repair is a potential source of pollution due to materials used and wastes created that are harmful to humans and the environment. Vehicle washing, engine repair and service (e.g., parts cleaning), refueling and fluid replacement (e.g., oil changes), and spills and leaks from vehicle / equipment storage areas can impact water quality and/or CRW operations if improperly discharged to a CRW sewer.

Purpose

To promote clean water in greater Harrisburg, property owners and vehicle repair businesses should prevent vehicle and equipment fluids and wastes from entering a CRW sewer (unless specifically allowed under CRW Rules and Regulations).

Control Strategies and Objectives

Education / Involvement

Capital Region Water (CRW) will develop and implement print, media, and internet-based education / involvement mechanisms targeted at property owners and vehicle maintenance businesses. These mechanisms will target the following practices in order to control pollutants associated with vehicle maintenance:

- Waste Management
    - Collect and dispose, reuse, or recycle waste and unused materials according to applicable laws and regulations.
- Vehicle/Equipment Wash Water
    - Direct wash waters through an oil-water separator and discharge to the sanitary sewer system except during rainfall events.
    - Encourage residential car washers to use commercial facilities or wash over pervious surfaces to minimize discharges to CRW sewers.
    - Clean vehicle parts without solvents and degreasers when possible to reduce waste.

- Spill Prevention and Response
    - Conduct activities and store leaking vehicles/equipment indoors or under cover.
    - Use drip pans to capture all spills and drips for proper disposal or recycling.
    - Sweep and use absorbents to maintain work areas and clean up spills and leaks.
    - Keep Spill Prevention Control and Countermeasure (SPCC) Plans up-to-date, and implement accordingly.

Rules, Regulations, and Incentives

City code 9-913.1 prohibits any non-stormwater discharge including sewage, process wastewater, and wash water, to enter the City of Harrisburg's separate storm sewer system or waters of the commonwealth. Individual residential car washing is authorized.

City code 9-501.7 prohibits discharges to the sanitary sewer containing wax, grease or oils of petroleum origin in excess of 100 mg/L, or petroleum products in amounts that will cause interference or pass-through at the Advanced Wastewater Treatment Facility (AWTF).

By August 10, 2016, CRW will adopt parallel rules and regulations that provide CRW with adequate legal authority to regulate discharges from vehicle and equipment maintenance activities into CRW sewers, In addition, CRW Rules and Regulations will incorporate the following control strategies:

- Require vehicle maintenance facility owners to train employees in the proper handling and disposal of engine fluids and waste materials and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Inspection / Surveillance

CRW will conduct the following inspection / surveillance activities:

- Maintain and promote a hot line for the public and/or other government agencies to report illegal dumping and respond to reports of improper disposal of vehicle fluids and wastes.
- Support the City of Harrisburg Sanitation Division's efforts to collect and properly dispose of wastes from vehicle and equipment maintenance.
- To the extent allowed under current legal authority, conduct inspections of vehicle and equipment storage and maintenance activities that may create a discharge into CRW sewers.
- CRW staff will report any related concerns observed during routine field activities.

Regulatory Requirements Addressed

- CSO NMC-1: Proper Operation and Regular Maintenance Programs: Source Investigations
- CSO NMC-6: Control of Solid and Floatable Materials: Corrective Actions/Pollution Prevention
- CSO NMC-7: Pollution Prevention Programs to Reduce CSO Contaminants
- MS4 MCMs1/2: Public Education / Outreach and Public Participation / Involvement
- MS4 MCM-3: Illicit Discharge Detection and Elimination (IDDE): Illegal Dumping Control, Illicit Connections

- MS4 MCM-6: Good Housekeeping Practices for Government Operations: Government Facility Controls

Appendix F

Asset Management Prioritization

Asset Management Plans

CAPITAL REGION | WATER™

March 31, 2024

v.1.0

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Capital Region Water

Strategic Asset Management Plan

August 2022

Strategic Asst Management Plan

Prepared for

Capital Region Water
Harrisburg, PA

August 2022

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Document Revision History				
Version	Summary	Editor	Data Edited	Description of Changes
1	Initial Draft	BC		

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Risk Policy- future state item

List of Abbreviations/ Definitions		
Asset		An item that has potential value to the organization such as equipment, buildings, etc.
Asset Management	AM	An integrated set of processes to minimize the lifecycle costs of infrastructure assets, at an acceptable level of risk, while continuously delivering established levels of service.
Asset Management Development Teams	AMDT	Asset Management teams that will be responsible for helping to implement the Asset Management Roadmap.
Asset Management Plans	AMP	Guide asset management processes at each facility or system. Each facility or system has its own tactical AMP, which includes technical elements such as: level of service measures, asset inventory, risk & criticality, O&M strategies, condition assessment, capital/engineering/rehab & replacement strategies, and information management.
Corrective maintenance	CM	Corrective maintenance
Capacity, Management, Operations and Maintenance	CMOM	A flexible, dynamic framework for municipalities to identify and incorporate widely accepted wastewater industry practices to: Better manage, operate, and maintain collection systems Investigate capacity constrained areas of the collection system (EPA)
Condition		Measure of the physical state of an asset.
Condition Assessment		Asset condition assessments involve monitoring assets periodically, and using the data collected from those inspections to determine the condition of each asset. The analysis of an asset's condition which may include categories for age, operating environment, performance, and utilization to develop a score for ranking the asset against similar assets.
Computerized Maintenance Management System	CMMS	Software that enables personnel to enhance their maintenance practices, take control of plan assets and practice expert maintenance management. A computerized system designed to enhance efficiency and effectiveness of maintenance activities. Typical features include planning, scheduling, and monitoring of work orders and maintenance needs. CRW uses Cityworks
Consequence of Failure	COF	The impact on level of service, utility, customers, or public resulting from an asset failure.
Critical Assets		Critical assets are those that have the potential to significantly impact organizational objective achievements. Criticality (i.e., the risk score) comprises two factors: (1) the likelihood of a failure, and (2) the consequence of that failure. Critical assets typically have enhanced maintenance strategies to mitigate failures.
Risk		A score formulated based on an asset's consequence and likelihood of failure.
Failure		The inability of an asset to provide the function for which it was installed.
Failure Codes		CMMS codes that designate the failure modes of an asset.
Geographic Information System	GIS	A computer system that analyzes and displays geographically referenced information. It uses data that is attached to a unique location (USGS) and is the repository for CRW assets.
Level of Effort	LOE	Used in the context of this document, pertains to the number of hours that are required of personnel to implement the activity.
Likelihood of Failure	LOF	The chance of an occurrence, such as an asset failure.
Level of Service	LOS	The output or objectives the organization intends to deliver to its stakeholders (i.e., Public, Board, Rate Commission, Regulators).

List of Abbreviations/ Definitions		
Lifecycle cost		The asset life cycle covers the time span from when the asset need is determined through its eventual replacement or disuse. How the asset's life cycle is managed is dependent on the strategies and goals of its management. These strategies normally include training, maximizing utility, preventive maintenance, evaluation and when use will stop. Total cost of an asset throughout its life (includes planning, design, acquisition, O&M, rehabilitation & disposal costs).
Nine Minimum Control	NMC	Nine Minimum Control
National Pollutant Discharge Elimination System	NPDES	The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. (EPA)
Operations and Maintenance	O&M	The functions, duties, and labor associated with daily performance and preservation of assets.
Performance		A measure of whether the asset is delivering level of service requirements.
Predictive maintenance	PdM	Predictive maintenance (PdM) programs are based upon the actual condition of the equipment and a determination of when maintenance should be performed to minimize costs. New technology techniques such as ultrasound, infrared and vibration online testing make PdM a viable alternative in certain circumstances. However, for most equipment the complex metrics for making educated guesses (predictive) is provided by preventive maintenance programs. PdM programs give you the ability to monitor equipment and track conditions over time to predict when maintenance should be performed. Maintenance schedules that are created to establish high levels of asset reliability and are mostly performed while the equipment is in service. The goal is to undertake maintenance activity before the assets loses optimum performance capability, therefore extensive condition monitoring is vital.
Preventive maintenance	PM	Inspection or servicing tasks designed to prevent or mitigate equipment-specific failure modes that could lead to a functional failure. These tasks are ALWAYS pre-planned, scheduled, and performed. Maintenance programs that are designed to prevent machinery assets from malfunctioning or breaking down by planning repairs, replacing components and servicing assets so that incipient failures can be detected or corrected before they occur or develop into major defects. PM programs give you the functionality of predefining and scheduling tasks or procedures associated maintaining your equipment.
Problem, Cause, Remedy Codes	PCR Codes	The CMMS codes used for failure reporting that indicate the problem, cause, and remedy to a failure.
Rehabilitation and Renewal	R&R	Phases of an asset lifecycle that focus on fixing or replacing an asset to meet the required service
Remaining Useful Life	RUL	The useful life remaining on an asset. An estimate of the number of remaining years that an asset can perform its duty.
Roadmap Implementation Groups	RIGs	CRW development team comprised of staff who have a direct subject matter expertise in the specific AM recommendations. The RIGs align with assigned AM Category and should have representation at the front-line level with people involved in the execution of the work.
Risk		The possibility that something negative will happen to the stakeholders/organization. In asset management terms, is the product of the likelihood of failure and the consequence of failure of an asset.
Roadmap Development Team	RDT	Asset Management team that includes cross-divisional representatives involved in guiding the development of the Asset Management Roadmap.
Supervisory Control and Data Acquisition	SCADA	A computerized system often used to collect real-time maintenance information for monitoring and control of assets. "A computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation."

List of Abbreviations/ Definitions		
Strategic Asset Management Plan	SAMP	Guides overall asset management processes to ensure consistency. Includes organizational elements such as: charter vision & goals, training, communications, engineering design & construction, capital planning & financing, project justification, and key processes and templates.
Useful Life		The amount of time that an asset can perform its function as designed.

Program Charter

The Strategic Asset Management Plan (SAMP) is the primary document that guides Capital Regional Water (CRW) efforts in the administration of asset management (AM) activities associated with facility and system assets: treatment plants, collection and distribution systems, and pump stations. It brings focus to the strategy for improved asset management, and provides the overarching framework for achieving the vision, mission, and strategic goals of the Asset Management Program, as described in the program charter. Rather than being an extensive manual of practice on asset management, the SAMP is a concise framework that creates a consistent approach for the divisions which operate and maintain the facilities and distributed systems. The SAMP framework provides the "rule book" for facility/system plans (Tactical Asset Management Plans – AMPs) to help meet the established service level expectations and other operational objectives at the lowest life cycle cost.

Section 1

Introduction

Capital Region Water (CRW) provides drinking water, stormwater, and wastewater services to the city of Harrisburg and neighboring municipalities. The protected DeHart Reservoir provides an abundant supply of source water, which is treated at the Water Services Center and distributed to 60,000 customers throughout the city of Harrisburg, and portions of Penbrook Borough, Lower Paxton Township, Swatara Township and Susquehanna Township.

CRW operates almost 230 miles of water mains that range from 6 inches to 42 inches in diameter and 1,800 fire hydrants and 20,884 service connections. Design flow of 20 MGD is treated at Dr. Robert E. Young Water Services Center Treatment Facility. There are three pumping stations namely Susquehanna River Pump Station, Gate House Pump Station, Union Square Industrial Park Booster Station.

CRW owns and operates an Advanced Wastewater Treatment Facility (AWTF), a conveyance system, and wastewater and stormwater collection system within city limits. The combined system consists of 175 miles of pipe and constitutes, 85% of the wastewater system (by length). The remaining 15% is a separate sanitary sewer system in which the sewers are directly connected to CRW's conveyance system without passing through CSO regulator structures.

This Strategic Asset Management Plan (SAMP) will guide overall asset management processes to ensure consistency including organizational elements such as: charter vision and goals, training, communications, engineering design and construction, capital planning and financing, project justification and key processes and templates.

Asset Management Definitions

"CRW's Asset Management Program is our decision-making framework designed to balance performance, risk and cost as we invest in our infrastructure with the right work at the right time for the right reasons."

(ISO 55000)

- **Asset.** Item that has potential value such as equipment, buildings, etc.
- **Condition.** Measure of the physical state of an asset.
- **Consequence.** Impact on level of service, utility, customers, or public resulting from an asset failure.
- **Failure.** Inability of an asset to provide the function for which it was installed.
- **Likelihood.** Chance of an occurrence, such as an asset failure.
- **Level of Service.** Output or objectives one intends to deliver to its stakeholders (i.e., Public, Board, Regulators).
- **Lifecycle cost.** Total cost of an asset throughout its life (incl. planning, design, acquisition, O&M, rehabilitation & disposal costs).
- **Risk value.** The combination of consequence and likelihood of a failure.

The SAMP serves several purposes:

1. Provides information about where the asset inventory data is located. Provides criticality criteria to determine individual asset inspection, replacement, and rehabilitation rankings.
2. Provides information on the established levels of service (LOS) and key performance indicators (KPIs).
3. Identifies renewal and replacement strategies and techniques. Identifies currently known data requirements and program enhancements.
4. Helps ensure that capital investments are proactive, flexible, and promote the most efficient use of available resources.
5. In recognition of the fact that each facility and system owned and operated has specific assets, conditions, and requirements under which they are operated, the management of these facility and system assets are also governed by a Tactical Asset Management Plan (AMP). The AMP structure is like that of the SAMP, but the SAMP provides a standardized approach for the overall asset management framework and business rules across facilities and systems; the AMP describes the specifics for asset management at a particular location and identifies actions that are being implemented to achieve the standards and goals herein listed. **The SAMP is intended as a guidance document to develop and implement the facility and system AMPs. It provides the ground rules to help achieve the vision of the Asset Management Program.** Figure 1-1 depicts the relationship between the SAMP and AMPs.

Figure 1-1. SAMP and AMPs Relationship.

6. The fundamental components of the SAMP are shown in Figure 1-2, and include Operations and Maintenance, Organizational Framework, Decision Making and Capital Planning topics, and Information Systems and Data Management topics.

In addition to the SAMP and AMPs, an Implementation Plan, or Roadmap, defines the sequencing, scheduling, and prioritization of asset management program activities. The AM Roadmap includes prioritized SAMP improvement strategies recommended for the ultimate fulfillment of a successful AM program. The Roadmap Development Team (RDT) will need to periodically review, reprioritize and/or adjust the SAMP, AMPs and Roadmap as conditions change.

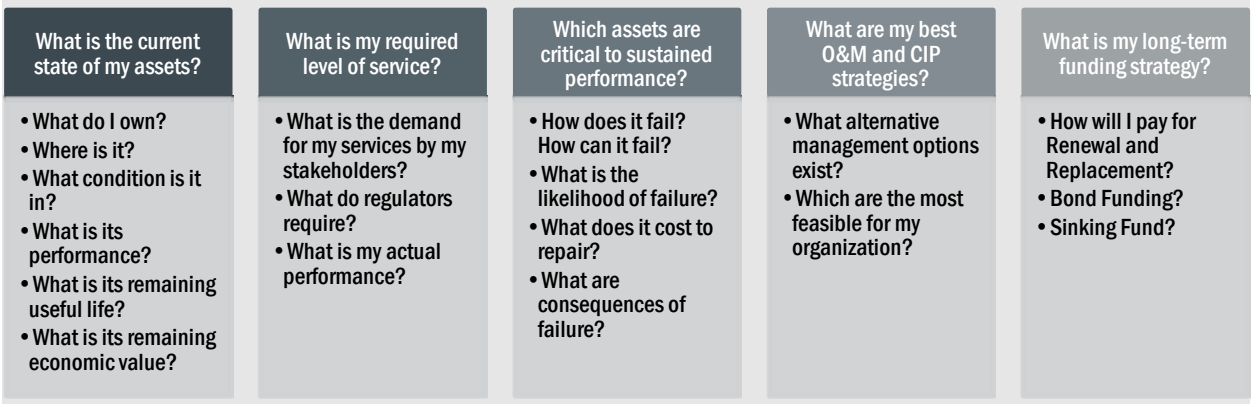
Figure 1-2. Asset Management Plan Components

1.1 Asset Management Overview

For purposes of using this SAMP as a guide for managing CRW's facility and system assets, asset management is defined as the following:

> Asset Management is a systematic process of operating, maintaining, and upgrading assets cost-effectively, including the practice of managing assets so that the greatest return is achieved with the objective of providing the best possible service to internal and external customers.[1]

Asset management helps organizations answer and address the questions:



The sections of the SAMP align with asset management industry standards: International Infrastructure Management Manual (IIMM) provides insight and examples of asset management practices and International Standards Organization (ISO) 55000 provides a broad framework for topics that should be addressed as part of a sound AM program.

[1] This definition is in alignment with IIMM and ISO 55000 asset definitions.

1.2 Asset Management Workflow

A typical path to achieve AM program excellence is shown in Figure 1-3. The key AM fundamentals are shown on the top row (i.e., organizational objectives, LOS, asset inventory and hierarchy, and risk assessment). Without those overarching objectives and procedures in place, it is difficult to implement an effective AM program. As such, the first step in an AM program is to develop the organizational objectives. The RDT collaboratively developed their organizational objectives: asset management program vision, mission, and goals. Those elements are the guiding force behind the decisions that are made for the short- and long-term needs of the asset management program. The LOS, asset inventory and hierarchy, and risk assessment build on those foundational elements.

The remainder of the activities (condition assessment and monitoring, maintenance strategies, operations and maintenance, business case justification and project prioritization) are the bulk of the AM program. The workflow helps guide sequencing of the AM program execution.

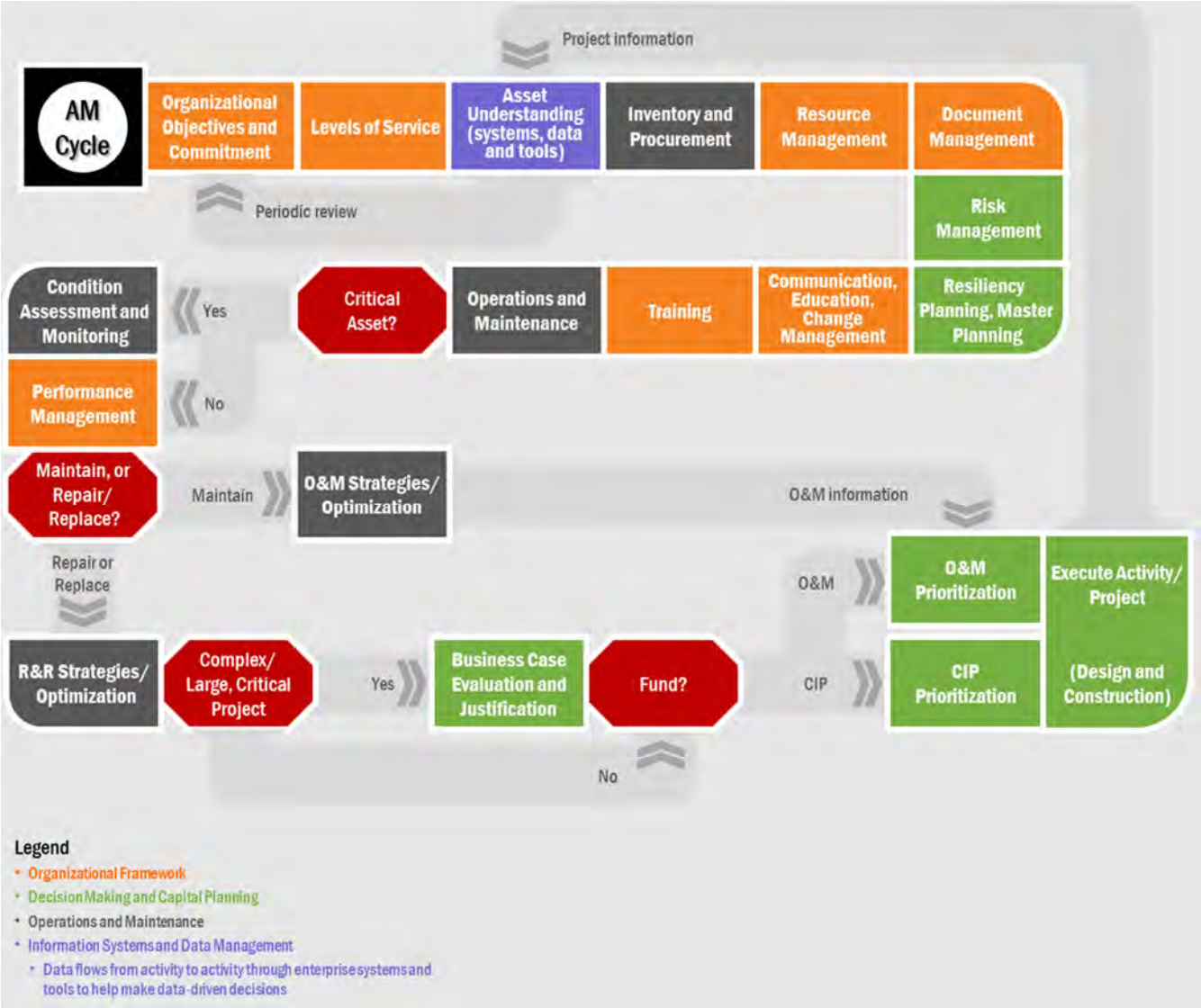


Figure 1-3. Asset Management Framework

1.3 SAMP Development and Maintenance

1.3.1 Development

The original contents of this SAMP were prepared by the Organizational Framework RIG members and representatives from sections throughout the organization with meetings and activities facilitated by Brown and Caldwell (BC). The meetings and activities were implemented to obtain input for the sections contained within this SAMP and included the establishment of a practical process to maintain and update the SAMP over time.

1.3.2 Administration

Managing the SAMP is a dynamic process of continuous planning, implementation, evaluation, and resultant adaptation to changing conditions and lessons learned. Through the active maintenance of this SAMP document, the Asset Management Program will continue to be refined and responsive to changing priorities. The RDT will conduct annual SAMP update meetings for the purposes of holistically reviewing and updating this SAMP, with specific actions listed in Table 1-1 and depicted in Figure 1-2

Table 1-1. SAMP Administration Duties

Topic	Action	Activities	Responsible Person
Monthly Status Sessions			
	Identify changes	Identify changes to SAMP defined process, section, workflow, or activity	All Requestors
	Record and document needs	Record identified changes in the AM change log and assign to appropriate RIG Champion	Requestor – Records, AM Group – Assigns
		Evaluate identified change for inclusion in the annual update to the SAMP and elevate to RDT as appropriate for consideration	RIG Champion
	Approve changes	Approve or reject the changes for inclusion in the annual SAMP update and memorialize the decision in the change log	RDT
	Communicate change decision	Communicate the RDT decision on recommended change items to the RIGs	AM Group
Annual Review Process			
	Review SAMP and change log	Meet to review status of the SAMP	OF RIG
		Identify successes in SAMP and AM Program implementation	All RIGs
		Identify ways to address gaps in recommendations	All RIGs
		Confirm roles and responsibilities are still appropriate	OF RIG Champion
		Compile logged updates/changes/edits to the SAMP	AM Group
	Identify and document needs	Discuss newly needed improvement activities	RIG Champion
		Confirm priorities	RDT
	Update the SAMP	Review recommended changes to the SAMP	RIG Champions

Table 1-1. SAMP Administration Duties			
Topic	**Action**	**Activities**	**Responsible Person**
		Approve changes recommended to the SAMP	RDT
		Incorporate approved changes into the SAMP on an annual basis	OF RIG
	Communication	Communicate SAMP changes to all staff	AM Group

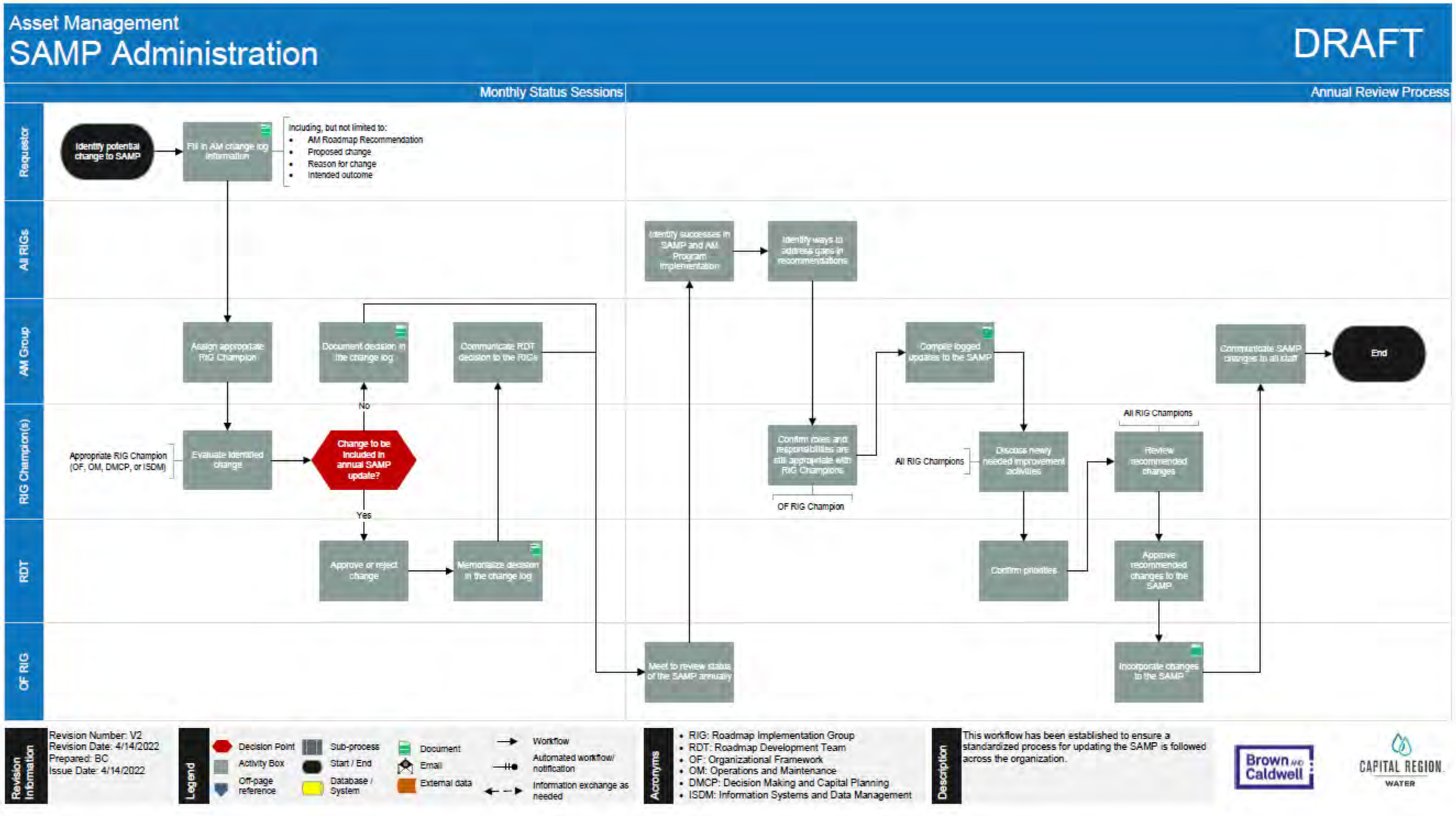


Figure 1-4. SAMP Administrative Process

1.3.3 Continuous Improvement Process

Continuous improvement is a vital part of any AM program. It is a best practice that helps utilities focus on a systematic way of making small adjustments and improvements to AM activities. Typical steps in a continuous improvement process are shown below in Figure 1-5.

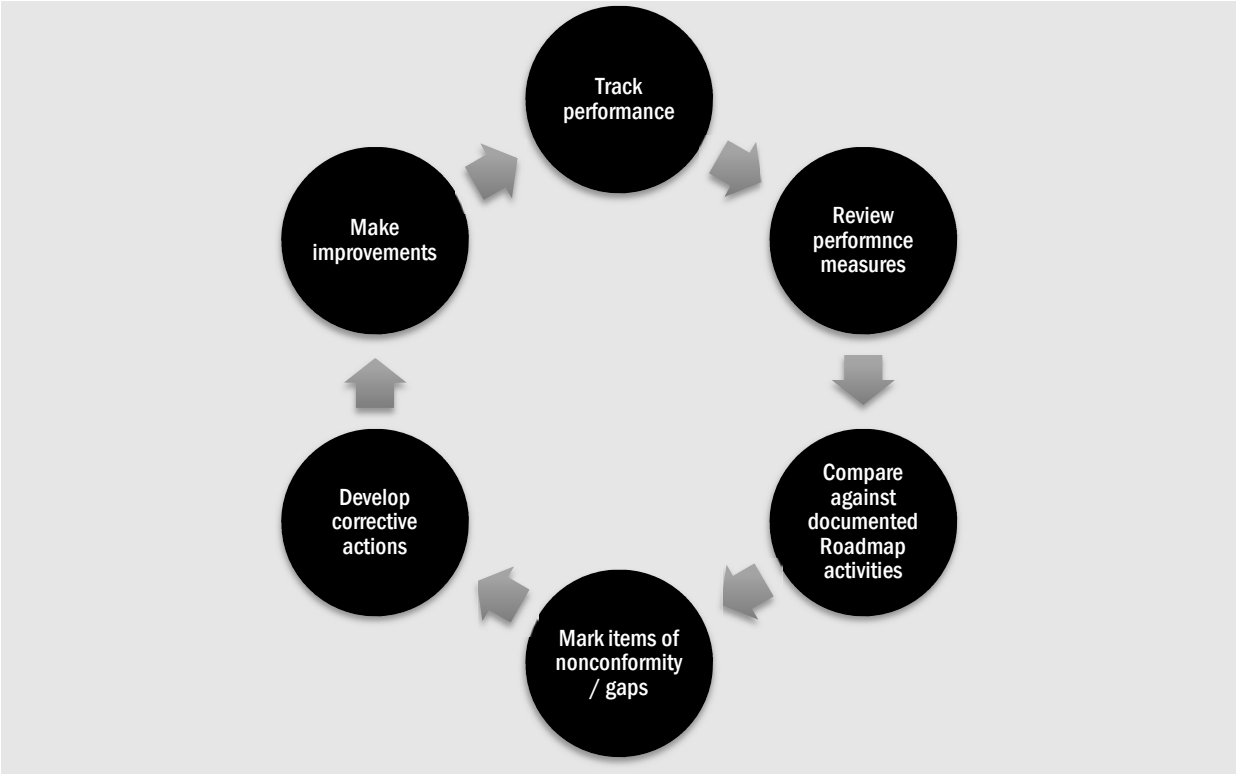


Figure 1-5. Continuous Improvement Cycle

Section 2

Organizational Framework

A successful, high-functioning asset management program depends on having a well though-out Organizational Framework. This includes having commitment from leadership; a solid understanding of organizational culture and an effective change management plan; comprehensive communications and document management procedures; levels of service and performance measures that allow the organization to track, understand and modify performance based on reliable data; and the right resources in place to make the AM program successful.

2.1 Leadership and Commitment

A vital step in building and maintaining a successful asset management program is getting support from leadership within the organization and from the governing body. To that end, it is important that the governing body understands the objectives of AM and treats it as a policy priority. CRW has defined goals/vision/mission for achievement in each AM performance area in the CRW Asset Management Roadmap. All levels of management have been trained on and understand the importance of AM and support activities to make improvements.

2.2 Culture and Change Management

Asset management is as much about culture as it is procedure. Uniformity, consistency, and repeatability, where needed, can be a challenge to achieve. As such, success relies on a greater involvement and participation of staff and the individuals serving as change agents more so than any other program. Culture change is therefore a critical element of success. Communication, training, education, and visibility by all personnel will be critical throughout implementation. Change management and communication methodologies are vital to a successful asset management program. A separate Management of Change (MoC) Plan is included in the asset management supporting documents.

2.3 Communications

A separate Communication Plan is included in the asset management supporting documents and ensures efficient use of available resources by identifying stakeholders, establishing clear messages, identifying effective communication methods, and anticipating critical issues. This Communication Plan also provides the methodology and details for communications with internal personnel during development and implementation of the AM Program.

The Plan can easily be used as a tool for communicating key messages and action items to the staff responsible for the development, implementation, and sustainability of the AM Program. The Communications Plan also includes a schedule of what communication activities are required to meet the AM Program Vision, Mission, and Goals (see Program Charter).

2.4 Document Management

Asset management topics and processes are identified, understood, evaluated, and documented. These include:

- The SAMP and the AMPs are located at: Asset Management Plans - Strategic and Tactical.

- Wastewater Collection and Conveyance System AMP, January 2020
- Water Transmission and Distribution System AMP, July 2020

Included in the AM Roadmap are identified AM gaps, and all associated elements (resources, responsibilities, reporting, etc.) have been specified.

- Asset Management Roadmap is located AM Roadmap.

Document management is a considered process that is readily understood and available throughout the organization.

- General document management practices are documented, and the file is located on the server
- General document management practices are documented, and the file is located on the intranet at DOCUMENT RECORDS LIBRARY.

2.5 Levels of Service and Performance Evaluation

A foundational part of asset management is the development of Levels of Service (LOS) that document desired performance of various programs and help inform decisions. LOS are any organizational services that a stakeholder perceives as valuable and that can be defined and measured. LOS usually relates to quality, quantity, reliability, responsiveness, environmental acceptability, and cost. LOS set expectations for managing assets and the outcomes that one strives to achieve.

The LOS developed as part of this SAMP focuses on standards for facilities and systems specifically related to asset management. Additional LOS measures that may impact the organization (such as budgeting, general workplace training, etc.) are not listed within this document since they are tracked and reported through other programs and groups in the organization.

Each of the documents and LOS listed in the following sections are assigned to one of the four aspects of the Balanced Scorecard (BSC), which is an industry standard approach to developing, managing, and tracking performance measures. BSC looks at organizational service and performance through four components: stakeholder, internal processes, employee learning and growth, and financial. Maintaining the four dimensions of the BSC provides a broader industry-accepted perspective and is consistent with the LOS and measures listed herein.

Definitions

Level of Service:

The description of the service output for a particular activity or service area against which performance is measured. (NAMS, 2007 - Developing Levels of Service and Performance Measures)

Key performance indicator:

Measurable value that demonstrates utility effectiveness in achieving goals and objectives.

Performance measure:

A qualitative or quantitative measure used to measure actual performance against a standard or other target.

Used to indicate how the organization is doing in relation to delivering levels of service.

Metric:

The numbers or values that can be summed and/or averaged, such as dollars, distances, durations, and temperatures, etc.

Performance Target:

A specific quantifiable target for performance, used in reference to a performance measure.

Considerations

- Consistent with business goals and objectives
- Clear and understandable
- Rewards the right behaviors: efficiency and effectiveness
- Forward-looking
- Follows SMART:

Simple -- Measurable -- Accurate, Achievable -- Responsive, Realistic, Relevant -- Targeted, Timebound

2.5.1 Information Sources

Table 2-1 lists the regulations, policies and plans that establish the LOS expectations and subsequent rules for managing assets

Table 2-1. Regulations, Polices and Plans Impacting Asset Management

Regulation/Policy/Plan	Description	BSC Dimension *
Strategic Business and Operating Plans	Sets the strategic objectives for the next few fiscal years	P
Consulting Engineer's Annual Report (CEAR)	Annual reports for CRW's water and wastewater system as required by a Trust Indenture to provide advice and recommendations as to the proper maintenance, repair, and operation during the fiscal year and estimate the amounts of money that should be expended.	P/F
Clean Water Act	Federal legislation defining conveyance and treatment standards	S
Department of Environmental Protection, Water Supply Manual 383-2125-108	State legislation defining design standards/requirements for Community System Design standards	S
CSO Long Term Control Plan (LTCP)	LTCPs are required under the Environmental Protection Agency's combined sewer overflow (CSO) Control Policy and is part of the CSO control strategy to reduce the frequency, duration, and intensity of CSO events	S
NPDES permits- Wastewater Discharge and Stormwater (MS4)	Permits for plants include performance criteria, discharge limits, and stormwater program requirements	P/S
Consent decree	Federal mandate relating to collection systems and pump station activities	S
Civil Service Rules	Personnel Rules for utility	E
CMOM master plan	Planning document for addressing Capacity, Maintenance, Operating and Management concerns and system issues; sets stage for some capital program requirements	P
Utility Charter	Defines the need and creation of the utility	S
Air permits (Title V)	State legislation defining air quality standards	S
FEMA – flood plain regulations	Defines LOS requirements for areas within the 100-year flood plain	S
Corps of Engineers – agreement	Defines level of service requirements for flood protection	P/S
Collective Bargaining Agreement	Labor agreements with various trade unions	E
Tri-County Regional Plan	Regional plan developed by Tri-County Regional Planning Commission (TCRPC)	S
AM Charter	Sets the strategic goals/objectives of the Asset Management program	P
Health & Safety Manual	Defines safety, environment, and health standards for staff	P
Annual Operating Budget	A zero-based budget that defines expected expenditures for the fiscal year	F

Table 2-1. Regulations, Polices and Plans Impacting Asset Management		
Regulation/Policy/Plan	Description	BSC Dimension *
GASB 34	Governmental standards that define asset recognition and accounting requirements	F
Rate Study	Cost of service and rate differential study for financial master planning	S
Training program	Development programs for apprentice and leadership personnel aimed at equipping staff with necessary skills to be successful	E
Standard Operating Procedures	Train personnel on the latest operating procedures handling water and wastewater assets.	E
Customer satisfaction survey	Performance and opportunities for improvement feedback from customers receiving service	S
Water Quality Report / Consumer Confidence Report	Water distribution system performance and opportunities for improvement feedback from customers receiving service	S
American Water Infrastructure Act	Risk and Resilience assessment and update emergency response plan	S
Lead and Copper Rule	Replace lead service lines to meet the new lead and copper rule. Under the new rule at least 3 percent of lead service lines must be replaced each year when 10 percent of sampling results are above 15 ppb.	S
AWTF Emergency shutdown plan	Emergency Shutdown Procedures for Advanced Wastewater Treatment Facility and Front Street, Spring Creek, and City Island Pump Stations.	S
Spill Prevention Contingency and Control Plan-	Spill prevention and response plan within the WTP and WWTP.	S
Water, Wastewater and Stormwater Master Plans	Planning documents for addressing water, wastewater, and stormwater planning and sets stage for some capital program requirements	P/S
Chapter 94 Municipal Wasteload Management Report	PADEP Ch. 94 Report Municipal Wasteload Management Annual Report to fulfill regulatory reporting requirements	P/S
Nine Minimum Control Plan (NMC)	Plan that outlines compliance with National COS Control Policy	P/S
Operation & Maintenance Manual (OMM)	CRW's plan describing current O&M practices for employees	P
Capital Improvement Plan	Summary of identified capital projects including general schedule, funding required, and scope of task	F
General Management Policy - Capital Assets	Defines when capitalization is appropriate, depreciation cycle, etc.	F
Purchasing ordinance	Rules and regulations related to the procurement process	F

** Balanced scorecard dimensions: E→ employee learning and growth; F→ financial; P→ internal processes; S→ stakeholders*

2.5.2 Levels of Service and Performance Measures

The LOS and corresponding performance measures were developed and agreed upon by RDT. They are listed below and are designed to be tracked and reported at an organizational level. Facility- and system-specific LOS and the related performance measures, which are available in the AMPs, roll up to the overall LOS.

Table 2.2 lists the LOS and related performance measures that will be tracked at the organizational level.

Table 2-2. Levels of Service aligned with Strategic Goals					
CRW Strategic Goal	LOS Description	Performance Measure	Description	Reporting frequency	Target*
Public Health and the Environment	Achieve or exceed all environmental and public health requirements in our drinking water, wastewater, and stormwater services	Violations caused by asset failures	Number of violations caused by asset failures / total number of violations	Monthly	TBD
		Near Misses (vertical assets)	Number of regulatory parameters within upper/lower warning limit of permit (vertical assets only)	Monthly	TBD
		Monitoring and Reporting Compliance	Number of reporting activities completed by due date / total reporting activities scheduled	Monthly	TBD
		Monitoring and Reporting Compliance	Number of sampling data points missed	Monthly	TBD
Infrastructure Stability	Operate and maintain assets in an efficient, sustainable, and resilient way	Work Order Compliance	Number work orders completed by the due date / total work orders due for a given period	Monthly	TBD
		Equipment Failures/Breakdowns	Number of equipment failures or breakdowns in a period	Monthly	TBD
		Workorder Backlog	Number of weeks of planned maintenance work (by craft) available for assignment to staff	Monthly	TBD
		Planned Maintenance vs. Corrective Maintenance	Percentage of planned maintenance vs corrective maintenance	Monthly	TBD
	Undertake prudent and affordable renewal and replacement projects targeted for the long-term viability of the CRW assets	Asset Renewal and Replacement Rate	Actual expenditures (or total amount of funds reserved for R/R for assets) / total present worth of R/R for assets	Monthly	TBD
		CIP Spending	Total annualized capital spending / approved CIP budget	Monthly	TBD
		Operations Spending	Total annualized operations spending / approved operations budget	Monthly	TBD
Customers and Stakeholders	Provide financial resources for CRW customers that qualify for assistance	Customer Assistance	Number of customers receiving relief from the Customer Assistance Program (CAP)/month	Monthly	TBD
		Shut-off for Non-payment	Percentage of customer accounts shutoff for non-payment/month	Monthly	TBD
		CAP Assistance vs. Total Debt	Dollar value of the assistance relief as it relates to total debt (internal and external assistance dollars)	Monthly	TBD
	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community	Stakeholder Interactions	Number of interactions (community outreach and education) with defined stakeholders / total number of planned interactions	Monthly	TBD
		Service Request Completion	Average time to correct all CRW-related service issues	Monthly	TBD
		Media Stories	Number of CRW driven stories/posts (traditional and social media) related to the utility during the reporting period	Monthly	TBD

Table 2-2. Levels of Service aligned with Strategic Goals					
CRW Strategic Goal	LOS Description	Performance Measure	Description	Reporting frequency	Target*
		Customer Satisfaction	Number of Technical Service Complaints per 1000 Customer Accounts	Monthly	TBD
		Number of Insurance Claims	Number of insurance claims compared to industry average	Monthly	TBD
		Severity of Insurance Claims	Severity (financial) of insurance claims compared to industry average	Monthly	TBD
Workforce	Develop and strive for a highly productive workforce through safe work practices, training, and growth opportunities	Training Compliance	Number of employees that completed each required training by the deadline / number of employees required to complete the training	Monthly	TBD
		Safety Metrics	Safety metrics include incidents, worker comp claims, and days off due to work-related issues / days worked	Monthly	TBD
		Succession Planning	Number key positions with a formal succession plan/total key positions	Monthly	TBD
	Attract staff that are representative of CRW's service area and provide a work environment that promotes growth, equity, and stability	Vacant Positions	Number of vacant positions, by job category / total number of positions	Monthly	TBD
		Employee Diversity	Ethnic and gender diversity percentages for the utility (also includes employees residing within service area)	Monthly	TBD
		Employee Turnover Rate	Percentage of employees that leave the utility either voluntary or involuntary during the reporting period	Monthly	TBD
		Time to Hire	Average number of days from decision to hire until new employee is at work	Monthly	TBD
Efficient Use of Resources	Execute the mission of CRW using risk informed decisions that provide best value to our customers, stakeholders, and organization	Critical Assets with high-risk value (future)	Dollar value of critical assets with high-risk score / total dollar value of critical assets	Monthly	Future measure
		Critical asset with high-risk score	Number of critical assets with high-risk score / total number of critical assets	Monthly	TBD

**Target reflects annual value Performance Evaluation*

Performance measures are specific indicators used to demonstrate how an organization is doing. They are written in a clear, easy to understand language so that they may be shared with a wide audience – both internally and externally. Each division is responsible for accurately collecting, analyzing, and reporting facility and system data required to properly calculate performance measures identified in this document and in the timeframe determined by the RDT. While some of these metrics are not currently being tracked, the information should be collected where possible in anticipation of greater measure reporting and communication.

The data associated with a performance measure is typically collected through various systems and groups and stored in an asset management system for trending and reporting. **Appendix A** includes a summary of the measure definitions and data requirements for tracking LOS and performance measures

2.5.3 Regulatory Reporting

Methods (data collection, reporting) to comply with regulatory requirements are established and documented in the organization. Regulatory requirements and pending requirements are continuously monitored and communicated.

2.6 Resource Management

Adequate staff, equipment and tools are available to develop and sustain an AM program (includes development, training, monitoring, controlling, reporting, auditing, and updating and improving the AM program).

2.6.1 Resources

The primary staff involved in asset management along with a brief description of their roles are shown in Figure 2-1, and in Table 2.3.

Figure 2-1. Asset Management organizational roles.

SAMP implementation responsibilities will fall to the staff/groups referred to in Figure 2-1. Specific responsibilities and required actions are listed in Table 2.3.

Table 2-3. SAMP Responsibilities by Role

CRW SAMP Activities (Year 1) Starting January 1, 2023	CEO	RDT	AM	RIG	Div	Quarter 1	Quarter 2	Quarter 3	Quarter 4
	Role (solid = Primary; hatched = support)								
Guide the development of the AM program	s	s	AM	s		a	a	a	a
Provide resources for AM program and ensure staff have the training required to understand their assigned roles	CEO	s	s				l	m	
Communicate progress to Board as required	CEO		s				l		
Review and provide input on the communications materials to CRW staff related to AM program		RDT	s	s	SI		m		
Develop and institute AM communication and management of change plans		s	s	OF RIG		m			
Serve as a liaison between the RDT, RIGs, staff, and other CRW departments and outside consultant services			AM			a	a	a	a
Participate in RDT meetings to oversee implementation of the Roadmap Implementation Plan		RDT	s				m		
Approve criteria that impacts AM Program at the strategic level (i.e., goals, risk, consequence and likelihood of failure criteria, LOS, etc.)		RDT	s	s			m		
Monitor and measure the performance of the AM program as it is implemented, and revise performance measures as needed		s	AM	s		m			
Participate in AM training	s	s	AM	s	s	a	a	a	a
Provide support to workflow process			s		SS	a	a	a	a
Provide support to enterprise systems			s		IT	a	l	a	a
Provide CMMS and GIS application support and subject matter expertise			s		GIS and AM	a	l	a	a
Identify issues during AM implementation and provide feedback to supervisors. Supervisory staff will provide a list of identified issues to RIG/AM for revision consideration. *†		s	s	s	All	m	a	a	a
Make annual revisions to the SAMP as required.*		RDT	s	s			h		

*Follow procedures noted in Table 1-1

†Follow procedures in the AM Communications Plan

LEGEND

Approximate Level of Effort

a	As needed support	*Partipcipation may be needed periodically (as needed), and should include pre-notice for planning and scheduling the assistance*
l	Low LOE	*Minimal participation needed in scheduled meetings (approximately 1-3 a period)*
m	Medium LOE	*Participation needed in scheduled meetings, and may require work outside of the working sessions (approximately 1-3 a period)*
h	High LOE	*Participation needed in scheduled meetings, and requires significant work outside of the working sessions (approximately 3-5 a period)*

Roles

CEO	*Chief Executive Officer*
RDT	*AM Roadmap Development Team*
AM	*Asset Manager/Team*
DMCP, ISDM, OF, OM	*AM Roadmap Implementation Groups*
Divisional Engagement	
SS	*Shared Services*
Fin	*Finance*
Eng	*Engineering*
Op	*Operations*
SI	*Strategic Initiatives*

2.6.2 Training

Staff require introductory and ongoing training so that they can be successful in their roles in executing their work. The training required to help advance the asset management program is summarized in Table 2-4.

Table 2-4. Summary of Training Needs

Topic	Training	Description	Recipients	Frequency
Asset Management	AM awareness training	A systematic approach for educating and motivating the work force to generate both direct and indirect value for the AM program has been established. The gap between needed AM competencies and staff capability are well understood at all levels of the organization and there is a plan to fill these gaps.	All	Initial, new hire
	Business Case Justification and Evaluation	Introductory training on monetized risk, Consequence of Failure, risk of failure and benefit scoring.	Engineering and Operations	Annually
	Systems knowledge-CMMS GIS SCADA Customer Billing Accounting	Understand how the utility's major systems are used to support the asset management program and overall utility mission	All	Annually
	Performance measures	Understand how to view and analyze the available LOS and performance measures	All	Annually
Organizational and Leadership	Change management	Periodic review of Management of Change Plan	RDT and RIG	Annually
	Communications	Periodic review of Communication Plan	Engineering, operations and RDT	Annually
Job Specific	Training development plan based on job classification	• Health and Safety • Technical Licenses and Certifications • Job Specific Technical • Emergency Response	All	Per plan

2.7 Business Continuity

CRW has evaluated threats to its operations, the community, and the environment that may impact the organization. CRW has a clear understanding of prevention activities and procedures to mitigate impacts to the organization and has documented them in a business continuity plan that covers staffing, systems and technology, and procedures related to communications, operations and financial decision making.

2.8 Continuous Improvement

People	Process	Technology
• Revist staffing assignments on an annual basis as part of the Asset Management Program review process.		

Section 3

Information Systems and Data Management

This section defines the high-level information associated with asset management-related data, tools, and systems. This includes the assets that comprise the facilities and systems, and the general hierarchy of managed assets that should be followed. Detailed asset inventories are managed and contained within the computerized maintenance management system (CMMS) and specific critical asset inventories are documented within the AMPs.

3.1 Overview

Organizations use a combination of systems, tools, and data to support day-to-day operations. The data collected are valuable repositories of information and used to support elements of the AM program. Table 3-1 shows the relationship of the AM categories with the enterprise systems, tools, and data along with the specific systems, tools, and data in use.

Table 3-1. Asset Management Systems, Tools, and Data

AM Element	Systems	Tools	Data
Organizational Framework			
Communications	• Everbridge Emergency Notification system	• Emails • Messages • Calls	• Incident log
Culture and Change Management	• SharePoint • ArcGIS Survey 123	• AM Change Management Plan • AM Communications Plan	• Organizational structure • Emails • Feedback surveys
Document Management	• CRW File Servers • Munilink • Munis • Teams • SharePoint	• Water and Wastewater Regulations • SOPs • Purchase Orders • Customer billing • Reporting/Dashboards	• Asset attributes • Operation costs • Regulations • Operational procedures • Accounting • Customer billing
Leadership and Commitment	• SharePoint	• AM Communications Plan • CRW Strategic Plan	• Roles and communication strategies

Table 3-1. Asset Management Systems, Tools, and Data

AM Element	Systems	Tools	Data
Levels of Service and Performance Evaluation	• CMMS-Cityworks • GIS • Customer Information System-Muni-link • Finance • Regulatory/Permitting	• LOS • CIP • PowerBI Dashboards • Monthly Reports	• Asset Attributes • Condition Data • Maintenance History • Annual operating budget • Water and Wastewater regulations • Regulatory data
Resource Management	• HR- Inova • Timekeeping-Inova	• Employee Development and CRW Training program	• Employee time • Employee training
Business Continuity	• NA	• Strategic Business and Operating Plans • Customer Satisfaction Survey	• Technology, staff, and operational changes • Communication with stakeholders
Information Systems and Data Management			
Inventory and Asset Profile	• CMMS-Cityworks • GIS • CIS-Muni-link • CCTV-WinCan • Fleet Tracking-Verizon Network Fleet • Document Management System	• Data collection Tools • As- built • Reporting/Dashboards	• Asset Attributes • Asset Classes • Asset Hierarchy • Asset Naming • Condition Data • Existing document repository including file plan
Decision Making and Capital Planning			
Risk Management	• CMMS- Cityworks • GIS • Operation Insights- Module within Cityworks	• High risk assets • Overflow reporting • Real Time Controls	• Consequence of Failure (COF) • Likelihood of Failure (LOF) • Asset Attributes • Condition Data • Maintenance History
CIP Development and Prioritization	• Rate Models-Arcadis • Hydraulic Models-WaterGEMS • SCADA-WIMS • CIS-Muni-link	• Business Case Project Justification • Prioritization • Replacement Planning Model • 10-year CIP • Rate Study • Condition Assessment	• Levels of Service (LOS) • Condition Data • Useful Life • Refurbishment Schemes • R&R Needs • Capacity info • Registry of assets requiring R&R and associated costs • CIP project by priority and cost

Table 3-1. Asset Management Systems, Tools, and Data			
AM Element	Systems	Tools	Data
Design and Construction	• CMMS • GIS • Finance	• CIP/Budgeting • As-builts • Water design manual-specifications and details • Sewer design manual-specifications and details	• Install Date • Replacement Cost • Asset Attributes • Maintenance History/Costs • R&R Costs • As built
Funding	• Assetic Predictor (included in AMPs, but not a system that CRW will use going forward) • Rate Studies • Finance	• Replacement Planning Model	• Budget • CIP
Operations and Maintenance			
Operations and Maintenance Strategies	• CMMS • GIS • Finance • SCADA • Inventory • CCTV	• Condition Assessment module tools • Reporting/Dashboards • CIP/Budgeting	• Asset Attributes • Condition Data • Maintenance History/Costs • O&M Manuals • PM Schedules • Job Plans • Labor Rates • Failure Coding
Inventory / Warehouse	• Inventory • Finance • CMMS	• Bar code / QR scanner	• Materials inventory
Optimization	• CMMS • GIS • SCADA	• Data Collection Tools	• Condition Data • Asset Attributes • PCR Codes • Condition Assessment Ratings

3.2 Systems

Various information systems are used to gather, manage, and maintain asset management data. All facilities staff will use the systems indicated in Table 3-2 for their intended use in the management of assets. Organizationally the use of core database repositories is key to data governance in support of collaboration and analysis. In cases where primary separate spreadsheets are used as working files for alteration, transformation and producing outputs, discovered edits of principal data necessitate preservation for updating the repository. Retaining edits of core data in working files in lieu of the defined information management systems will misrepresent critical end products for all.

Table 3-2. Enterprise Information Systems			
Type	**Product**	**Links to other systems**	**Description**
CMMS	Cityworks	GIS Mobile IPS app Wincan – in the future	Primary system used for work management. It also contains asset information and is the system of record for all managed facility assets.
GIS	ESRI ArcGIS Platform (ArcGIS Enterprise and ArcGIS Online	Innovyze InfoAsset Planner Cityworks	• System of record for all managed distributed system assets • Assets synced with IPS using Geo Administrator tool • Provides map-based applications as primary interface for viewing linear asset data
CIS	Muni-link	NONE	Billing and account information
Document Management System	Microsoft SharePoint	Office365	File plans for managing documents through their life-cycle in accordance with the Municipal Records Manual.
SCADA	WIMS / Hach	NONE	WIMS pulls data to produce report outputs
Hydraulic Models	WaterGEMS	NONE	
Finance	Munis- Accounting System Munilink – Customer Billing	API to interface in future	Other products = interfaces for BoA (Pcard), CS Fixed Assets (does not interface)
Rate Models		NONE	CRW provided inputs from financial systems with consultation
Inventory	Material and Equipment Leaf in Cityworks Granger service for vending machines (PPE) readouts	NONE	Parts and materials associated with work orders are documented and tracked in the CMMS.
HR	Paycor/Inova	NONE	
Timekeeping	Paycor/Inova	NONE	
Legal	Part of Document Mgmt. Sys	NONE	Contracts MOU/Legal Documents
Fleet Management	Cityworks for maintenance and inv Verizon Network Fleet for location tracking	GIS	Used to track fleet assets and related maintenance
Regulatory/Permitting	WIMS Document Mgmt. Sys – EPA/PADEP portals	NONE	Reports. WIMS used for Water Quality reporting, will be used for Wastewater in future

3.3 Tools

All facilities staff will use the tools indicated in Table 3-3 for their intended use in the collection and analysis of asset data.

- User-friendly methods exist for entering and retrieving asset information for all users. Users have a clear understanding of which systems to use for data management.

- Data collection tools are readily available and used to streamline the process of data input and improve accuracy of information in the systems and databases.

Table 3-3. Enterprise Tools

Type	Product	Description
Data Collection Tools	• Hardware-Laptops • Tablets • GIS, • Data Prep Tools (prepackaged scripts) • Cityworks • Excel • SQL	Cityworks Administrator executes Data Prep Tools to create feature classes for Cityworks Operational Insights. GIS Manager publishes the new GIS service(s) to Cityworks upon completion of Data Prep Tools.
As-builts	• CAD files • PDFs	As-builts of existing facilities are saved as CAD files or pdfs
Criticality	• Cityworks Operational Insights	Pipelines are scored based on proximity to Critical Customers, Apartment Buildings, Railroads, and natural waterways.
Risk Matrix	• Cityworks Operational Insights	Operational Insights provides organizations with a means to identify and assess high-risk assets and to establish maintenance strategies to increase their lifespan. With its tie to ArcGIS, the results can be displayed on a map so that capital improvement funding can be prioritized and applied spatially and accurately
CIP/Budgeting	• Business Case Project Justification • Prioritization • 10-year CIP • Rate Study	Projects are prioritized by a triple bottom line approach for high-risk assets. Social, Financial and Environmental consequences of an asset's failure can be expressed and quantified applying the TBL approach.
Business Case Project Justification	• CIP	
Prioritization	• Assetic Predictor • Cityworks operational Insights • Innovyze – InfoAsset Planner	Once assets have been assigned a priority level from 1-5, the next step is to determine the highest priority assets within each priority zone. This is accomplished by reviewing relative BRE scores for each asset in each zone. Assets with a higher BRE within a zone are given priority
Replacement Planning Model	• GIS • Cityworks • Innovyze – InfoAsset Planner	
LOS	• AWWA Benchmarking Utility Survey	
Demand Forecasting	• CIP	
Condition Assessment	• CMMS • GIS • CCTV	
Dashboards	• MS Power BI	Power BI is used for visualization of R&R reports

3.4 Data

3.4.1 Asset Definition

A working definition of an asset was developed (Figure 3-1). It is intended to describe the criteria under which an item would be considered an asset. If any one of the three criteria below is met, then the item is considered an asset.

Examples of assets would include dams, intakes, equipment, vehicles, structures, tanks, distribution piping, storage tanks, sewers, green infrastructure, instrumentation, technology, and information, etc. Assets may include an assembly of components that are operated, maintained, and managed together.

Linear assets could be split into separate assets when a) changes in materials, size, or install date for point repairs exist or b) physical break in linear feature caused by a manhole, fitting, valve, pump station, meter, or treatment plant exist. Lampholes, covers and bends do not split a linear asset into multiple assets.

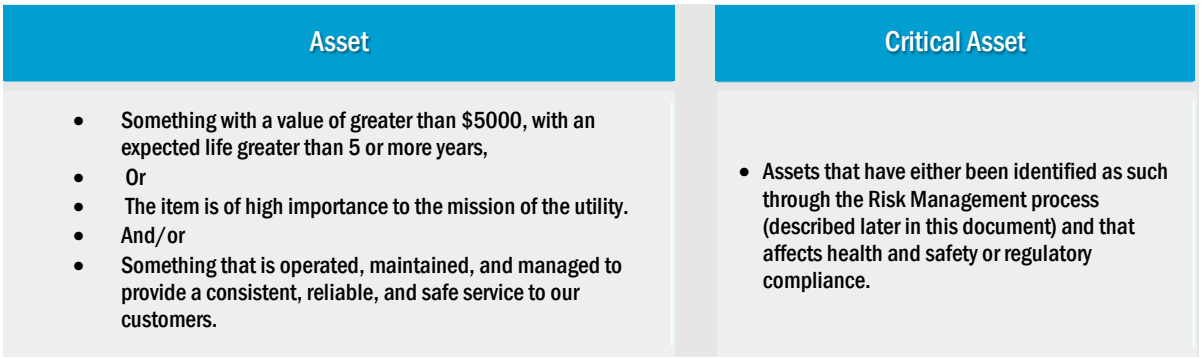


Figure 3-1. Asset Definitions.

3.4.2 Asset Inventory

An asset inventory has been developed and is managed in the GIS in conjunction with the Cityworks, CMMS for both vertical and horizontal assets. Asset inventory information is comprised of different characteristics including the attributes describing the assets, the hierarchy in which assets are organized, and naming conventions used to identify and link data to assets. The inventory is vital to a successful AM program.

Figure 3-2 shows how the different asset characteristics relate to create a complete picture of the CRW asset inventory. Each of these components is described in the following sections.

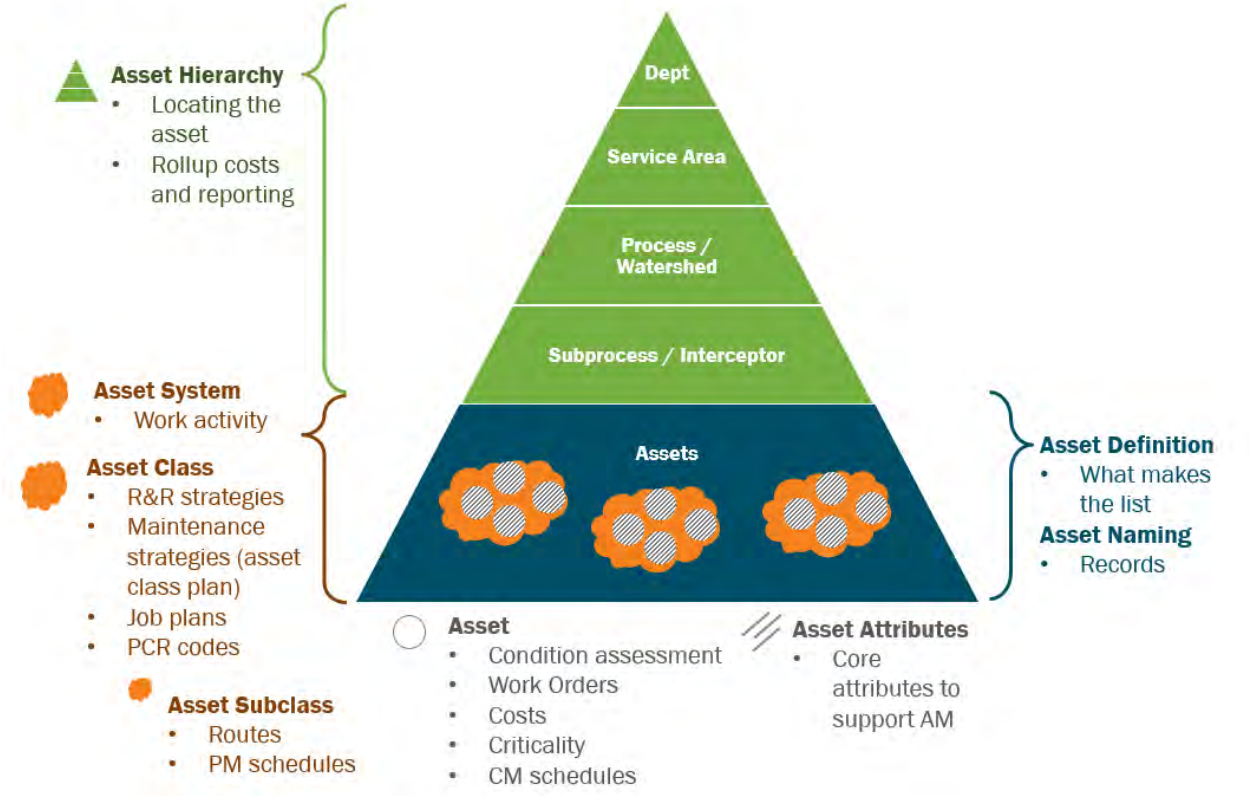


Figure 3-2 Asset Inventory Components

3.4.3 Required Asset Data

Assets are documented with a set of attributes that describe what is known about the asset. These attributes vary between asset classes: some attributes may only apply to one asset type, while other "core attributes" that represent the essential details apply to all asset types in support of the asset management program. The core attributes fall into four categories:

- Core attributes – attributes to be collected for all assets
- Physical attributes – attributes to be collected for specific types of assets which will vary by asset class which will be further defined in the TAMPs
- Financial attributes – attributes relating to the cost of the asset and warranty information
- Asset Management attributes – attributes pertaining to asset management principles such as condition and risk
- The list of required asset attributes is included in **Appendix B**.

Templates are to be used for importing equipment, spare parts, and job plan data into Cityworks. Contractors are required to deliver completed asset information in a compatible format prior to final payment. This will allow for all new equipment to be brought into Cityworks with the proper information and job plans.

3.4.4 Asset Classes

The separation of assets into distinct asset classes is an essential component of managing the asset inventory as it defines the level of information detail to be collected for each type of asset and forms the basis for remaining useful life analysis and R&R planning.

3.4.4.1 Vertical Assets

Asset classes are identified for all assets, and definitions of the class have been documented. Table 3-4 includes a list of vertical asset classes, which are stored as "object classes", or stand-alone tables in the GIS geodatabase.

Table 3-4. Asset Classes – Vertical Water

Actuator	Heat Trace	Security
Drive Belts	Instrumentation	Structure
Building General	Mechanical	Transmitter
Building	Mixer	Tank
Control Panel	Motor	Valve
Drives	Pneumatic	Ventilation
Electrical	Pipe	Vehicles
Facilities	Pump	VFD
Feeder	Scale	Weir Flume
Filter	Screen	

Table 3-5. Asset Classes – Vertical Wastewater

Actuator	Heat Trace	Screen
Belt	Instrumentation	Solenoid
Building General	Lab Equipment	Structure
Buildings	Laboratory Equipment	Tank
Control Panel	Motor	Transmitter
Electrical	Mixer	Vaporizer
Feeder	Pipe	Valve
Filter	Pneumatic	Vehicles
Gearbox	Pump	VFD
Generator	Sampler	Weir Flume
HVAC	Safety	
Heat Exchanger	Scale	

3.4.4.2 Horizontal Assets

CRW's horizontal assets are stored as GIS "feature classes" in the GIS geodatabase. Table 3-6 lists the horizontal asset classes.

Table 3-6. Horizontal Asset Classes				
System	Water	Sanitary	Storm	Combined
Feature Class	Booster Pump Fitting Hydrant Hydrant Valves Lateral Lateral Valves Manhole Meter Meter Pit Pipe Release Valves Tank Valves Valve Operator	Cleanout Junction Lateral Manhole Pipe Pump Station Valve	Cleanout Inlet Junction Manhole Outfall Pipe Pump Station Swale Valve	Outfall CSO Chamber

3.4.5 Hierarchy

Standardizing the asset hierarchy provides order to the asset registry, and a means by which metrics can be rolled up for reporting. Typically, there are two hierarchies housed in a CMMS: (1) the location hierarchy and (2) the equipment class hierarchy.

- The location hierarchy defines where a piece of equipment lives within the organization's universe:
  - An example is the "walk-to" location that is defined by where the asset is physically located, such as a water treatment plant, headworks building 1, floor 2, or room 1.
  - Another way to create a location hierarchy is to use the processes to define the location, such as water treatment plant, raw water system, or influent pumps.
- The equipment class hierarchy defines where the asset lives within a class of assets:
  - A well-defined equipment class hierarchy allows PMs to be written at a higher hierarchy level, and CMs to be written at lower level.
    - Assigning PM to a higher level allows planners to understand which components (i.e., assets) have upcoming PM tasks scheduled that the maintenance staff can perform during unscheduled down time—making the work more efficient.
    - Assigning CM to the lowest level, failure modes can be identified and analyzed, which can help set the asset maintenance strategy.
  - An example class hierarchy is pumps → submersible pumps → influent pump 1.

ISO 14224 defines both the location and equipment class hierarchy for reliability-centered maintenance for petrochemical operations. Table 3-7 identifies the levels of the ISO 14224 hierarchy, shows the split between the location and equipment class information, and provides examples of the levels in the ISO 14224 hierarchy.

Table 3-7. ISO 14224 Hierarchy Level Definitions			
Category	Level	Name	Definition
Use location data		Industry	Type of main industry
		Business category	Type of business or processing stream
		Installation	Type of facility
		Plant or unit	Type of plant or unit
		Section or system	Main section/system of the plant
Equipment sub-division		Equipment class/unit	Class of similar equipment; each equipment class contains comparable equipment units
		Sub-unit	A sub-system necessary for the equipment unit to function
		Component or maintainable item [a]	The group of parts of the equipment unit that are commonly maintained (i.e., repaired or restored) as a whole
		Part [b]	A single piece of equipment

a. For some types of equipment, there might not be a maintainable item. For example, if the equipment class is piping, there may be no maintainable item, but the part can be "elbow."

b. While this level can be useful in some cases, it is considered optional in this standard.

Facility Hierarchy

CRW uses slightly different hierarchies for the Advanced Water Treatment Facility (AWTF) and Water Services Center (WSC) facilities, but they both contain a process/subprocess level (though with minimally different names for the levels). The hierarchies that have been developed are adequate for each group. Table 3-8 shows the levels for the AWTF and WSC.

Table 3-8. Facility Hierarchy Levels				
Level	Water	Description	Wastewater	Description
1	Upper-Level Process	Main water process (ex: Raw Water, Treatment, etc.)	Wastewater Section	Area within Wastewater (ex: Treatment, Collection, etc.)
2	Sublevel Process	Subprocess (ex: Intake, Flow Controls etc.)	Process	Process area for treatment or name of facility for pumping stations (ex: Prelim Process, Spring Creek, etc.)
3	Asset System	Asset System – can be a facility or building/area within the facility (ex: Riverfront Pump Station, Pipe Gallery, etc.)	Subprocess	Treatment subprocess – not used for other areas (ex: Grit Removal, Disinfection, etc.)

The following standard location hierarchy for facilities has been established. Figure 3-3 shows a graphic representation of the AWTF hierarchy.

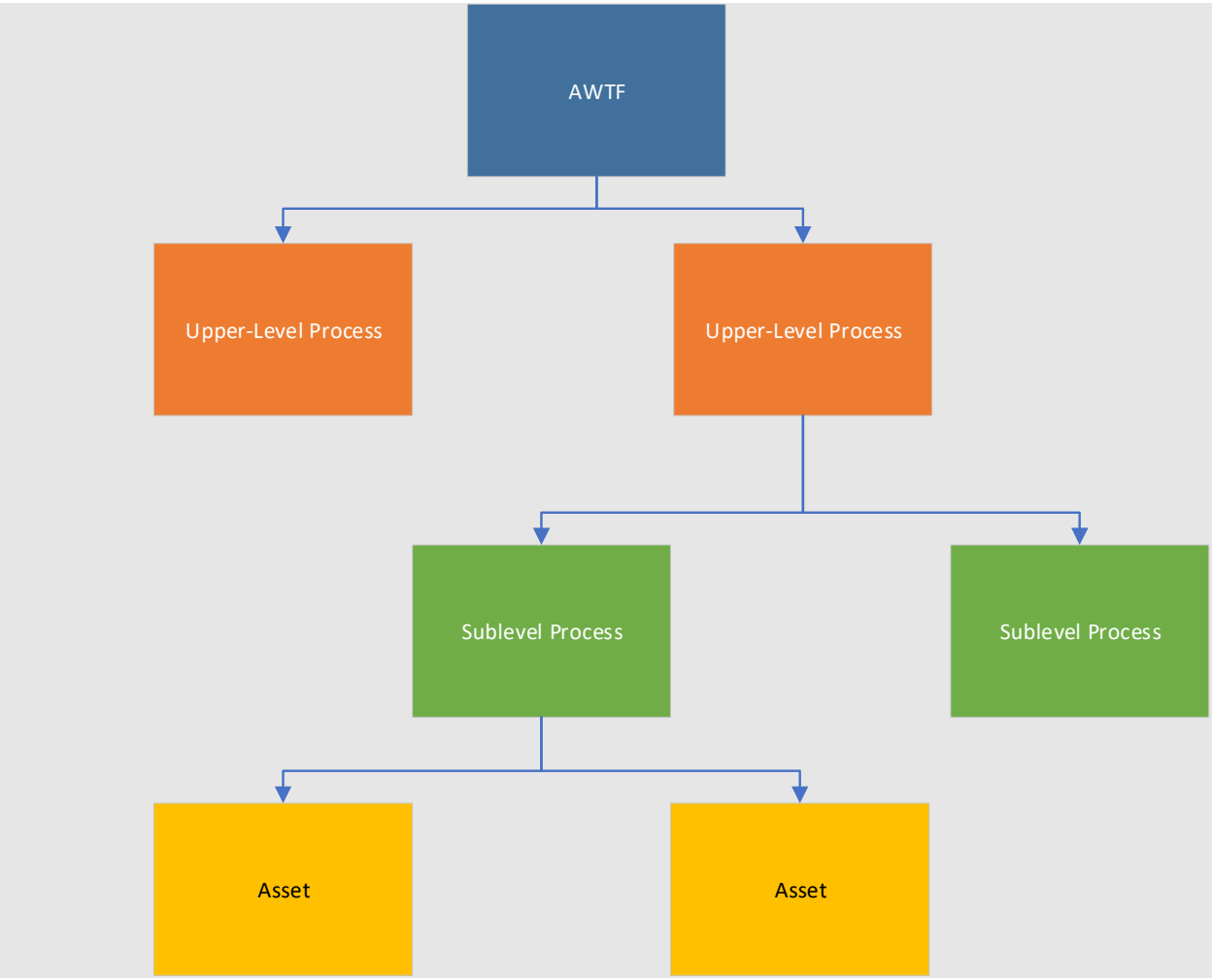


Figure 3-3. AWTF Hierarchy

Figure 3-4 shows a graphic representation of the WSC hierarchy.

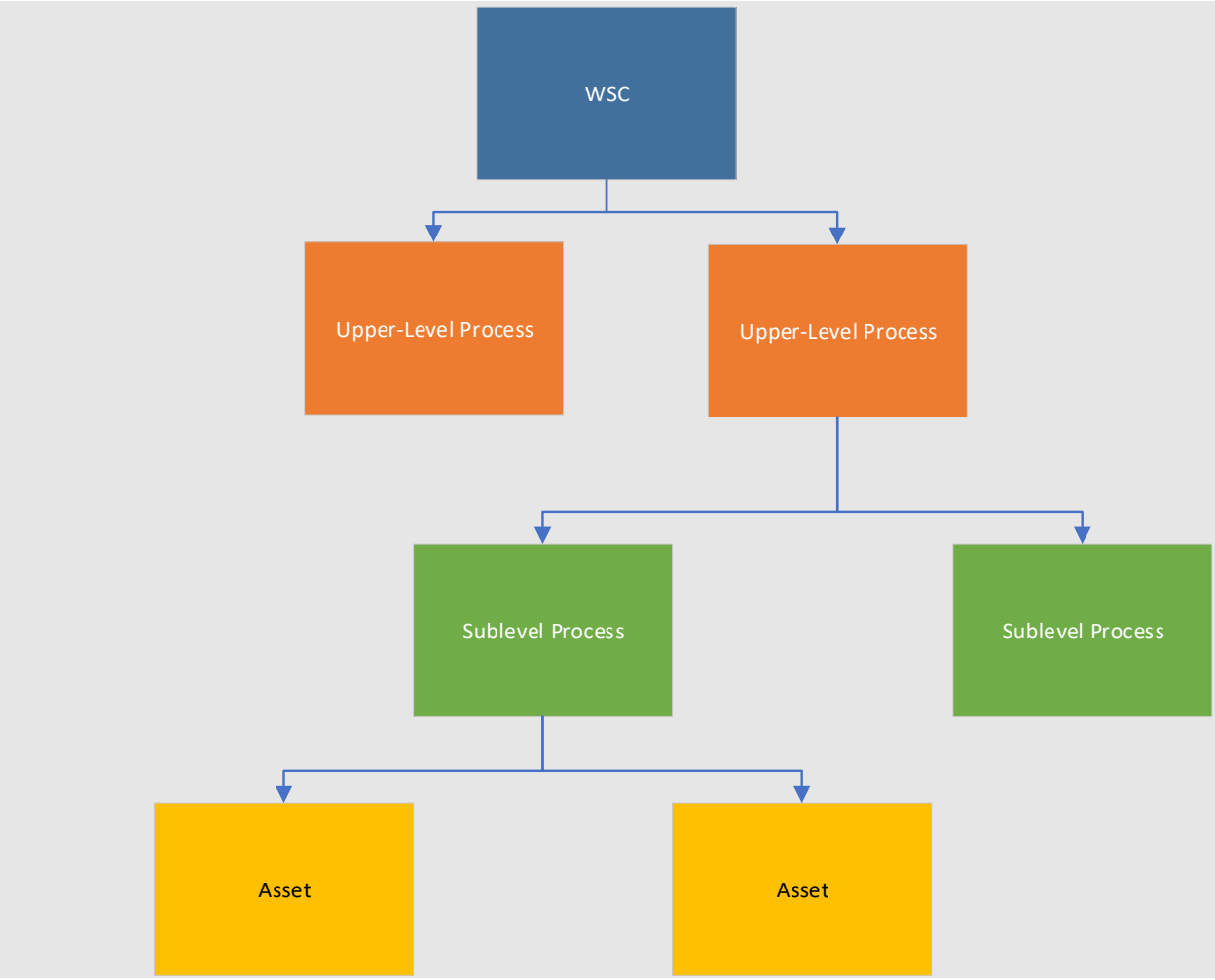


Figure 3-4. WSC Hierarchy

Distributed System Hierarchy

The horizontal assets do not track a location hierarchy via asset attributes, but the position of an asset in the system (watershed, interceptor, basin, etc.) can be determined through spatial queries in GIS.

Naming Convention

Assets are assigned names comprised of a combination of an asset class abbreviation followed by a 6-digit unique integer that is generated from an “N+1” auto-incrementing sequence. An example ID for a water line would be: “WL-000365”.

A Crystal Report is used to keep track of the next available number to avoid assignment of duplicate IDs.

3.4.6 Asset Commissioning and Decommissioning Process

The asset commissioning and decommissioning business process to be performed is as follows:

- The asset commissioning and decommissioning business process includes personnel from Engineering, GIS, Operations and Finance.
- Depending on the type of asset (capital or other) contractors and construction managers may be involved in the asset commissioning process.
- The process is similar for commissioning and decommissioning, and centers around developing a work order to initiate the processes and trigger personnel to add or remove assets from the CMMS, SCADA, GIS, inventory, and balance sheets.
- A list of information needed to add a new asset to GIS is included in **Appendix B**.

Process flow diagrams describing the asset commissioning and decommissioning process are shown in Figure 3-5 and Figure 3-6. All facility/systems divisions will adopt these process steps as the procedure for asset commissioning and decommissioning.

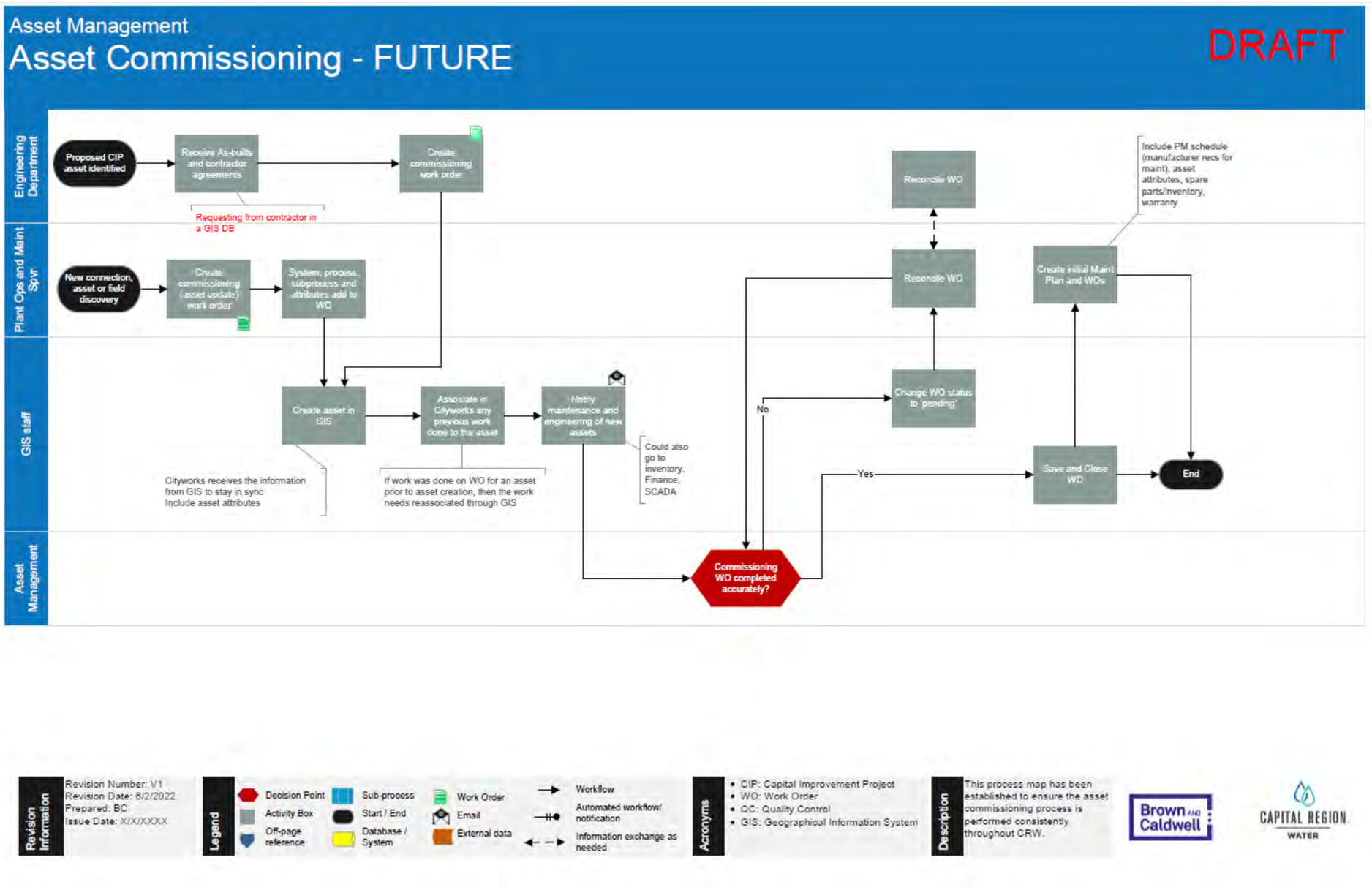


Figure 3-5. Asset Commissioning - Future State

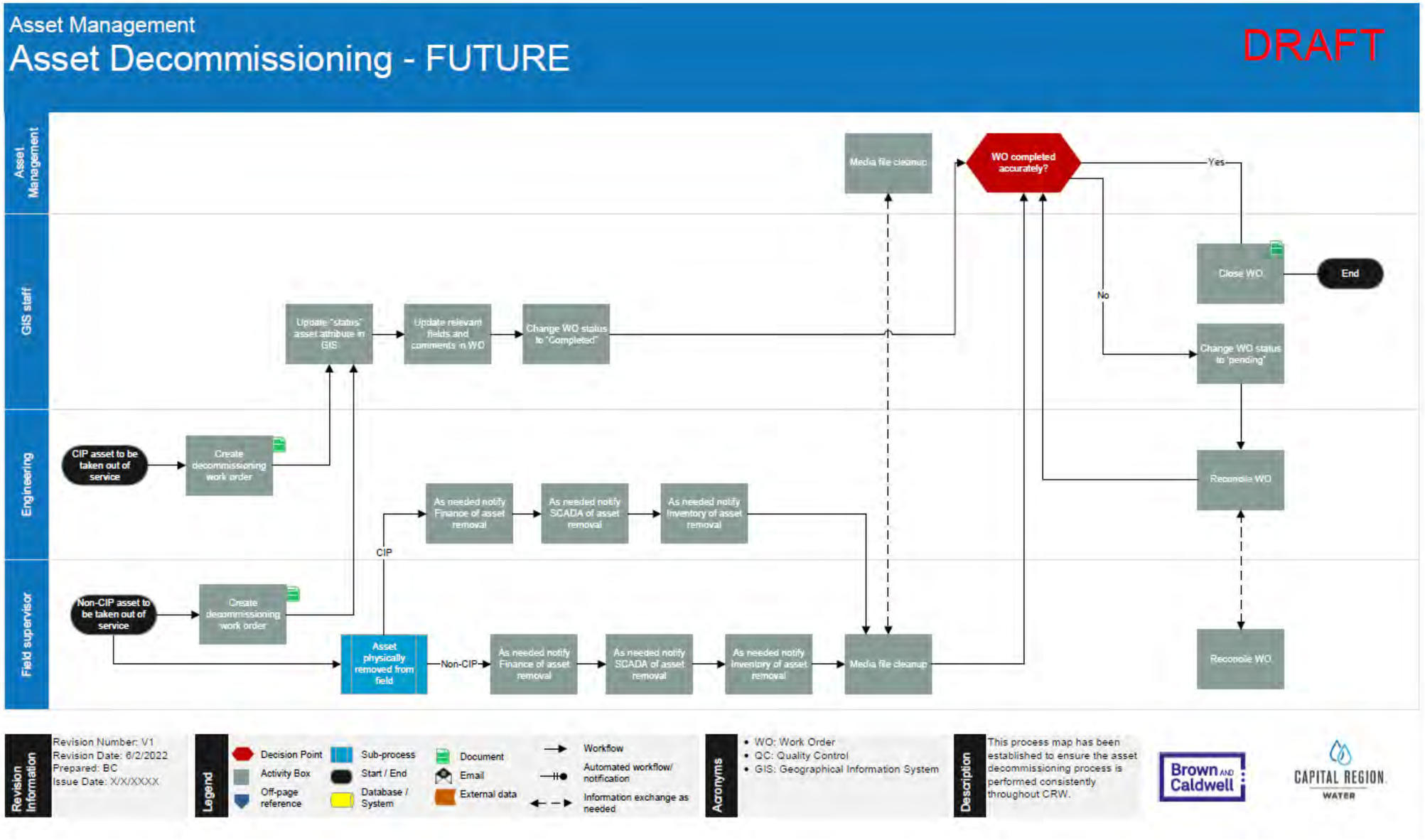


Figure 3-6. Asset Decommissioning - Future State

3.5 Continuous Improvement

People	Process	Technology
	• The asset hierarchy will be reviewed for each TAMP to assure compliance with this hierarchy so that costs and other data can appropriately be rolled up. Inconsistencies that are found in this analysis will be resolved during tactical AMP implementation to assure consistency. • Develop an asset creation template that contains all required data needed for new assets to be entered into GIS. • Develop an SOP for providing the asset creation form to contractors to complete when installing new assets and entering the data into Cityworks. • Document all hierarchies in an SOP. • Verify all assets have hierarchy attributes correctly assigned. • Develop SOP documentation for the assignment of asset IDs	• Make sure to capture valves in GIS • Update the horizontal asset classes once the GIS schema revisions made as part of migrating to the Esri Utility Network Migration ahve been implemented • Update the asset ID scheme documentation to include the new ID scheme reflecting the revised GIS schema once it has been implemented • Update water service line GIS schema to accomodate material determination and line replacement tracking as part of the Lead and Copper Rule Revision program

Section 4

Operations and Maintenance

A critical component of an asset management program is a standardized and repetitive maintenance program. Facilities and systems managers will implement the best appropriate maintenance practices in the areas identified below across all assets to support achieving and exceeding asset useful lifecycles.

4.1 Operations Strategy

Operational procedures are defined for the facilities and systems and are included in the appropriate O&M manuals which are developed in conjunction with the construction of a new system or updates as part of a rehabilitation project. The development of these documents is discussed in Section 5. The operational costs are tracked to the facility (or asset where appropriate and available) and analyzed using the Cityworks system. Operational practices are outlined in several CRW documents including the Drinking Water O&M Manual and Collections and Conveyance O&M Manual.

Operational strategies and processes are reviewed periodically through a continual improvement process and appropriate updates are made to O&M manuals and procedures. CRW also uses SCADA which contains the parameters and control points that were envisioned in the design of the facilities. Operational performance is assessed periodically to minimize maintenance expenses caused by operational factors.

4.2 Maintenance Strategy

Performing optimal maintenance for each asset is the goal of a maintenance strategy. Establishing, performing preventive and corrective maintenance effectively, scheduling and tracking work in the CMMS, and understanding costs associated with the maintenance is part of that overall strategy. In general, the asset, its intended service, historical reliability, and criticality influence the strategies used during its life. Maintenance strategies will tend to evolve (optimized) for various assets as overall asset program knowledge increases.

4.2.1 Asset Class Plans/Job Plans

As a future state item, CRW will continue to enhance their maintenance strategy by developing specific plans for managed asset classes. Currently, CRW uses a combination of manufacturer provided maintenance recommendations and staff experience to develop maintenance strategies for assets. CRW would like to continue to document and standardize their maintenance strategies and attach this information to the asset records for ready access by staff. Asset Class plans (long- interval activities) and Job Plans (short interval activities) include the following information:

- Manufacturer's recommended schedule
- Seasonal operations
- Availability of equipment
- Timing/need
- Condition/age
- Institutional knowledge

Short-interval Activities (Job Plans). Includes activities/tasks with standard labor hours, parts and materials for preventive maintenance, calibration, adjustment, cleaning, and condition assessment. Allowances for planned levels of corrective maintenance are also included.

Job Plans will be used to standardize how work is performed on each asset class, assist in planning and scheduling work, and capture institutional knowledge. Job Plans should be created for all maintenance strategies based on the manufacturer's recommendations contained in the Operations and Maintenance manual along with institutional knowledge, especially where environmental conditions impact equipment performance. Job Plans will be linked to the appropriate preventive maintenance work order in Cityworks and include the following information:

- Personnel
- Duration
- Tools/Equipment
- Materials
- Parts
- Tolerances/Thresholds

Long-interval Activities. Asset Class Plans include years and estimated costs of long-interval refurbishments and replacement. Costs include salvage values (if any) and disposal costs.

4.2.2 Work Order Priority Types

CRW has refined their work order priority codes and now uses templates to assign work priorities. The rules governing work order priority are readily understood by CRW staff and assignments are dynamic based upon the daily activities within the facilities and in the Collection and Conveyance and Distribution Systems. CRW assigns work order priority codes in Cityworks as noted in Table 4-1 includes a description of the priority codes. The priority code value within a Cityworks activity can be changed by anyone assigned edit permissions which is the vast majority of Cityworks users.

Table 4-1. CMMS Priority Codes

Number	Description	Definition	Response Time	Schedule Responsibility
1	Low	• As defined by WO template • General Preventative Maintenance work • Noncritical assets or systems	As staff are available once Moderate and High priority WOs are completed	Maintenance supervisor reviews WOs and assigns accordingly
2	Moderate	• As defined by WO template • Critical assets that do not require immediate action due to redundancy or facility operations requirements	Within 24-48 hours of WO generation	Maintenance supervisor reviews WOs and assigns accordingly
3	High	• As defined by WO template • All vertical assets at the AWTF and WSC are classified as high priority • Emergency work orders • REPAIR work orders	Immediate repair as appropriate	Maintenance supervisor reviews WOs and assigns accordingly on daily basis

4.2.3 Maintenance Management Types

CRW will adopt the use of the maintenance categories in Table 4-2 for CRW assets. Using the appropriate maintenance activity on each asset will increase the reliability of the system and can extend the useful life of an asset. Having a standardized set of maintenance criteria also provides the foundation for developing performance measures that can be used for analyzing maintenance performance. Workflows for the maintenance categories are included in **Appendix C**.

Table 4-2. Maintenance Management Types

Maintenance Category	Description	Application	Examples
Preventative Maintenance (PM)	Preventive maintenance (PM) is an equipment maintenance strategy based on replacing or restoring an asset at a fixed interval (calendar or hours of operation) which will be planned and scheduled in Cityworks. Trends in assessed condition, long-term cost estimates and near-term schedules for corrective maintenance, along with cost and risk analyses, are used to update intervals for preventive maintenance.	All PMs are planned and scheduled weekly, bi-weekly, monthly, semi-annual, and annual schedule exists to adjust workload and account for seasonal outages. Some PM activities may trigger a CM for follow up work such as changing drive belts.	• Hot spot manholes • Hydrant Flushing • CSOs • Lubrication • Instrument calibration • Seasonal maintenance activities
Corrective Maintenance (CM)	Used to repair assets and restore to its designed LOS. Corrective maintenance is an intrusive action used to correct an asset failure and is used to keep assets in a ready state to meet capacity and regulatory requirements.	With the exceptions of emergencies, corrective maintenance will be planned and scheduled to ensure all parts and materials are ready before work begins	• Emergency work • Necessary repairs identified in PM tasks and inspections
Run to Failure (RTF)	No planned maintenance. Assets will be run to failure and immediately replaced with stocked spares. Run to Failure (RTF) is a maintenance strategy that is used on less critical equipment where the other maintenance activities are not cost effective. This strategy does require stocking or having access to replacement assets within a specified amount of time.	May use this strategy on noncritical assets.	• Sump pump hoses • Circuit breakers • Electric motors
Predictive Maintenance (PdM)	Predictive maintenance (PdM) and condition monitoring are used interchangeably in the maintenance industry and provide valuable information in support of an asset management program. Typically, predictive technologies are non-intrusive and inform O&M staff how an asset is performing, predicts required maintenance activities, increases reliability, and avoids unanticipated failures.	All PdMs are planned and scheduled monthly and annual schedule exists to adjust workload and account for seasonal outages. PdM technologies can be used on critical or appropriate assets. Some PdM is completed as part of a PM.	• Oil analysis • PACP and condition assessment on linear assets. • Infrared thermography • Acoustic testing

4.2.4 Work Scheduling

Currently, O&M Supervisors schedule all work to allow for identification of resource issues, and effective issuing and tracking of work performed. Work orders are reviewed daily, and schedule adjustments are made as appropriate. Work scheduling between vertical and linear assets does

differ at CRW with the primary driver for linear being regulatory required efforts in the Collections and Conveyance System.

4.2.5 Maintenance Costs

Costs for equipment and labor are being tracked in Cityworks for work orders and inspections. CRW uses the Equipment, Labor and Material, ELM module in Cityworks to track equipment to support maintenance, labor to maintain/fix assets, and materials to support maintenance activities. Currently, materials are not being fully captured in the ELM module due to transmission of invoices and reconciliation of this information in Cityworks.

Accurately collecting costs associated with maintenance activities is an important piece of information that can be used to develop annual maintenance budgets and to determine if replacement vs. continuing to do extra maintenance is more cost effective. The ability to efficiently do this costing depends on the implementation of the Cityworks storeroom module.

4.3 Inventory/Warehouse

Parts and materials associated with work orders are documented and tracked in several systems at CRW. Finance tracks assets and equipment with a value of $5,000 or greater on an annual basis. CRW is in the process of creating a material inventory for drinking water and wastewater systems that can be used in either Cityworks Storeroom or Munis Warehouse module for tracking parts associated with assets. Policies and procedures for the purchasing of parts and materials for use within maintenance activities are documented.

4.4 Optimization

4.4.1 Vertical Asset Condition Assessment Methods

Monitoring and assessing asset condition provides essential information to decision-makers regarding when to repair, rehabilitate and replace assets. In addition to making rehabilitation and replacement decisions, condition assessment also informs asset managers on how best to operate and maintain an asset. For example, condition assessment results may indicate there is a need to adjust preventive maintenance schedules.

Monitoring and assessing the condition of critical vertical assets at facilities and systems will be performed through two approaches:

- **Visual Inspection.** A sensory evaluation of an asset to determine whether further action, including condition monitoring, is needed.
- **Condition Monitoring.** The collection and analysis of data to identify a change in the condition and/or performance of the asset over time.

Divisions will conduct a baseline condition assessment on critical assets using the visual inspection approach in accordance with the Condition Assessment Guidance Manual (**Appendix D**). They may perform ongoing condition monitoring to identify changes in condition and performance over time using the methods deemed appropriate for different asset types.

Vertical assets where this approach will be used are shown in Figure 4-1.

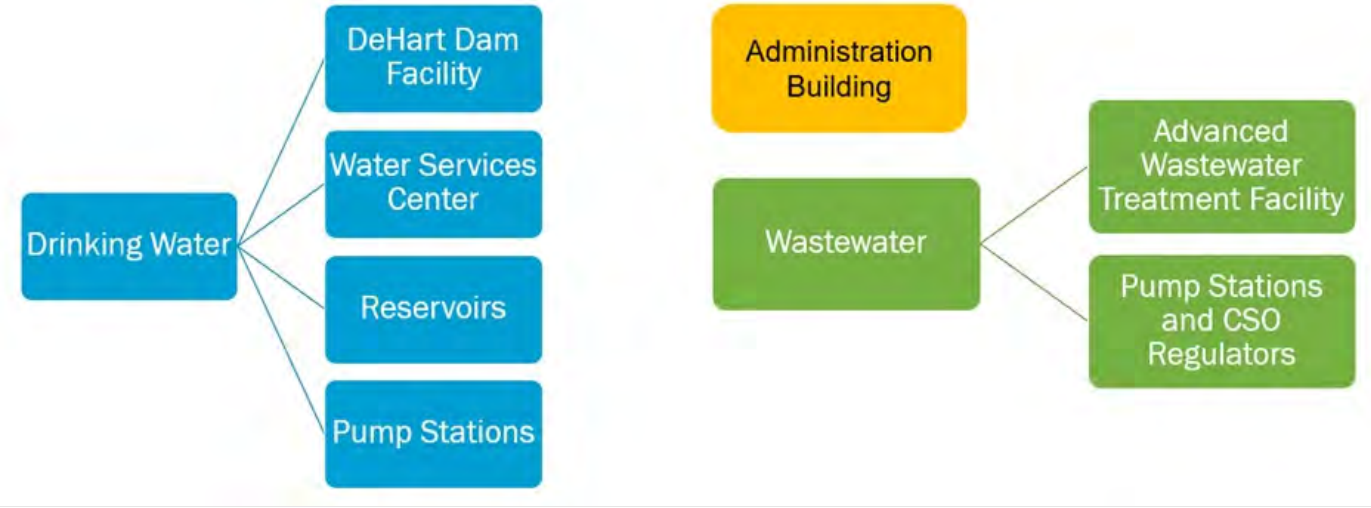


Figure 4-1. CRW Facilities where Vertical Condition Ratings will be Applied

The condition assessment approaches and how the standard ratings are to be used within each approach are described in more detail below.

Condition Assessment Ratings

Standardized condition, and recommendation ratings have been established to ensure consistent documentation of asset condition. A standardized approach supports planning and prioritization of renewal and replacement decisions. When conducting visual inspection and condition monitoring, the assessment team at a particular location should document their findings using the standardized condition assessment format that includes the ratings listed in Table 4-3. Condition assessment data is to be documented in the CMMS. Based on the results of the visual inspection or condition monitoring, a recommendation should be made using the recommendation ratings included in the rating description as a starting point.

Table 4-3. Standard Ratings

Rating	Rating Description
1 Very Good Condition	Like new with little signs of wear. Monitor asset condition and no further action required at present.
2 Good Condition	Minor defects evident. Monitor and trend asset condition for possible additional actions.
3 Fair Condition	Normal signs of wear for age of asset. Continue to monitor asset condition and evaluate for rehabilitation.
4 Poor Condition	Significant defects are evident. Continue to monitor asset condition, repair as needed and expediate plan for rehabilitation or replacement.
5 Very Poor Condition	Asset has failed or shows excessive wear and should be replaced as soon as possible.

Routine (Sensory) Inspection

Sensory inspection involves the use of visual, auditory, tactile, and olfactory senses to document the physical state of an asset (e.g., condition) and determine whether an asset is delivering its LOS requirements (e.g., performance). At a minimum, the following will be noted by staff if observed during an inspection:

- Vibration
- Abnormal temperature
- Noise
- Corrosion
- Wear and material loss
- Leaking
- Belts loose
- Cavitation
- Odor

Assessment teams are to use these observations to support and justify the selection of condition, performance, and recommendation ratings. The sensory inspection approach is used to establish a baseline condition for critical assets and to assess the condition of assets over time where detailed condition monitoring is not warranted.

Condition Monitoring

Condition monitoring involves tracking specific asset parameters (i.e., vibration or temperature) over time with the goal of identifying changes that may indicate an impending failure. Figure 4-2 illustrates how condition monitoring may be used to predict an asset failure over time.

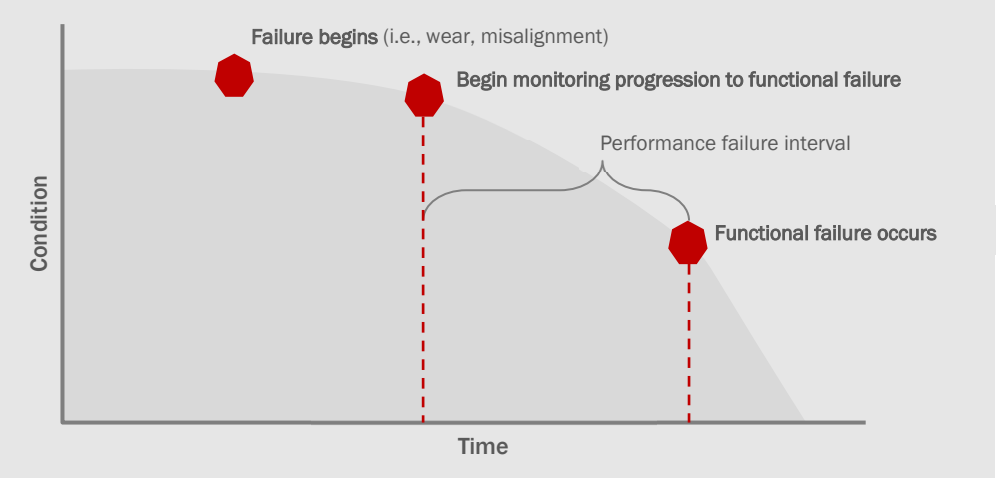


Figure 4-2. Performance Failure Curve

Managers may use condition monitoring as part of a predictive maintenance strategy (see Section 4.2.3) to predict and avoid unanticipated failures and intervene before catastrophic failures occur. Specifically, condition monitoring is used to:

- Identify hidden failures
- Predict maintenance activities
- Avoid unanticipated failures
- Inform maintenance and operations how equipment is running
- Increase efficiency in performing work (planned vs. unplanned)
- Increase reliability
- Reduce lifecycle costs
- Extend equipment life
- Minimize environmental (regulatory) impact
- Make sure equipment is installed to spec (acceptance testing)
- Make knowledge-based decisions

As noted in Table 4-4, CRW uses the following condition monitoring approaches to predict asset failure.

Table 4-4. Condition Monitoring Approaches at CRW

Analysis	Asset Type	Frequency	CRW able to Perform?	CRW Equipment?
Performance Testing	Pumps	Qtrly @ WSC for finished water and backwash pumps	No (Contracted)	AWTF - No, WSC - Yes
Battery Check	UPS	Replace units when they Fail.	Yes	Yes
Boiler Water/Cooling Water Loops	Boilers	Monthly cooling tower	No (Contracted)	No
Laser Alignment Check	Pumps/Motors	Currently during installation	No (Contracted)	No
Load Testing	Generators	30-day Full load	No (Service Contract)	No
Meg and Current Testing	Motors	Currently trouble shooting only	Yes	Yes
Oil Analysis	Engine/Generators (over 400KW), transformers	WSC-Quarterly on our routine service contract through vendor contract	No (Service Contract)	No
Physical Dimension Measurement	Pump Wear Rings	During rebuilds	No (Contracted for Larger Equipment)	No
Run Testing	Transformers	Regulations every 5 years	No	No
Relay Test	Switchgear	Needs contracted	AWTF - Yes, WSC-No	No
Thermography/IR	Substations, MCCs, Switchgear	WSC-Yearly and some testing in-house	AWTF – No WSC – limited capability	No

Table 4-4. Condition Monitoring Approaches at CRW				
Analysis	Asset Type	Frequency	CRW able to Perform?	CRW Equipment?
Vibration (external/internal)	Rotating Equipment	Devices equipped	AWTF - Built-in for some equipment WSC-some	Yes

Condition Assessment Evaluation Process

Data collection associated with routine (sensory) inspection and condition monitoring activities will be documented in the CMMS. Routine (sensory) inspection data will routinely be collected by operations and maintenance staff. Operations and maintenance staff will collect ongoing condition monitoring data and, in some instances, use contracted resources for monitoring requiring specialized equipment and expertise. Condition monitoring data is to be documented in the inspection module in the CMMS. Figure 4-3 illustrates the visual inspection and condition monitoring process.

All divisions will adopt these process steps as the SOP for routine (sensory) inspection and condition monitoring.

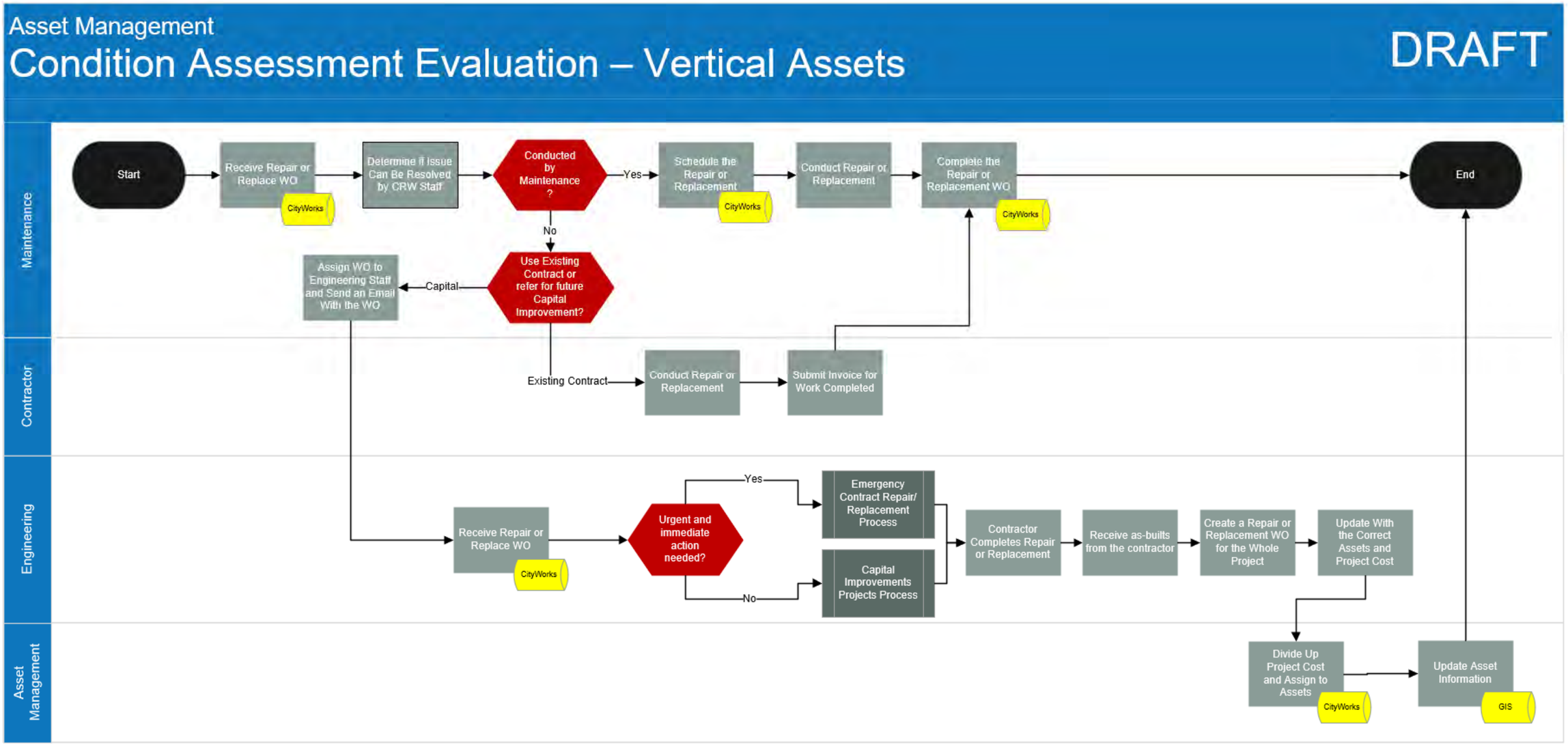


Figure 4-3. Vertical Asset Condition Assessment Evaluation Process

4.4.2 Linear Asset Condition Assessment Methods

Gravity Pipe Condition Assessment

Closed Circuit Television (CCTV) inspections are conducted to assess the condition of gravity pipelines. Inspections are conducted based on the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification program (PACP), Manhole Assessment and Certification Program (MACP), and Lateral Assessment and Certification Program (LACP). The NASSCO rating system is used to identify the types and severity of the defects found during the inspection. The NASSCO defect coding provides a level of consistency in the defect rating, and confidence in the data that allows staff reviewing the inspection records to make informed analyses and decisions. The PACP quick rating is used to prioritize repairs and replacements. The NASSCO methodology uses a 1 to 5 scale which allows the scores to be integrated and compared with the vertical asset condition scores defined in the previous section.

Pressure Pipe Condition Assessment

The assessment of water mains and force mains creates a unique challenge due to the inaccessibility of the inside of the pipe during typical operating conditions. Assessment usually requires access to the inside or outside of the pipe and can include destructive and non-destructive testing. There are dozens of technologies currently being used in some manner for inspection of pressure pipelines. Most of these were originally developed for use in potable water mains or in petrochemical pressure mains and are now being adapted for use in force mains. These technologies can be categorized into the following groups:

- Acoustic (leak detection; and air/gas entrainment and pocket detection)
- Electromagnetic and Ultrasonic Thickness (wall thickness measurement, wall loss calculation)
- Visual (structural defect detection)
- External Corrosion Testing Methods (wall thickness measurement, wall loss calculation)

Due to the variety of technologies and approaches that may be implemented to assess pressure pipes, standardized condition ratings like those used for gravity pipes are not readily available. The findings of pressure pipe assessments will need to be adapted to the ratings presented in Section 4.4.1 and assigned a score using the 1 to 5 scale.

Linear assets and the corresponding assessment approaches are shown in Figure 4-4

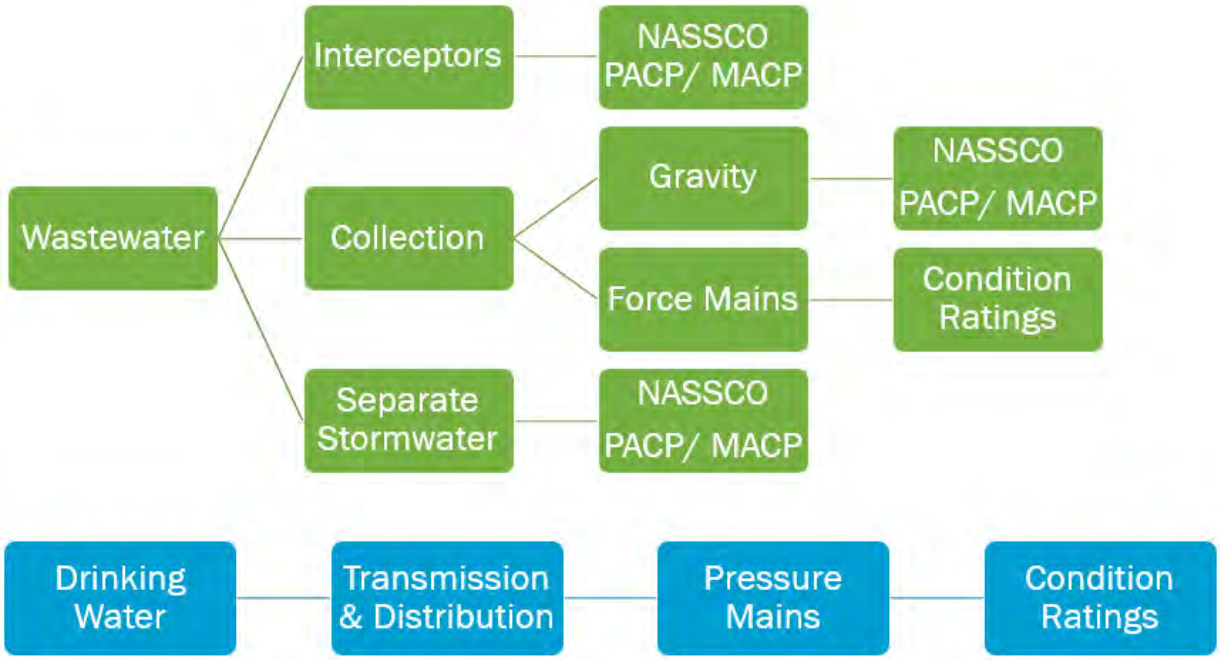


Figure 4-4. CRW Linear Assets and Type of Condition Ratings that will be Applied

Condition Assessment Evaluation Process

Data collection associated with the assessment of linear assets will be documented in the CMMS. Maintenance staff will routinely collect gravity main CCTV inspection data. Pressure pipe assessment data will typically be collected using contracted resources for assessment requiring specialized equipment and expertise. Figure 4-5 illustrates the linear asset condition assessment evaluation process.

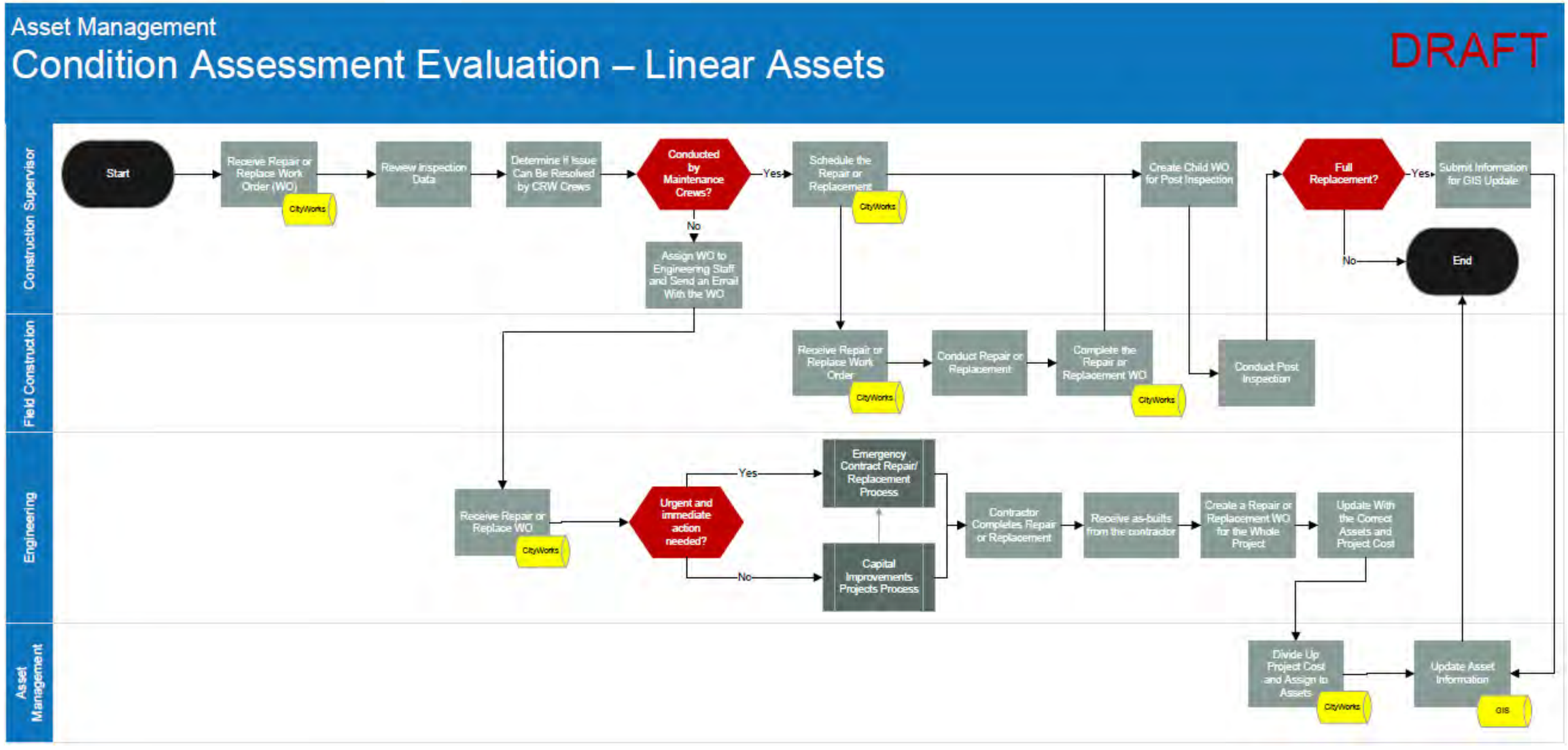


Figure 4-5. Linear Asset Condition Assessment Evaluation Process

4.4.3 Root Cause Failure Analysis

Failure Codes

Failure codes also known as Problem, Cause, and Resolution (PCR) codes are used to assist with trouble shooting failures and trending like failures across the CRW divisions. The key to successfully using PCR codes is having a set of standard codes for each asset class. A standardized set of PCR codes has been developed for both linear and vertical assets and are included in **Appendix E.** When CRW staff initiate a work order in Cityworks, they will be required to apply the appropriate problem code. Prior to the technician closing out a work order they will have to apply the appropriate cause and remedy code.

PCR codes assist in the following

- Track and trend asset failures
- Identify the causes of failure
- Change maintenance procedures to reduce failures
- Identify problem manufacturers and equipment

Root Cause Analysis

PCR codes will be used as part of completing root cause failure analysis (RCFA) on critical assets. Using failure codes and performing RCFA, CRW staff can make data-driven decisions related to adjustments to maintenance and operations procedures, engineering designs, and equipment selections to assist in reducing equipment failure. Figure 4-6 depicts a future failure reporting and analysis process that CRW can use to assess the root cause failure of assets.

All divisions will assign properly trained staff to complete this analysis on a periodic basis to support the AM program and continuous improvement of the operations and maintenance program.

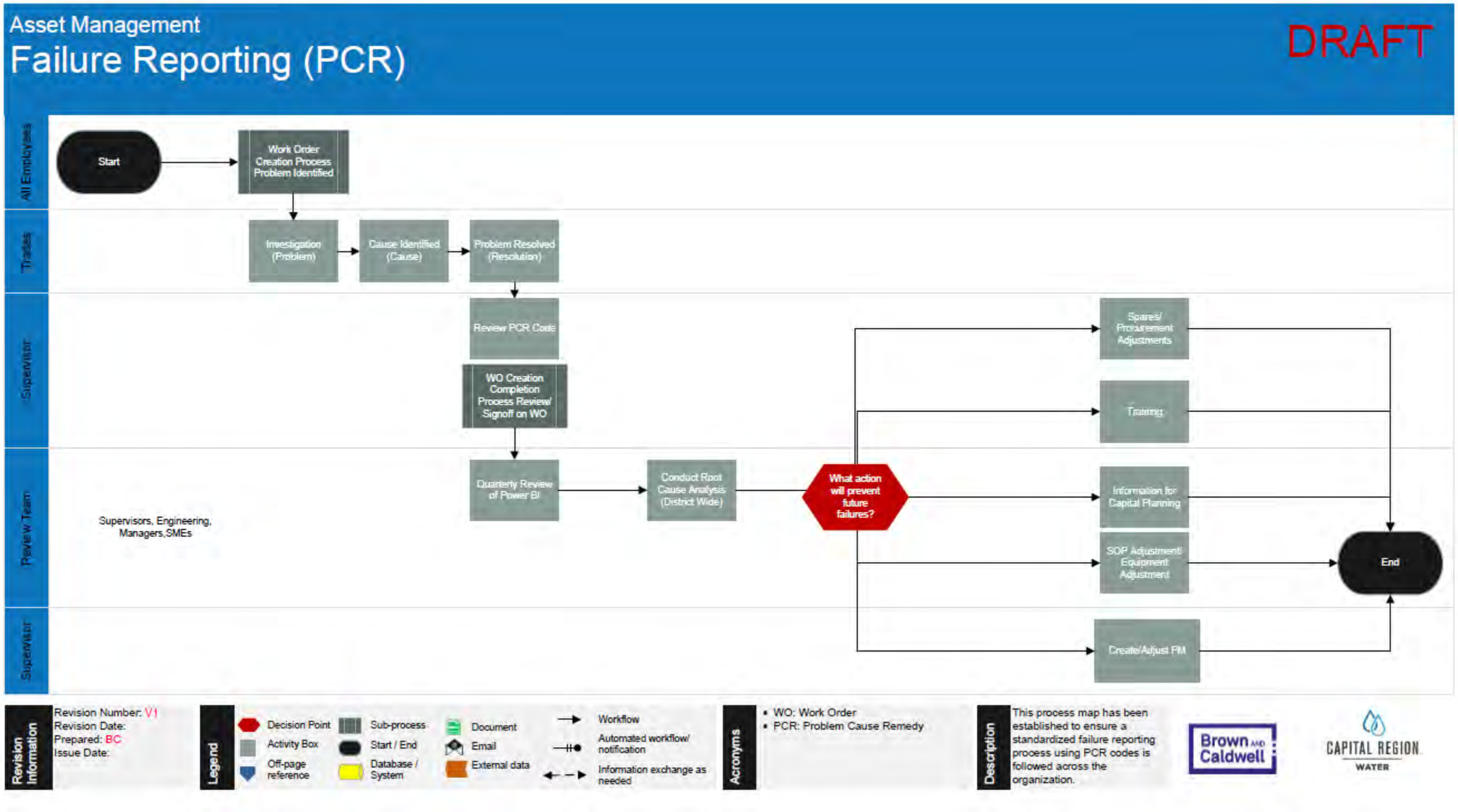


Figure 4-6. Failure Reporting (PCR) Process Future State

4.5 Continuous Improvement

People	Process	Technology
• Ensure staff have the approprate trainng to complete planning /scheduling and RCFA. • Ensure staff have the appropriate training to complete visual inspetion of critical assets.	• Based on trending and tracking of the applicable condition assessment parameters, staff will update the baseline condition, performance and recommendation ratings established for critical assets during inspections when there is an observed change in the parameter that warrants further action. • Based on PCR code information and RCFA, staff will update maintenance strategies to increase asset availabilty and decrease asset down time.	• Staff will evaluate the availablity of predictive technology and optomize mainteannce strategies by apply the approprate predictive maintnenace technology to move towards condition based maintenance

Section 5

Decision Making and Capital Planning

An asset management capital planning strategy includes both long-term and near-term components to address rehabilitation and replacement (R/R) needs. Long-term R/R plans involve identifying the aggregate R/R needs of each facility and system over the next fifty years, which helps establish needed funding levels. Near-term capital planning involves the identification and justification of specific R/R projects, prioritization of those projects using the risk-based prioritization criteria, and the development of a five-year capital program. Asset commissioning and decommissioning reflects how new assets are delivered and old assets are retired as part of the engineering design and construction process.

5.1 Risk Management

This section describes the risk management strategies used to manage risk at the facilities and systems. This approach to risk management involves the development of a risk register and risk-based prioritization for each facility and system.

5.1.1 Risk Policy

As part of the Asset Management Policy, CRW leads practices that are focused on seeking the lowest total life-cycle cost of ownership for infrastructure assets while delivering services and minimizing risk to the community. A key guiding principle for sustainable asset management is to understand and manage CRW's business risk exposure. This is accomplished by:

- Identifying and focusing on those assets that are critical to CRW's service levels and prioritizing their management to prevent their failures.
- Identifying, understanding, and managing the business risks associated with operating CRW's resources.

CRW will be developing a risk policy as a future state development task.

5.1.2 Risk Register

A risk register is used to document areas that have the potential to impact service levels, regulatory compliance, financial objectives, and other business objectives. The register includes the following—details are described in each AMP:

- **High level risk.** Describes an event that may occur and cause a negative impact on the facility/system
- **Impacts.** Describes the impact the event may have on the facility/system if it occurs

Definitions

Risk relates to the consequence of an event happening and the certainty that it will happen. Within the context of asset management, risk is defined as the "likelihood" that an asset is unable to provide the function for which it was installed, combined with the impacts resulting from the asset failure.

- **Risk Register.** Documents the high-level risks to the organization, likelihood and consequence of occurrence and any risk mitigation measures.
- **Risk-based Prioritization.** Process for setting priorities and ranking assets using likelihood and consequence of failure criteria.

- **Likelihood Rating (LR).** Value that quantifies the certainty that the event may occur as low (1), moderate (3), or high (5)
- **Consequence Rating (CR).** Value that quantifies the severity of the impact of the event as low (1), moderate (3) or high (5)
- **Risk Rating.** The result of multiplying the likelihood rating by the consequence rating
- **Risk Mitigation Measures.** Options for reducing the certainty and/or impact of the event.

Table 5-1 provides an organizational risk register to be used by facilities and systems. It also includes an example event to illustrate the use of the risk register. As part of the development of the AMPs, each Division will be responsible for developing an appropriate risk register and mitigation actions for their facilities. The Organizational Risk Register should be reviewed and revised as part of the annual SAMP update.

Table 5-1. Organizational Risk Register

Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
Organizational	Loss of institutional knowledge/ asset records	• Lower productivity • Equipment breakdowns/repair times • Violations • Operational issues due to inexperience • Budgetary impacts for hiring 3rd parties • Safety and injuries • Lost information requiring reproduction • Lost shop drawings	5	5	25	• Scanning documents, electronic backup • Records management, documentation attachment in Cityworks • Training employees • Sustainable documentation • SOP documentation • Retention planning, succession planning • Apprenticeship programs
Capacity	Exceeding capacity of the existing stormwater system beyond the flood protection system.	• Structural or road flooding • Property damage • Public health and safety • Economic impacts	5	5	25	• Capital improvements (i.e., Drainage/ stormwater pump station) • Facility planning/ Master Plan for flood protection • Public education on safety measures • Early warning system
Failure	Failure of aging infrastructure	• Loss of treatment	5	5	25	• Identify assets in need of repair and replacement before failure
Failure	Large diameter structural failure (cave-ins, collapse) of gravity sewer	• Public health and safety • Regulatory impacts • Economic impacts • Public relations impacts	5	5	25	• • Proactive inspection • Risk based rehabilitation or replacement • Soil testing and/or

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
						geotechnical assessment/modeling • Forensics on failures after they happen for lessons learned (i.e., like materials failing)
Failure	Dry weather CSO discharges to waters of the US	• Public health and safety • Regulatory impacts • Economic impacts • Environmental impacts	5	5	25	• Preventive maintenance • Visual inspection • Flow meters in manholes • Visual inspection and calibration of flow meters • Level sensors upstream of the dam to identify CSO before it occurs
Organizational	Insufficient staff and/or insufficient qualified and trained staff for mission critical duties	• Increased overtime • Equipment/assets degrade due to deferred maintenance • Increased costs for contractors/outsourced resources • Loss of system knowledge • Increased costs for repairs and running assets to failure • Opportunity and innovation costs	5	5	25	• Staffing and skills studies • Update engineering standards to include FTE estimate and required skills and training with new facilities and/or equipment • Documented Standard operating procedures and training on those SOPs • Testing and recertification as appropriate • Relationships with community partners for skill development • Outsource staffing, if needed
Failure	Structural failure (cave-ins/collapse) of stormwater pipes	• • Structural or road flooding • Property damage • Public health and safety • Economic impacts	5	5	25	• • Condition assessment • Facility planning • Capital improvements • Critical assets and spare parts availability
Failure	Water Main Break	• Economic impacts • Community/neighborhood impacts • Reputation/Public relations impact • Public health and safety	5	3	15	• Condition assessment • Contingency/Emergency Response Plans • Forensics on failures after they happen for lessons learned • Valve Exercising

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
						• Testing and assessment • Soil Testing and/or geotechnical assessment /modeling
Failure	Regional (large diameter) force main breaks reaching waters of the US	• Environmental impacts. Potential discharge to creeks, rivers, and streams • Economic impacts • Community/neighborhood impacts • Reputation/public relations impact • Public health and safety	5	3	15	• Contingency/Emergency Response Plans • Force main walks (visual assessment) and ARV inspections performed annually • Forensics on failures after they happen for lessons learned • Engineering standard changes for ARV material and replacement of stainless steel ARVs to prevent corrosion • Testing and assessment • Soil testing and/or geotechnical assessment/modeling
Financial	Insufficient capital funding	• Regulatory impacts • Health and safety impacts • Public relation impacts	3	5	15	• Public education • Potential for use of grant funding or low interest loans • Look for efficiency gains, including controlling the scope and schedule • Potential innovative approaches that are more efficient • Planning, prioritization, and justification of projects
Financial	Capital delays and/or overruns of construction projects	• Regulatory impacts • Economic impacts • Public relations impact • Public health and safety • Operational impacts	3	5	15	• Implement Construction Project Risk Registers • Involve O&M in the design process • Project planning • Follow PM procedures
Treatment	Odor issues	• Customer complaints • Regulatory impacts	3	5	15	• • Chemical treatment • Source determination • FOG Program

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
						• Address untrapped catch basins • Proactive watering down in dry times • Public education • Odor eliminators
Capacity	Insufficient design capacity at a wastewater treatment plant	• Economic impacts, including development • Regulatory impacts • Odor issues • Public health and safety • Capital impacts • Health and safety	5	3	15	• Facility planning and hydraulic modeling • Capital improvements • Monitoring of future development and determination of available capacity • Monitor regulatory changes that could impact capacity
Safety	Serious Injury	• Lost Time • Costs • Low employee morale • Loss of productivity	5	3	15	• Safety program • Standard operating procedures • Safety Inspections • Safety Training • General policies • Job Plan specific safety protocols are needed
Natural	Widespread power outages with generator failure or lack of standby power	• Structural or road flooding • Property damage • Public health and safety • Economic impacts • Environmental impacts	5	3	15	• Capital projects to add more generators and standby power capabilities (portable and onsite) • Contingency and emergency response plans • Preventive maintenance and testing/inspections of generators • Prioritize critical sites where standby power would be needed • Solar power
Systems and Data	Unauthorized access to information systems	• Economic impacts • Reputation impacts • Public health and safety • Regulatory impacts	5	3	15	• System backups • Security • More frequent and robust cybersecurity training • Review of appropriate staff responsibilities, access, and clearances • Business Continuity Plan

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
Systems and Data	Information systems going down for extended period during high priority event	• Economic impacts • Reputation impacts • Public health and safety • Regulatory impacts	5	3	15	• Emergency and contingency plans • Redundancy • Documented manual processes • Business Continuity Plan
Failure	Damage to operational and/or administrative facilities	• Disrupts operation • Public health and safety • Regulatory impacts • Economic impacts	5	3	15	• Emergency Response Plan • Business Continuity Plan • Redundancy • Emergency Action Plans (Facility and/or asset specific)
Treatment	Lack of available land for expansion and/or new facilities	• Economic impacts • Reputation impacts • Delay to project schedules • Regulatory impacts	3	5	15	• Proactively search for available land adjacent to facilities • Negotiate/buy options with adjacent landowners • Monitor and prevent encroachment on existing facilities • Identify areas where expansion might be needed as part of Facility Planning
Third Party	Sabotage and/or vandalism at a facility	• Public health and safety • Economic impacts • Public relations	5	3	15	• Security monitoring • Identify key locations where stolen equipment is sold • Analyze existing reports on vandalism and theft to identify key locations • Fences, locks, etc. to secure facilities
Third Party	Third-party damages critical collection system infrastructure	• Public health and safety • Environmental impacts • Economic impacts • Public relations impacts • Regulatory impacts	5	3	15	• Contingency and emergency response plans • Put a deterrent in place, including legal/enforcement actions • Full and accurate asset inventory • Processes associated with utility locates
Treatment	Loss of solid disposal options	• Solids backup at plant • Permit violations, odor issues • Treatment compromised	3	3	9	• Cake could be hauled to the back of plant for storage if necessary • Landfill and land application options
Natural	Tornado	• Potential personnel injury • Loss of plant operations • Equipment damage • Loss of plant access	3	3	9	• Emergency plan

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
Failure	Spill or discharge	• Permit violation • Personnel Safety	3	3	9	• SOP's, Good operations
Treatment	Changing regulatory requirements (i.e., nutrients)	• Higher cost (CIP and Operations) • New permits	3	3	9	• Current plant designed for addition of nutrient process
Natural	Complete Loss of utility power for 24 hours (both feeds)	• Permit violation • Would need to reseed the plant	5	1	5	• Redundant feeds with auto transfer • PMs on electrical equipment • Knowledgeable staff • Storage capability • Generator power for control building
Capacity	Insufficient design capacity in the collection system	• Public health and safety • Regulatory impacts • Economic impacts, including development • Public relations impacts • Basement backups	1	5	5	• Facility planning and hydraulic modeling • Capital improvements • Monitoring of future development and determination of available capacity
Systems and Data	Internal Data Controls (SCADA)	• Loss of system monitoring and controls	5	1	5	
Systems and Data	Loss of utilities (communication)	• Loss of internet more critical • CMMS/GIS/Email depend on internet connection • Phones on same line as internet	1	5	5	• Cell phones could be used as backup for communication
Organizational	Damage to private property	• Plant failure may cause basement backups	1	5	5	• Bypass if there is a plant failure
Treatment	Major Permit violation (NPDES, air permit, etc.)	• Reporting and communications with the regulatory authority • Negative publicity • Fines • Notice of Violation • Potential need for operational changes/capital improvements • Stricter permit for chronic violations • Enforcement/Consent Decree potential	3	1	3	• Environmental compliance work order system • Standard operating procedures • Training staff
Third Party	Terrorist attack	• Potential personnel injury • Loss of plant operations	3	1	3	• Emergency plan

Table 5-1. Organizational Risk Register						
Risk ID	High Level Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR x LR)	Risk Mitigation Action
		• Equipment damage • Danger to personnel				
Safety	Fire	• Loss of records • Personnel safety • Loss of treatment	3	1	3	• Fire risk minimal in process areas • Fire alarms in key areas • Fire extinguishers throughout plant
Organizational	Legal action (manhole or RF)	• Bad Publicity • Fines	1	3	3	• Meet permit conditions • Good plant operations, SOP's • Training
Natural	Earthquake	• Potential personnel injury • Loss of plant operations • Equipment damage • Loss of plant access	3	1	3	• Emergency plan • Newer equipment and buildings designed to current code
Natural	Flooding	• Facilities would be underwater	1	1	1	• Trailer mounted pump available for recovery • A flood emergency plan is in place.
Financial	Exceeding allocated budget	• Defer other work • Schedule delays • Rate impacts	1	1	1	• Budget planning • Contingencies • Budget tracking
Treatment	Loss of utilities (potable water)	• Solids will back up in the plant • Loss of showers, drinking water, toilets	1	1	1	• Bottled water can be brought in for personnel • Portable toilets can be brought in

5.1.3 Risk-Based Prioritization

Standardized risk criteria are used to identify critical equipment at each facility and system, and to prioritize identified projects and maintenance programs. The consequence of failure (COF) criteria is defined in Table 5-2 and identify the impact a failure may have on level of service. Likelihood of failure (LOF) criteria are defined in Table 5-3.

Each facility and system should apply the LOF and COF criteria to identify the highest priority assets as shown in Figure 5-1.

Figure 5-1. Risk-Based Prioritization Steps.

The outcome of this process is a risk-ranking of assets that can be used to prioritize condition assessment activities, operations and maintenance activities, spare parts inventories, and risk-mitigation projects (such as replacement/rehabilitation). Criticality ratings are also to be used to determine the priority and timeframe for corrective actions as part of capital planning. As part of the development of the TAMPs, each division will be responsible for developing prioritized assets for their facilities.

Table 5-2. Consequence of Failure Criteria

Category	Criteria	Description	Negligible - 1	Low - 2	Moderate - 3	High - 4	Very High - 5	Weight (must sum to 100)
Environmental	Regulatory Compliance	Regulatory compliance: Overflows Permit Violations USACE Violations MS4 Violations Consent Decree Violation/Stipulated Penalties	Short duration, contained within facility. No violation.	Minor disruption, few complaints, short process upset, local regulatory fines.	Substantial disruption, numerous complaints, prolonged process recovery. Violation or fines.	Major disruption, temporary/partial loss of process, 0–6-month recovery time. Violation, fines and/or prosecution.	Major disruption, complete loss of process,> 6-month recovery time. Inability to operate.	15
	Environmental Impact	Severity and duration of impact to the environment. Includes volume of permitted combined sewer overflow (CSO), dry weather overflow (DWO), sanitary sewer overflow (SSO), unauthorized release.	Negligible impact on the environment. CSO, DWO, SSO, or unauthorized release less than or equal to 1K gals.	Minor recoverable, ecological impact. CSO, DWO, SSO, or unauthorized release greater than 1K gals., but less than or equal to 10K gals.	Minor environmental damage, short term effect. CSO, DWO, SSO, or unauthorized release greater than 10K gals., but less than or equal to 250K gals.	Medium to long term environmental damage. CSO, DWO, SSO, or unauthorized release greater than 250K gallons, but less than or equal to 1M gals.	Significant environmental impact with long term effects. CSO, DWO, SSO, or unauthorized release greater than 1M gals.	15
Social	Customers Affected	Number of customers, assets, and/or facilities impacted due to a failure.	Less than 10 services affected. Localized impact.	Up to 100 services affected.	Up to 1,000 services affected. Multiple systems/areas impacted. One	Up to 2,500 services affected. Two critical customers out of service.	More than 2,500 services affected. Facility-wide/system-wide disruption. More than two	15

Table 5-2. Consequence of Failure Criteria								
Category	Criteria	Description	Negligible - 1	Low - 2	Moderate - 3	High - 4	Very High - 5	Weight (must sum to 100)
							critical customers out of service.	
	Public Image	Media coverage based on number of people affected, environmental impacts, financial loss, lawsuits	Public inquiry or complaint. No media coverage.	Multiple public inquiries or complaints. No media coverage.	1 to 2 days local adverse media. Correspondence from State and/or local officials.	Multi-agency interests and/or > 2 days exposure across multiple social media platforms.	Broad adverse media, Neighboring jurisdictions impacted. Impact to Bond Ratings.	15
	Health and Safety	Public health and safety impacts, employee safety, regulatory compliance.	First aid required (cut, bruise, topical rash)	Minor injury (Sprain, stitches)	Moderate injury (broken bone) or illness lasting several days	Severe injury or illness with permanent damage	Fatality, localized illness impacting multiple individuals	15
Financial	Financial Impact	**Internal Financial Impact** - Total repair, rehabilitation and/or replacement costs. Increased operational costs. **External Impact** - Lost revenue, liability costs, fines, property damage	Less than $20K	$20K to $100K	$100 to $200K	$200K to $1M	$1M or greater	25

Table 5-3. Likelihood of Failure Criteria								
	Criteria	Description	Negligible - 1	Low - 2	Moderate - 3	High - 4	Very High - 5	Weight (must sum to 100)
	Proactive Maintenance and Inspection History	Proactive maintenance, testing or inspections completed in accordance with plans.	Consistent Preventive Maintenance and inspection scheduled and performed	--	Preventive Maintenance and inspection scheduled, but infrequently performed	--	No planned preventive maintenance or inspection	25
	Historical Asset Failure	Frequency of asset failure under normal operating conditions based on historical asset operation and	No known failures in the last 2 years	--	1 failure in the last 2 years	--	2 or more failures in the last 2 years	30

Table 5-3. Likelihood of Failure Criteria								
	Criteria	Description	Negligible - 1	Low - 2	Moderate - 3	High - 4	Very High - 5	Weight (must sum to 100)
		maintenance records.						
	Life Remaining	Remaining useful life based on the age of the asset.	New or like new. Greater than 80% of useful life remaining	80% to 60% useful life remaining	60% to 40% useful life remaining	20% to 40% useful life remaining	At end of life or nearing end of life. Less than 20% of useful life remaining	15
	Usage/Run Times	Frequency of use as an indicator of operational and/or capacity issues.	Low run times	--	Moderate run times	--	High run times	15
	Capacity	Meets desired capacity requirements.	Significant available capacity during peak conditions	Available capacity during peak conditions	At capacity during peak conditions	At capacity during average conditions	Exceeds capacity during average conditions	15

5.1.4 Consequence of Failure Analysis

The COF criteria used to identify the impact a failure may have on level of service. Each facility/system should apply the COF criteria to identify the highest priority locations as follows:

1. List the locations, systems, and assets for each facility.
2. Review each COF scoring criteria and review the criteria description. (Table 5-2)
3. Assign a COF score (1= best or least, and 5= worst or most) to each criterion at the location/system level.
4. Weights for each criterion are already established.

COF Criteria	Score	Weight	COF Score
Regulatory Compliance	3	0.15	0.45
Environmental Impact	3	0.15	0.45
Customers Affected	3	0.15	0.45
Public Image	4	0.15	0.60
Health and Safety	3	0.15	0.45
Financial Impact	2	0.25	0.50
		LOF Total	2.90

5. A COF score will be calculated for each location/system for facilities with vertical assets. A COF score will be calculated for each asset for linear assets.
6. Review the applied COF scores and verify that the score is appropriate for the location/system.
7. Populate the data within the CMMS.

5.1.5 Likelihood of Failure Analysis

The COF criteria used to identify the impact a failure may have on level of service. Each facility/system should apply the LOF criteria to identify the highest priority locations (based on COF) as follows.

1. List the assets for each facility, starting with the high COF locations identified previously.
2. Review each LOF scoring criteria and review the criteria description. (Table 5.3)
3. Assign a LOF score (1= best or least, and 5= worst or most) to each criterion.

LOF Criteria	Score	Weight	LOF Score
Proactive Maintenance & Inspection History	3	0.25	0.75
Historical Asset Failure	1	0.30	0.30
Life Remaining	3	0.15	0.45
Usage/Run Times	4	0.15	0.60
Capacity	2	0.15	0.30
		LOF Total	2.4

4. Weights for each criterion are already established.
5. A LOF score will be calculated for each asset.
6. Review the applied LOF scores and verify that the score is appropriate for the location/system.
7. Populate the data within the CMMS.

5.1.6 Risk Score Analysis

Once the COF and LOF criteria have been applied to locations and assets at each facility/system they are placed on the risk matrix (Figure 5-2). The thresholds shown below are examples and will be established by CRW at a future date.

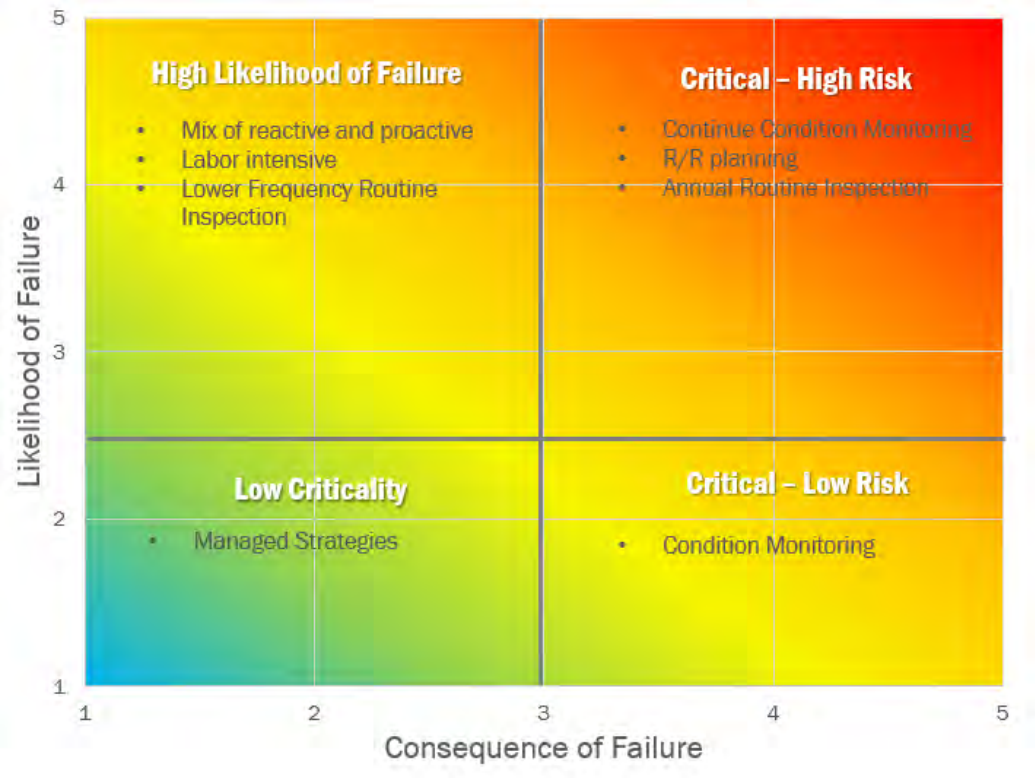


Figure 5-2. Asset Risk Matrix.

It should be noted that COF will be static year to year and only significantly change when processes are modified, or facilities built/abandoned. LOF, on the other hand, is more dynamic in nature and over time will move towards a higher score. The asset LOF scores will be influenced by the asset condition rating.

The outcome of this process is a risk-ranking of assets that can be used to prioritize condition assessment activities, operations and maintenance activities, spare parts inventories, and risk-mitigation projects (such as replacement/rehabilitation). Criticality ratings are also to be used to determine the priority and timeframe for corrective actions as part of capital planning.

Critical—High Risk Assets	Critical—Low Risk Assets	High Likelihood of Failure Assets	Low Criticality Assets
• COF score greater than 3 and LOF score greater than 2.5. • Assets are vital to the operation and take priority over other assets. Assets need to be very reliable and maintenance activities focused on eliminating the potential for failures. As the asset condition rating becomes worse, rehab/replacement plans need to be put in place to sustain operations.	• COF score greater than 3 and LOF score less than 2.5. • These assets are important to the operation; however the likelihood of failure is lower than critical assets. Assets within this group are good candidates for condition monitoring. This monitoring is the trigger for maintenance activities or R&R plans.	• COF score less than 3 and LOF score of greater than 2.5. • These assets are less vital to the operation; however, can become a focal point due to the frequency (i.e., likelihood) of failure and require significant resources (time and materials) to sustain.	• COF score less than 3 and LOF score less than 2.5. • Assets in this group are less vital to the operation and are unlikely to fail.

5.2 CIP Development and Prioritization Process

5.2.1 Rehabilitation and Renewal Process: Long-term Capital Project Planning

Long-term R/R plans for critical assets should be developed for each facility and system. R/R plans should be comprised of estimated R/R costs for each critical asset over a designated period (i.e., 50-year horizon). The example shown in Figure 5-3, illustrates the various anticipated R/R costs over the lifecycle of a single asset.

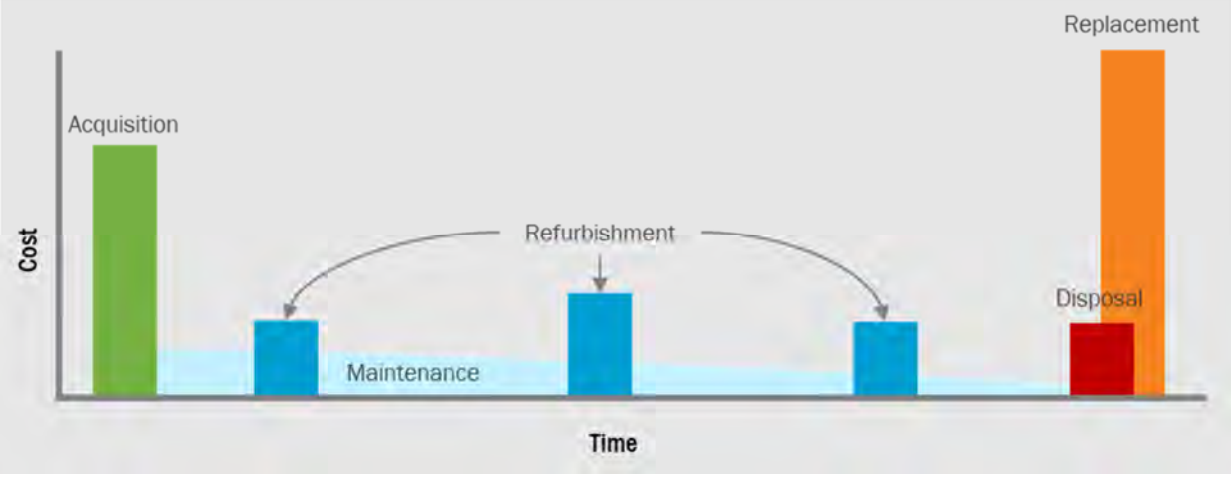


Figure 5-3. Typical costs incurred in an asset lifecycle.

The steps to be used by staff to develop long-term R/R plans for critical assets are shown in Figure 5-4.

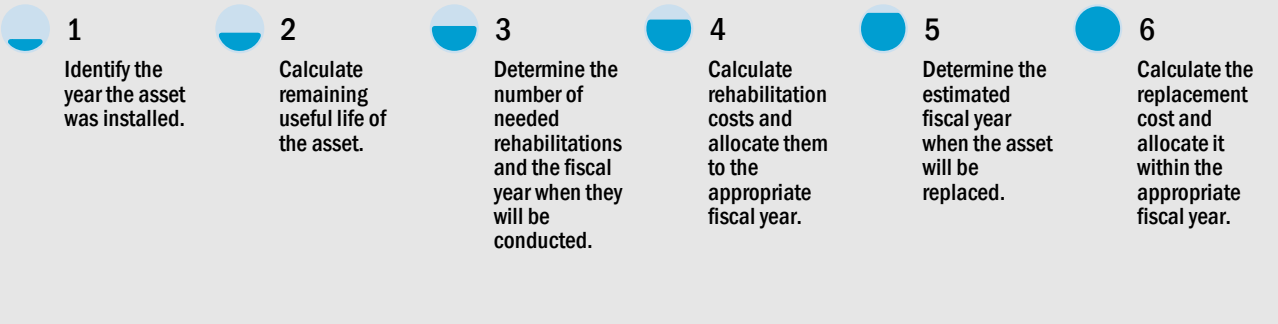


Figure 5-4. Long-term R/R Planning Process.

The table included in **Appendix F** has been developed for use by facilities and systems managers to develop planning level estimates for use in R/R plan development. It includes the following key pieces of information that each facility/system will need to establish an R/R plan for critical assets.

- **Asset Class Name.** Describes a group or type of assets with similar characteristics
- **Number of Rehabs.** The number of rebuilds or refurbishments that the asset will undergo during its lifetime.
- **Rehabilitation Interval.** Describes how frequently the rehabilitation will occur, in years.
- **Rehabilitation Cost Percent of Replacement Cost.** Provides the assumed percent of the replacement cost that will be used to estimate the rehabilitation cost.
- **Rehabilitation Cost.** The replacement cost multiplied by the Rehabilitation Cost Percent.
- **Asset Useful Life.** Typical life, in years, of an asset assuming that a reasonable and normal level of preventive maintenance is performed.
- **Replacement Cost.** Typical cost to purchase a new asset when the existing asset is decommissioned.
- **Condition and Performance Ratings.** When condition and/or performance information is available, the remaining useful life of an asset may be adjusted based on the observed condition/performance of the asset. In these instances, the R/R plan should be adjusted to reflect the updated remaining useful life. Each facility/system will be responsible for developing R/R plans for critical assets in the timeframe determined by the RDT.

5.2.2 Capital Project Request and Evaluation

Providing a sound business case for projects is essential to developing and delivering a healthy, sustainable capital program. A standardized approach to justifying needs/projects has been developed to allow staff to determine project priorities and make the case for funding projects. A Capital Project Request form for use by staff to facilitate this process is included in **Appendix G**.

- Required for all capital assets/projects (Cost >$5k+, Estimated useful life >3yrs), when approved informs the 10-year capital plan and funding needs. Single form can be used for multiple assets if the assets are individually identified and reasonably grouped.
- Staff will be trained on the business case justification process following the details noted in Table 2-4.

5.2.3 Project Prioritization Process

Developing and prioritizing the resulting CIPs involves operations and maintenance, engineers, finance, and management. The compiled CIP is based on division needs and the Capital Request forms (see Section 5.2.5).

- Operations and Engineering collaboratively complete the Capital Request Form (**Appendix G**) for long-term (within the 10-year forecast) or significant capital project.
- The completed forms are sent to Finance for review and tabulation into a preliminary budgetary CIP. Finance then attempts to balance budgets within current rates.
- Finance then returns the preliminary CIP to Operations and Engineering to determine project prioritization.
- The prioritized list, along with the corresponding Project ID Sheets and Business Case Justification forms, should then be submitted to the Finance for inclusion in the overall 10-year capital program.

5.2.4 Growth and Forecasting

Analyses of growth and necessary capacity are performed on a scheduled basis and used to determine the funding needs. Forecasting is done using optimization tools (capacity planning, asset acquisition, maintenance analysis, R&R alternatives, etc.).

Periodic analyses are undertaken of the financial results and used to determine future costs of assets and asset operation and maintenance costs. Procedures to review the trend in funding plans and available funds are done to update the funding plan and policies.

5.2.5 Forecasting Long-term R/R Needs

Periodic analyses are undertaken to determine future costs of asset renewal and replacement, including asset maintenance costs. Procedures to review the trend in funding needs and available funds are available.

5.2.6 Budget Strategy

Once an asset R/R need has been justified, an integral part of the process is deciding the budget source. All legally available delivery methods are considered, such as in-house, design and construct, design-build (DB), design-build-own (DBO), design-build-own-operate (DBOO), and selection made with due consideration of comparative lifecycle costs. Includes leasing and buying of equipment.

There are several types of funding methods available to support the AM program. Table 5-4 provides details about potential budget options.

Table 5-4. Budget Strategy

Budget	Description	Application
Operations	Budget used for standard O&M of assets -rehabilitation and replacement	
Capital Program	Budget process for specific asset R/R projects over longer planning horizon (3-5 years). Engagement with Engineering for asset R/R sequencing within capital program.	In-house, design and construct, design-build (DB), design-build-own (DBO), design-build-own-operate (DBOO)

5.3 Design and Construction

The capital improvement program plays a significant role in the inclusion of new and replacement assets and infrastructure. The design and construction processes include opportunities for compiling asset information and making it available to the asset management effort prior to startup. The workflow shown in Figures 5-5 through 5-12 describes how asset management information is included in project design and construction.

5.3.1 Design Requirements

The design process defines what assets will be constructed and added to the CRW hierarchy. During design, the specifics of these assets are typically not yet known but decisions on what the contractor will provide are determined as the contract specifications take shape. The design process will define requirements including, startup and commissioning activities, asset data attributes, spare parts, staff training, warranty specifications, etc. The design drawings should identify assets by the standard hierarchical enumeration scheme to facilitate inclusion into the GIS and the CMMS database.

Other important decisions can be facilitated during the design process through engagement of the O&M staff. For some projects, considerations on staffing numbers or skills will be identified. Maintenance of operations during construction and safety concerns associated with the construction or long-term operations also are understood during design, offering the opportunity to make plans well ahead of startup.

It is essential that the design community serving CRW understands the ultimate use of asset information and what form it is required to be delivered. This will help to achieve consistency in the information associated with the new assets that are constructed. Figures 5-5 through 5-8 depict the design process at CRW.

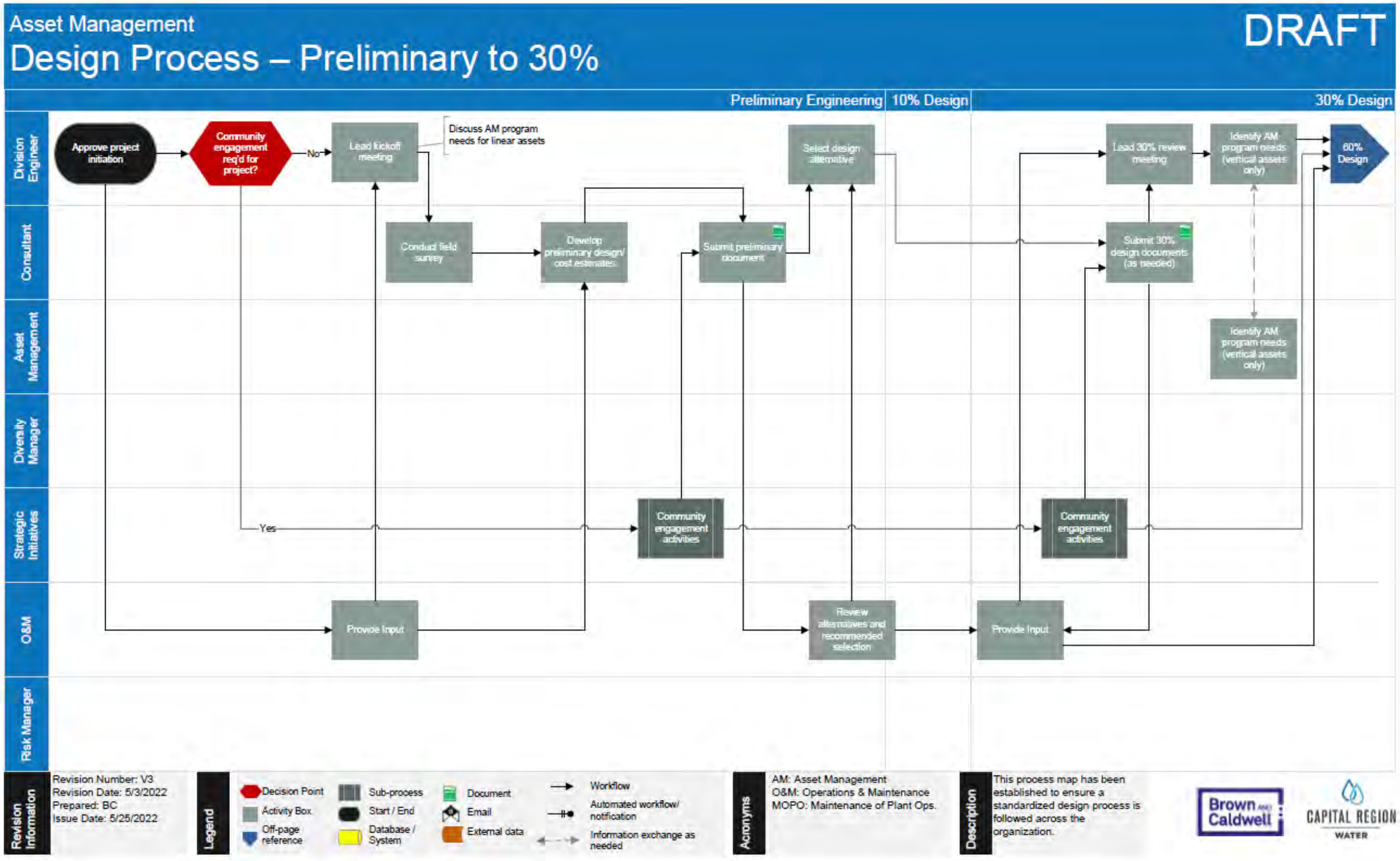


Figure 5-5. Design Process - Preliminary Design to 30% Design Stage

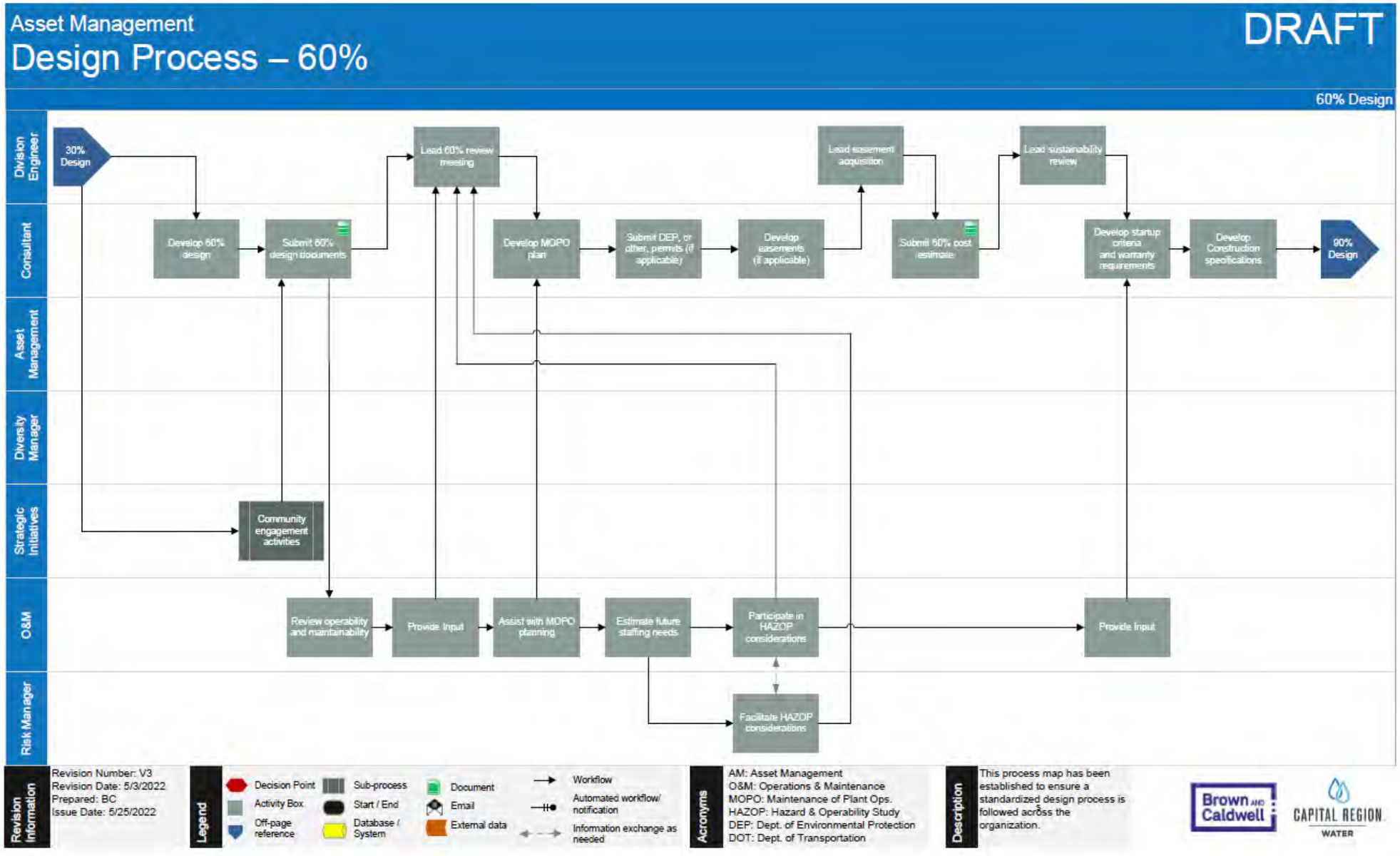


Figure 5-6. Design Process - 60% Design Stage

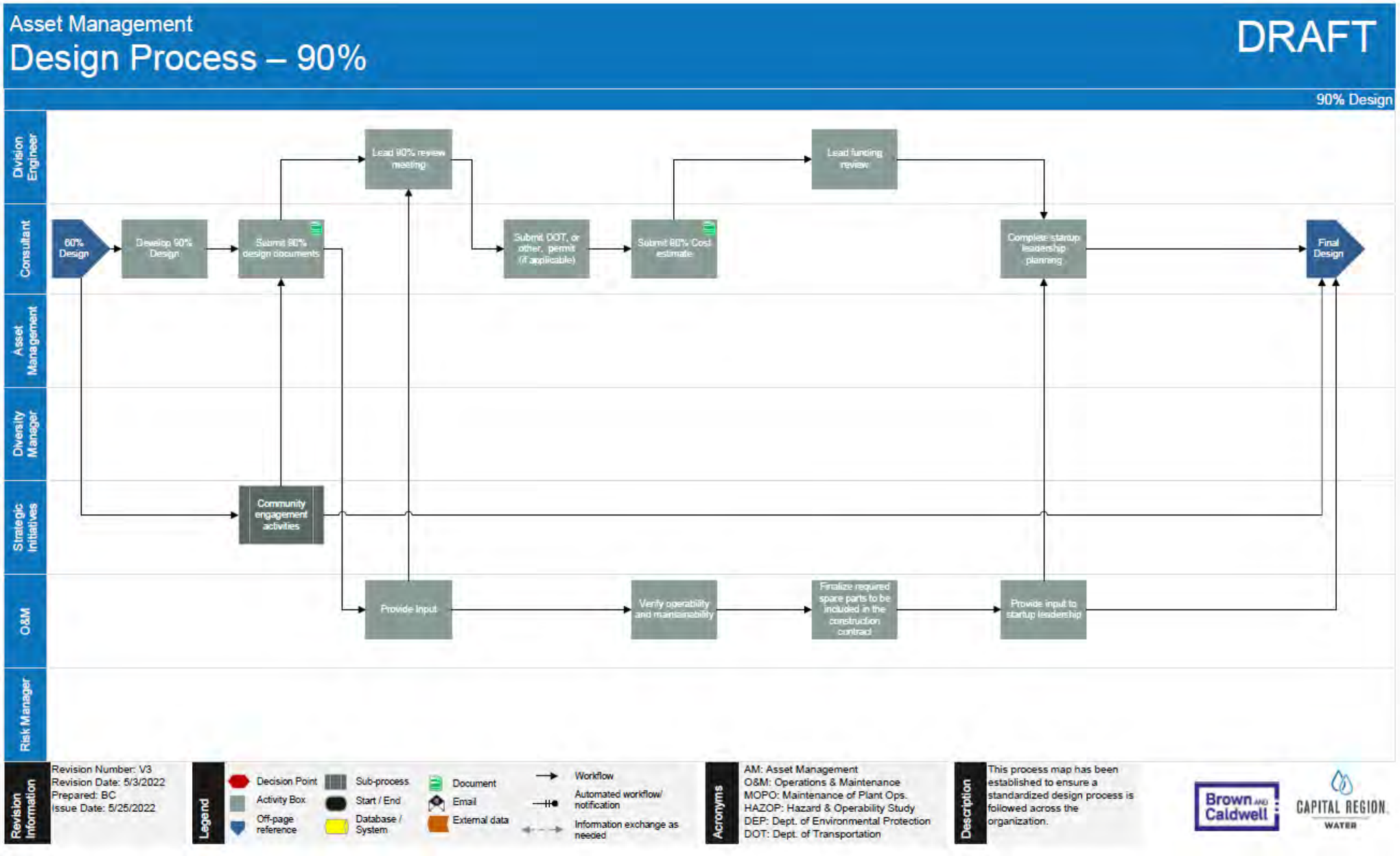


Figure 5-7. Design Process - 90% Design Stage

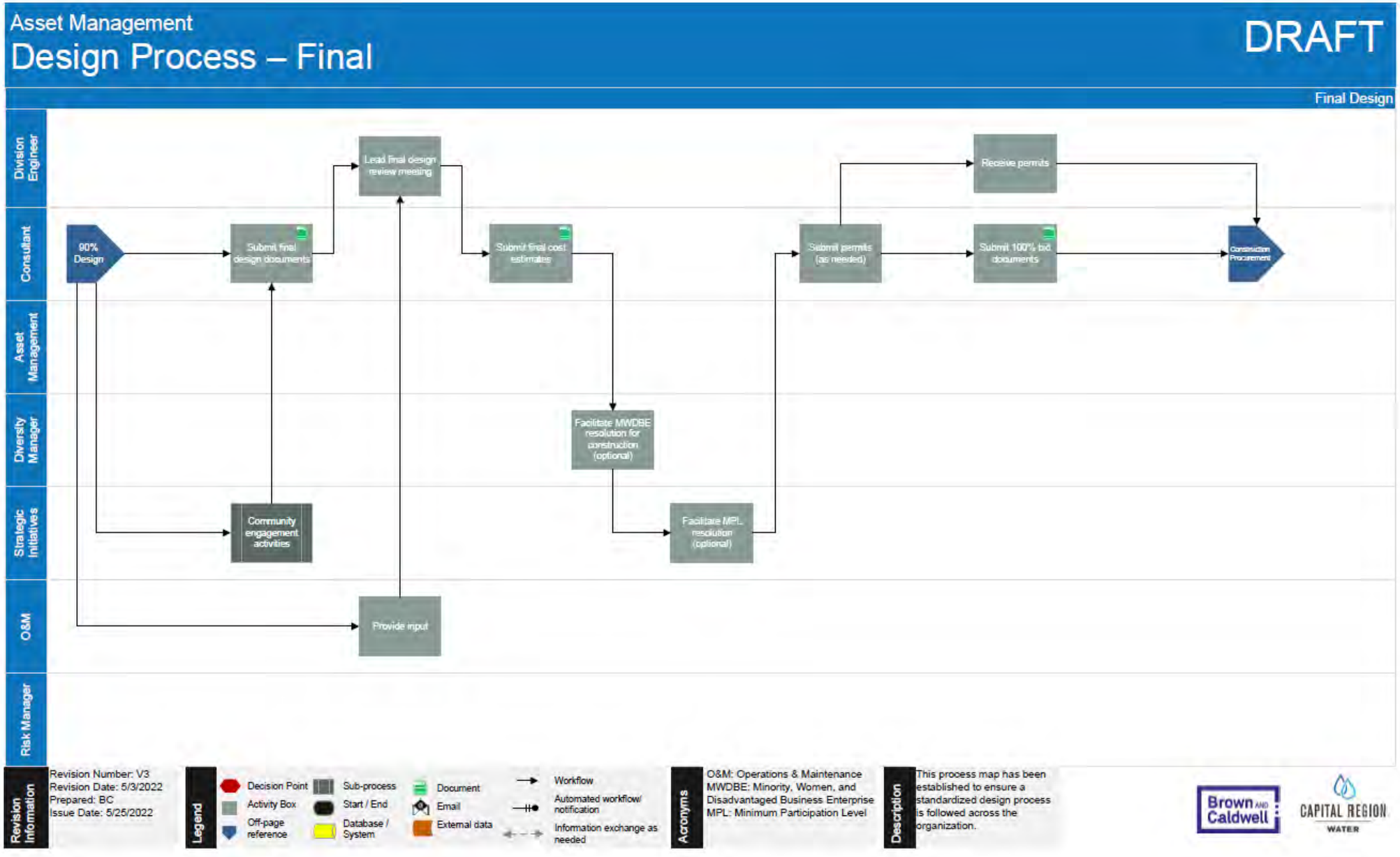


Figure 5-8. Design Process Final Design Stage

5.3.2 Construction Requirements

It is in construction that all the specific details regarding new assets becomes clear. Facility/system projects are delivered with asset listings in accord with the enumeration scheme provided for in the design. Significant attribute data may be required of the contractor to inform that asset management effort that will exist during the life of the assets (see **Appendix B**). Acquisition costs and lifecycle data at the asset level are delivered along with the asset listings.

The transmission of required assets and asset attributes to the owner must be complete and done per the specification standard. To ensure this, construction management and or consultant engineer activities geared to quality review and assurance of this information are essential.

During construction, activities to support successful testing, commissioning, and training should be planned, as appropriate with the owners O&M staff. Planning should consider the maintenance of operations during the startup, an assessment of startup readiness agreed upon by all parties, appropriate staff availability, timeframes for training, etc. These planning activities should occur well ahead of the scheduled startup of new assets. Figures 5-9 through 5-12 depict the construction process at CRW.

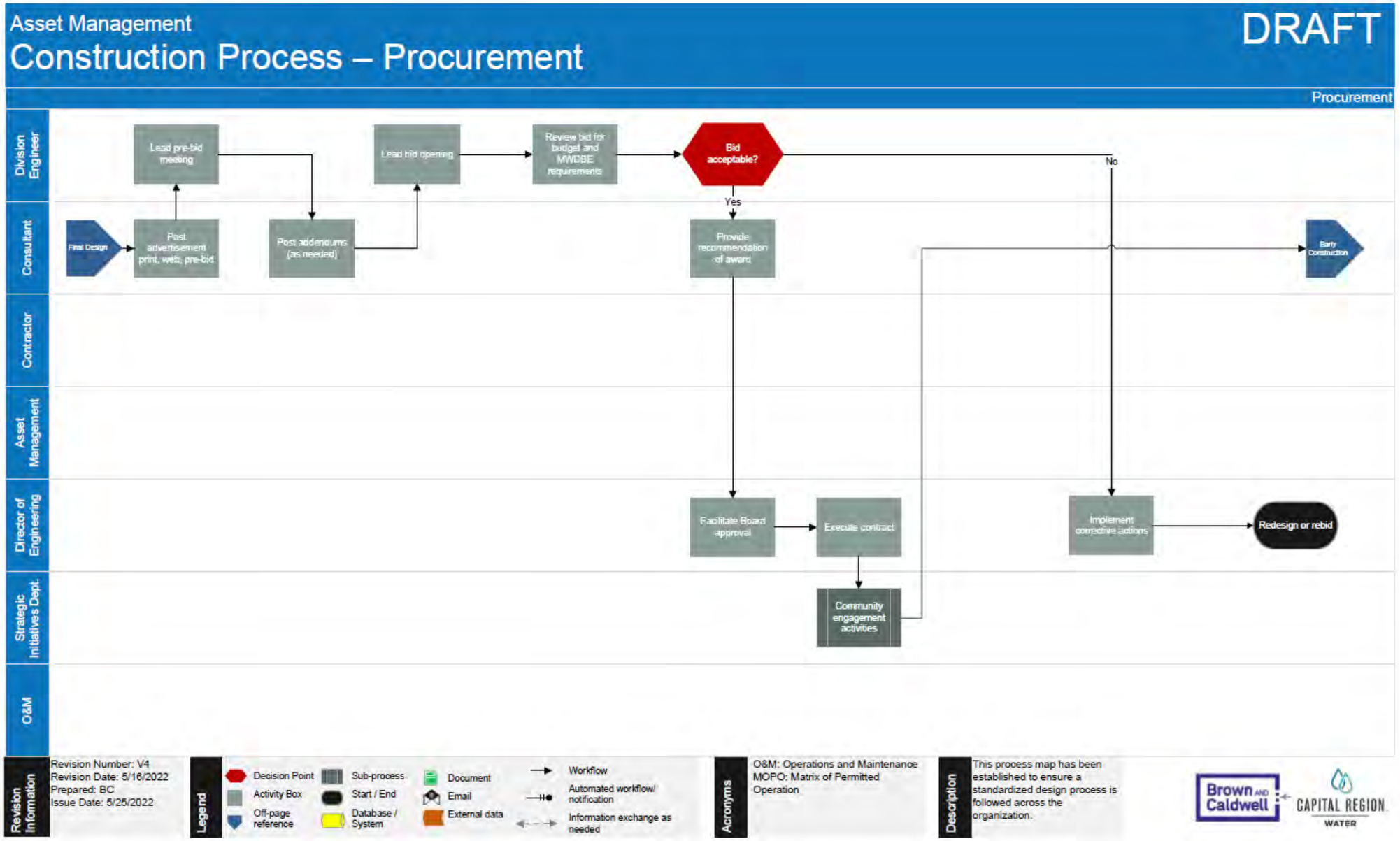


Figure 5-9. Construction Phase Procurement

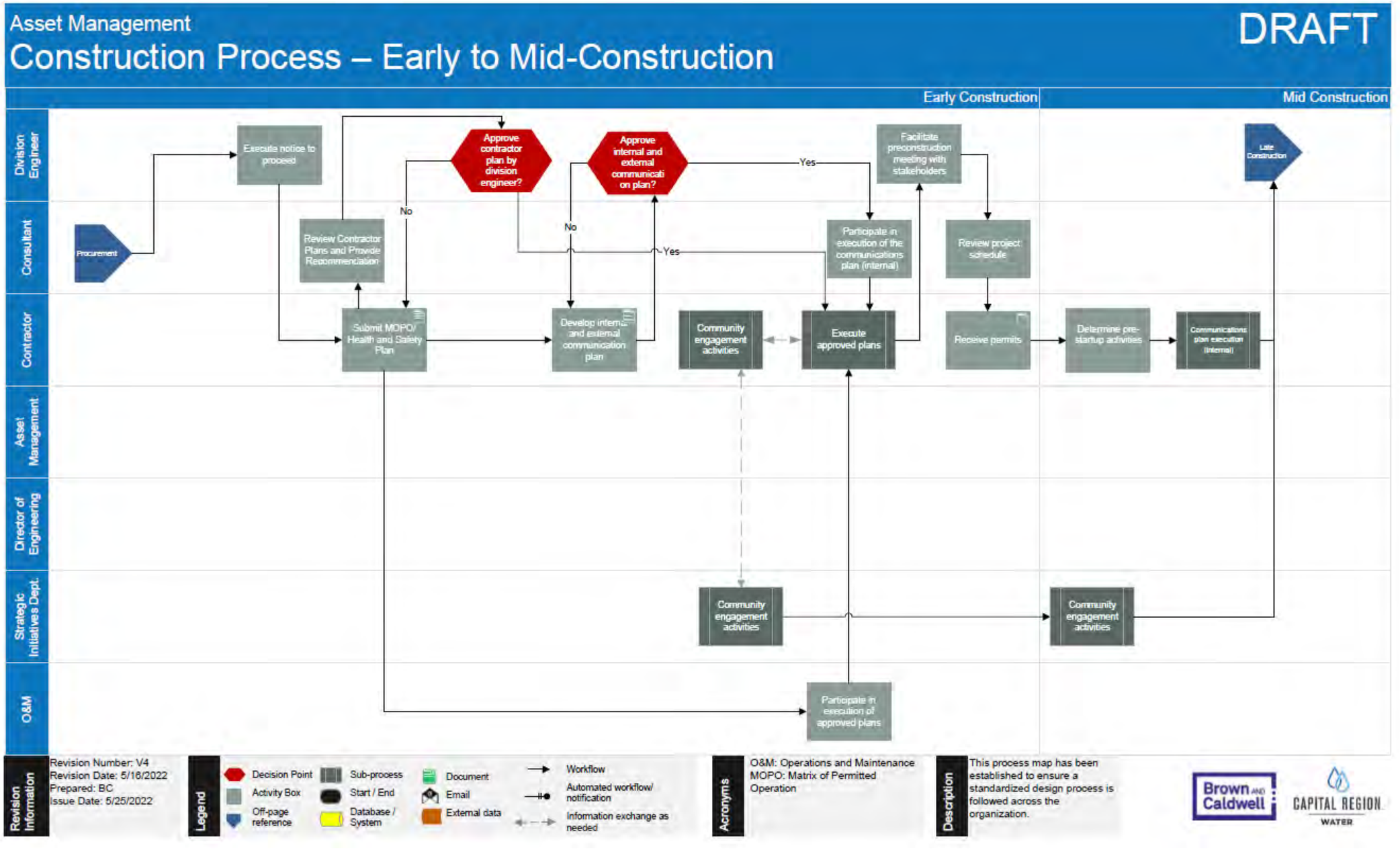


Figure 5-10. Construction Phase Early to Mid-Construction

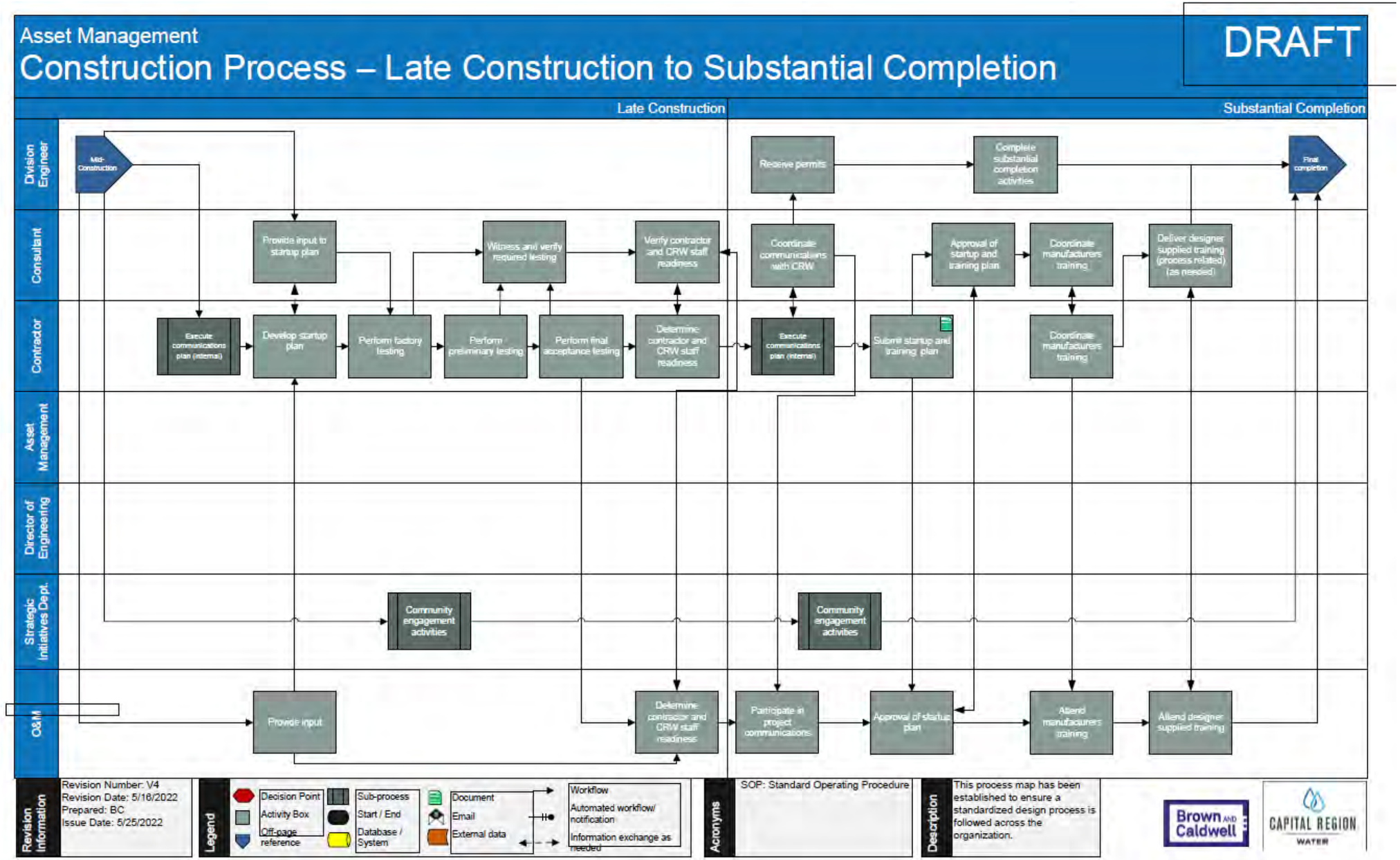


Figure 5-11. Construction Phase - Late Construction to Substantial Completion

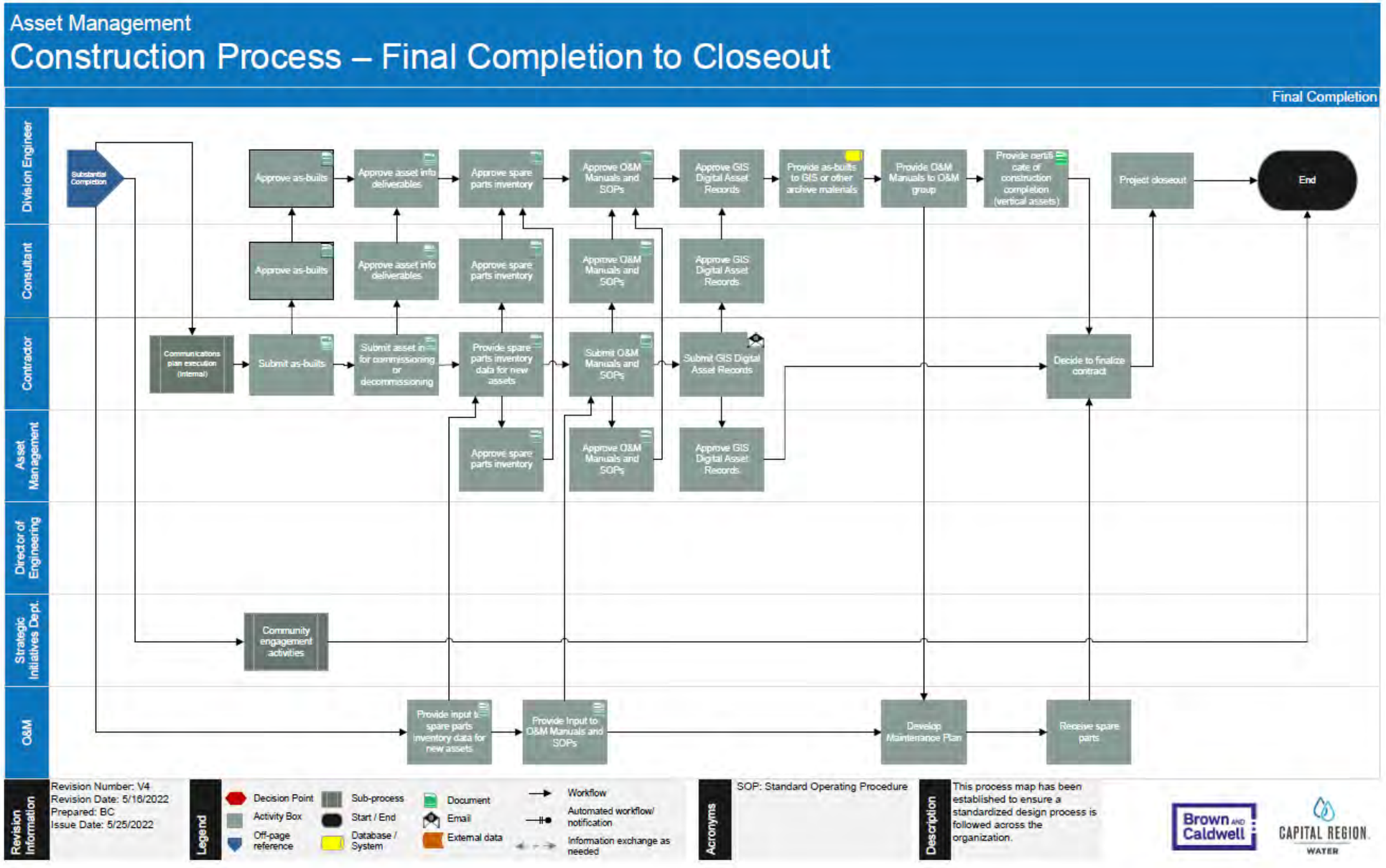


Figure 5-12. Construction Phase - Final Completion to Closeout

5.3.3 Operating Manuals, Procedures, and Guarantees

Where appropriate, design and construction requirements will include delivery of operating and maintenance manuals, guarantee information, and asset data which were defined in the design process. Additionally, in some cases, the contract specification may require the development of maintenance and/or operating procedures that are included in the above-mentioned training and then memorialized for inclusion in standard operating procedures or in the CMMS as maintenance job plans. As required, training materials and visuals should be turned over to the owner for their use. When contractor or designer supplied training will be extensive, the specifications may require that it be recorded for periodic refresher training.

When contact specifications require the delivery of operating manuals, procedures and/or warranty information it is essential that they be delivered prior to startup. Substantial completion and turnover of assets should require this documentation.

5.3.4 R/R Costs and Attributes

R/R costs, including indirect costs, are recorded in the asset history. This information is best obtained during the completion of a capital investment. Future decisions regarding renewal and/or replacement of assets will rely upon these costs and attributes.

The life extension (if any) brought about by the R/R work of the underlying asset is estimated at the end of the project. The remaining useful life of the asset is updated and may be included in revisions to the financial fixed asset inventory. This is used to appropriately increase the book value of the financials and start added depreciation of the newly renewed assets.

5.4 Continuous Improvement

People	Process	Technology
	• The COF and LOF scores of individual facility/system assets need to be reviewed on a periodic basis to ensure that the critical assets at each facility are being evaluated appropriately. As the asset management program evolves, the number of critical assets may expand or contract based on priorities. Additionally, as processes are modified at facilities, it will be appropriate to re-evaluate the COF and LOF of assets to ensure that they are designated appropriately. At a minimum, each facility will conduct annual COF and LOF review meeting for purposes of reviewing and updating the COF and LOF scores, with specific actions listed in the table below. • The table included in Appendix E should be re-evaluated on an annual basis and/or updated as appropriate when additional information regarding project costing is available.	

Section 6

Limitations

This document was prepared solely for Capital Region Water in accordance with professional standards at the time the services were performed and in accordance with the contract between Capital Region Water and Brown and Caldwell dated August 25, 2021. This document is governed by the specific scope of work authorized by Capital Region Water; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Capital Region Water and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Appendix A: Measure Definition Sheets

Capital Region Water
Asset Management Program
SAMP Level of Service (LOS) Performance Measures

Metric No.	Priority (H/M/L)	Strategic Goal Category	Value Statement	Detailed LOS_CRW	Internal / External statement	Measure Name	Equation	Description	Type	In AWWA Utility Benchmarking Survey	(2017) AWWA Median Value	Data Available	Data Source	Target	Actual	Reporting Frequency
SAMP-01		Public Health and the Environment	Protect and support the long-term health of our community and environment	Achieve or exceed all environmental and public health requirements in our drinking water, wastewater, and stormwater services		Violations caused by asset failures	Number of violations caused by asset failures / total number of violations	Measure of violations that occur due to asset failures, specifically. Indicates violations that may be preventable with implementation of AM practices.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-02		Public Health and the Environment	Protect and support the long-term health of our community and environment	Achieve or exceed all environmental and public health requirements in our drinking water, wastewater, and stormwater services		Near Misses (vertical assets)	Number of regulatory parameters within upper/lower warning limit of permit (vertical assets only)	Measure of regulatory parameters relative to permit requirements. Indicates when action is needed to ensure permit compliance.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-03		Public Health and the Environment	Protect and support the long-term health of our community and environment	Achieve or exceed all environmental and public health requirements in our drinking water, wastewater, and stormwater services		Monitoring and Reporting Compliance	Number of reporting activities completed by due date / total reporting activities scheduled	Measure of reporting activities completed on time. Indicates compliance with reporting requirements.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-04		Public Health and the Environment	Protect and support the long-term health of our community and environment	Achieve or exceed all environmental and public health requirements in our drinking water, wastewater, and stormwater services		Monitoring and Reporting Compliance	Number of sampling data points missed	Measure of sampling data points missed. Indicates potential monitoring and reporting compliance issues.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-05		Infrastructure Stability	Proactively maintain and improve our infrastructure	Operate and maintain assets in an efficient, sustainable, and resilient way		Work Order Compliance	Number work orders completed by the due date / total work orders due for a given period	Measure of work orders completed on time. Indicates work order compliance and overall O&M performance.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-06		Infrastructure Stability	Proactively maintain and improve our infrastructure	Operate and maintain assets in an efficient, sustainable, and resilient way		Equipment Failures/Breakdowns	Number of equipment failures or breakdowns in a period	Measure of equipment failures or breakdowns. Indicates state of CRW's assets and overall O&M performance.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-07		Infrastructure Stability	Proactively maintain and improve our infrastructure	Operate and maintain assets in an efficient, sustainable, and resilient way		Workorder Backlog	Number of weeks of planned maintenance work (by craft) available for assignment to staff	Measure of planned maintenance work backlog. Indicates resource needs and overall O&M performance.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-08		Infrastructure Stability	Proactively maintain and improve our infrastructure	Operate and maintain assets in an efficient, sustainable, and resilient way		Planned Maintenance vs. Corrective Maintenance	Percentage of planned maintenance vs corrective maintenance	Measure to track level of preventative maintenance in comparison to corrective maintenance to ensure that an optimal effort and investment is focused on preventive maintenance.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-09		Infrastructure Stability	Proactively maintain and improve our infrastructure	Undertake prudent and affordable renewal and replacement projects targeted for the long-term viability of the CRW assets		Asset Renewal and Replacement Rate	Actual expenditures (or total amount of funds reserved for R/R for assets) / total present worth of R/R for assets	Measure of rehabilitation and renewal expenditure over time. Relative to the average age of assets and when they are reaching their expected useful life.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-10		Infrastructure Stability	Make prudent investments to improve the system.	Undertake prudent and affordable renewal and replacement projects targeted for the long-term viability of the CRW assets		CIP Spending	Total annualized capital spending / approved CIP budget	Measure of capital spending versus budget. Indicates appropriate spending of funds to improve state of CRW's assets.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-11		Infrastructure Stability	Make prudent investments to improve the system.	Undertake prudent and affordable renewal and replacement projects targeted for the long-term viability of the CRW assets		Operations Spending	Total annualized operations spending / approved operations budget	Measure of operations spending versus budget. Indicates appropriate spending of funds to efficiently operate and maintain CRW's assets.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-12		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Provide financial resources for CRW customers that qualify for assistance		Customer Assistance	Number of customers receiving relief from the Customer Assistance Program (CAP)/month	Measure of CRW's assistance to qualifying customers. Indicates CRW's level of support to customers in need.	LOS	N		Y	?	TBD		Monthly
SAMP-13		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Provide financial resources for CRW customers that qualify for assistance		Shut-off for Non-payment	Percentage of customer accounts shutoff for non-payment/month	Measure of customers with non-payment status. Indicates potential future customer support needs from CRW.	LOS	N		Y	?	TBD		Monthly
SAMP-14		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Provide financial resources for CRW customers that qualify for assistance		CAP Assistance vs. Total Debt	Dollar value of the assistance relief as it relates to total debt (internal and external assistance dollars)	Measure of customer assistance relative to customer debt. Indicates CRW's level of support to customers in need.	LOS	N		Y	?	TBD		Monthly
SAMP-15		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Stakeholder Interactions	Number of interactions (community outreach and education) with defined stakeholders / total number of planned interactions	Measure of amount of interaction with stakeholders. Indicates level of engagement with the community.	LOS	N		Y	Cityworks, Tracking spreadsheet	TBD		Monthly
SAMP-16		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Service Request Completion	Average time to correct all CRW-related service issues	Measure of time to correct service issues. Indicates CRW responsiveness and commitment to the community.	LOS	N		Y	Cityworks	TBD		Monthly
SAMP-17		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Media Stories	Number of CRW driven stories/posts (traditional and social media) related to the utility during the reporting period	Measure of CRW stories/posts. Indicates level of engagement with the community.	LOS	N		Y	Tracking spreadsheet	TBD		Monthly
SAMP-18		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Customer Satisfaction	Number of Technical Service Complaints per 1000 Customer Accounts	Measure of the performance of CRW's services. Can be caused by many factors.	LOS	N		Y	Cityworks	TBD		Monthly

Capital Region Water
Asset Management Program
SAMP Level of Service (LOS) Performance Measures

Metric No.	Priority (H/M/L)	Strategic Goal Category	Value Statement	Detailed LOS_CRW	Internal / External statement	Measure Name	Equation	Description	Type	In AWWA Utility Benchmarking Survey	(2017) AWWA Median Value	Data Available	Data Source	Target	Actual	Reporting Frequency
SAMP-19		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Number of Insurance Claims	Number of insurance claims compared to industry average	Measure of insurance claims. Indicates performance of CRW's services.	LOS	N		Y	?	TBD		Monthly
SAMP-20		Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and by demonstrating value to our community.	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community		Severity of Insurance Claims	Severity (financial) of insurance claims compared to industry average	Measure of severity of insurance claims. Indicates performance of CRW's services.	LOS	N		Y	?	TBD		Monthly
SAMP-21		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Develop and strive for a highly productive workforce through safe work practices, training, and growth opportunities		Training Compliance	Number of employees that completed each required training by the deadline / number of employees required to complete the training	Measure of training completed by a due date. Indicates priority of employee training at CRW.	LOS	N		?	?	TBD		Monthly
SAMP-22		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Develop and strive for a highly productive workforce through safe work practices, training, and growth opportunities		Safety Metrics	Safety metrics include incidents, worker comp claims, and days off due to work-related issues / days worked	Measure of safety incidents, claims, and issues. Indicates status of safety culture at CRW.	LOS	N		Y	?	TBD		Monthly
SAMP-23		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Develop and strive for a highly productive workforce through safe work practices, training, and growth opportunities		Succession Planning	Number key positions with a formal succession plan/total key positions	Measure of formal succession planning. Indicates ability to handle turnover and sustain a productive workforce.	LOS	N		?	?	TBD		Monthly
SAMP-24		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Attract staff that are representative of CRW's service area and provide a work environment that promotes growth, equity, and stability		Vacant Positions	Number of vacant positions, by job category / total number of positions	Measure of vacant positions. Indicates ability to grow the workforce at CRW, as needed.	LOS	N		Y	?	TBD		Monthly
SAMP-25		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Attract staff that are representative of CRW's service area and provide a work environment that promotes growth, equity, and stability		Employee Diversity	Ethnic and gender diversity percentages for the utility (also includes employees residing within service area)	Measure of employee ethnic and gender diversity. Indicates employment of local residents and equitable practices across the organization.	LOS	N		Y	?	TBD		Monthly
SAMP-26		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Attract staff that are representative of CRW's service area and provide a work environment that promotes growth, equity, and stability		Employee Turnover Rate	Percentage of employees that leave the utility either voluntary or involuntary during the reporting period	Measure of employees leaving the utility. Indicates ability to retain and promote staff.	LOS	N		Y	?	TBD		Monthly
SAMP-27		Workforce	Attract, develop, and retain a skilled, dedicated, and unified CReW	Attract staff that are representative of CRW's service area and provide a work environment that promotes growth, equity, and stability		Time to Hire	Average number of days from decision to hire until new employee is at work	Measure of time from hiring decision to employee start date. Indicates efficiency of initial onboarding process.	LOS	N		Y	?	TBD		Monthly
SAMP-28		Efficient Use of Resources		Execute the mission of CRW using risk informed decisions that provide best value to our customers, stakeholders, and organization		Critical Assets with high-risk value (future)	Dollar value of critical assets with high-risk score / total dollar value of critical assets	Measure of dollar value of high-risk, critical assets. Indicates potential funding needs due to asset failures.	LOS			N	?	TBD		Future measure
SAMP-28		Efficient Use of Resources	Optimize the use of our resources thourgh innovative technologies, effective processes, and sustainable solutions	Execute the mission of CRW using risk informed decisions that provide best value to our customers, stakeholders, and organization		Critical asset with high-risk score	Number of critical assets with high-risk score / total number of critical assets	Measure of number of high-risk, critical assets. Indicates potential funding needs due to asset failures.	LOS	N		N	?	TBD		Monthly

Appendix B: Required Asset Attributes

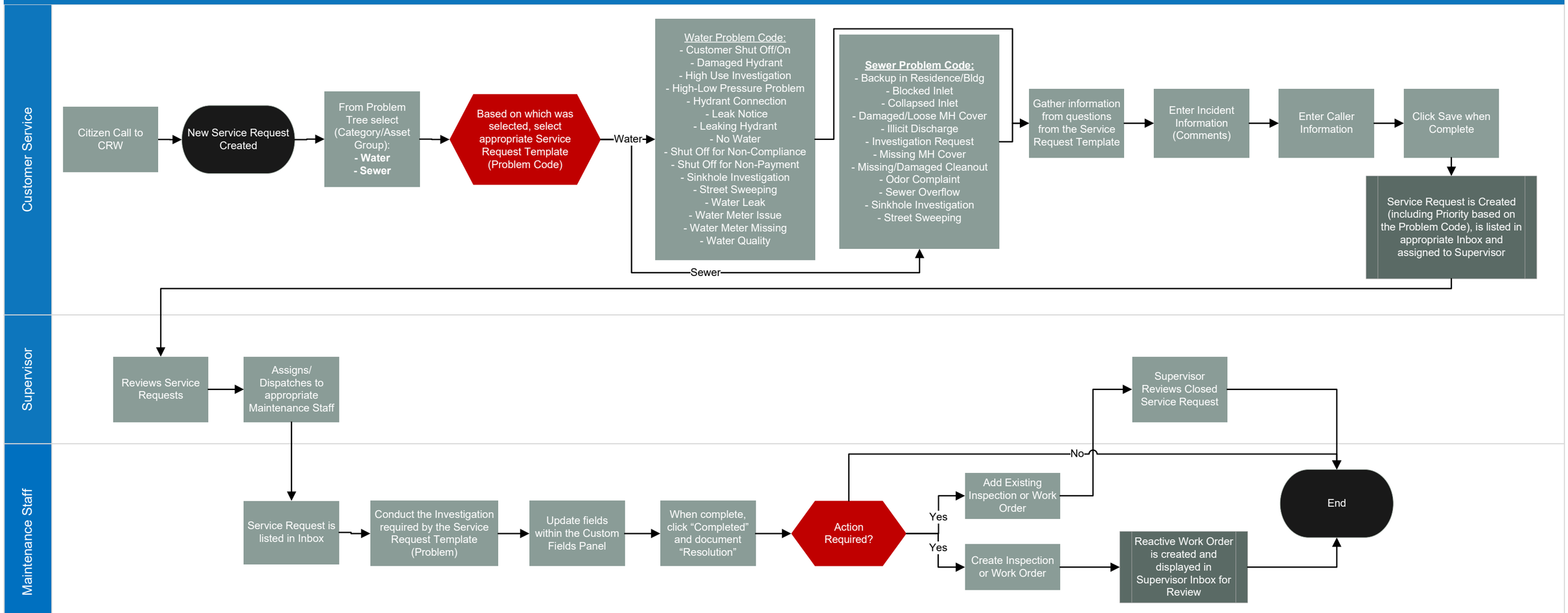
Required Vertical Asset Attributes		
Attribute	Description	Notes
Asset ID	System ID of the asset	
Name	Descriptive name of the asset	
Asset Type	Type of asset (asset class)	
Status	In/Out of service	
Material	Material of the asset, if applicable	
Manufacturer	Manufacturer of the asset, if applicable	
Model Number	Model number of the asset, if applicable	
Serial Number	Serial number of the asset, if applicable	
Installation Date	The date the asset was installed	
Purchase Cost	Purchase cost of the asset	This includes design cost, etc.
Replacement Cost	Replacement cost of the asset	Replacement cost of the equipment
Warranty Start Date	Date the warranty starts, if applicable	
Warranty End Date	Date the warranty ends, if applicable	
Physical Condition	Physical condition of the asset	
Performance Condition	Performance Condition of the asset	Potentially use predictive maintenance information
Criticality	Criticality of the asset	Either risk score or flag indicating whether the asset is a critical asset or not
Rehab Date	Date the asset was rehabilitated	

Required/Core Horizontal Asset Attributes		
Logical Attribute Name	Required?	Description
Asset ID	Yes	Unique identifier for the asset
Asset Name	No	Name commonly used to describe the asset in conversation
Asset Group	Yes	Type of asset (per Esri Utility Network)
Asset Type	Yes	Sub-type of asset (per Esri Utility Network)
Ownership / Responsibility	Yes	Agency with ownership and/or maintenance responsibility for an asset
Location	Yes	Description of the general location of the asset (interceptor, watershed, basin)
Critical Asset	No	Is the asset is considered critical?
Condition	No	Most recent condition rating/score for the asset
Risk Rating	No	Risk calculated based on COF and LOF
Installation Date	Yes	Date asset/equipment was installed
Status	Yes	The state of the asset in its lifecycle

Appendix C: Maintenance Strategy Workflows

Asset Management

Corrective Maintenance – Cityworks Service Requests (Linear Assets)



Revision Information

Revision Number: V2
Revision Date: 6/17/2022
Prepared: BC
Issue Date: 6/17/2022

Legend

- Decision Point
- Activity Box
- Off-page reference
- Sub-process
- Start / End
- Database / System
- Document
- Email
- External data
- Workflow
- Automated workflow/ notification
- Information exchange as needed

Acronyms

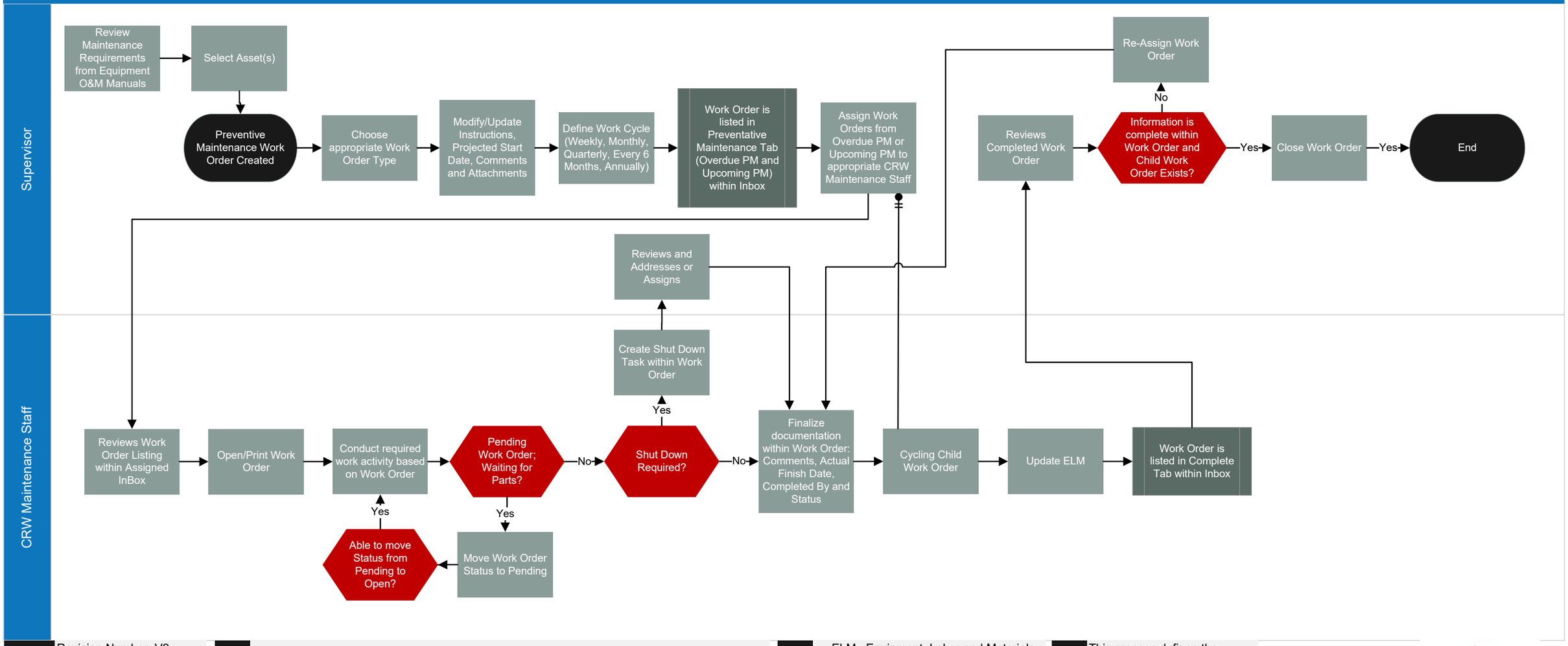
- MH = Manhole
- Bldg = Building

Description

This process defines the workflow for the Service Request activities within CRW using Cityworks.

Asset Management

Preventative Maintenance - Cityworks



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- Automated workflow/ notification
- Information exchange as needed

Acronyms

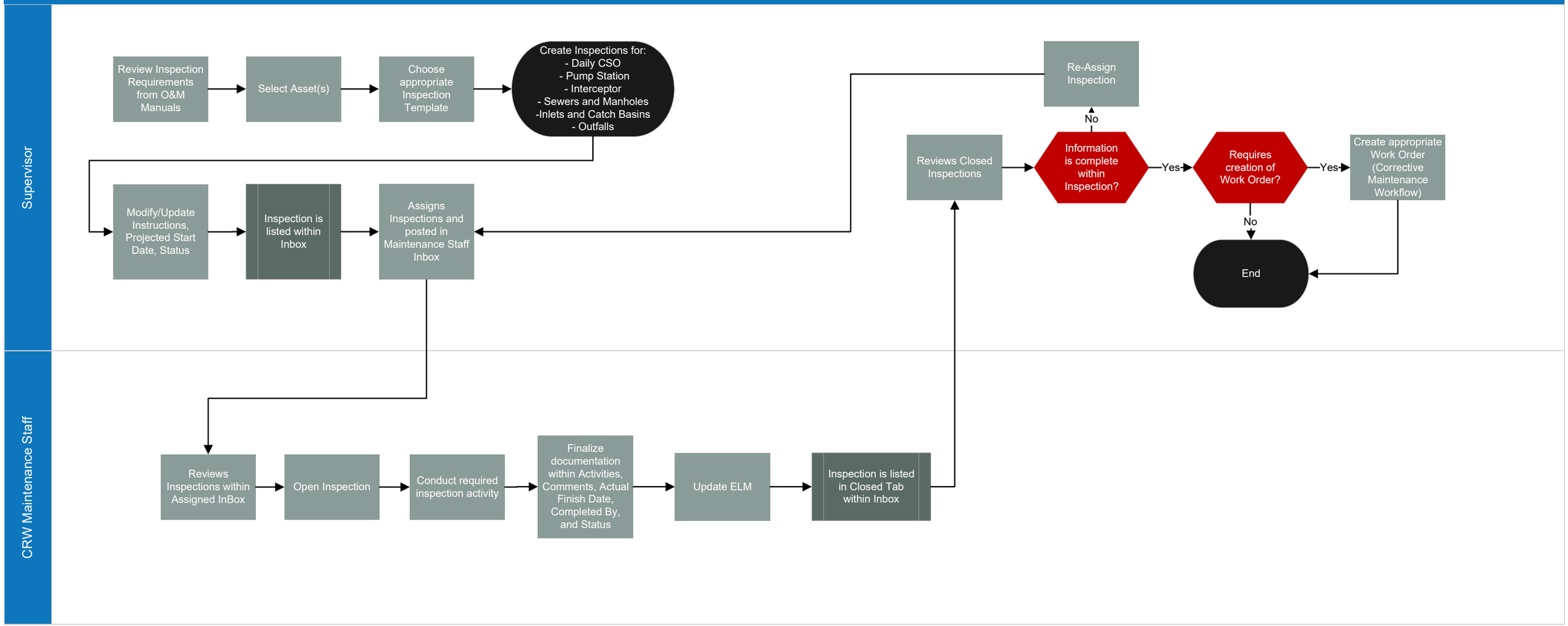
- ELM: Equipment, Labor and Materials

Description

This process defines the workflow for the Preventive Maintenance activities within CRW using Cityworks.

Asset Management

Preventative Maintenance (Inspections) - Cityworks



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- Database / System
- Document
- Email
- External data
- Workflow
- Automated workflow/ notification
- Information exchange as needed

Acronyms

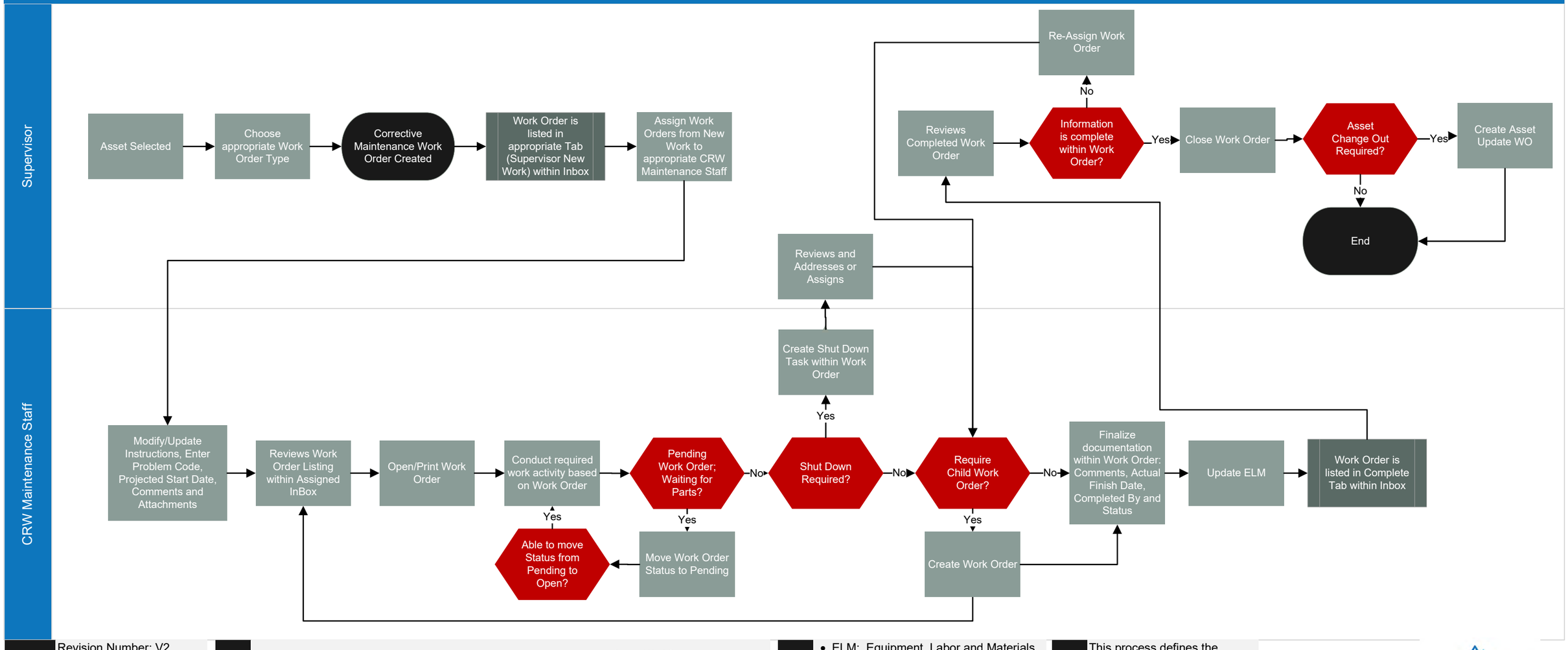
- ELM: Equipment, Labor and Materials

Description

This process defines the workflow for the Preventive Maintenance (Inspections) activities within CRW using Cityworks.

Asset Management

Corrective Maintenance – Cityworks Work Orders



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- Document
- Email
- External data
- Workflow
- Automated workflow/ notification
- Information exchange as needed

Acronyms

- ELM: Equipment, Labor and Materials

Description

This process defines the workflow for the Corrective Maintenance activities within CRW using Cityworks.

Appendix D: Condition Assessment Guidance Document

Condition Assessment Guidance Manual

Prepared for
Capital Region Water
July 15, 2022

Brown AND Caldwell

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Section 1

Purpose

The purpose of this document is to provide a reference guide for Capital Region Water (CRW) staff scoring the physical condition of critical vertical assets through the Visual Inspection process. This guidance works in conjunction with several other documents developed as part of the Asset Management program including the Strategic Asset Management Plan (SAMP) and facility or system specific Tactical Asset Management plans (TAMP). Vertical assets where this approach will be used are shown in Figure 1-1.

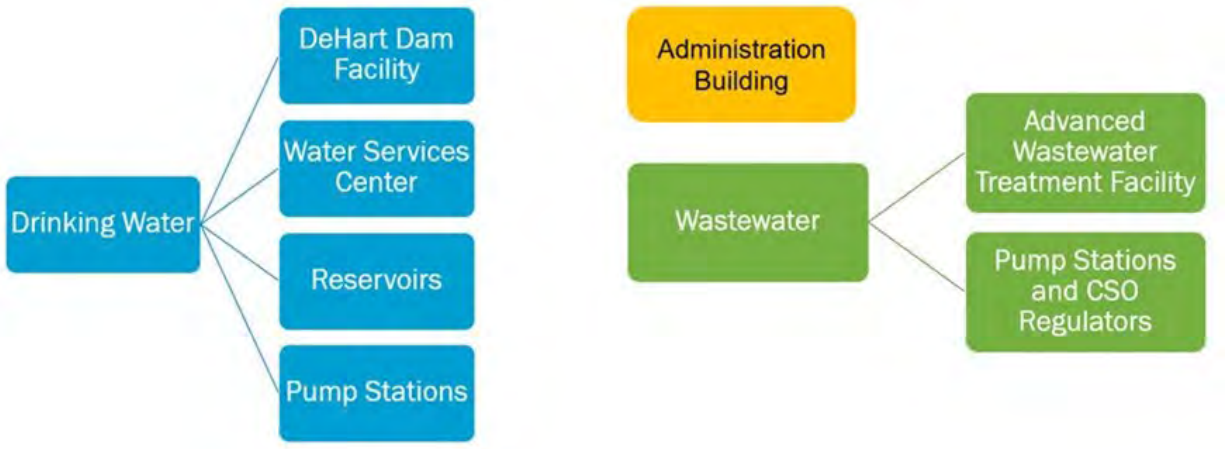
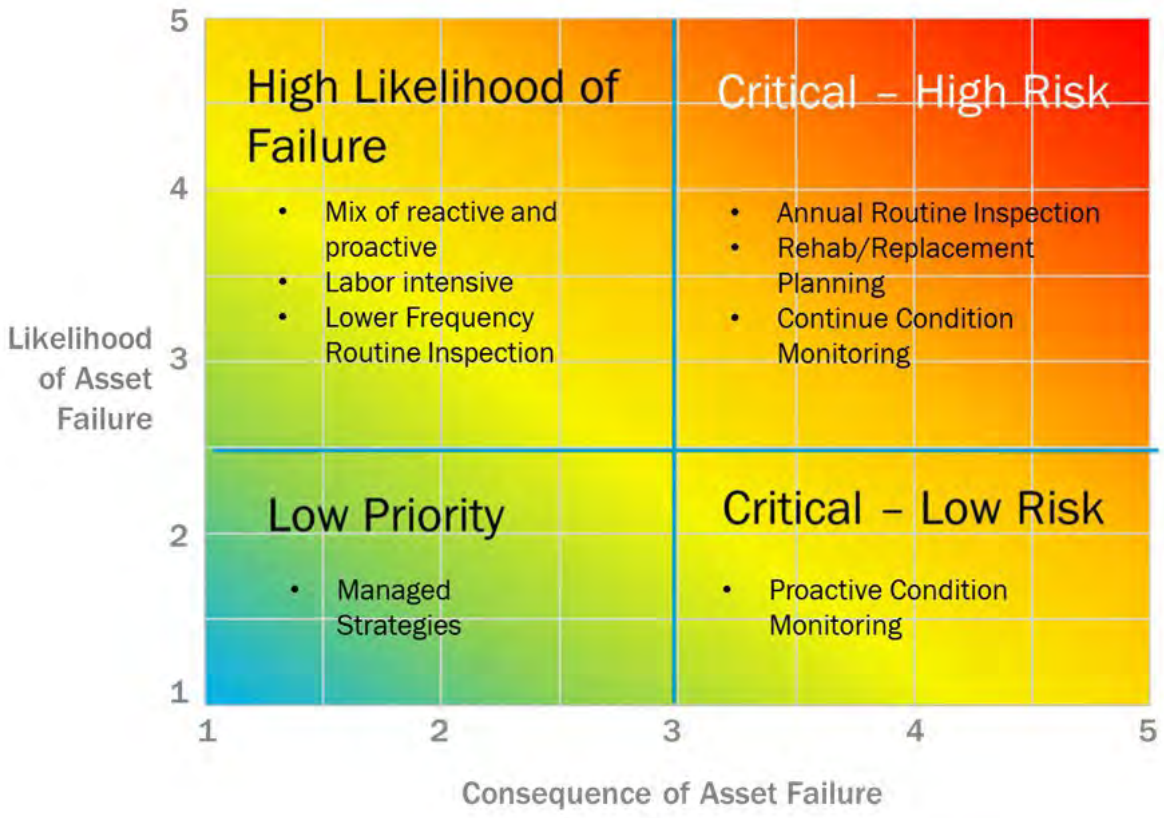


Figure 1-1. CRW Facilities Where Vertical Condition Ratings Will Be Applied.

CRW has identified critical assets for each facility based upon assigned CoF and LoF scores based on the following formula:

$$\text{Risk} = \text{CoF} \times \text{LoF}$$

Assets with a certain risk threshold have been identified as 'critical-high risk' assets identified for visual inspection. These critical-high risk assets will be inspected as established in the facility specific TAMP. A list of critical high-risk assets is available in each facility specific TAMP and constitute the list of assets that will be assessed as part of the Visual Inspection.



Visual Inspection will also be performed on the high likelihood of failure assets, however at a lower frequency of inspection that will be based on the previous condition rating. To initiate the process all high likelihood of failure assets will be inspected as established in Appendix B. Those assets with a poor condition rating will have their cycles shortened; those assets with good condition ratings will have their cycles lengthened. Critical – low risk assets will implement a proactive condition monitoring program, while managed strategies will be used for low priority assets.

1.1 Visual Inspection Benefits

Visual inspection is a sensory level inspection of the assets to document the baseline condition of the assets. Table 1.1 provides a summary of the reasons and details for visual inspection.

Table 1-1. Visual Inspection Benefits

Reason	Details
Ensure Consistency	• Standardized assessment methodology across all facilities • "Poor Condition" at Pump Station A should mean the same thing as "Poor Condition" at Pump Station B
Document Asset History	• Physical state and performance of our assets not "in someone's head"
Inform Key Programs	• Maintenance – adjust frequency and priority of PMs • Capital – adjust priority of capital improvements
Avoid Surprises	• Verify results of desktop likelihood of failure scoring • Minimize costly catastrophic failures and emergency repairs • Predict resource needs (maintenance, rehab, renewal)

Cost-Effective "Triage"	• Trigger more detailed assessment and/or follow-up • Understand urgency/timing of corrective actions

1.2 Roles and Responsibilities

The primary staff responsible for conducting visual inspection of critical assets at CRW and a brief description are listed below.

- Maintenance – Maintenance staff are responsible for conducting the visual inspection, documenting visual inspection observations, assigning condition scores, conducting repairs or replacements for any issues that are identified, and/or referring issues that cannot be addressed in-house to Engineering.
- Engineering – Engineering staff are responsible for addressing condition assessment findings referred by Maintenance requiring contracted resources either through an Emergency Contract or through a Capital Improvements Project. Engineering administers the project and works with the Contractor to implement the needed improvements.
- Contractor – Contractors work with Engineering to conduct repairs or replacements through an Emergency Contract or through a Capital Improvements Project.
- Asset Management – Asset Management staff make any needed changes and updates to the asset data in the CMMS based on the rehabilitation and replacement of the assessed assets. Staff also support any data management needs during the collection of the asset condition data.

Section 2

Visual Inspection Scoring and Criteria

The purpose of this section is to summarize the guidelines for conducting a Visual Inspection for mechanical, electrical, structural, instrumentation and controls (I&C), and earthen feature assets.

2.1 Visual Inspection Process

The physical condition of the asset is the current state of repair and operation of the asset as influenced by age, operating environment, and historical maintenance. A Visual Inspection will be the first step in the evaluation of the physical condition of an asset and a baseline inspection will occur initially and then at a frequency as set forth in the facility specific TAMP. In practice, the assessor must initially determine if the asset is operational and functioning as intended. The general process for conducting the inspection is summarized below:

- Identify assets to inspect and schedule the inspection
- Perform inspection
- Assign condition ratings
- Record inspection data and condition ratings using the Computerized Maintenance Management System (CMMS)
- Review and analyze the data
- Identify assets that warrant follow-up work order
- Adjust assessment frequency, as needed.

2.2 Scoring Descriptions

All visual inspections are evaluated on a 1 to 5 scale. Assets receiving a condition score of 1 are in good condition and assets receiving a condition score of a 5 are in very poor condition. An asset with a score of 2 to 4 is intended to represent the observed condition between those good and very poor condition ratings. The following scoring descriptions apply to all asset types for Visual Inspection of CRW assets:

Table 2-1. Standard Ratings	
Rating	**Rating Description**
1 - Very Good Condition	Like new with little signs of wear. Monitor asset condition and no further action required at present.
2 - Good Condition	Minor defects evident. Monitor and trend asset condition for possible additional actions.
3 - Fair Condition	Normal signs of wear for age of asset. Continue to monitor asset condition and evaluate for rehabilitation.
4 - Poor Condition	Significant defects are evident. Continue to monitor asset condition, repair as needed and expediate plan for rehabilitation or replacement.
5 - Very Poor Condition	Asset has failed or shows excessive wear and should be replaced as soon as possible.

2.2.1 Mechanical Assets

The following table summarizes the criteria and scoring approach for a Visual Inspection of mechanical assets which include pumps, motors, HVAC, grinders, etc.:

Table 2-2. Mechanical Visual Condition Assessment							
Criteria	**Evaluation**	**1**	**2**	**3**	**4**	**5**	**Weight**
Corrosion	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%	10
	Structural (loss of metal)	None or minor surface only	Multiple minor Surface	Significant corrosion affecting structure	Multiple Significant corrosion affecting structure	Major Corrosion compromising structure	
Leakage	Gaskets / Connections	None or historic	_	Significant leakage but equipment still operating	-	Leakage level will impact equipment operation imminently	25
	Holes / Failures	-	-	1 location	>1 location	>3 locations	
	Packing Gland/mechanical seal	Normal leakage	-	Excessive leakage with adjustment available	-	Excessive leakage with no adjustment available	
Vibration/ Noise	Noise	Within what is considered normal	-	Higher than what is expected during normal operations	-	Abnormal noise not associated with normal operation	25

Table 2-2. Mechanical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Vibration (measured using installed sensors)	Within Normal Operating Range	-		-	Above normal operating range	
	Vibration Apparent with Noise	None or normal vibration	-	Moderate (vibration level sensed but within operating standards)	-	Severe vibration (level measured beyond acceptable limits)	
	Non-Structural Damage	-	-	Yes	-	-	
	Structural Damage	-	-	-	-	Yes	
Heat	Measured using installed temperature gauges or heat gun (if available) with equipment operating at least 1 hour	Within Normal Operating Range (Typical 140-180)	-	10-20 degrees above normal operating range	-	>20 degrees above normal	15
Concrete Support	Surface Cracking / Loose Grout	Presence of surface cracks or loose grout	Multiple surface cracks	Potential loss of asset anchor point	Asset stability compromised due to surface cracks	Asset stability failed due to surface cracks	10
	Spalling	<10%	10%-50%	>50% - 75%	>75%; stability compromised	>95%; Asset stability failed	
	Through Cracks	Presence of through cracks	Multiple through cracks	Foundation settling	Equipment stability compromised	Equipment stability failed	
	Missing Pieces (within 6 inches of equipment mounts)	-	-	-	1 or more	3 or more	
Metal Supports	Surface Corrosion	<10%	10%-50%	50%-75%	>75%	>95%	10
	Structural Corrosion	-	-	<25%	>=25%	>=50%	
	Missing/Broken Anchors	-	-	<25%	>=25%	>=50%	
Painting/coating	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%	5
Corrosion	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%	10
	Structural (loss of metal)	None or minor surface only	Multiple minor Surface	Significant corrosion affecting structure	Multiple Significant corrosion affecting structure	Major Corrosion compromising structure	

Table 2-2. Mechanical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
Leakage	Gaskets / Connections	None or historic	_	Significant leakage but equipment still operating	-	Leakage level will impact equipment operation imminently	25
	Holes / Failures	-	-	1 location	>1 location	>3 locations	
	Packing Gland/mechanical seal	Normal leakage	-	Excessive leakage with adjustment available	-	Excessive leakage with no adjustment available	
Vibration/Noise	Noise	Within what is considered normal	-	Higher than what is expected during normal operations	-	Abnormal noise not associated with normal operation	25
	Vibration (measured using installed sensors)	Within Normal Operating Range	-		-	Above normal operating range	
	Vibration Apparent with Noise	None or normal vibration	-	Moderate (vibration level sensed but within operating standards)	-	Severe vibration (level measured beyond acceptable limits)	
	Non-Structural Damage	-	-	Yes	-	-	
	Structural Damage	-	-	-	-	Yes	
Heat	Measured using installed temperature gauges or heat gun (if available) with equipment operating at least 1 hour	Within Normal Operating Range (Typical 140-180)	-	10-20 degrees above normal operating range	-	>20 degrees above normal	15
Concrete Support	Surface Cracking / Loose Grout	Presence of surface cracks or loose grout	Multiple surface cracks	Potential loss of asset anchor point	Asset stability compromised due to surface cracks	Asset stability failed due to surface cracks	10
	Spalling	<10%	10%-50%	>50% - 75%	>75%; stability compromised	>95%; Asset stability failed	
	Through Cracks	Presence of through cracks	Multiple through cracks	Foundation settling	Equipment stability compromised	Equipment stability failed	

Table 2-2. Mechanical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Missing Pieces (within 6 inches of equipment mounts)	-	-	-	1 or more	3 or more	
Metal Supports	Surface Corrosion	<10%	10%-50%	50%-75%	>75%	>95%	10
	Structural Corrosion	-	-	<25%	>=25%	>=50%	
	Missing/Broken Anchors	-	-	<25%	>=25%	>=50%	
Painting/coating	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%	5

Photographs depicting mechanical assets with scores corresponding to 1 (good) to 5 (very poor) are included in Appendix A.

2.3 Electrical Assets

The following table summarizes the criteria and scoring approach for a Visual Inspection for an electrical asset:

Table 2-3. Electrical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
Corrosion	Surface only (enclosure)	<10%	10%-50%	>50% - 75%	>75%	>95%	10
	Structural	None or minor surface only	Multiple minor Surface	Significant corrosion affecting structure	Multiple Significant corrosion affecting structure	Major Corrosion	
	Connections	<10%	10%-50%	>50% - 75%	>75%	>95%	
Leakage	Transformer/Connection Leaks	None or historic	_	Significant leakage but equipment still operating	-	Leakage level will impact equipment operation imminently	15
Vibration/Noise	Vibration (use handheld monitor)	None or normal vibration	-	Moderate (vibration level sensed but within operating standards	-	Severe vibration level measured beyond acceptable limits	5

Table 2-3. Electrical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Motors noise level while operating	Normal	-	Moderate (Indicating eqmt condition issue	-	Severe noise level (indicating imminent issue)	
Electrical Damage	Evidence of Overheating	Within spec limits	-	Abnormal heat, but asset is still operating and possible cause for concern	-	Exceeding spec limits	25
	Evidence of Arcing	None	-	Evidence of arcing, but asset is still operating and possible cause for concern	-	Evidence of arcing, asset inoperable	
	Grounding Missing/Damaged	Minor ground connection damage, No loss of gnd connection	-	Corrosion evident, but grounding can be cleaned	-	Total loss of eqmt grounding	
	Cooling System	Ambient temperature is appropriate for asset operations	-	Operating temperature is above normal for asset operations	-	Ambient temperature significantly above asset operating condition and/or loss of cooling system	
	Connections Loose/Broken	Cover off or missing	-	Connection loose or exposed or not properly dressed	-	Connections broken	
Concrete Supports	Surface Cracking / Loose Grout	Presence of surface cracks or loose grout	Multiple surface cracks	Potential loss of equipment anchor point	Equipment stability compromised due to surface cracks	Equipment stability failed due to surface cracks	5
	Through Cracks	Presence of through cracks	Multiple through cracks	Foundation settling	Equipment stability compromised	Equipment stability failed	
Metal Supports	Surface Corrosion	<10%	10%-50%	>50%-75%	>75%	>95%	5

Table 2-3. Electrical Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Structural Corrosion	Presence of corrosion	>10%	<25%	>=25%	>=50%	
	Supports/Unistrut/channel	Support moving or vibrating	support anchor loose or severely corroded	Single Support not performing function	Supporting system compromised	Supporting system failed	
Housekeeping (Cleanliness)	Evidence of dust	None	-	Minimal	Minor	Severe	5
	Evidence of pests	None	Evidence of pests, but no current activity	Present- no damage to asset	Present- minor damage. Corrective action required by asset still operating	Present- significant damage and asset not operating	
	Evidence of water damage	None	-	Evidence of moisture	-	Standing water	
Smell	Chemical, burning, etc.	Normal	-	-	-	Abnormal	10
Loose/Unsupported Conduit	Conduit damaged or not properly secured	None	-	Signs of damage, but asset functional	-	Holes in conduit or broken conduit, asset not functional	5
Exposed Wiring	Signs of exposure, cut, frayed, cracked, split, uncovered, etc.	None	-	Good	-	Insulation is significantly damaged or bare wire	15

Photographs depicting electrical assets with scores corresponding to 1 (good) to 5 (very poor) are included in Appendix A.

2.4 Structural Assets

The following table summarizes the criteria and scoring approach for a Visual Inspection for structural assets:

Table 2-4. Structural Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
Paint/Coating	Missing paint or coating	<10%	10%-50%	>50% - 75%	>75%	>95%	5
Leakage	Cracks/Joints/Penetrations/Failures	None or Historic only	Damp	Drip or seep	Stream >1 loc	Stream >3 loc	15

Table 2-4. Structural Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
Concrete/Masonry Surface Damage/Joint Damage	Cracking (Width of crack)	< 1/16 inches	1/16-1/8 inches	1/8-1/4 inches	>1/4 inches	>1/2 inches	15
	Exposed Reinforcement	-	-	1 location	>1 location	>3 locations	
	Spalling, Exposed Aggregate., Pitting, Delamination, Freeze/Thaw Damage	<10%	10%-50%	>50% - 75%	>75%	>95%	
	Settling/Heaving	-	-	1 location	>1 location	>3 locations	
Metal Damage	Cracking	-	-	1 location	>1 location	>3 locations	15
	Fatigue/Connection Failure	-	-	1 location	>1 location	>3 locations	
	Seating (gate and valves)	Fully seated	minor wear	wear with minor leakage	significant leakage, but manageable	complete bypass of gate or valve	
	Deformation	<10%	10-50%	>50% - 75%	>75%	>95%	
	Corrosion/Metal Loss	<10%	10-50%	>50% - 75%	>75%	>95%	
Wood Damage	Dry Rot	-	-	1 location	>1 location	>3 locations	5
	Warping/Splitting	-	-	1 location	>1 location	>3 locations	
	Biological Growth (algae)	<10%	10-50%	>50% - 75%	>75%	>95%	
	Connection Failure (nail pops)	-	-	1 location	>1 location	>3 locations	
	Loss of Section	<10%	10-50%	>50% - 75%	>75%	>95%	
Water/Drainage	Evidence of Standing Water along Foundation, walkways, driveways (soil settling)	Inadequate grass cover	-	Swale; <1-foot wide and 1-inch deep	-	Ponded; >2-foot wide and 3-inches deep	5
Asphalt Surfaces	Sealer Missing	<10%	10-50%	>50% - 75%	>75%	>95%	5
	Roadbed Failure	<10%	10-50%	>50% - 75%	>75%	>95%	
	Cracking	<10%	10-50%	>50% - 75%	>75%	>95%	

Table 2-4. Structural Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Heaving/potholes	None or <2 inches deep	-	>2 inches deep and less than 12-inch diameter	-	>6 inches deep and >12-inches in diameter	
	Aggregate Exposure	<10%	10-50%	>50% - 75%	>75%	>95%	
Roof Condition	Ponding	<10%	10-50%	>50% - 75%	>75%	>95%	10
	Shingle Grit Loss/cracking	<10%	10-50%	>50% - 75%	>75%	>95%	
	Missing Shingles	-	-	<10	>10	>20	
	Dry Rot of Rubber Membrane	-	-	1 location	>1 location	>3 locations	
	Metal roofing damage	-	-	1 location	>1 location	>3 locations	
	Torn/split Membrane	-	-	1 location	>1 location	>3 locations	
	Flashing Issues	-	-	1 location	>1 location	>3 locations	
	Attic space Issues/leaks	-	-	1 location	>1 location	>3 locations	
Windows/doors	Broken Glass	None	-	Cracked	-	Broken or Missing	10
	Caulking	None or minor issues	-	Noticeable/ loose caulking	-	>50% caulk loose or missing	
	Leakage	None	-	Moisture present between window panes	-	Leaking	
	Warpage/alignment/rot	None or minor issues	-	Issue noted, but still functional	-	Not functional	
	Hardware Issues	None or minor issues	-	Issue noted, but still functional	-	Not functional	
Security and Fencing	Fence Damage	None or minor issues	-	Issue noted, but still functional	-	Asset not functional and security risk	15

Table 2-4. Structural Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Gate	None or minor issues	-	Issue noted, but still functional	-	Asset not functional and security risk	
	Access issues (lock, actuator, scanner)	None or minor issues	Asset functional	Asset functional, but signs of wear	Significant condition issues noted, but asset functional	Missing, damaged, or cut and asset not functional	

Photographs depicting structural assets with scores corresponding to 1 (good) to 5 (very poor) are included in Appendix A.

2.5 Instrumentation and Control Assets

The following table summarizes the criteria and scoring approach for a Visual Inspection of instrument and control assets which include meters, PLCs, control centers, etc.:

Table 2-5. Instrumentation and Control Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
Corrosion	Surface only (enclosure)	<10%	10%-50%	>50% - 75%	>75%	>95%	10
	Structural	None or minor surface only	Multiple minor Surface	Significant corrosion affecting structure	Multiple Significant corrosion affecting structure	Major Corrosion	
	Connections	<10%	10%-50%	>50% - 75%	>75%	>95%	
Mounted Instruments	Damaged/non functional devices	No Damage	-	Environmental interference present (dirt, grease, etc.) and can be restored with cleaning	-	Not functioning	20
Concrete Supports	Presence of surface cracks or loose grout	Multiple surface cracks	Potential loss of equipment anchor point	Equipment stability compromised due to surface cracks	Equipment stability failed due to surface cracks	Equipment stability failed due to surface cracks	5
	Presence of through cracks	Multiple through cracks	Foundation settling	Equipment stability compromised	Equipment stability failed	Equipment stability failed	
Metal Supports	Surface Corrosion	<10%	10%-50%	>50%-75%	>75%	>95%	5

Table 2-5. Instrumentation and Control Visual Condition Assessment							
Criteria	Evaluation	1	2	3	4	5	Weight
	Structural Corrosion	Presence of corrosion	>10%	<25%	>=25%	>=50%	
	Supports/Unistrut/channel	Support moving or vibrating	support anchor loose or severely corroded	Single Support not performing function	Supporting system compromised	Supporting system failed	
Housekeeping (Cleanliness)	Evidence of dust	None	-	Minimal	Minor	Severe	5
	Evidence of pests	None	Evidence of pests, but no current activity	Present- no damage to asset	Present- minor damage. Corrective action required by asset still functional	Present- significant damage and asset not functional	
	Evidence of water damage	None	-	Evidence of moisture	-	Standing water	
Loose/Unsupported Conduit	Conduit damaged or not properly secured	None	-	Signs of damage, but asset functional	-	Holes in conduit or broken conduit, asset not functional	5
Human Machine Interface (HMI)	Display	No Damage	Dirt/sludge on display screen or touchpad	Pixilation or touch screen/keypad not operating as designed, but unit has limited functionality	Sun fade or scratches/cracks on the screen	Not functioning	25
Battery Life	Status	Charged		Low Battery Alarm		Drained	5
Communications (modem, ethernet, etc.)	Signal	No damage, operational	-	Damaged equipment/loose connections	-	Not functioning	20

Photographs depicting instrumentation and control assets with scores corresponding to 1 (good) to 5 (very poor) are included in Appendix A.

2.6 Earthen Feature Assets

Earthen feature assets will be included in future versions of this document.

Section 3

Visual Inspection Documentation

3.1 Visual Inspection Form

The following form was developed for the visual inspection of the critical assets at each plant and the pump stations. A consolidated assessment form was created to capture process mechanical, structural, and electrical condition of an asset, as applicable. Inspection efforts will utilize a mobile inspection form with the same criteria and entry fields. An example Visual Inspection Form is shown below:

MECHANICAL - VISUAL INSPECTION ASSESSMENT FORM

Asset ID		Asset Description:	
Assessor's Name:		Date of Assessment:	____/____/_____

Photos *(keep photo size low (~2 mb) - turn time/date stamp on)*

Did you take a photo? yes no (If yes, attach to work order) Extra photos for major damage (all 5's) or project specific purposes? yes no

(Circle one score in every row. If not applicable, circle the choice in column 1.)

Criteria	Evaluation	1	2	3	4	5
Corrosion	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%
	Structural (loss of metal)	None or minor surface only	Multiple minor Surface	Significant corrosion affecting structure	Multiple Significant corrosion affecting structure	Major Corrosion compromising structure
Leakage	Gaskets / Connections	None or historic	-	Significant leakage to eqmt still operating	-	Leakage level will impact equipment operation imminently
	Holes / Failures	-	-	1 location	>1 location	>3 locations
	Packing Gland / mechanical seal	Normal leakage	-	Excessive leakage with adjustment available	-	Excessive leakage with no adjustment available
Vibration/Noise	Noise	Within what is considered normal	-	Higher than what is expected during normal operations	-	Abnormal noise not associated with normal operation
	Vibration (measured using installed sensors)	Within Normal Operating Range	-		-	Above normal operating range
	Vibration Apparent with Noise	None or normal vibration	-	Moderate (vibration level sensed but within operating standards)	-	Severe vibration (level measured beyond acceptable limits)
	Non-Structural Damage	-	-	Yes	-	-
	Structural Damage	-	-	-	-	Yes
Heat	Measured using installed temperature gauges or heat gun (if available) with equipment operating at least 1 hour	Within Normal Operating Range (Typical 140-180)	-	10-20 degrees above normal operating range	-	>20 degrees above normal
Concrete Support	Surface Cracking / Loose Grout	Presence of surface cracks or loose grout	Multiple surface cracks	Potential loss of asset anchor point	Asset stability compromised due to surface cracks	Asset stability failed due to surface cracks
	Spalling	<10%	10%-50%	>50% - 75%	>75%; stability compromised	>95%; Asset stability failed
	Through Cracks	Presence of through cracks	Multiple through cracks	Foundation settling	Equipment stability compromised	Equipment stability failed
	Missing Pieces (within 6 inches of equipment mounts)	-	-	-	1 or more	3 or more
Metal Supports	Surface Corrosion	<10%	10%-50%	50%-75%	>75%	>95%
	Structural Corrosion	-	-	<25%	>=25%	>=50%
	Missing/Broken Anchors	-	-	<25%	>=25%	>=50%
Painting/coating	Surface only	<10%	10%-50%	>50% - 75%	>75%	>95%

ADDITIONAL COMMENTS:

3.2 Visual Inspection Equipment

Following completion of the Visual Inspection activities, data and photos should be available for review in the CMMS. Note- assets that are rated a '5' for one or more criteria will require a work order for additional evaluation. Although Visual Inspection is a sensory level assessment, some equipment may be useful to document the asset condition. At a minimum, the assessor should have the following equipment available for use during a Visual Inspection:

- Digital Camera to photo document observed asset condition
- Tape Measure to evaluate structural cracking.
- Flashlight to provide additional lighting as necessary
- Temperature gun to assess temperature of equipment
- Rag or cloth to wipe away debris or material from an asset tag
- Small Wire Brush to assess presence of historic leakage

3.3 Photo Documentation

It is important to document the asset condition during a Visual Inspection and digital cameras will be provided to document observed conditions for possible review during follow-up. Photos will also be loaded into the CMMS on the work order to document asset condition over time. The following guidelines should be followed regarding photo documentation:

- Set camera at lowest megapixel setting (1-2 MB).
- Set-up date stamping
- Record photo number on assessment sheet
- Rename photo to Asset ID after downloading
- Take photos sparingly:
    - One photo minimum per group and one per structure.

Additional photo of individual assets in very poor condition- all assets scoring a 5 require additional photos for engineering referral.

3.4 Program Execution

Condition assessment approaches and intervals will be established based on the Condition Assessment Methods in Appendix B. Assets will be scheduled in the CMMS as a recurring work order for planning and tracking.

Asset CoF and LoF will be re-evaluated on an annual basis to group assets accordingly on the matrix. Visual Inspections will be performed on critical – high risk and high likelihood of failure asset categories.

Section 4

Post-Visual Inspection Analysis

The purpose of this section is to summarize the guidelines for conducting analysis and follow-up after the Visual Inspections have been completed and the results have been compiled.

4.1 Condition Assessment Evaluation Process

An overview of the condition assessment evaluation process is provided in Figure 4-1. A detailed description of the key steps in the process is provided in the sections that follow.

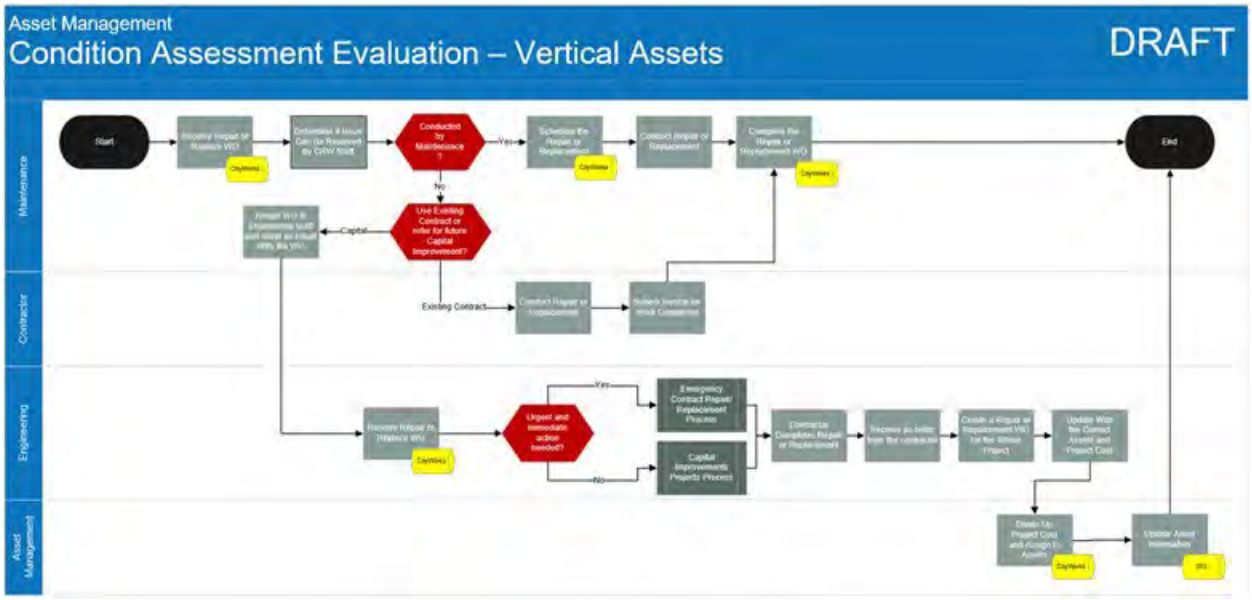


Figure 4-1. Condition Assessment Evaluation Process

4.2 Overall Condition Score

An overall condition score will be calculated in the CMMS for each asset that was inspected as follows:

- The highest score for each criterion is the score for that criteria.
- The criteria score is multiplied by the weight of that criteria.
- The weighted criteria score is totaled for the asset and is used as the overall condition score.
- If multiple asset inspection types apply to the asset being assessed, then both are performed, and the higher score is used for the asset.

4.3 Scoring Analysis

Analysis of the scores will include not only high scores (i.e., '5's) but also looking at score trends over time. Once the overall condition score has been calculated, it can be compared to the historical scores to identify changes in condition over time to predict asset failure before it happens and to

determine the best timing for mitigation activities such as repair, rehabilitation, replacement, and modification of the maintenance strategy for that asset.

4.4 Physical Condition Scores

As the physical condition scores of critical high-risk and high likelihood of failure assets are monitored and trended over time, the following recommended actions may be taken for the given scoring ranges:

- 1: Monitor asset condition and no further action required at present.
- 2: Monitor and trend asset condition for possible additional actions. Consider if asset is a good candidate for condition monitoring*, set the visual inspection frequency to 2 years.
- 3: Continue to monitor asset condition and evaluate for rehabilitation. Consider if asset is a good candidate for condition monitoring*, continue with 1-year visual inspection frequency
- 4: Continue to monitor asset condition, repair as needed and expediate plan for rehabilitation or replacement. Develop estimate of remaining useful life, develop scope/plan for rehabilitation and replacement, develop costs to plan timing for budget/funding needs, continue 1-year visual inspection frequency until repairs can be made
- 5: Immediate corrective action required. Asset should be replaced as soon as possible.

*Note: Condition monitoring readings of concern should trigger a work order for conducting a visual inspection as part of troubleshooting the issue.

4.5 Engineering Follow-up and Troubleshooting

As shown in the Visual Inspection process (Section 2.1), the Engineering Division will receive an Engineering Referral Work Order in instances where the asset receives an individual observation score of five (5) for any criteria category. The Post-Visual Inspection Analysis and Follow-up process shown in Figure 4-1 includes the steps to be taken by engineering. The outcome of the follow-up activities conducted by engineering may include:

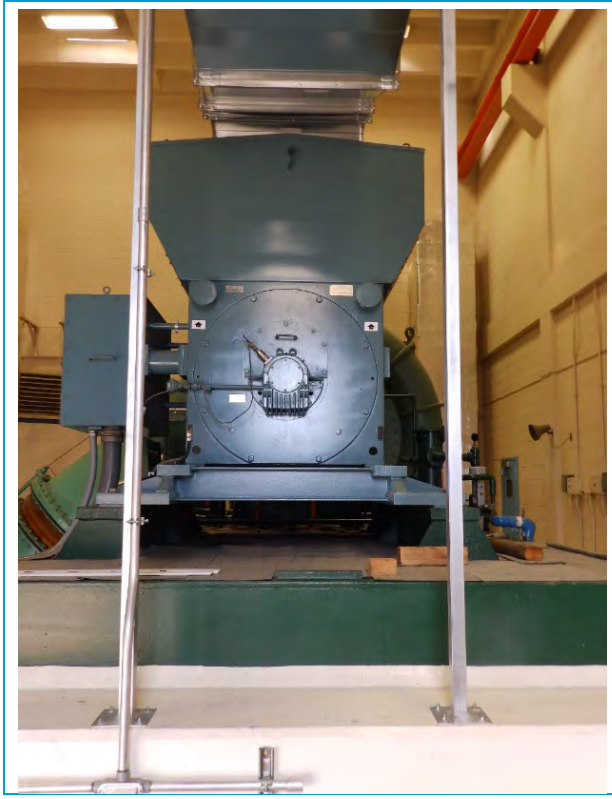
- Verification of score
- Referral for repair by CRW maintenance staff
- Scoping and planning for rehabilitation and replacement by CRW staff or outside contractor within the plant budget
- Scoping and planning for rehabilitation and replacement for referral to CIP
- Referral for adjustment of maintenance strategy
- Rescoring of asset upon maintenance, rehabilitation, or replacement

Appendix A: Condition Reference Photographs

Mechanical Assets in Very Good Condition

Table A.1 Mechanical Asset in Very Good Condition: Score = 1	
	<10% Surface corrosion and historic leakage only noted.
	No corrosion or leakage noted.

Table A.1 Mechanical Asset in Very Good Condition: Score = 1	
	No corrosion; new asset.
	<10% corrosion and evidence of historic leakage.

Table A.1 Mechanical Asset in Very Good Condition: Score = 1	
	No signs for vibration. Corrosion <10% and historic only leakage noted.

Mechanical Equipment in Good Condition

Table A.2: Mechanical Equipment in Good Condition: Score = 2	
	Surface corrosion 10-50%, evaluate for recoating.

Mechanical Equipment in Fair Condition

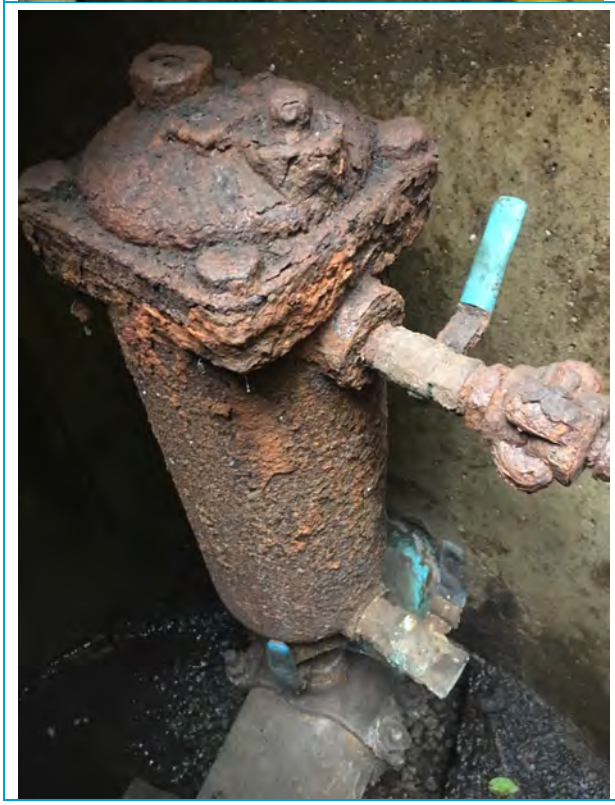
Table A.3: Mechanical Equipment in Fair Condition: Score = 3	
	Leakage noted (drip only).

Mechanical Equipment in Poor Condition

Table A.4: Mechanical Equipment in Poor Condition: Score = 4	
	Leakage and metal support structural corrosion >=25% noted.
	Surface corrosion noted, but not compromising the asset. Evaluate for recoating.

Mechanical Equipment in Very Poor Condition

Table A.5: Mechanical Equipment in Very Poor Condition: Score = 5	
	Major corrosion compromising structure, structural corrosion >50%
	Stream leakage noted.
	Major corrosion compromising structure, structural corrosion >50%

Table A.5: Mechanical Equipment in Very Poor Condition: Score = 5	
	Major structural corrosion compromising structure, Coating missing >95%
	Major structural corrosion compromising structure, Coating missing >95%

Electrical Equipment in Very Good Condition

Table A.6: Electrical Equipment in Very Good Condition: Score = 1	
	Local control panel with no corrosion. Like new condition.
	No evidence of corrosion; covers and panels in good condition. No evidence of leakage or visible damage.

Table A.6: Electrical Equipment in Very Good Condition: Score = 1

Minor surface only corrosion and panels in good condition. No visible damage or loose conduit.

Electrical Equipment in Good Condition

Table A.7: Electrical Equipment in Good Condition: Score = 2	
	Surface corrosion (<50%), no leakage or visible damage noted.

Electrical Equipment in Fair Condition

Table A.8: Electrical Equipment in Fair Condition: Score = 3	
	Evident signs of corrosion.

Electrical Equipment in Poor Condition

Table A.9: Electrical Equipment in Poor Condition: Score = 4	
	Multiple significant structural corrosion affecting structure. Metal supports structural corrosion >25%

Electrical Equipment in Very Poor Condition

Table A.10: Electrical Equipment in Very Poor Condition: Score = 5	
	Corrosion on inside of panel that compromises asset. Corrosion has completed eroded metal.
	Evidence of pests that compromise asset performance

Table A.10: Electrical Equipment in Very Poor Condition: Score = 5	
	Visible Damage on exterior of panel, Evidence of overheating/arcing exceeding spec limits.

Structural Assets in Very Good Condition

Table A.11: Structural Asset in Very Good Condition: Score = 1	
	Concrete shows no signs of spalling, cracking, leakage, or exposed rebar.
	Concrete pedestal showing no signs of cracking, leakage, or spalling.

Table A.11: Structural Asset in Very Good Condition: Score = 1	
	<10% spalling of concrete, no cracks observed, no exposed rebar. No structural corrosion observed.
	Concrete cracking <1/16 inches, spalling <10%, metal loss <10%

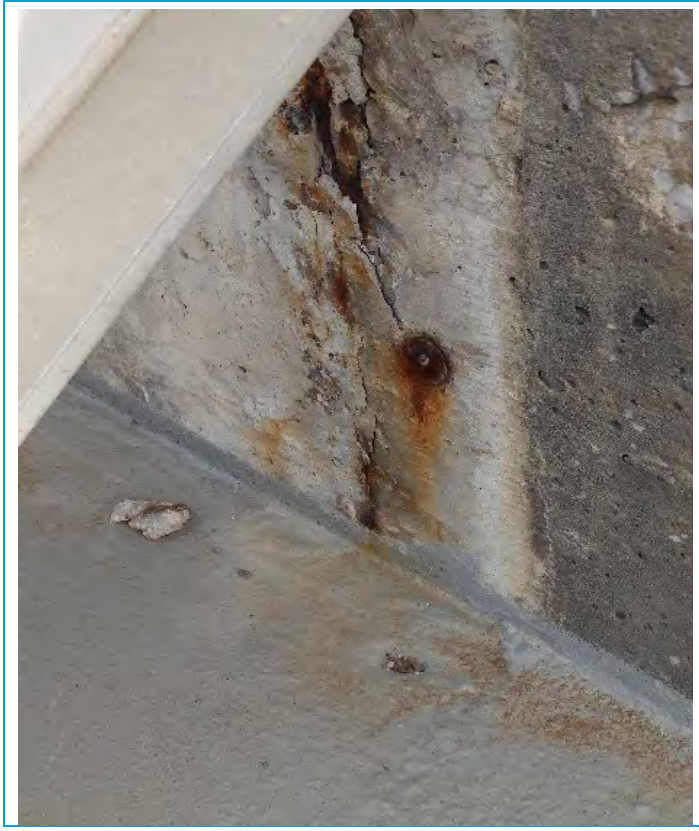
Structural Assets in Good Condition

Table A.12: Structural Assets in Good Condition: Score = 2	
	Security access issues, asset functional
	Cracks >1/16-inch and >10% spalling.

(Metal Housing)
Metal corrosion 10-50%

Structural Assets in Fair Condition

Table A.13: Structural Assets in Fair Condition: Score = 3	
	Concrete showing some (<25%) spalling and evidence of cracking.
	Moderate surface corrosion 10-50%, Missing paint >50%-75%

Table A.13: Structural Assets in Fair Condition: Score = 3	
	Exposed rebar at one location with >50-75% concrete spalling.

Structural Assets in Poor Condition

Table A.14: Structural Assets in Poor Condition: Score = 4	
	Cracking > ¼ inch
	(concrete basin) Concrete cracking >1/4-inch, spalling >75%

Table A.14: Structural Assets in Poor Condition: Score = 4

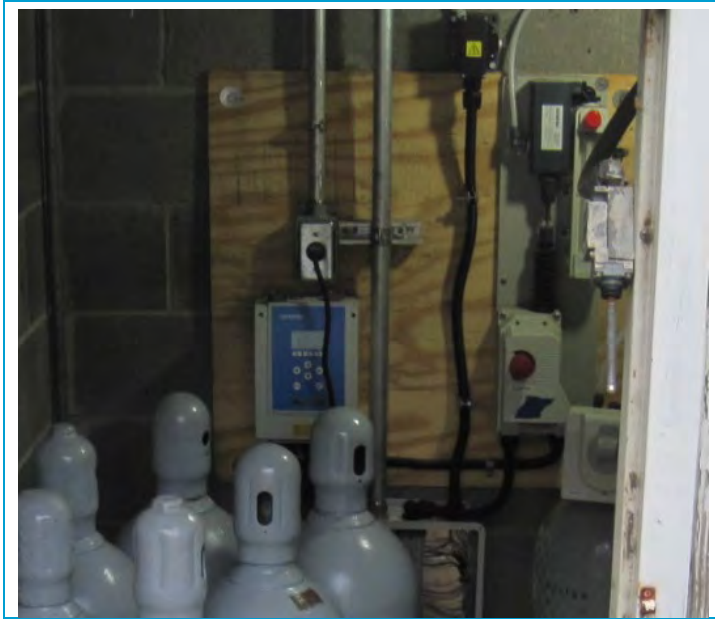
Structural Asset in Very Poor Condition

Table A.15: Structural Asset in Very Poor Condition: Score = 5	
	Exposed reinforcement >3 locations, cracking > ½ inch
	(metal platform) Metal corrosion >95%, missing coating >95%, metal fatigue >3 locations

Table A.15: Structural Asset in Very Poor Condition: Score = 5	
	
	Connection failure >3 locations, corrosion/metal lost >95%
	Concrete cracking > ½ inch, freeze/thaw damage >95%, metal loss >95%, water damage >2-foot wide and 3-inches deep

Table A.15: Structural Asset in Very Poor Condition: Score = 5	
	Connection failure >3 locations,
	Concrete cracking >1/2inch, damage >95%
	Concrete crack >1/2 inch

Instrument and Control Assets in Very Good Condition

Table A.16: Instrumentation and Control Assets in Very Good Condition: Score = 1	
	Corrosion none or minor surface only, no damage,
	Corrosion none or minor surface only, no damage,

Instrumentation and Controls Assets in Good Condition

Table A.17: Instrumentation and Control Assets in Good Condition: Score = 2	
	Good housekeeping, no evident damage. PLC cabinet has minor external corrosion.

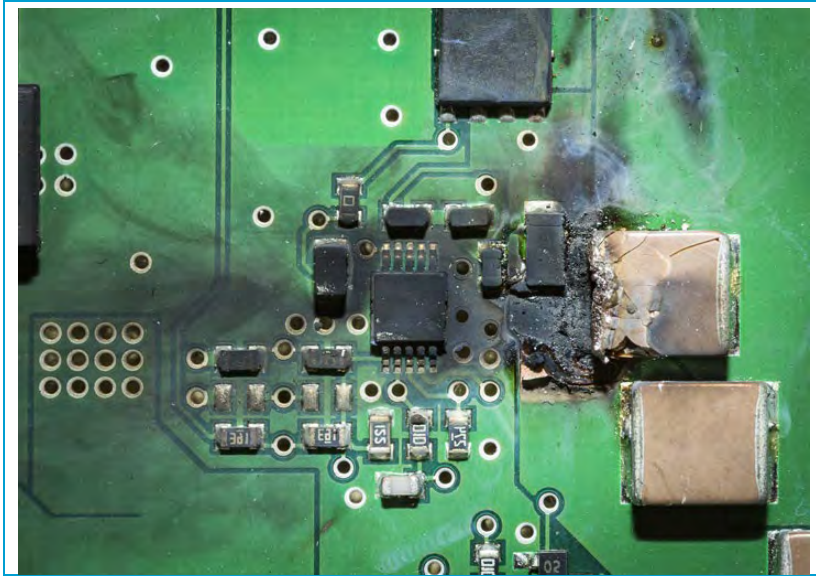
Instrumentation and Controls Assets in Fair Condition

Table A.18: Instrumentation and Control Assets in Fair Condition: Score = 3	
	Slow response and outdated screen, but unit functional

Instrumentation and Controls Assets in Poor Condition

Table A.19: Instrumentation and Control Assets in Poor Condition: Score = 4	
	Damaged HMI screen with scratches evident.

Instrumentation and Controls Assets in Very Poor Condition

Table A.20: Instrumentation and Control Assets in Very Poor Condition: Score = 5	
	Surge damaged PLC board.

Appendix B: Condition Assessment Methods

Table B-1. Condition Assessment Techniques (Vertical Assets)				
Analysis	Asset Type	Data Source	CRW or Contractor?	Typical Data Collection Frequency*
Visual Inspection	All Equipment	Visual condition	CRW	As determined in TAMPs
Performance Testing	Pumps	Performance data	Contractor	6-month or annual
Battery Check	UPS	Instrument measured	CRW	Quarterly
Boiler Water/Cooling Water Loops	Boilers	Analytical results	Contractor	Monthly or Quarterly
Laser Alignment Check	Pumps/motors	Instrument measured	Contractor	Annual
Load Testing	Generators	Instrument measured	Contractor	Weekly or monthly
Insulation (Meg) and Current Testing	Motors	Instrument measured	CRW	Annual
Oil Analysis	Engine/ generators	Analytical results	Contractor	Annual
Physical Dimension Measurement	Pump wear rings	Direct measure	Contractor	Annual
Relay Tests	Switchgear	Instrument measured	CRW	Annual
Thermography/Infrared	Substations, MCCs, switchgear	Instrument measured	CRW	Annual
Vibration (external and on-line)	Rotating equipment	Instrument measured	CRW	Annual (if not built-in)

*Note: Inspection frequency will vary based on the asset type and the risk rating (consequence and likelihood of failure).

Appendix E: Problem, Cause, Resolution Codes

Appendix E- Sewer Collection & Water Distribution Problem, Cause, Resolution Lists

Fill in only when there is a problem - done by the person creating the work order	Fill in when the problem is diagnosed - done by person receiving the work order	Required on all - fill in the result of work performed on all work orders PM or CM
Problem	**Cause**	**Resolution**
Adjustment Needed	Abnormal Conditions	Abandon
Broken / Damaged	Animals	Adjust
Dirty/Debris/Overgrowth	Contractor/Third Party	CCTV
Flood	Debris/Obstructions	Clean
Hard to Operate	Design Flaw	Close
Inaccurate Reading	Improper Installation/Construction	Disinfect/Dose
Joint Failure	Improper PM Cycle	Exercise
Leaking / Seepage	Inflow/Infiltration	Flow/Flush
Mechanical Failure	Lubrication (Excessive/Lack of)	Locate/Stake
No Service / Not Working	Operator Error	Lubricate
Odor	Packing	No Action
Overflowing / Surcharge	Poor Soils	Open
Pressure (High, Low, None)	Procedures Incorrect	Operate
Pressure (Low, None)	Roots	Paint
Settlement/Erosion	Transient Pressure	Pull Meter
Stoppage	Age/Wear/Use	Relocate
Unable to Locate / Missing	Capacity	Remove Debris/ Obstruction
Vandalism/Theft	Condition	Remove/Decommission
Water Quality	Corrosion	Repair
	Cross Contamination	Replace
	Defective Material	Restore Surface
	FOG	Seal/Grout
	Hardware (Stem/Rounded Nut)	Turn On/Off
	Incorrect Records	
	Joint Failure	
	Mud/Silt/Sludge	
	Other Structural Failure	
	Poor Housekeeping	
	Power Failure	
	Structural Failure	
	Traffic Load	

Appendix E- Problem, Cause, Resolution Lists
Advanced Wastewater Treatment Facility

Problem: The nature of the maintenance or repair issue.	Cause: The underlying reason for a specific issue.	Resolution: The solution to the problem as reflected in work task detail and overall job content of the work order.
Fill in only when there is a problem - done by the person creating the work order	Fill in when the problem is diagnosed - done by person receiving the work order	Required on all - fill in the result of work performed on all work orders PM or CM

AWTF Problem
Air Leak
Alarm or Problem Indicator
Broken/Damaged
Communication Failure
Dirt or Foreign Matter Problem
Equipment Adjustment Required
Equipment Cutting Out
Equipment Jammed
Equipment PC or Microprocessor Hung Up
Excessive Lubrication
Excessive Noise
Excessive Vibration
Function (Lack of/None)
Hard to Operate
Heat
Lack of Lubrication
Leak/Seepage (Air, Oil, Water)
Loose
Loose or Broken Connection or Wire
Misalignment
No Air
No Power
Odor

AWTF Cause
Abnormal Conditions
Age/Wear/Use
Capacity
Contractor/Third Party Damage
Corrosion
Dead Battery
Debris/Obstructions (Animals/Trash/Sticks)
Defective Material
Design Flaw
Electrical Issue / Failure
Hardware (Stem/Rounded Nut)
Improper Installation/Construction
Improper PM Cycle
Mechanical Issues / Failure
Operator Error
Poor Housekeeping
Power Outage
Procedures Incorrect
Structural Issues / Failure
Vandalism

AWTF *REQUIRED FIELD* Resolution
Adjust
Adjust Operational Settings
Clean
Lubricate
No Action
Operate
Refer to Contractor
Rehab /Fabricate
Relocate
Remove Obstruction
Repair
Replace

Appendix E- Problem, Casue, Resolution Lists
Water Services Center

Problem: The nature of the maintenance or repair issue.	Cause: The underlying reason for a specific issue.	Resolution: The solution to the problem as reflected in work task detail and overall job content of the work order.
Fill in only when there is a problem - done by the person creating the work order	Fill in when the problem is diagnosed - done by person receiving the work order	Required on all - fill in the result of work performed on all work orders PM or CM

WSC Problem
Air Leak
Alarm or Problem Indicator
Broken/Damaged
Communication Failure
Dirt or Foreign Matter Problem
Equipment Adjustment Required
Equipment Cutting Out
Equipment Jammed
Equipment PC or Microprocessor Hung Up
Excessive Lubrication
Excessive Noise
Excessive Vibration
Fluid Level
Function (Lack of/None)
Hard to Operate
Lack of Lubrication
Leak/Seepage (Air, Oil, Water)
Loose
Loose or Broken Connection or Wire
Misalignment
No Air
No Power
Water Quality
Oil Leak
Overheating or Smoking

WSC Cause
Abnormal Conditions
Age/Wear/Use
Capacity
Contractor/Third Party Damage
Corrosion
Debris/Obstructions (Animals/Trash/Sticks)
Defective Material
Design Flaw
Electrical Issue / Failure
Hardware (Stem/Rounded Nut)
Improper Installation/Construction
Improper PM Cycle
Joint Failure
Mechanical Issues / Failure
Operator Error
Poor Housekeeping
Power Outage
Procedures Incorrect
Structural Issues / Failure
Vandalism
Weather

WSC *REQUIRED FIELD* Resolution
Adjust
Adjust Operational Settings
Clean
Lubricate
No Action
Operate
Refer to Contractor
Rehab /Fabricate
Relocate
Remove Obstruction
Repair
Replace

Appendix F: Rehabilitation and Renewal Schedule-Template Placeholder

Appendix F

Asset Classes Rehabilitation and Renewal Schedule

Appendix F: Asset Classes with R/R Schema							
Asset Type		Useful Life (Years)	Replacement Cost	Replacement Cost Unit	Rehabilitation Interval (Years)	Rehab Cost (Or Percent of Replacement Cost)	Notes
Vertical							
Horizontal-Water							
Horizontal-Sewer							

Appendix G: Capital Budget Request Form

CAPITAL REGION WATER

CAPITAL PROJECT REQUEST/CHANGE FORM for FISCAL YEAR 2022

Directors/Managers must complete one form for every project. To be considered as a Capital Project, the following should apply: 1) Cost exceeds $5,000
2) Estimated useful life over three years

% of Total (Typically 100%)		Type of Project (Check One):		Project is:	
Water		System Expansion		New Request	
Wastewater		Process Improvement		Change in Priority	
Stormwater		Regulatory Requirement		Change in Cost	
Administrative		Replacement		Change in Timing	
		Other - Identify			

Project Name: _____

Project Location: _____

Requested By: _____ **Date of Request:** _____

Project Description/Justification/Benefits/Alternatives:

Anticipated Project Milestones:

Projected Start Date : _____
50% Completion Date: _____
Project Completion Date: _____

Priority:

High _____
Medium _____
Low _____

Anticipated Costs:	L-T-D (thru FY'21)	FY'22	FY'23	FY'24	FY'25	FY'26
Engineering-Design						
Construction Mgmt						
Material						
Contract Labor						
Internal Labor						
Sub-Total	$ -	$ -	$ -	$ -	$ -	$ -
Less: Contributions						
Less: Grants						
Less: Asset Trade-in						
Sub-Total	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Outlay	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Anticipated Costs:	FY'27	FY'28	FY'29	FY'30	FY'31	Project Total
Engineering-Design						$ -
Construction Mgmt						$ -
Material						$ -
Contract Labor						$ -
Internal Labor						$ -
Sub-Total	$ -	$ -	$ -	$ -	$ -	$ -
Less: Contributions						$ -
Less: Grants						$ -
Less: Asset Disposal						$ -
Sub-Total	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Outlay	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Anticipated changes in operational costs resulting from asset - personnel needs, inc/dec in maintenance costs, chemicals, etc:

Approvals: **Date:**

Director _____ _____
CFO _____ _____
CEO _____ _____

Accounting GL Project Code: _____

Prepared by:

Brown AND Caldwell

100 Matsonford Road, Ste. 250
Radnor, PA 19087
Phone: 484.253.4700

Capital Region Water

Asset Management Plan Wastewater Collection System

July 2023

Wastewater Collection System Asset Management Plan

Prepared for

Capital Region Water
Harrisburg, Pennsylvania

July 2023

Project 158036

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Document Revision History				
Version	Summary	Editor	Data Edited	Description of Changes
1	Year 1 CAMP	BC		

Table of Contents

Section 1

Introduction

The Asset Management Plan (AMP) is the facility level document that guides efforts in the administration of asset management activities as outlined in the Strategic Asset Management Plan (SAMP).

The SAMP provides the overarching framework for achieving the purpose, vision, and strategic goals of the Asset Management (AM) Program, as described in the AM Program Charter. Rather than being an extensive manual of practice on asset management, the SAMP is a concise framework that creates a consistent approach for the operating divisions which operate and maintain the facilities and systems. The SAMP framework provides the "rule book" for how the AMPs (Asset Management Plan) help meet the established service level expectations and other operational objectives at the lowest life cycle cost.

The AMP structure is like that of the SAMP but brings focus to the specific Wastewater Collection System assets. The primary difference between the SAMP and AMP is that the SAMP provides a standardized approach for the overall asset management framework and business rules across the facilities and systems; the AMP describes the specifics for asset management at a location and identifies actions that are being implemented to achieve the standards and goals herein listed.

AMPs have been developed to establish how assets will be managed and serve as an asset management guide for facility staff. Key components of the AMP include:

- Roles and responsibilities
- Asset and system information
- Levels of service and performance measures
- Risk management
- Condition assessment
- Operations and maintenance management
- R&R and capital planning needs

Asset Management Definitions"" CRW's Asset Management Program is our decision-making framework designed to balance performance, risk, and cost as we invest in our infrastructure with the right work at the right time for the right reasons."

- **Asset.** Something with a value of greater than $5,000, with an expected life greater than 5 or more years, or the item is of high importance to the mission of the utility and/or something that is operated, maintained, and managed to provide a consistent, reliable, and safe service to our customers.
- **Condition.** Measure of the physical state of an asset.
- **Consequence.** Impact on level of service, utility, customers, or public resulting from an asset failure.
- **Failure.** Inability of an asset to provide the function for which it was installed.
- **Likelihood.** Chance of an occurrence, such as an asset failure.
- **Level of Service.** Output or objectives one intends to deliver to its stakeholders (i.e., Public, Board, Regulators).
- **Lifecycle cost.** Total cost of an asset throughout its life (incl. planning, design, acquisition, O&M, rehabilitation & disposal costs).
- **Risk value.** The combination of consequence and likelihood of a failure.

The AMPs will use the guidelines and policies established under the SAMP to ensure consistency across Divisions. The AMP also:

- Provides baseline of information and acts as a training aide for new staff being incorporated into the facility.
- Documents and formalizes standardized processes through process flows and used as the official record/reference for staff.
- Captures the asset inventory and related data – what do they have, is it mapped, are the attribute fields populated?
- Outlines the roadmap for where the facility 'wants to be'.
- Provides criticality criteria to determine individual asset inspection, replacement, and rehabilitation rankings.
- Provides information on the established levels of service (LOS) and key performance indicators (KPIs).
- Identifies renewal and replacement strategies and techniques.
- Identifies currently known data requirements and program enhancements.
- Tool to manage assets and plan for asset replacements/rebuilds.
- Resource to refine maintenance practices and more effectively use the CMMS (Computerized Maintenance Management System) to plan, schedule, and perform maintenance tasks.
- Provides resources to track maintenance measures.
- Use as a guide to plan and implement projects.

1.1 Wastewater Collection System Overview

The Capital Region Water collection system consists of approximately 186 miles of pipe and is a combined system. That is, approximately 85% of the system (by length) collects and conveys stormwater and wastewater in the same network of pipes to the Advanced Wastewater Treatment Facility (AWTF). The combined collection system is defined as the portion of the collection system that is upstream of the CSO (combined sewer overflows) regulator structures. The remaining 15% is a separate sanitary sewer system.

To facilitate proper asset management practices, the Collections System assets will be addressed in multiple AMPs. This AMP addresses asset management at the tactical level for the assets shown in Table 1.1 below.

Table 1.1 Collection System Asset Overview

Asset Type	Quantity	Unknown Percentage of System			
		Material	Size	Install Date	Depth of Bury
Manholes	3955	24.4%	Non-discrete	Missing	20.7%
Catch Basins Storm Inlets (MS4 associated)	3939	33%	34.2%	93.8%	Unreliable
Trunk Sewers (=> 18 IN)	69.4 Miles	0.99%	0%	29.81%	24.68%
Branch Sewers (< 18 IN)	116.73 Miles	10.57%	12.48%	26.87%	24.79%

Further details regarding asset classes included in this AMP can be referenced in Section 3 of the AMP. Service areas are represented in Figure 1-1.

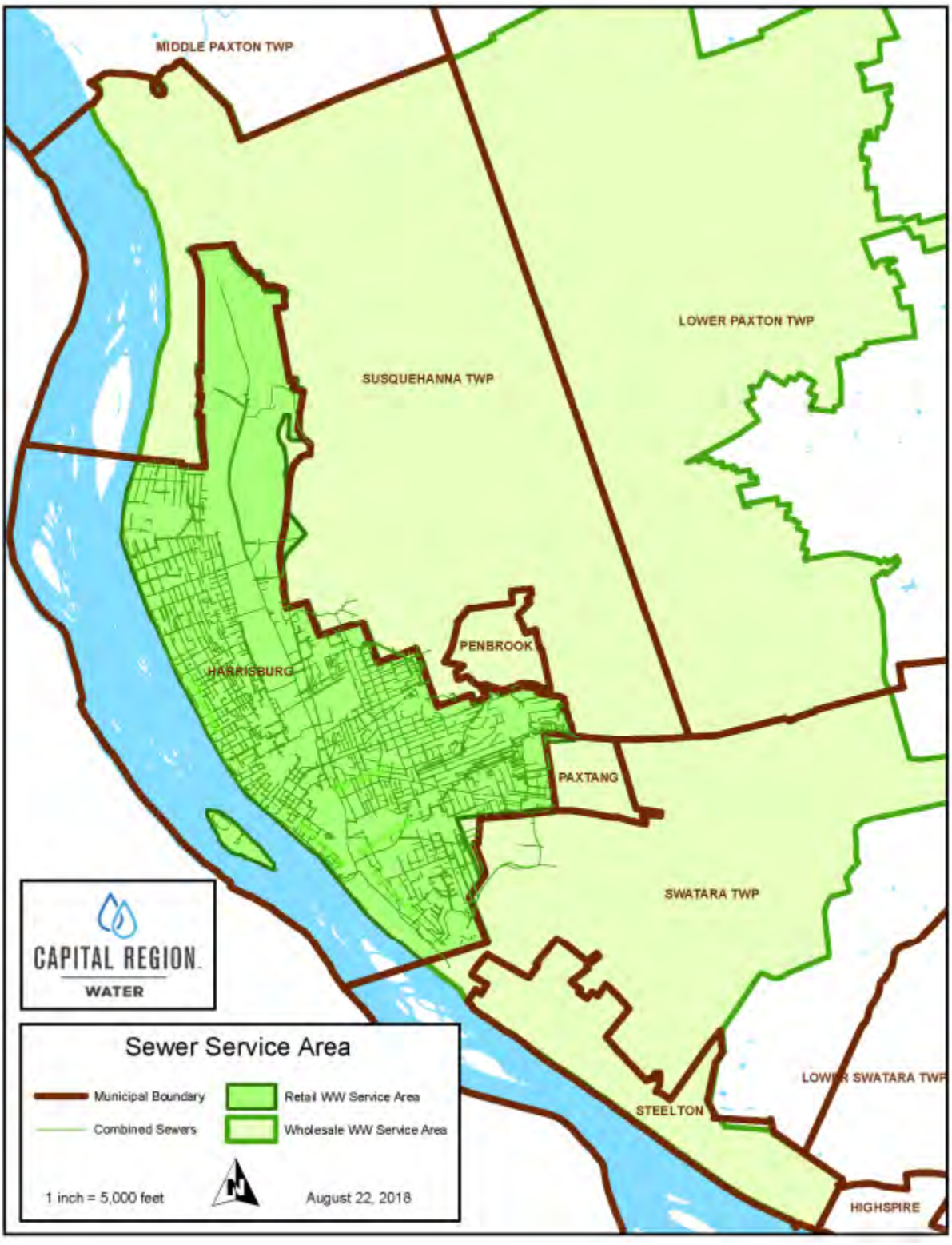


Figure 1.1 GIS Sewer Service Map

1.2 AMP Development and Maintenance

1.2.1 Development

The contents of this AMP were prepared by the Wastewater Collection System Asset Management Team with development meetings and activities facilitated by Brown and Caldwell (BC). The meetings and activities were implemented to obtain input for the sections contained within this AMP and included the establishment of a practical process to maintain and update the AMP over time.

1.2.2 Administration

Managing the AMP is a dynamic process of continuous planning, implementation, evaluation, and resultant adaptation to changing conditions and lessons learned. The Collection System AM Team will record changes identified for revision in a change log. This change log will be used to track potential AMP modifications for the annual update to the document. The following staff will be responsible for identifying, tracking, documenting, reviewing, and approving changes to the Collection System AMP document (**Error! Reference source not found.**).

Table 1.2.2 Wastewater Collection System AMP Administration Duties

Topic	Activities	Responsible Person				
		AM Group	RDT	OF Champion	OF RIG	SME*
Monthly Review Process						
AMP progress review	Track progress on AMP Section 6 Implementation Plan	x				
	Prepare change documentation for review and discussion at OF RIG meetings				x	
	Identify changes to AMP defined process, section, workflow, or activity and recommend to their supervisor					x
	Record changes on change log (refer to AM Management of Change Plan for a copy of the change log and corresponding change workflow) and update approval status as appropriate to facilitate annual updates to the AMP	x				
Quarterly Update Process						
RDT Updates	Provide findings, resource needs, potential changes, and successes on the AMP to the RDT	x				
Annual Update Process						
Review AMP and change log	Meet to review status of the AMP				x	x
	Identify successes in AMP and AM Program implementation				x	x
	Identify ways to address gaps in recommendations				x	x
	Confirm roles and responsibilities are still appropriate			x		
	Compile logged updates/changes/edits to the AMP	x				
Assess Performance	Assess improvement activity performance	X				X
	Review and audit the business process workflows for compliance and capture improvement suggestions				X	X
	Determine if the right information is being gathered to track performance and adjust as necessary				x	x
Identify and document needs	Discuss newly needed improvement activities				x	x
	Confirm priorities				x	x

Table 1.2.2 Wastewater Collection System AMP Administration Duties						
Topic	Activities	Responsible Person				
		AM Group	RDT	OF Champion	OF RIG	SME*
Update the AMP	Review change documentation and submit to RDT for review				x	
	Review recommended changes to the AMP and submit to RDT for approval				x	
	Approve changes recommended to the AMP		x		x-	
	Incorporate approved changes into the AMP on annual basis	x				

*SME (Subject Matter Expert): Includes relevant Managers and supervisors

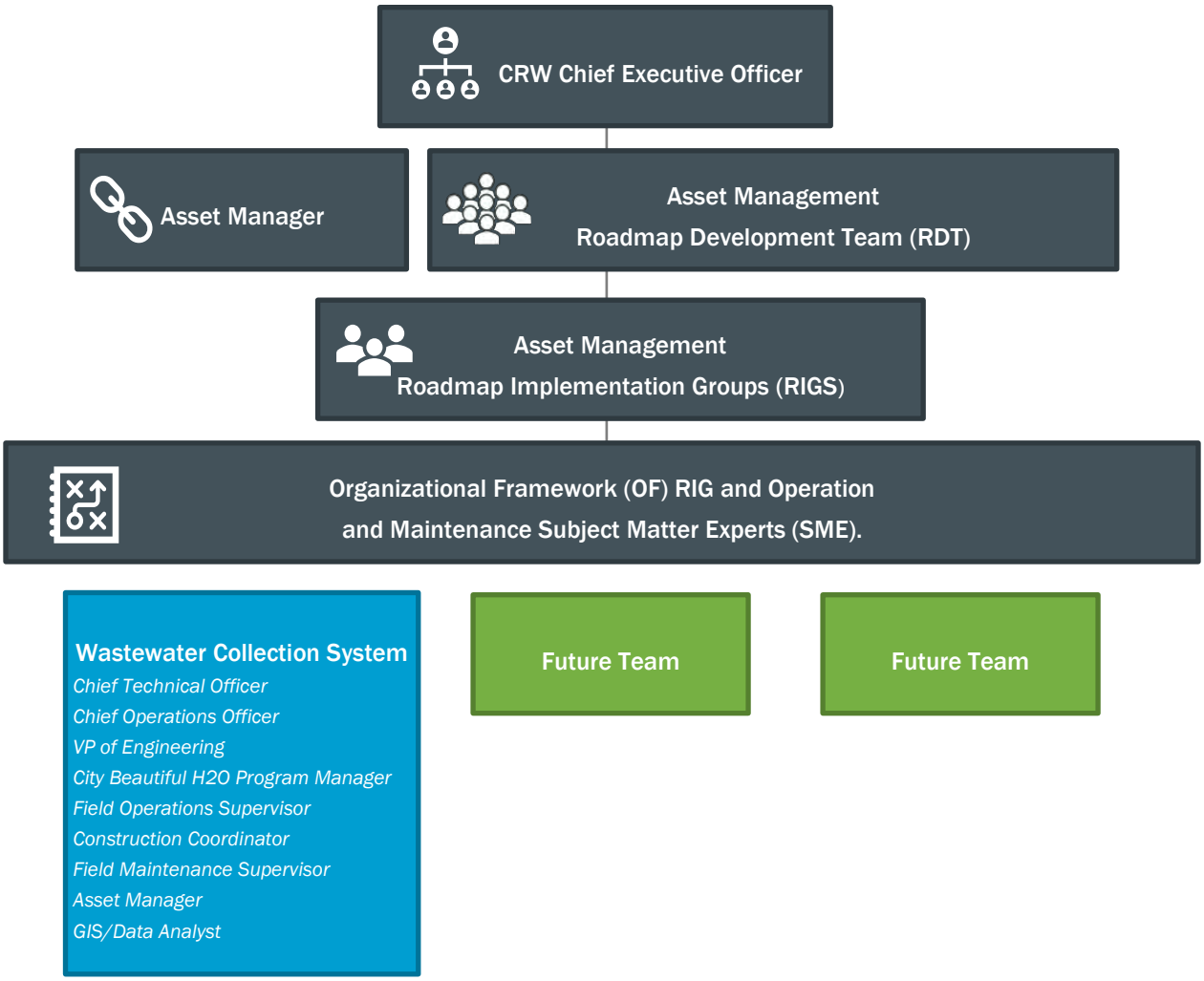


Figure 1.2.2 Wastewater Collection System AMP Organization Roles

Section 2

Organizational Framework

A successful, high-functioning asset management program depends on having a well thought out Organizational Framework. This includes having commitment from leadership; a solid understanding of organizational culture and an effective change management plan; comprehensive communications and document management procedures; levels of service and performance measures that allow the organization to track, understand and modify performance based on reliable data; and the right resources in place to make the AM program successful.

The AMP provides overarching direction for the organizational framework components. This AMP provides details related to document management, performance measures, and resource management.

2.1 Leadership and Commitment

A vital step in building and maintaining a successful asset management program is getting support from leadership within the organization and from the governing body. To that end, it is important that the governing body understands the objectives of AM and treats it as a policy priority. CRW has defined goals/vision/mission for achievement in each AM performance area in the CRW Asset Management Roadmap. All levels of management have been trained in and understand the importance of AM and support activities to make improvements.

2.2 Culture and Change Management

Asset management is as much about culture as it is procedure. Uniformity, consistency, and repeatability, where needed, can be a challenge to achieve. As such, success relies on a greater involvement and participation of staff and the individuals serving as change agents more so than any other program. Culture change is therefore a critical element of success. Communication, training, education, and visibility by all personnel will be critical throughout implementation. Change management and communication methodologies are vital to a successful asset management program. A separate Management of Change (MoC) Plan is included in the asset management supporting documents and is available using the link provided in Section 2.4 of this AMP.

2.3 Communications

A separate Communication Plan has been prepared and ensures efficient use of available resources by identifying stakeholders, establishing clear messages, identifying effective communication methods, and anticipating critical issues. This Communication Plan also provides the methodology and details for communications with internal personnel during development and implementation of the AM Program. The Communication Plan is available using the link provided in Section 2.4 of this AMP.

The Plan can easily be used as a tool for communicating key messages and action items to the staff responsible for the development, implementation, and sustainability of the AM Program. The Communications Plan also includes a schedule of communication activities required to meet the AM Program Vision, Mission, and Goals (see Program Charter).

2.4 Document Management

Asset management topics and processes are identified, understood, evaluated, and documented. These include:

- The SAMP is located at: Asset Management Plans - Strategic and Tactical.

Included in the AM Roadmap are identified AM gaps, and all associated elements (resources, responsibilities, reporting, etc.) have been specified.

-
- Asset Management Roadmap is located AM Roadmap.

Document management is a considered process that is readily understood and available throughout the organization.

- General document management practices are documented, and the file is located on the intranet at DOCUMENT RECORDS LIBRARY.
- Wastewater Collection System-specific Operations and Maintenance Manual located Operations and Maintenance Manual.

2.5 Levels of Service and Performance Evaluation

2.5.1 Information Sources

Refer to the SAMP for details about available sources of information related to the Levels of Service for the organization.

2.5.2 Levels of Service

Levels of Service (LOS) and their measures were developed as part of the SAMP. Refer to the SAMP for details about the LOS.

2.5.3 Performance Measures

The measures listed below (**Error! Reference source not found.**) a re Wastewater Collection System specific and intended to be collected, tracked, and analyzed at the division level for its use and benefit.

Definitions

Level of Service:

The description of the service output for a particular activity or service area against which performance is measured. (NAMS, 2007 - Developing Levels of Service and Performance Measures)

Key performance indicator:

Measurable value that demonstrates utility effectiveness in achieving goals and objectives.

Performance measure:

A qualitative or quantitative measure used to measure actual performance against a standard or other target.

Used to indicate how the organization is doing in relation to delivering levels of service.

Metric:

The numbers or values that can be summed and/or averaged, such as dollars, distances, durations, and temperatures, etc.

Performance Target:

A specific quantifiable target for performance, used in reference to a performance measure.

Considerations

- Consistent with business goals and objectives
- Clear and understandable
- Rewards the right behaviors: efficiency and effectiveness.
- Forward-looking
- Follows SMART:

Simple -- Measurable -- Accurate, Achievable -- Responsive, Realistic, Relevant -- Targeted, Timebound

Table 2-1. Wastewater Collection System Performance Measures

CRW Strategic Goal	LOS Description	Performance Measure	Description	Reporting frequency	Target*
Infrastructure Stability	Operate and maintain assets in an efficient, sustainable, and resilient way	Collection System Planned (PM) Maintenance Ratio	Planned wastewater collection maintenance work hours per total wastewater maintenance work hours completed	Monthly	*70%*
		Collection System Integrity	Number of mainline failures (blockages and collapses) per 100 miles of pipe	Monthly	*2.0*
		Collection System Inspection Rate	Feet of CCTV inspections performed with PACP coding and scoring per total linear feet in Collection System	Monthly	*1.0%*
		Sinkhole Liability Rate	Number of sinkholes caused by sewer infrastructure failures per total number of sinkholes.	Monthly	*25%*
		Flushed Footage	Linear footage completed for sanitary and storm sewer flushing.	Monthly	*8,300LF*
		Inlet Integrity	Total number of inlets attached to R/R/C/M work orders (repair, replace, clean, modify/retrofit)	Monthly	*120*
		CCTV Completion Rate	Comparison of linear of footage assigned for CCTV and actual footage of pipe videoed (short term measure)	Monthly	*80%*
		Collection System Data Integrity	Count and/or footage of assets with completed/accurate attribute fields (year, material, size, renewal) relevant to the quantification of risk using Innovyze	Monthly	*90%*
	Undertake prudent and affordable renewal and replacement projects targeted for the long-term viability of the CRW assets	Collection System O&M Cost	Costs associated with equipment, material, and labor on all work orders per 100 miles of collection system pipe	Annually	*TBD*
		Collection System Renewal/ Replacement Rate (Expenditure)	Actual expenditure (or reserved funds) for Collection and Conveyance Pipe renewal and replacement in year per total present worth of Collection R&R needs	Monthly	*TBD based on IAP calculation*
		Collection System Renewal/Replacement Rate (Linear)	Actual linear feet of Collection System pipeline renewed or replaced in year per total linear feet in Collection System	Monthly	*TBD*

Table 2-1. Wastewater Collection System Performance Measures					
CRW Strategic Goal	LOS Description	Performance Measure	Description	Reporting frequency	Target*
Customers and Stakeholders	Ensure customer and stakeholder confidence through engagement and demonstration of value to our community	Customer Satisfaction	Number of technical service complaints per 1000 accounts (backup in residence/building, blocked inlet, collapsed inlet, damaged/loose manhole cover, illicit discharge, sinkhole investigation, investigation request, missing manhole cover, odor complaint, sewer overflow, and backup due to system hydraulics)	Monthly	*TBD*
		Building Backups (SSO Liability Rate)	Number of building backups and SSOs per 100 miles of pipe	Monthly	*0*
Efficient Use of Resources	Execute the mission of CRW using risk informed decisions that provide best value to our customers, stakeholders, and organization	Collection System Business Risk Exposure	*calculations performed in Innovyze (once the ops strategy levels are set)*	Future Measure	*TBD*

2.5.4 Performance Evaluation

Performance measures are specific indicators used to demonstrate how an organization is doing. They are written in a clear, easy to understand language so that they may be shared with a wide audience – both internally and externally. Wastewater Collection System staff are responsible for accurately collecting, analyzing, and reporting system data required to properly calculate performance measures identified in this document and in the period determined in Table 2.1.

CRW has collected data for the performance measures listed in Table 2.1 and dashboards have been developed to trend and visualize this information. Data trends for the various performance measures are available and continued analysis of this information will be used to inform decisions related to the management of these assets. CRW future state for tracking performance measures will be to have PowerBI dashboards designed to display measures on monitors located in common areas.

2.5.5 Regulatory Reporting

Methods (data collection, reporting) to comply with regulatory requirements are established and documented in the organization. Regulatory requirements and pending requirements are continuously monitored and communicated.

2.6 Resource Management

The primary staff involved in asset management along with a description of their roles are discussed in the SAMP.

Adequate staff, equipment and tools are available to develop and sustain an AM program as it relates to the Wastewater Collection System (includes development, training, monitoring, controlling,

reporting, auditing, and updating and improving the AM program). Resource needs are considered in the annual budgeting process.

2.6.1 Resources

CRW has skilled staff responsible for managing the Wastewater Collection System and those staff are depicted in the organizational chart linked here: Departments/Groups Site - Home (sharepoint.com) Wastewater Collection System specific responsibilities and required actions are listed by group and are indicated as being performed on an ongoing, monthly, quarterly, or annual basis (Table 2.1).

Table 2.1. Roles and Responsibilities for Asset Management Activities

Role	Responsibility
CEO	Champion AM as it relates to Wastewater Collection System to CRW staff
	Communicate AM program and Wastewater Collection System goals, priorities, successes, and status to Board
Director of Wastewater Operations	Accountable for meeting metric targets
	Communicate improvement recommendations up to the CEO
	Coordinate with Field Operations and Field Construction Supervisors and provide technical assistance (as needed)
	Champion AM as it relates to Wastewater Collection System to CRW staff
	Collaborate with RIG (Roadmap Implementation Group) champions to improve AM processes that support CRW's AM goals
	Recommend or authorize project needs and requests, and secure resources from or communicate needs to CIP Team (as needed)
	Provide resources or communicate needs (budget, availability, and staffing) to implement Wastewater Collection AMP and recommendations for improvement
OF and O&M RIGs	Review Wastewater Collection System AMP and prepare documentation for approved changes
	Review the SAMP and provided suggestions for the Wastewater Collection System AMP alignment
	Review/refine/add performance measures and analyze for improvements
	Review critical asset list
	Champion AM as it relates to Wastewater Collection System to CRW staff
Wastewater Field Operations Supervisor	Communicate project needs and requests
	Coordination with construction supervisor to ensure work is completed as planned
	Review and optimize maintenance strategies
	Responsible for reviewing performance metrics and providing feedback to staff
	Champion AM as it relates to Wastewater Collection System to CRW staff
	Communicate improvement recommendations from staff to Director of Wastewater Operations
	Responsible for data entry, accuracy, and completeness
Wastewater Field Construction Supervisor	Coordination with construction, operations, maintenance activities to ensure work is completed as planned
	Communicate project needs and requests
	Champion AM as it relates to Wastewater Collection System to CRW staff
	Communicate improvement recommendations from staff to Director of Wastewater Operations
	Responsible for data entry, accuracy, and completeness

Table 2.1. Roles and Responsibilities for Asset Management Activities	
Role	**Responsibility**
Engineering	Communicate improvement recommendations to Director of Wastewater Operations
	Collaborate with Operations staff on lessons learned about wastewater collection system to inform design standards
	Coordinate capital projects during construction
AM Manager/Team	Monitor and coordinate on performance metrics
	Support OF and O&M RIGs on refinements to Wastewater Collection System AMP
	Implement GIS, Cityworks, and IAP updates and advocate for updates/improvements to other enterprise systems
	Support business workflows related to SAMP and Wastewater Collection System AMP as applicable
	Develop and share reports on performance measures, analyses and supporting documentation
	Assistance with meeting coordination and facilitation
	Liaison with other departments and stakeholders on AM needs
	QC (Quality Control) use of Problem/Cause/Remedy (PCR) codes
Staff	Implement specific Wastewater Collection System AMP functions as related to their jobs
	Identify AMP changes for improvement and relay to supervisors
	Responsible for data entry, accuracy, and completeness

2.6.2 Training

Staff require introductory and ongoing training so that staff can be successful in their roles in executing their work. The training required by the staff that is needed to help advance the asset management program is included in the SAMP; Wastewater Collection System training is summarized in Table 2.2.

Table 2.2. Summary of Training Needs			
Topic	**Training Description**	**Recipients**	**Frequency**
Asset Management- in addition to training identified in SAMP; AM Awareness and Business Case Evaluation			
Wastewater Collection System AMP Orientation/Review	Provide overview of AMP as part of onboarding process	New employees	As needed
Operations and Maintenance			
Operator's License	Department of Pennsylvania Licensure	As required for job function	As needed
NASSCO PACP	NASSCO Pipeline Assessment Certification Program	As required for job function	As needed
NASSCO MACP	NASSCO Manhole Assessment Certification Program	As required for job function	As needed
NASSCO LACP	NASSCO Lateral Assessment Certification Program	As required for job function	As needed
Information Systems and Data Management- in addition to training required in SAMP; CMMS, GIS, SCADA, Billing and Accounting			
Innovyze InfoAsset Planner Software	IAP orientation for risk model for assessing wastewater collection system assets	Engineering and Operations staff	As needed

Table 2.2. Summary of Training Needs			
Topic	**Training Description**	**Recipients**	**Frequency**
Performance Measure Dashboards	Orientation on Wastewater Collection System performance measure dashboards	As required for job function	As needed
Organizational Framework- in addition to training required in SAMP; Change Management and Communications			
NMC	Nine Minimum Controls (NMC) required training	As required for job function	As needed
GSI	Green Infrastructure Training (future)	As required for job function	As needed
Safety	CRW required safety training including confined space entry, hot work, and LOTO	As needed for job function	As required
CDL	Commercial Driver's License (CDL)	As needed for job function	As required

2.7 Business Continuity

CRW has evaluated threats to its operations, the community, and the environment that may impact the organization. CRW has a clear understanding of prevention activities and procedures to mitigate impacts to the wastewater collection system and has documented them in a business continuity plan that covers staffing, systems and technology, and procedures related to communications, operations and financial decision making.

2.8 Continuous Improvement

People	Process	Technology
• Develop and implement staff succession plans	• Develop/revist the targets for the listed performance measures (Table 2.2)	• Improve work manangement through automation processes and phase out siloed data.

Section 3

Information Systems and Data Management

This section defines the high-level information associated with asset management-related data, tools, and systems. This includes the assets that comprise the facilities and systems, and the general hierarchy of managed assets that should be followed. Detailed asset inventories are managed within the Geographic Information System (GIS) and consumed within the computerized maintenance management system (CMMS) to track asset related activities. Specific critical asset inventories are documented within the AMPs (Asset Management Plan).

3.1 Overview

Organizations use a combination of systems, tools, and data to support day-to-day operations. The data collected are valuable repositories of information and used to support elements of the AM (Asset Management) program. Table 3-1 shows the relationship of the AM categories with the enterprise systems, tools, and data along with the specific systems, tools, and data in use.

Table 3-1. Asset Management Systems, Tools, and Data

AM Element	Systems	Tools	Data
Organizational Framework			
Information Systems and Data Management			
Inventory and Asset Profile	• CMMS-Cityworks • GIS • CIS-Muni-link • CCTV-Wincan • Fleet Tracking-Verizon Networkfleet • DMS - Document Management System • Remote Monitoring System • Microsoft PowerBI	• Data collection tools • As-builts • Reporting/Dashboards	• Asset Attributes • Asset Classes • Asset Hierarchy • Asset Naming • Condition Data • Existing document repository including file plan
Decision Making and Capital Planning			
Risk Management	• CMMS- Cityworks • GIS • InfoAsset Planner (IAP)	• Overflow reporting • Critical and High-Risk Assets	• Consequence of Failure (COF) • Likelihood of Failure (LOF) • Asset Attributes • Condition Data • Maintenance History

Table 3-1. Asset Management Systems, Tools, and Data

AM Element	Systems	Tools	Data
CIP (Capital Improvement Plan) Development and Prioritization	• Rate Models (Arcadis) • CIS (Muni-Link)	• Business Case Project Justification • Prioritization • Replacement Planning Model • 10-year CIP • Rate Study • Condition Assessment	• Levels of Service (LOS) • Condition Data • Useful Life • Refurbishment Schemes • R&R Needs • Capacity info • Registry of assets requiring R&R and associated costs • CIP project by priority and cost • Cost Library
Design and Construction	• CMMS • GIS • Finance	• CIP/Budgeting • As-builts • Sewer design manual-specifications and details	• Install Date • Asset Attributes • Maintenance History/Costs • R&R Costs • As-builts
Funding	• Rate Studies • Finance	• Replacement Planning Model	• Budget • CIP
Operations and Maintenance			
Operations and Maintenance Strategies	• CMMS • GIS • Finance • Inventory • CCTV • DMS • Microsoft PowerBI	• Condition Assessment module tools • Reporting/Dashboards • CIP/Budgeting	• Asset Attributes • Condition Data • Maintenance History/Costs • O&M (Operations & Maintenance) Manuals • PM (Preventative Maintenance) Schedules • Job Plans • Labor Rates • Failure Coding
Inventory / Warehouse	• Inventory • Finance • CMMS	• Bar code / QR scanner	• Materials inventory
Optimization	• CMMS • GIS • Remote Monitoring System	• Data Collection Tools	• Condition Data • Asset Attributes • PCR (Problem, Cause, and Resolution) Codes • Condition Assessment Ratings • Real-Time Sensor Data

3.2 Systems

Various information systems are used to gather, manage, and maintain asset management data as described in the SAMP (Strategic Asset Management Plan) and as noted in Table 3-2. Organizationally the use of core database repositories is key to data governance in support of collaboration and analysis. In cases where primary separate spreadsheets are used as working files for alteration, transformation and producing outputs, discovered edits of principal data necessitate preservation for updating the repository. As noted in the SAMP, retention of core data edits in working files in lieu of the defined information management systems will misrepresent critical end products for all.

Table 3-2. Enterprise Information Systems

Type	Product	Links to other systems	Description
CMMS	Cityworks	GIS Mobile app Wincan	Primary system used for work management. It also contains asset information and is the system of record for all managed facility assets.
GIS	ESRI ArcGIS Platform (ArcGIS Enterprise and ArcGIS Online	Innovyze InfoAsset Planner Cityworks	• System of record for all managed distributed system assets • Provides map-based applications as primary interface for viewing linear asset data
CIS	Muni-Link	NONE	Billing and account information
Document Management System	Microsoft SharePoint	Office365	File plans for managing documents through their life cycle in accordance with the Municipal Records Manual.
Finance	Munis- Accounting System Muni-Link – Customer Billing Penn BID	API to interface in future	Other products: interfaces for BoA (Pcard), CS Fixed Assets (does not interface) Penn BID is used for online management of the procurement/submittal process
Inventory	Material and Equipment Leaf in Cityworks Granger service for vending machines (PPE) readouts	NONE	Parts and materials associated with work orders are documented and tracked in the CMMS.
HR	Inova	NONE	
Timekeeping	Inova	NONE	
Legal	Part of Document Mgmt. Sys	NONE	Contracts MOU/Legal Documents
Fleet Management	Cityworks for maintenance and Verizon Network Fleet for location tracking	GIS	Used to track fleet assets and related maintenance
Remote Monitoring System	Telog		Rain gauge data

3.3 Tools

Wastewater Collection staff will use the tools indicated in Table 3-3 for their intended use in the collection and analysis of asset data.

- User-friendly methods exist for entering and retrieving asset information for all users. Users have a clear understanding of which systems to use for data management.
- Data collection tools are readily available and used to streamline the process of data input and improve accuracy of information in the systems and databases.

Table 3-3. Enterprise Tools

Type	Product	Description
Data Collection Tools	• Hardware: Laptops, Tablets • GIS (Esri apps: Field Maps, Survey123) • Verizon Networkfleet (truck AVL) • Cityworks • Excel	GIS Manager publishes GIS service(s) to Cityworks
As-builts	• CAD files • PDFs	As-builts of existing systems are saved as CAD files or pdfs
Criticality	• Innovyze InfoAsset Planner	Pipelines are scored based on proximity to Critical Customers, Apartment Buildings, Railroads, and natural waterways.
Risk Matrix	• Innovyze InfoAsset Planner	Includes tools to identify high-risk assets and to establish maintenance strategies to increase their lifespan. With its tie to ArcGIS, the results can be displayed on a map so that capital improvement funding can be prioritized and applied spatially and accurately
CIP/Budgeting	• Business Case Project Justification • Prioritization • 10-year CIP • Rate Study	Projects are prioritized by a triple bottom line approach for high-risk assets. Social, Financial and Environmental consequences of an asset's failure can be expressed and quantified applying the TBL approach.
Business Case Project Justification	• CIP	The Capital Project Request Form standardizes the approach to project justification and evaluation.
Prioritization	• Innovyze – InfoAsset Planner	Once assets have been assigned a priority level from 1-5, the next step is to determine the highest priority assets within each priority zone. This is accomplished by reviewing relative BRE scores for each asset in each zone. Assets with a higher BRE within a zone are given priority
Replacement Planning Model	• GIS • Cityworks • Innovyze – InfoAsset Planner	A roadmap to prioritize renewal projects with available budget for short-term and long-term operation and maintenance goals.
LOS	• AWWA (American Water Works Association) Benchmarking Utility Survey	Service level targets set by the organization and standard performance metrics guide investment decisions.
Condition Assessment	• CMMS • GIS • CCTV	Develop comprehensive picture of physical condition and functional performance of assets.
Reporting/Dashboards	• Microsoft Power BI • ArcGIS o Web maps/apps	Power BI is used for visualization of R&R reports. SSMS used to present data via SQL queries to be visualized/accessed via Microsoft Excel

Table 3-3. Enterprise Tools		
Type	**Product**	**Description**
	○ Geo Event Server (visualizing streaming/event data) • SAP Crystal Reports • SQL Server Management Studio (SSMS) + Microsoft Excel	Geo Event Server is used in conjunction with AVL data to show location history of CRW (Capital Region Water) fleet assets and their work activities
Monitoring and Notification	• Everbridge	Alerts and Notifications
Utility Locates/Marking	• One Mark	Managed by Drinking Water Division

3.4 Data

3.4.1 Asset Definition

The SAMP contains the CRW definition of both an asset and the criteria that are applied to designate a critical asset.

3.4.2 Asset Inventory

The asset inventory for Wastewater Collections assets is managed in GIS. Asset inventory information is comprised of distinctive characteristics including the attributes describing the assets, the hierarchy in which assets are organized, and naming conventions used to identify and link data to assets. Each of these components is described in the following sections.

3.4.3 Required Asset Data

Assets are documented with a set of attributes that describe what is known about the asset. These attributes vary between asset classes as some attributes only apply to one asset type vs. another, but there is a set of "core attributes" outlined in the SAMP that represent the essential details needed regardless of asset type to support the asset management program. The completeness of these required attributes for the Wastewater Collection assets are covered in this AMP (Asset Management Plan) and discussed in the next two sections.

3.4.4 Core Attributes

CRW's horizontal assets are stored as GIS "feature classes" in the GIS geodatabase. Table 3-4 lists the core attributes for horizontal asset classes.

Table 3-4. Core Attributes- Wastewater Collection Assets		
Logical Attribute Name	Required?	Description
Asset ID	Yes	Unique identifier for the asset
Asset Name	No	Name commonly used to describe the asset in conversation
Asset Type	Yes	Type of asset
Ownership / Responsibility	Yes	Agency with ownership and/or maintenance responsibility for an asset
Location	Yes	Description of the general location of the asset
Critical Asset	No	Is the asset considered critical?
Condition	No	Most recent condition rating/score for the asset
Risk Rating	No	Risk calculated based on COF and LOF in IAP
Installation Date	Yes	Date asset/equipment was installed
Status	Yes	The state of the asset in its lifecycle

Additionally, there are other attributes that are important to the assets that CRW would like to have noted within this section. Table 3.5 provides a listing of those attributes.

Table 3-5. Other Important Attributes- Wastewater Collection Assets		
Attribute Name	Required?	Description
Size	Yes	A diameter measurement of a circular asset.
Material	Yes	Material used for the creation of the asset.
Length	Yes	Length of the asset
As Built	Yes	As Built is used as the source for the asset.
Invert Elevation	Yes	Invert elevation of the main coming into the asset.
Rim Elevation	Yes	Rim elevation of the main coming into the asset.
Elevation Date	Yes	Date the elevation of the main coming into the asset was gathered.
Asset Lined	Yes	Notation designating if the asset is lined.

Percent complete is based on sewer data that has been captured/collected and is currently being managed in CRW's GIS. Also, percent complete is a calculation of null values against total records per asset class. It does not recognize instances to where a default value is populated which can skew a true % complete understanding.

3.4.5 Asset Classes

Asset classes for Wastewater Collection Assets are defined in Cityworks with corresponding feature classes in the enterprise GIS geodatabase. The GIS organizes assets into geodatabase feature classes which each store an attribute named "COMPTYPE," which is a numeric number that corresponds to an IPS asset class type for each asset that it contains. Assets within a feature class are additionally categorized by type using an attribute called "UNITTYPE."

3.4.6 Hierarchy

The overall asset hierarchy is defined in the SAMP. Linear assets included in this AMP have a simplified hierarchy organized by GIS feature classes and associated geographic designations. These designations are sewer service areas and watersheds and are used to define the conveyance/flow of the associated assets to either treatment centers or bodies of water. Additionally, these designations also provide CRW with the ability to coordinate and manage maintenance activities and resources within defined, manageable areas.

The collection system-related asset feature classes and their attribute structure can be found here; Sewer_GISDatasets.xlsx.

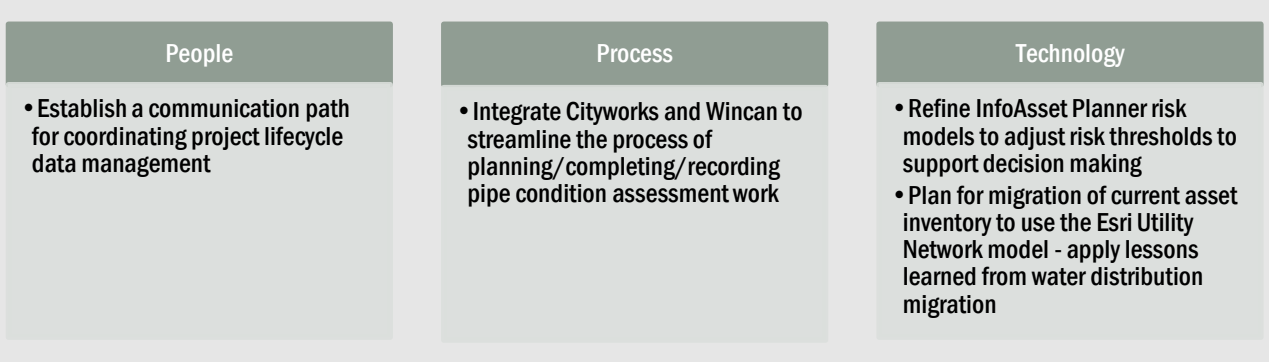
3.4.7 Asset Naming Convention

Refer to the SAMP for additional details on the asst naming convention for Wastewater Collections assets.

3.4.8 Asset Commissioning and Decommissioning Process

Refer to the SAMP for details related to the asset commissioning and decommissioning process.

3.5 Continuous Improvement



Section 4

Operations and Maintenance

All operations and maintenance staff are tasked with implementing the most appropriate practices required to achieve the lowest possible asset total cost of ownership and securing the lowest possible asset life cycle cost. The SAMP (Strategic Asset Management Plan) provides additional strategic level information related to maintenance management. This AMP (Asset Management Plan) focuses on activities that directly support and sustain the assets in the Wastewater Collection System.

4.1 Operations Strategy

A successful operations strategy is intended to:

- Efficiently and effectively do the right things at the right time, and
- Meet the defined levels of services.

Operational procedures are defined for specific asset classes and systems. Operational costs are tracked by asset and analyzed using GIS, Cityworks and InfoAsset Planner software. Tracked metrics are recorded monthly as a.pdf formatted document of PowerBI visual dashboards. The operations strategy for the assets covered in the Wastewater Collection System AMP are included in the following documents:

- Operations and Maintenance Manual
- Nine Minimum Control Plan Maintenance Strategy

Maintenance is defined as the actions taken to sustain a desired level of asset performance. A successful maintenance program is intended to:

- Efficiently and effectively do the right things at the right time,
- Increase overall asset reliability, and
- Reduce the volume, severity, and frequency of emergency work undertaken with little to no planning/scheduling.

The maintenance strategy for the assets covered in the Wastewater Collection System AMP are included in the following documents:

- Operations and Maintenance Manual link: OMM 2023-03 Version 7
- Nine Minimum Control Plan link: NMC 2022 Version 8.0

4.1.1 Asset Class Plans and Job Plans

Asset Class Plans include short-interval activities (job plans) and long-interval activities.

- Job plans include tasks/activities with standard labor hours, parts and materials for preventive maintenance, calibration, adjustment, cleaning, and condition assessment.
- Long-interval activities include years and estimated costs of long-interval refurbishments and replacement.

Table 4.1 represents the percentage of required job plan information populated in the CMMS. The table also shows the percentage of job plans with task duration and materials populated. *Note-*

completeness of data is not an indication of data accuracy and actual data should be reviewed, verified, and updated by staff during completion of work orders or as otherwise observed.

Table 4.1. Asset Class and Job Plan Elements

Description	Item	Sources	Percent Completed
Long-Interval Activities (Asset Class Plan)			
Asset Class Plans include years and estimated costs of long-interval refurbishments and replacement (R&R schema). Costs include salvage values (if any) and disposal costs.	• Asset Class Overview • Routine Maintenance Tasks • Periodic Inspections • Periodic Replacements • Operational Test • Rehabilitation and Replacement • References	• R&R costs • Condition/age • LOF and COF • Risk policy	Asset Class Plans are 90% complete and need to be aligned with assets in Cityworks. Outstanding elements in each asset class plan will be reviewed and refined during the annual update to the AMP.
Short-Interval Activities (Job Plan)- FUTURE STATE ITEM			
Job Plans will be used to standardize how work is performed on each asset class, assist in planning and scheduling work, and capture institutional knowledge. Job Plans should be created for all maintenance strategies based on the manufacturer's recommendations contained in the O&M manual along with institutional knowledge, especially where environmental conditions impact equipment performance.	Job Plans will be linked to the appropriate preventive maintenance work order in Cityworks and include the following information: • Preparation Work • Safety • Maintenance Task Details • Labor Information • Training • Materials • Equipment/Tools • References	• Manufacturer's recommended schedule • Institutional knowledge • Regulatory requirements	Job Plans are future state items and will be developed with CRW O&M staff. Job plans will be aligned with assets in Cityworks and will be reviewed and refined during the annual update to the AMP.

4.1.2 Work Order Priority Types

Refer to the SAMP for details about approved work order priority codes. CRW is currently evaluating the assignment of priority codes to work orders for the Collection System assets and refinements to the process are ongoing. A future state will be to leverage asset risk data to inform work order prioritization.

4.1.3 Maintenance Management Types

The following maintenance applications will be used on Wastewater Collection System assets in accordance with the SAMP.

Table 4-2. Maintenance Management Types			
Maintenance Category	Description	Application	Examples
Preventative Maintenance (PM)	Preventive maintenance (PM) is an equipment maintenance strategy based on replacing or restoring an asset at a fixed interval (calendar or hours of operation) which will be planned and scheduled in Cityworks. Trends in assessed condition, long-term cost estimates and near-term schedules for corrective maintenance, along with cost and risk analyses, are used to update intervals for preventive maintenance.	All PMs are planned and scheduled weekly, bi-weekly, monthly, semi-annual, and annual schedule exists to adjust workload and account for seasonal outages. Some PM activities may trigger a CM for follow up work such as changing drive belts.	• Hot spot manholes • Catch basins
Corrective Maintenance (CM)	Used to repair assets and restore to its designed LOS. Corrective maintenance is an intrusive action used to correct an asset failure and is used to keep assets in a ready state to meet capacity and regulatory requirements.	With the exceptions of emergencies, corrective maintenance will be planned and scheduled to ensure all parts and materials are ready before work begins	• Emergency work • Necessary repairs identified in PM tasks and inspections
Run to Failure (RTF)	No planned maintenance. Assets will be run to failure and immediately replaced with stocked spares. Run to Failure (RTF) is a maintenance strategy used on less critical equipment where other maintenance activities are not cost-effective. This strategy does require stocking or having access to replacement assets within a specified amount of time.	May use this strategy on noncritical assets.	
Predictive Maintenance (PdM)	Predictive maintenance (PdM) and condition monitoring are used interchangeably in the maintenance industry and provide valuable information in support of an asset management program. Typically, predictive technologies are non-intrusive and inform O&M staff how an asset is performing, predicts required maintenance activities, increases reliability, and avoids unanticipated failures.	All PdMs are planned and scheduled monthly and annual schedule exists to adjust workload and account for seasonal outages. PdM technologies can be used on critical or appropriate assets. Some PdM is completed as part of a PM.	• PACP and condition assessment on linear assets.

4.1.4 Work Scheduling

Currently, O&M Supervisors schedule all work to allow for identification of resource issues, and effective issuing and tracking of work performed. Work orders are reviewed daily, and schedule adjustments are made as appropriate. Work scheduling for the assets in the Collection System is driven by regulatory requirements detailed in the Consent Decree and supporting documents including the Nine Minimum Control Plan and Operations and Maintenance Manual.

4.1.5 Maintenance Costs

As noted in the SAMP, costs for equipment and labor are being tracked in Cityworks for work orders and inspections. CRW uses the Equipment, Labor and Material, ELM module in Cityworks to track equipment to support maintenance, labor to maintain/fix assets, and materials to support

maintenance activities. Currently, materials are not being fully captured in the ELM module due to transmission of invoices and reconciliation of this information isolated from Cityworks.

Accurately collecting costs associated with maintenance activities is an important piece of information that can be used to develop annual maintenance budgets and to determine if replacement vs. continuing to do extra maintenance is more cost effective. The ability to efficiently do this costing depends on the implementation of the Cityworks storeroom module.

4.2 Inventory/Warehouse

As noted in the SAMP, parts and materials associated with work orders are documented and tracked in several systems at CRW. Finance tracks assets and equipment with a value of $5,000 or greater on an annual basis. CRW is in the process of creating a material inventory for drinking water and wastewater systems that can be used in either Cityworks Storeroom or Munis Warehouse module for tracking parts associated with assets. Policies and procedures for the purchasing of parts and materials for use within maintenance activities are documented.

4.3 Optimization

4.3.1 Condition Assessment Methods

Monitoring and assessing asset condition provides essential information to decision-makers regarding when to repair, rehabilitate and replace assets. In addition to making rehabilitation and replacement decisions, condition assessment also informs asset managers on how best to operate and maintain an asset.

CRW has a well-defined process for condition assessment of the assets in the Wastewater Collection System defined in the SAMP and the associated documents that align with regulatory drivers. Assessment activities are completed by CRW staff and contractors within the Collection System.

4.3.2 Root Cause Failure Analysis

Problem, Cause, and Resolution Codes

Failure codes also known as Problem, Cause, and Resolution (PCR) codes are used to assist with trouble shooting failures and trending like failures across the CRW divisions. The key to successfully using PCR codes is having a set of standard codes for each asset class. A standardized set of PCR codes has been developed for Collection System assets and are currently being used by staff on work orders. When CRW staff initiate a work order in Cityworks, they will be required to apply the appropriate problem code. Before the technician closes out a work order, they must apply the appropriate cause and remedy code.

PCR codes assist in the following:

- Track and trend asset failures
- Identify the causes of failure
- Change maintenance procedures to reduce failures
- Identify problem manufacturers and equipment

Root Cause Analysis

As a future state item and as further detailed in the SAMP, PCR codes will be used as part of completing root cause failure analysis (RCFA) on critical assets. Using failure codes and performing RCFA, CRW staff can make data-driven decisions related to adjustments to maintenance and

operations procedures, engineering designs, and equipment selections to assist in reducing equipment failure.

4.4 Continuous Improvement

People	Process	Technology
• Ensure staff have the approprate trainng to complete planning /scheduling of work in the system. • Ensure staff have the appropriate training to complete inspetion of critical assets.	• Staff to refine asset class and develop job plans as appropriate to support O&M of assets. • Based on PCR code information, staff will update maintenance strategies to increase asset availabilty and decrease asset down time. • Use the business risk score from InfoAsset Planner to prioritize work orders.	• Continue to update InfoAsset Planner with newly collected CCTV data to optimize business risk scores for prioritization efforts.

Section 5

Decision Making and Capital Planning

The SAMP details the overall strategy for asset rehabilitation and renewal (R/R) that all facilities are required to implement. This TAMP section details the process that CRW currently uses to support this strategy including how to identify and justify an asset need, as well as how to identify the best funding strategy to finance the asset R/R.

5.1 Risk Management

This section describes the risk management strategies used to manage risk within the Collection System. This approach to risk management involves the development of a risk register and risk-based prioritization for the Collection System.

5.1.1 Risk Policy

As part of the Asset Management Policy, CRW leads practices focused on seeking the lowest total life-cycle cost of ownership for infrastructure assets while delivering services and minimizing risk to the community. A key guiding principle for sustainable asset management is to understand and manage CRW's business risk exposure. This is accomplished by:

- Identifying and focusing on those assets that are critical to CRW's service levels and prioritizing their management to prevent their failures.
- Identifying, understanding, and managing the business risks associated with operating CRW's resources.

Refer to the SAMP for details about the Risk Policy.

5.1.2 Risk Register

As noted in the SAMP, a high level or organizational risk register is used to document the following:

High level risk – Describes an event that may occur and cause a negative impact at the Collection System

Impacts – Describes the impact the event may have on the Collection System if it occurs.

Likelihood rating – Value that quantifies the certainty that the event may occur as low (1), moderate (3), or high (5)

Consequence rating – Value that quantifies the severity of the impact of the event as low (1), moderate (3) or high (5)

Risk Rating – The result of multiplying the likelihood rating by the consequence rating.

Risk mitigation measures – Options for reducing the certainty and/or impact of the event.

The organizational risk register is shown in .

Table 5.1. Organizational Risk Register

Risk ID	Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR X LR)	Risk Mitigation Measures
Organizational	Loss of institutional knowledge/ asset records	• Lower productivity • Equipment breakdowns/repair times • Regulatory violations • Operational issues due to inexperience • Budgetary impacts for hiring 3rd parties • Safety and injuries • Lost information requiring reproduction • Lost shop/record drawings	5	5	25	• Scanning documents, electronic backup • Records management, documentation attachment in Cityworks • Training employees • Sustainable documentation • SOP documentation • Retention planning, succession planning • Apprenticeship programs
Failure	Large diameter structural failure (cave-ins, collapse) of gravity - sewer and storm	• Public health and safety • Regulatory impacts • Economic impacts • Public relations impacts	5	5	25	• • Proactive inspection • Risk based rehabilitation or replacement • Soil testing and/or geotechnical assessment/modeling • Forensics on failures after they happen for lessons learned (i.e., like materials failing)
Failure	Dry weather CSO discharges to waters of the US	• Public health and safety • Regulatory impacts • Economic impacts • Environmental impacts • Public relations impacts	5	5	25	• Preventive maintenance • Daily Visual inspection • Flow meters in manholes • Visual inspection and calibration of flow meters • Level sensors upstream of the dam to identify CSO before it occurs
Organizational	Insufficient staff and/or insufficient qualified and trained staff for mission critical duties	• Increased overtime • Equipment/assets degrade due to deferred maintenance • Increased costs for contractors/outsourced resources • Loss of system knowledge • Increased costs for repairs and running assets to failure • Opportunity and innovation costs	5	5	25	• Staffing and skills studies • Update engineering standards to include FTE estimate and required skills and training with new facilities and/or equipment • Documented Standard operating procedures and training on those SOPs • Testing and recertification as appropriate • Relationships with community partners for skill development • Outsource staffing, if needed
Failure	Structural failure (cave-ins/collapse) of small	• • Structural or road flooding • Property damage • Public health and safety • Economic impacts	5	5	25	• Facility planning • Capital improvements • Critical assets and spare parts availability

Table 5.1. Organizational Risk Register

Risk ID	Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR X LR)	Risk Mitigation Measures
	diameter stormwater pipes	• Public relations				
Failure	Regional (large diameter) force main breaks reaching waters of the US	• Environmental impacts. Potential discharge to creeks, rivers and streams • Economic impacts • Regulatory impacts • Community/neighborhood impacts • Reputation/public relations impact • Public health and safety	5	3	15	• Contingency/Emergency Response Plans • Force main walks (visual assessment) and ARV inspections performed annually • Forensics on failures after they happen for lessons learned • Engineering standard changes for ARV material and replacement of stainless steel ARVs to prevent corrosion • Testing and in-pipe condition assessment • Soil testing and/or geotechnical assessment/modeling
Financial	Insufficient capital funding	• Regulatory impacts • Health and safety impacts • Public relation impacts	5	5	15	• Public education • Potential for use of grant funding or low interest loans • Look for efficiency gains, including controlling the scope and schedule • Potential innovative approaches that are more efficient • Planning, prioritization, and justification of projects
Financial	Capital delays and/or overruns of construction projects	• Regulatory impacts • Economic impacts • Public relations impact • Public health and safety • Operational impacts	3	5	15	• Implement Construction Project Risk Registers • Involve O&M in the design process • Perform Integrated Change Management • Project planning • Follow PM procedures
Safety	Serious Injury	• Lost Time • Costs • Low employee morale • Loss of productivity	5	3	15	• Safety program • Standard operating procedures • Safety Inspections • Safety Training • General policies • Job Plan specific safety protocols are needed
Natural	Widespread power outages with	• Structural or road flooding • Property damage • Public health and safety	5	3	15	• Capital projects to add more generators and standby power capabilities (portable and onsite)

Table 5.1. Organizational Risk Register						
Risk ID	Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR X LR)	Risk Mitigation Measures
	generator failure or lack of standby power	• Economic impacts • Environmental impacts • Public relations impacts				• Contingency and emergency response plans • Preventive maintenance and testing/inspections of generators • Prioritize critical sites where standby power would be needed
Systems and Data	Unauthorized access to information systems	• Economic impacts • Reputation impacts • Public health and safety • Regulatory impacts	5	3	15	• System backups • Security • More frequent and robust cybersecurity training • Review of appropriate staff responsibilities, access and clearances • Business Continuity Plan
Systems and Data	Information systems going down for extended period during high priority event	• Economic impacts • Reputation impacts • Public health and safety • Regulatory impacts	5	3	15	• Emergency and contingency plans • Redundancy • Documented manual processes • Business Continuity Plan
Failure	Damage to operational and/or administrative facilities	• Disrupts operation • Public health and safety • Regulatory impacts • Economic impacts	5	3	15	• Emergency Response Plan • Business Continuity Plan • Redundancy • Emergency Action Plans (Facility and/or asset specific)
Treatment	Lack of available land for expansion and/or new facilities	• Economic impacts • Reputation impacts • Delay to project schedules • Regulatory impacts	3	5	15	• Proactively search for available land adjacent to facilities • Negotiate/buy options with adjacent landowners • Monitor and prevent encroachment on existing facilities • Identify areas where expansion might be needed as part of Facility Planning
Third Party	Sabotage and/or vandalism at a facility	• Public health and safety • Economic impacts • Public relations	5	3	15	• Security monitoring • Identify key locations where stolen equipment is sold • Analyze existing reports on vandalism and theft to identify key locations

Table 5.1. Organizational Risk Register

Risk ID	Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR X LR)	Risk Mitigation Measures
						• Fences, locks, etc. to secure facilities
Third Party	Third-party damages critical collection system infrastructure	• Public health and safety • Environmental impacts • Economic impacts • Public relations impacts • Regulatory impacts	5	3	15	• Contingency and emergency response plans • Put a deterrent in place, including legal/enforcement actions • Full and accurate asset inventory and markings (PA One Call) • Processes associated with utility locates
Natural	Tornado	• Potential personnel injury • Loss of plant operations • Equipment damage • Loss of plant access	3	3	9	• Emergency plan
Failure	Spill or discharge	• Permit violation • Personnel Safety	3	3	9	• SOP's, Good operations
Capacity	Insufficient hydraulic capacity in the collection system	• Public health and safety • Regulatory impacts • Economic impacts, including development • Public relations impacts • Road flooding • Basement backups	1	5	5	• Facility planning and hydraulic modeling • Capacity-driven Capital improvements • Monitoring of future development and determination of available capacity
Third Party	Terrorist attack	• Potential personnel injury • Loss of plant operations • Equipment damage • Danger to personnel	3	1	3	• Emergency plan
Safety	Fire	• Loss of records • Personnel safety • Loss of treatment	3	1	3	• Fire risk minimal in process areas • Fire alarms in key areas • Fire extinguishers throughout plant
Organizational	Legal action (regulatory fine, personal injury)	• Bad Publicity • Fines	1	3	3	• Meet permit conditions • Good plant operations, SOP's • Training
Natural	Earthquake	• Potential personnel injury • Loss of plant operations • Equipment damage • Loss of plant access	3	1	3	• Emergency plan • Newer equipment and buildings designed to current code
Natural	Flooding	• Facilities would be underwater	1	1	1	• Trailer mounted pump available for recovery

Table 5.1. Organizational Risk Register						
Risk ID	Risk	Description of Impact	Consequence Rating (1,3,5)	Likelihood Rating (1,3,5)	Risk Rating (CR X LR)	Risk Mitigation Measures
						• A flood emergency plan is in place.
Financial	Exceeding allocated budget	• Defer other work • Schedule delays • Rate impacts	1	1	1	• Budget planning • Contingencies • Budget tracking • Perform Integrated Change Management
Safety	Major Vehicle Accident	• Public health and safety • Public relations impact • Economic impact • Operational impacts	3	5	15	• Employee training • Routing to minimize travel times • Safety reminders • Fleet maintenance • Follow existing policies and procedures • Walk-arounds and inspections prior to using vehicles • A flood emergency plan is in place.

5.1.3 Risk Mitigation Strategies

Risk mitigation strategies for the critical assets within the Collection System were developed to ensure they are operating as required and support the risk register noted in the SAMP. Table 5.2 provides a summary of the risk mitigations strategies and Emergency Response Plans (ERPs) identified for the Collection System.

Table 5.2. Risk Mitigation Strategies			
Risk Mitigation Strategy	Description	Responsible Party	Status
Business Continuity Plan	The Business Continuity Plan (BCP) was adopted by CRW at the enterprise level to support the continued operation of critical organizational functions during emergencies	Executive Leadership and Risk	Ongoing
Capital Improvements	Projects identified to address organizational and asset level risks	Engineering	Ongoing
Education of the public and other stakeholders	Education and engagement to improve communication and involve stakeholders in addressing potential risks.	Strategic Initiatives	Ongoing
Participation in industry organizations to monitor and provide input to potential changes	Active involvement in organizations that have input into the future of the industry, including regulatory changes.	Executive Leadership	Ongoing

Table 5.2. Risk Mitigation Strategies			
Risk Mitigation Strategy	Description	Responsible Party	Status
Maintaining relationships with Regulators	Active communication with regulatory agencies to maintain a positive relationship.	Executive Leadership and Engineering	Ongoing
Standard Operating Procedures	Establishment of clear and consistent procedures for operations, maintenance, and business functions.	Operations and Engineering	Ongoing
Training	Program to provide training to staff to ensure the appropriate skills are understood to successfully perform the roles of their position.	Human Resources and Operations	Ongoing
Physical Security	Measures to physically secure CRW assets and facilities	Risk and Safety	Ongoing
Information Security	Measures to secure electronic information and controls.	Information Technology	Ongoing
Safety Program	Training and measures to provide protection from potential hazards	Risk and Safety	Ongoing
Succession Planning	Evaluation of current and future staffing needs, and actions to ensure continuity of staff	Executive Leadership	Ongoing
Engineering Standards and Practices	Engineering standards and practices to incorporate design requirements that may prevent or minimize risk in improvements to existing or future facilities. Engineering Standards and Practices are anticipated to result in reduction of the likelihood of a risk event occurring.	Engineering	Ongoing
Operations and Maintenance	Modification of strategies for operating and maintaining existing and future CRW assets to proactively minimize the likelihood of the risk occurring. They may include modification of staffing levels, SOP and/or maintenance planning and scheduling.	Operations	Ongoing

5.1.4 Risk Based Prioritization

The Collection System uses the general process developed in the SAMP (Figure 5-1) to establish the LOF and COF scores, which identify the highest priority assets to prioritize condition assessment activities, operations and maintenance activities, spare parts inventories, and risk-mitigation projects. CRW adopted the use of InfoAsset Planner (IAP) as their decision tool for assigning risk to the Collection System assets.

Figure 5-1. Risk-based prioritization steps.

5.1.5 Consequence of Failure Analysis

CRW uses IAP for assignment of consequence of failure criteria. Criteria were established in 2022 and described in the InfoAsset Planner Risk Model Implementation Technical Memorandum (August 2022). Scoring criteria and weights were revisited in April 2022 and are summarized in Table 5.3.

Table 5.3. Consequence of Failure Criteria in IAP

Criteria	Criteria Description	Percentage Weighting in Model
COF 1	Combined Size Larger of Height/Weight	25
COF 3	Proximity to Critical Customers	15
COF 5	Combined Transportation (Larger of Traffic Impact/Railroad)	20
COF 6	Environmental Impact (within 75 feet of waterbody)	10
COF 8	Depth of bury	30
	Total	100

5.1.6 Likelihood of Failure Analysis

CRW uses IAP for assignment of consequence of failure criteria. Criteria were established in 2022 and described in the InfoAsset Planner Risk Model Implementation Technical Memorandum (August 2022). Scoring criteria and weights were revisited in April 2022 and are summarized in Table 5.4.

Table 5.4. Likelihood of Failure Criteria in IAP

Criteria	Criteria Description	Percentage Weighting in Model
LOF 1	Install Date	20
LOF2	Material	20
LOF 5A	PACP Structural Quickscores	60
	Total	100

5.1.7 Risk Score Analysis

Once the COF and LOF criteria have been applied to Collection system assets, they are placed on the risk matrix (**Error! Reference source not found.**). The thresholds shown below were developed by C RW in April 2023 and should be revisited periodically for applicability.

It should be noted that COF will be static year to year and only significantly change when processes are modified, or facilities built/abandoned. LOF, on the other hand, are more dynamic in nature and

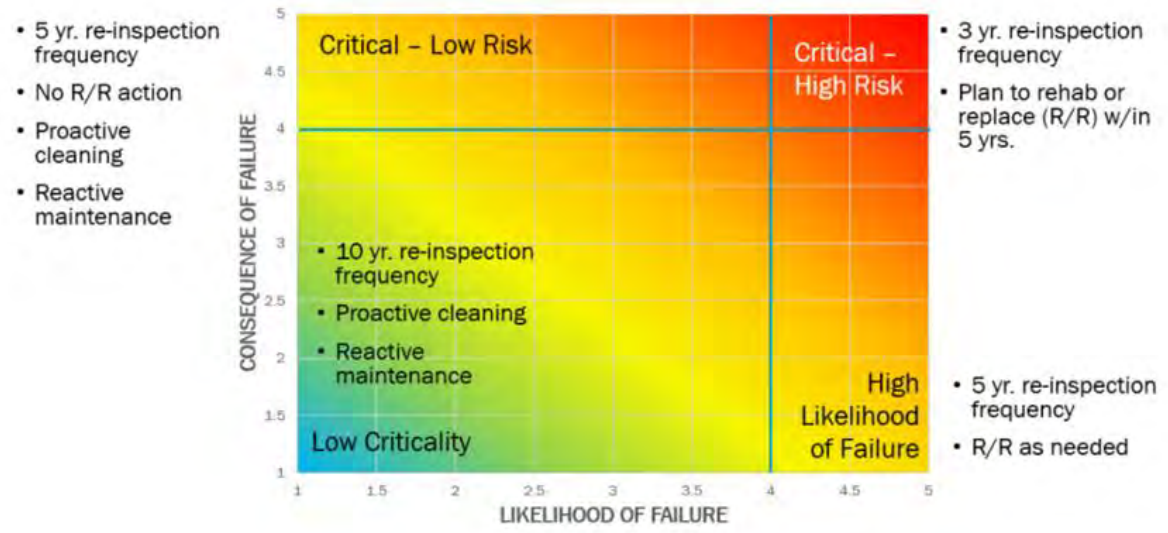


Figure 5-2. Collection System Asset Risk Matrix.

The outcome of this process is a risk ranking of assets that can be used to prioritize condition assessment activities, operations and maintenance activities, and risk mitigation projects (such as rehabilitation and replacement). Criticality ratings are also used to determine priority and timeframe for corrective actions as part of capital planning.

Critical-High Risk Assets	Critical-Low Risk Assets	High Likelihood of Failure Assets	Low Criticality Assets
• COF score greater than or equal to 4 and LOF score of greater than or equal to 4. • Assets are vital to the operation and take priority over the other assets. Assets need to be very reliable and maintenance activities focused on eliminating the potential for failures. As the asset condition rating becomes worse, R/R plans need to be put in place to sustain operations.	• COF score greater than or equal to 4 and LOF score of less than 4. • These assets are important to the operation; however, the likelihood of failure is lower than critical assets. Assets within this group are good candidates for condition monitoring. This monitoring is the trigger for maintenance activities or R/R plans.	• COF score less than 4 and LOF score of greater than or equal to 4. • These assets are less vital to the operation; however, can become a focal point due to the frequency (i.e., likelihood) of failure and require significant resources (time and materials) to sustain.	• COF score less than 4 and LOF score less than 4. • Assets in this group are less vital to the operation and are unlikely to fail.

Figure 5-3. Collection System Criticality Ratings.

5.2 CIP Development and Prioritization Process

5.2.1 Rehabilitation and Renewal Process: Long-term Capital Project Planning

Near and Long-term R/R plans for critical assets should be developed for each facility and system. R/R plans should be comprised of estimated R/R costs for each critical asset over a designated period (i.e., 50-year horizon). The example shown in Figure 5-5, illustrates the various anticipated R/R costs over the lifecycle of a single asset.

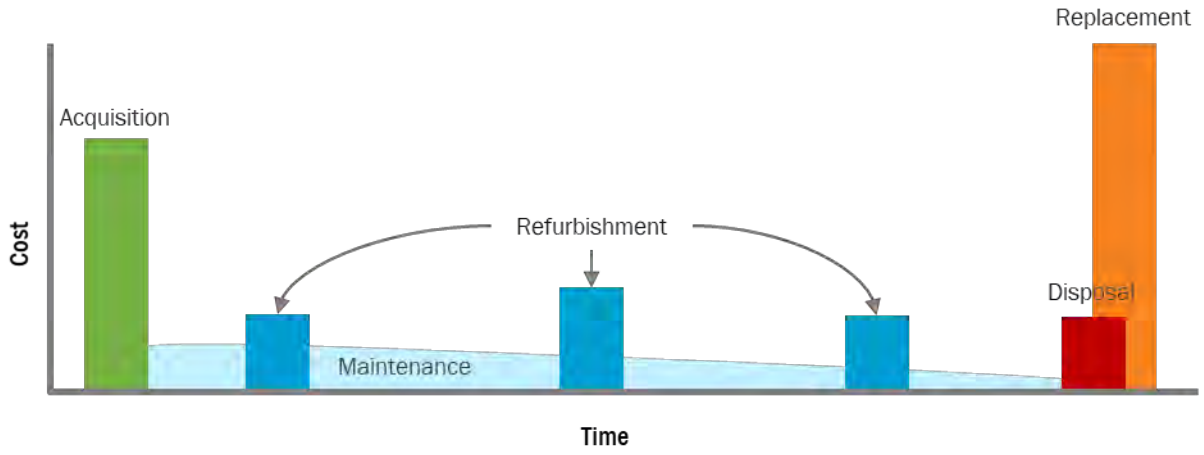


Figure 5-5. Typical costs incurred in an asset lifecycle.

The process for developing a long-term R/R plan for critical assets is described in the SAMP.

Data Needs

5 summarizes the data needs used by the division in support of project identification and/or business case justification. This information is incorporated into the appropriate format to support asset R/R justification.

Table 5.5. Data to Support Asset R/R Justification

Data Type	Description	Data Source
Condition Assessment (CCTV and Routine Inspection)	Routine inspection data that is trended over time to justify need for asset R/R	IAP, CCTV, Laser, Sonar
Risk Rating/Criticality	Calculated risk (COF x LOF) rating to justify the asset R/R	IAP
Work Order History/Mean Time Between Failures	Work order history that supports the asset R/R justification including, but not limited to calculated mean time between failures.	Cityworks
Total Cost of Ownership	Calculated cost of operation trends showing increased cost of operation/maintenance to justify asset R/R	Cityworks
Safety	Identified, investigated, and documented safety issue to justify asset R/R	Cityworks
Compliance	Identified and documented compliance related issue to justify asset R/R	CD reporting

5.2.2 Capital Project Request and Evaluation

Providing a sound business case for projects is essential to developing and delivering a healthy, sustainable capital program. A standardized approach to justifying needs/projects has been developed to allow staff to determine project priorities and make the case for funding projects. The Capital Project Request form can be found in the SAMP.

5.2.3 Project Prioritization Process

Developing and prioritizing the resulting CIPs involves operations and maintenance, engineers, finance and management. Refer to the SAMP for CRW's project prioritization process.

5.2.4 Growth and Forecasting

Analyses of growth and necessary capacity are performed on a scheduled basis and used to determine the funding needs. Forecasting is done using optimization tools (capacity planning, asset acquisition, maintenance analysis, R&R alternatives, etc.).

Refer to the SAMP for details about forecasting funding needs based on projected growth and capacity needs.

5.3 Budget Strategy

5.3.1 Forecasting Long-term R/R Needs

Periodic analyses are undertaken to determine future costs of asset renewal and replacement, including asset maintenance costs. Procedures to review the trend in funding needs and available funds are available as detailed in the SAMP.

5.3.2 Budget Strategy

CRW's budget strategy for Collection System assets is included in the SAMP.

5.4 Design and Construction

5.4.1 Design and Construction Requirements

CRW has developed workflows that set for the process for obtaining asset information during design and construction. The details about CRW's design and construction requirements can be found in the SAMP.

5.4.2 Operating Manuals, Procedures, and Guarantees

Refer to the SAMP for details about delivery of manuals and related asset information.

5.4.3 R/R Costs and Attributes

R/R costs, including indirect costs, are recorded in the asset history. This information is best obtained during the completion of a capital investment. Future decisions regarding renewal and/or replacement of assets will rely upon these costs and attributes.

The life extension (if any) brought about by the R/R work of the underlying asset is estimated at the end of the project. The remaining useful life of the asset is updated and may be included in revisions to the financial fixed asset inventory. This is used to appropriately increase the book value of the financials and start added depreciation of the newly renewed assets.

An R/R Schedule of Values was created for the Collection System using project award data provided by CRW. This cost library is included here Collection AMP Cost Library.

5.5 Continuous Improvement

People	Process	Technology
• Provide ongoing IAP training for staff • Designate a resource to update the R/R Schedule of Values	• Revist the COF/LOF theshholds for applicability to asset maintenance • Update R/R Schedule of Values on annual basis or upon major project award	• Ensure that the Collection System data is accurate and complete to generate IAP model scenarios

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Appendix G

Public Notification Plan

Public Notification Plan
Combined Sewer Overflow Events

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September 2023

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Public Notification Plan
Combined Sewer Overflow Events
September 2023

CAPITAL REGION WATER

Public Notification Plan
Combined Sewer Overflow Events

September 2023

Purpose

As documented in the Modification to the Partial Consent Decree[1] between the United States and PADEP v. Capital Region Water and the City of Harrisburg, specifically Paragraph V.B.10(f)i[2] regarding Public Notification, and the associated Nine Minimum Controls (NMC) Plan required under the Combined Sewer Overflow (CSO) Control Policy, Capital Region Water is committed to developing and implementing a Public Notification Plan (Plan) for CSO activity. **This Plan serves to describe and specify how Capital Region Water will ensure that the public receives timely information regarding the occurrence of CSO events.** Further education and awareness are intended to facilitate understanding of the operation and performance of the combined sewer system as it relates to untreated or partially treated sewage flows. This Plan has been informed by public input and is subject to further review and comment.

Background

Harrisburg's wastewater (i.e., sewer) system, owned and operated by Capital Region Water, includes both separate sanitary sewers and combined sewers. Over half of Harrisburg's sewer pipes are part of a combined sewer system, where polluted stormwater runoff and sanitary sewage are conveyed in the same pipe for treatment. During wet weather, stormwater flows can exceed system capacity, discharging the mixture into the Susquehanna River and/or Paxton Creek. A CSO event is a discharge from the combined sewer system to one of those receiving waters. Capital Region Water is committed to providing notification to the public regarding the occurrence of CSO discharge activity. The information and protocols in this Plan are intended to help the Harrisburg community understand the operation and performance of the wastewater system, specifically how and when the public will be notified about CSO events.

Regulatory/Planning Overview

Capital Region Water is committed to clean water in our local waterways. Since taking ownership and operation of the wastewater and stormwater systems in late 2013, Capital Region Water has been planning and implementing solutions to improve water quality and rehabilitate the network of pipes, sewers, and pumps (i.e., infrastructure), which was built decades ago. This investment has included nearly $200 million in direct infrastructure spending.

[1] Modification to the Partial Consent Decree between the United States and PADEP v. Capital Region Water and the City of Harrisburg as filed in Federal District Court for the Middle District of Pennsylvania on August 25, 2023.

[2] According to Paragraph V.B.10(f)i, *Within 30 days of the Effective Date, CRW shall submit a Public Notification Plan to Plaintiffs for review and comment. The Public Notification Plan shall describe and specify how CRW will notify the public about CSO events, including the design, location, and planned installation date of any signs, placards, monitors, or other public notification system that CRW must install pursuant to the Paragraph.*

Our built infrastructure must work in tandem with the surrounding natural infrastructure – namely Paxton Creek and the Susquehanna River. Approximately 80 percent of the collection system was installed before 1940, meaning that most of the wastewater/stormwater infrastructure is more than 80 years old. The age of this infrastructure, coupled with decades of deferred maintenance, has resulted in several structural issues, operational deficiencies, and debris buildup.

Since 2015, Capital Region Water has been operating under a Partial Consent Decree to ensure necessary measures are taken to achieve full compliance with the federal Clean Water Act and Pennsylvania's Clean Streams Law. This Partial Consent Decree required Capital Region Water to control discharges from the sewer system, which consists of the combined and separate sanitary sewer collection system, conveyance and treatment systems, and the municipal separate stormwater sewer system (MS4) within the City of Harrisburg.[3]

Capital Region Water has negotiated a material modification to the 2015 Partial Consent Decree. This Modification to the Partial Consent Decree addresses alleged violations of the Clean Water Act and Pennsylvania's Clean Streams Law, primarily due to sewer overflows and the discharge of polluted stormwater. The modification also establishes baseline conditions for an acceptable Long-Term Control Plan to further reduce CSO discharges. The goal remains the same – improved water quality and implementation of defined compliance measures.

System Overview

Capital Region Water operates and maintains 59 CSO regulator structures located along the Front Street, Paxton Creek, Paxton Creek Relief, and Hemlock Street interceptor sewers, which ultimately direct combined wastewater (sanitary wastewater and stormwater) to the Advanced Wastewater Treatment Facility (AWTF). During dry weather conditions, the CSO regulator structures divert all the combined wastewater from the trunk sewer lines to the interceptor sewers and then to the AWTF for treatment before being discharged. During wet weather, the rate and volume of the sanitary and stormwater flow from the system of collector sewers increases significantly, and can exceed the capacity of the downstream interceptor sewers and the treatment facility. When this occurs, the CSO regulator structures (sometimes called diversion structures) divert a controlled volume of flow to the interceptor, while untreated excess combined stormwater and wastewater is discharged to receiving waters. This discharge is necessary to avoid basement and other building backups, releases from manholes, or other damage to the system that might be caused by surcharged conditions. The receiving waters are the Susquehanna River for regulator structures along the Front Street interceptor, and Paxton Creek (a tributary of the Susquehanna) for regulators along the Paxton Creek, Paxton Creek Relief, and Hemlock Street interceptors. Each regulator has a dedicated outfall, with one

[3] The intent of the 2015 Partial Consent Decree was to ensure that CRW could achieve a baseline level of control necessary to implement an approved Long Term Control Plan. The plan serves as a roadmap for ongoing system improvements, moving CRW toward its goal of full compliance with state and federal clean water regulations. It has since been discovered that the system was in a worse condition than previously expected, meaning more time was necessary to provide basic maintenance and assess baseline conditions. It also means that additional projects are necessary to meet CRW's goals.

exception in which two regulators serve a common outfall for a total of 58 permitted outfall structures within Capital Region Water's combined sewer system. In addition to the 58 permitted outfall structures, there are permitted emergency outfalls (CSO-002 and CSO-003) that activate only during a mechanical failure of the pump stations or if the station capacities are exceeded during extreme storm events.

Susquehanna River

There are 27 permitted CSO outfall structures along the Front Street Interceptor (see Figure 1). This includes CSO numbers 04-20 and CSO numbers 49-58. CSO-04 at the cross streets of Front & Vaughn is the farthest upstream outfall discharging to the Susquehanna River. CSO-20 is the farthest downstream at Front & Hanna streets. These outfalls are within a 4-mile distance, largely located in or parallel to Riverfront Park, which is located between Front Street and the Susquehanna River. The area is publicly accessible, with visitors frequently recreating between multiple outfall locations as the park is commonly used for walking, running, and biking.

Paxton Creek

There are 26 permitted CSO outfall structures along the Paxton Creek Interceptor (CSO numbers 21-34, 37-46, 48, and 59) and five (5) CSO regulator structures along the Hemlock Creek Interceptor (CSO numbers 60-64) (see also Figure 1). CSO-21 located at Cameron & Schuylkill streets is the farthest upstream outfall location and CSO-64 located at Cameron & Magnolia streets is the farthest downstream location along Paxton Creek.

The Paxton Creek corridor within the City of Harrisburg stretches about six miles with the majority of this portion of the creek highly modified. A concrete-lined channel was constructed by the City of Harrisburg circa 1914 to remedy its heavily polluted and stagnant condition, resulting from the City's rapid urban and industrial development beginning in the early 1800s. Such growth and development have caused extensive ecological degradation to Paxton Creek, and it currently suffers from Urban Stream Syndrome. Urban Stream Syndrome is typified by flash flooding, elevated concentrations of nutrients and contaminants, altered channel morphology, and reduced biotic richness, with an increased dominance of non-native species. A number of factors have limited access and recreational use in and along Paxton Creek. These outfall locations are less accessible to the public.

Emergency Outfalls

In addition to the 58 permitted CSO outfalls, there are two additional CSO outfalls at the Front Street pumping station and the Spring Creek pumping station. These are permitted emergency outfalls (CSO-002 and CSO-003) that activate only during a mechanical failure of the pump stations or if the station capacities are exceeded during large storms (see also Figure 1). There are no regulator structures associated with these outfalls, but they are included in this plan because the outfalls are inspected daily along with the regulators to identify and quantify any dry or wet weather CSO discharges.

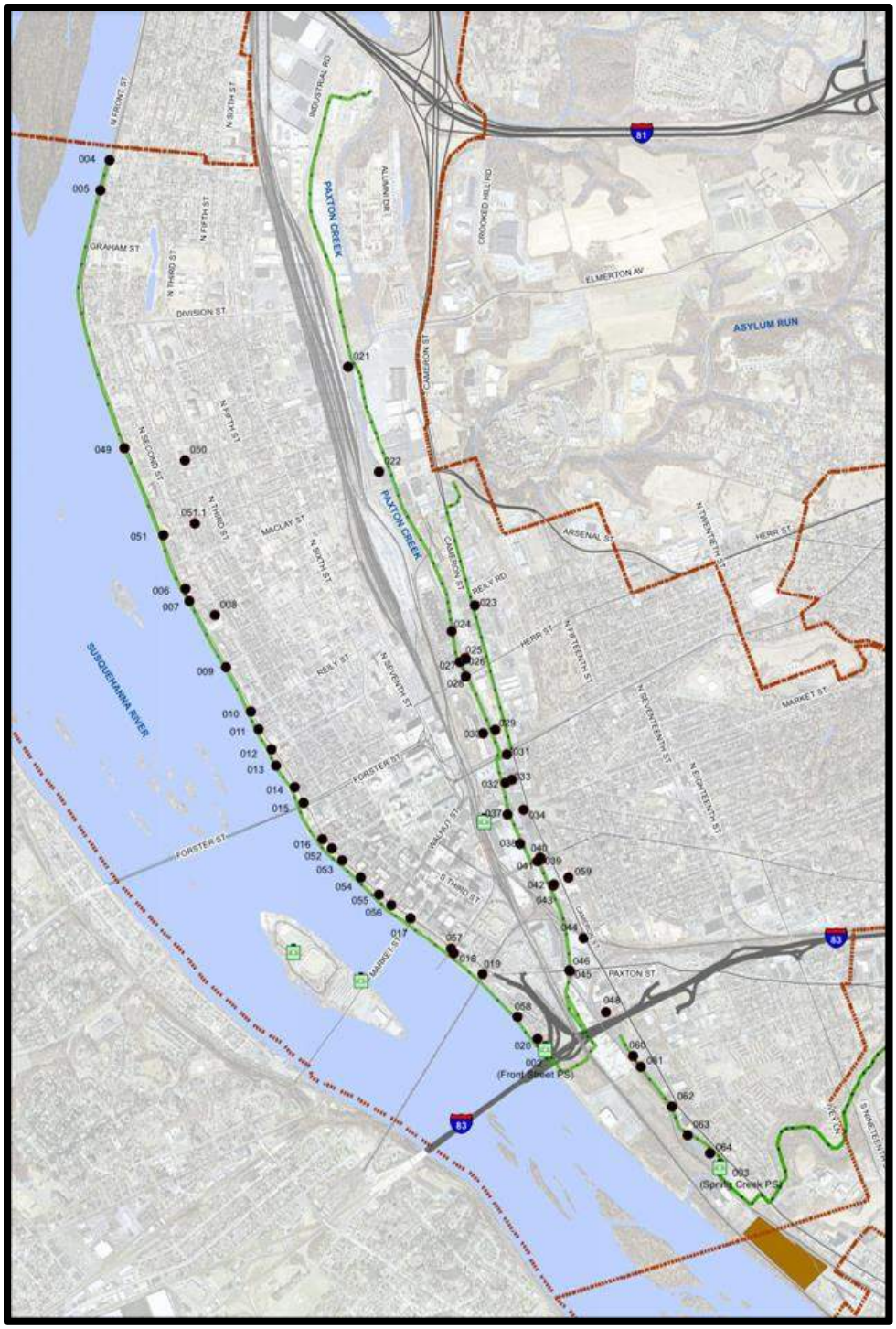


Figure 1: Map of CSO Outfall Locations by Asset Identification Number

Community Considerations

Environmental Justice

Inherent in Capital Region Water's mission, vision, and standard operations is a commitment to environmental justice (EJ), because the communities that we serve experience a disproportionate share of environmental burdens. This is typified by lower-income communities as well as communities of color, which simultaneously lack environmental assets and access to associated improvements in their neighborhoods.

The median income of households within the City of Harrisburg is less than $45,000 with nearly 30 percent of residents experiencing poverty.[4] Utilizing the U.S. EPA's EJScreen tool, Harrisburg's EJ scores can be reviewed in comparison to state and national environmental indicators. Harrisburg experiences elevated EJ concerns, including socioeconomic indicators, that trend higher than state and national averages. Harrisburg's EJScreen Report is included as Appendix A.

Using various definitions and indicators, the communities served by the combined sewer system, including associated outfalls, are historically considered minority and low-income. The majority of Harrisburg lies within PA DEP's Environmental Justice tracker (see Figure 2) with many of the 2015 census tracts identified as an "EJA" or Environmental Justice Area. Take, for example, the farthest north and south or upstream and downstream census tracts along the Paxton Creek corridor in Harrisburg. The northernmost upstream census tract, tract 211 in Dauphin County, reports a poverty rate of 32 percent and a minority population of 91 percent. The southernmost or downstream census tract (at the confluence with the Susquehanna River), census tract 214, reports a 55 percent poverty rate and a minority population of 91 percent.[5]

[4] U.S. Census Bureau QuickFacts: Harrisburg city, Pennsylvania – https://www.census.gov/quickfacts/harrisburgcitypennsylvania

[5] Capital Region Water acknowledges that the Shapiro Administration is seeking to adopt an updated Environmental Justice (EJ) Policy, which is expected to be implemented in 2024. Additionally, PA DEP is improving its mapping tool to better identify EJ areas in Pennsylvania with an expanded list of environmental, health, and socioeconomic indicators. Under the current Environmental Justice Public Participation Policy, PA DEP defines an EJ Area as any census tract where 20 percent or more individuals live at or below the federal poverty line, and/or 30 percent or more of the population identifies as non-white minority, based on U.S. Census Bureau data and federal guidelines for poverty. There is not a universally accepted definition of an Environmental Justice area.

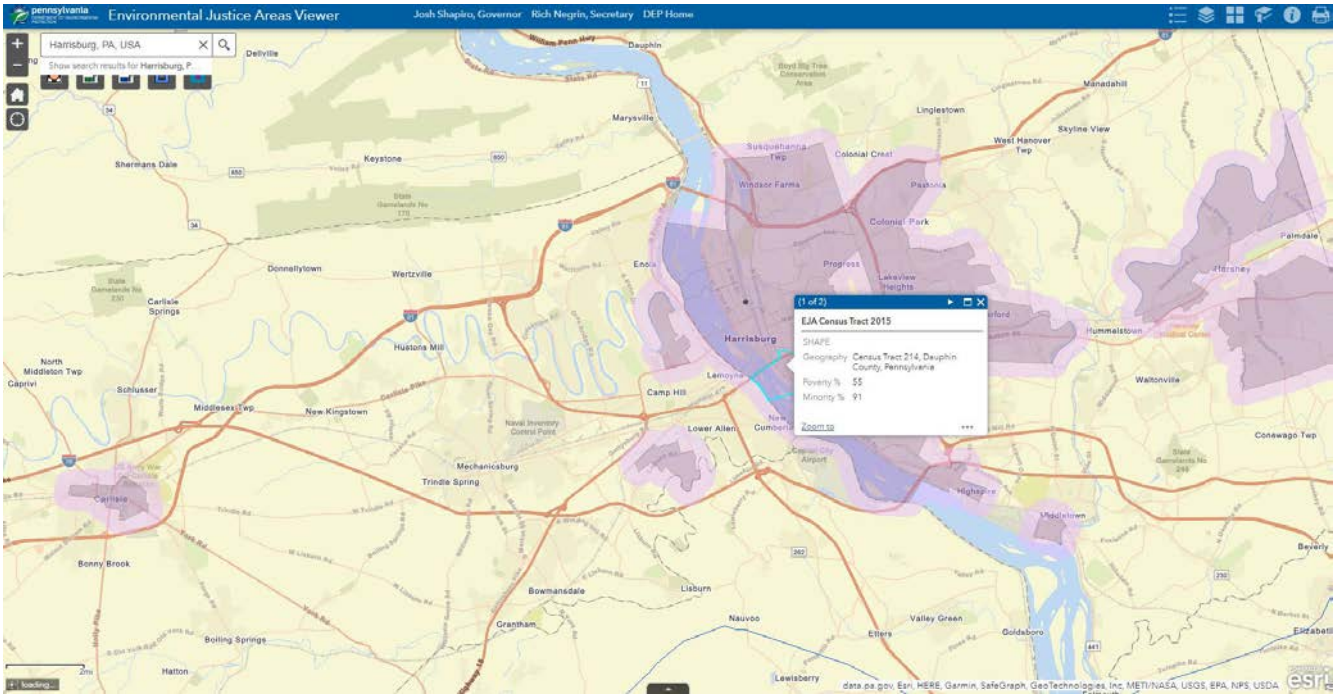


Figure 2: PA DEP Environmental Justice Viewer for Harrisburg, PA

Public Participation

Capital Region Water remains committed to ensuring that all communities we serve have the same protection from environmental and health hazards and equal access to the associated decision-making and public participation processes. This is evident from our collective work since our inception in 2013. Capital Region Water routinely and intentionally engages the community through regular programming, outreach, events, and communications. Staff convenes a team of Community Ambassadors to meet monthly and provide guidance to the larger organization. Community Ambassadors are neighborhood residents who serve as voices for their communities. With experience, insight, and connection, Ambassadors as well as other stakeholders assist in determining how to best utilize resources and address community concerns.

Upon submission of this Public Notification Plan,[6] Capital Region Water commits to consideration of any written comments and/or input received. A copy of the Plan shall be made publicly available on Capital Region Water's website.

Combined Sewer System & Combined Sewer Overflow Signage

As required in the Modification to the Partial Consent Decree, specifically Paragraph V.B.10(f)ii and Paragraph V.B.10(f)iii,[7] Capital Region Water is committed to installing and continually maintaining signs at each CSO outfall location notifying the public of the outfall location and providing direction to avoid contact with water during and following wet weather, as well as appropriate contact information. Minimum sign elements include: 1) warning and/or notice language alerting the public to avoid contact with waters during and following wet weather/rainfall events; 2) bilingual language content and universally accepted symbols; 3) Capital Region Water branding, including contact information; and 4) detail to learn more and/or report discharge.

In 2015, Capital Region Water staff visited and inventoried signage at each CSO outfall and public access points along the east shore of the Susquehanna River. This inventory has been documented in the annual NMC Plan and updated with each subsequent version of the NMC Plan to reflect recent inventory. A community participation process also aided in the development of a signage implementation plan to gather input on a

[6] According to Paragraph V.B.10(f)i, *Within 30 Days of the Effective Date, CRW shall submit a Public Notification Plan to Plaintiffs for review and comment. CRW shall simultaneously provide a copy of the Public Notification Plan to the City, which may provide input on the Plan. Any input from the City must be submitted to Plaintiffs and CRW within fourteen (14) Days of CRW's submission.*

[7] According to Paragraph V.B.10(f)ii, *CRW shall install and continuously maintain signs or placards at each CSO outfall that notify and alert the public to avoid contact with waters near or downstream of discharging CSO outfalls, in accordance with the Public Notification Plan. Signs or placards shall, at a minimum, be installed within ten (10) feet of each CSO Outfall point, and shall be made from durable weatherproof material. Signs or placards shall be visible to the unaided eye from both land and water at each CSO Outfall.* Furthermore, Paragraph V.B.10(f)iii states, *CRW shall also install warning signs, in accordance with the Public Notification Plan, at public stream access points (e.g., boat launches, beaches) that notify and alert the public to avoid recreational contact with waters during or just after any wet weather event.*

comprehensive approach to signage development and installation. Community input influenced the subsequent design and installation of signage in 2016 and 2017.

A documented signage inspection was completed in 2021 to inform an updated signage implementation strategy. In 2022, Capital Region Water started updating and standardizing signage as catalogued in the organization's maintenance management system (i.e., Cityworks). In addition to three-digit asset identification tags identifying each outfall number, various placards and signs are represented at each outfall throughout Capital Region Water's service territory. Variation in signage is necessary to accommodate various configurations of overflow locations, outfall structures, pedestrian access, visibility (from both land and water), and associated physical barriers. Capital Region Water also acknowledges that the 27 CSO regulator structures discharging to the Susquehanna River are located within a public park, lending consideration to public access as well as park aesthetics.

In addition to the standard three-digit asset identification placard, there are five sign types available to notify and/or educate the public about CSO activity. By ensuring consistency in signage, residents and recreators can begin to recognize and anticipate overflow areas. Capital Region Water's objective is to alert the public to the potential health and environmental impacts of CSOs and raise public consciousness concerning the effect of CSO discharges on the receiving water bodies (i.e., Paxton Creek and Susquehanna River). Included below (Figures 3 - 7) are the five sign templates installed at and nearby each of the outfall locations.

Figure 3: 9" x 6" Warning Placard (Posted at each outfall)

Figure 4: 18" x 24" Warning Notice
(deployed along Paxton Creek at 24 locations)

Figure 5: 18" x 24" Public Notice
(deployed along Susquehanna River at 6 locations)

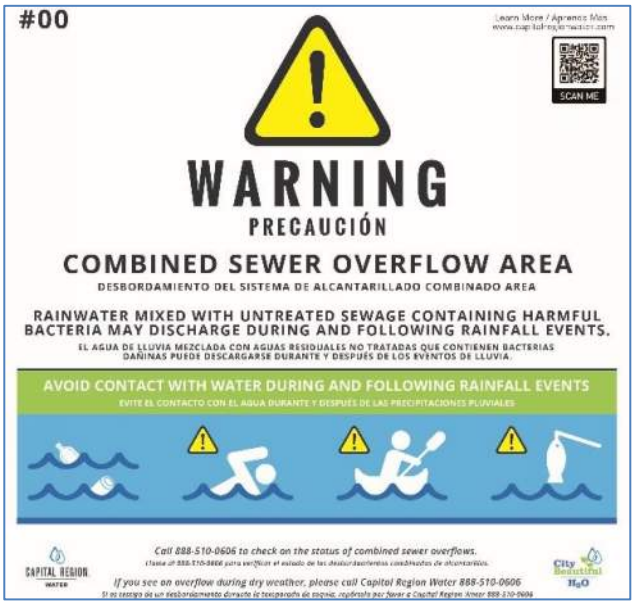


Figure 6: 36" x 36" Warning Sign
(deployed along both Susquehanna River & Paxton Creek at 13 locations)

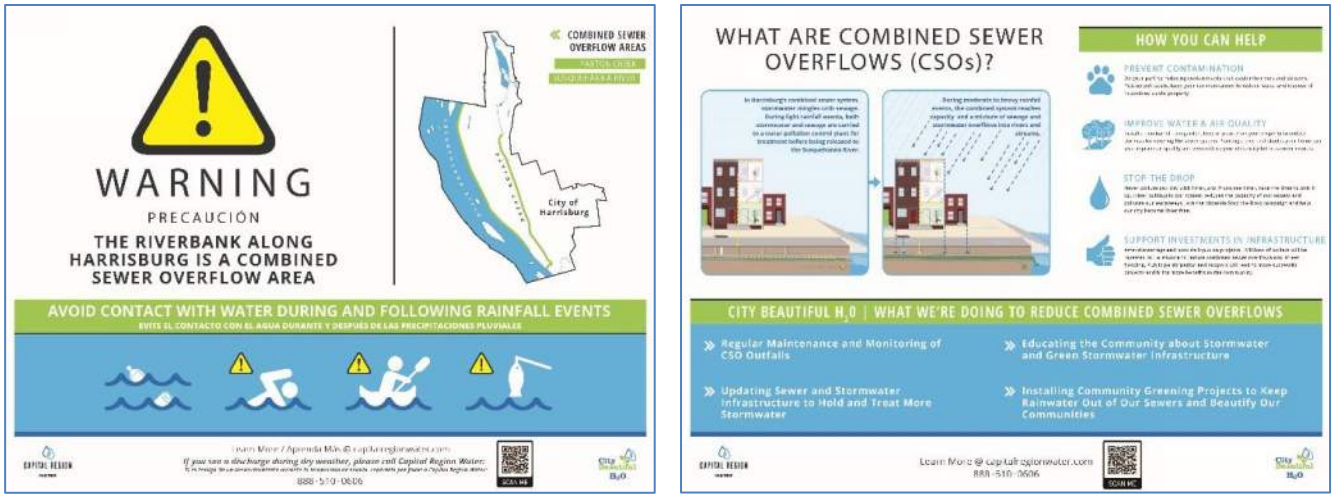


Figure 7: 60" x 36" Educational Sign
(2 - 30" x 36" individual signs posted side-by-side at 4 locations along the Susquehanna River)

Each sign template provides warning and/or notice of combined sewer overflow activity and caution to avoid contact with water during and following rainfall events. Spanish language content as well as information to contact Capital Region Water is included. Signage also includes a QR code, a two-dimensional or matrix barcode, containing data that directs a user to a website or application by use of a smart phone or other electronic device. In this case, the user will be directed to Capital Region Water's website at www.capitalregionwater.com for further information on CSOs and related activity. Users can cross-reference the CSO asset ID with data on an interactive map to learn more about relevant CSO activity within a 48-hour period. Figure 8 below includes a screenshot of the CSO information map and website landing page.

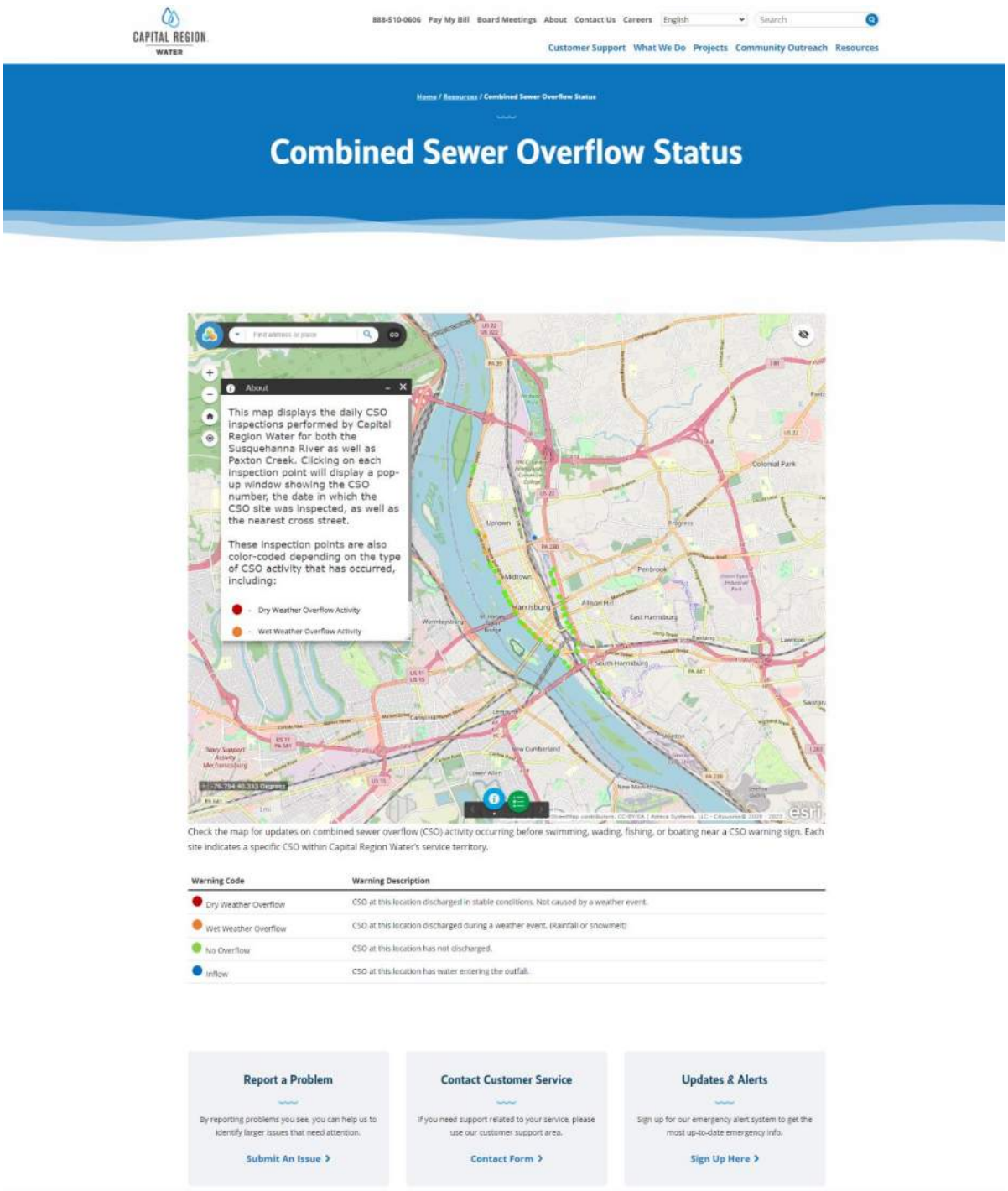


Figure 8: CSO Information Map and CRW Website Landing Page

An outfall identification number placard and warning placard will be maintained at each CSO outfall and within ten (10) feet of the outfall location. Each of the 60 permitted CSO outfalls (58 standard outfalls and the two emergency outfalls) will have additional signage installed and maintained. The following table (Table 1) documents the signage inventory by outfall and location. Any currently outstanding signage will be installed by December 31, 2023. As part of the CSO inspection and maintenance program, all outfall signs will be inspected annually. An annual signage inspection as documented through Capital Region Water's existing maintenance management system (i.e., Cityworks) will be completed each year, with subsequent updates provided in the Semi-Annual Reports on Consent Decree Implementation. This annual inspection will ensure that signs are both present and legible. This information will serve to inform an annual review and subsequent recommendation and implementation schedule to replace and/or enhance signage. Outfall locations with missing and/or damaged signs will be scheduled for replacement and/or repair within 90 days by way of a documented work order system.

CSO Outfall Signage Strategy				
CSO Outfall ID	**Receiving Waters**	**Location**	**Number of Signs**	**Sign Description**
2 (Emergency Outfall)	Susquehanna River	Front Street Pump Station/Dock Street Boat Launch	2	9x6 Warning Placard; 60x36 Educational Sign
3 (Emergency Outfall)	Paxton Creek	Spring Creek Pump Station	2	9x6 Warning Placard; 36x36 Warning Sign
4	Susquehanna River	Front & Vaughn	2	9x6 Warning Placard; 36x36 Warning Sign
5	Susquehanna River	Front & Lewis	3	9x6 Warning Placard; (2) 36x36 Warning Sign
6	Susquehanna River	Front & Geiger	3	9x6 Warning Placard; 36x36 Warning Sign; 18x24 Public Notice
7	Susquehanna River	Front & Peffer	2	9x6 Warning Placard; 36x36 Warning Sign
8	Susquehanna River	Front & Muench	2	9x6 Warning Placard; 36x36 Warning Sign
9	Susquehanna River	Front & Hamilton	2	9x6 Warning Placard; 18x24 Public Notice
10	Susquehanna River	Front & Reily	2	9x6 Warning Placard; 18x24 Public Notice
11	Susquehanna River	Front & Calder	1	9x6 Warning Placard
12	Susquehanna River	Front & Verbeke	1	9x6 Warning Placard
13	Susquehanna River	Front & Cumberland	3	9x6 Warning Placard; 36x36 Warning Sign; 60x36 Educational Sign
14	Susquehanna River	Front & Boas	1	9x6 Warning Placard
15	Susquehanna River	Front & Forster	2	9x6 Warning Placard; 60x36 Educational Sign
16	Susquehanna River	Front & Liberty	1	9x6 Warning Placard
17	Susquehanna River	Front & Market	3	9x6 Warning Placard; 36x36 Warning Sign; 60x36 Educational Sign
18	Susquehanna River	Front & Mulberry	2	9x6 Warning Placard; 18x24 Public Notice
19	Susquehanna River	Front & Paxton	2	9x6 Warning Placard; 36x36 Warning Sign
20	Susquehanna River	Front & Hanna	1	9x6 Warning Placard
21	Paxton Creek	Cameron & Schuylkill	1	9x6 Warning Placard
22	Paxton Creek	Cameron & Forrest	2	9x6 Warning Placard; 18x24 Warning Notice
23	Paxton Creek	Cameron & Calder	2	9x6 Warning Placard; 18x24 Warning Notice
24	Paxton Creek	Hill Chamber T.R.W.	2	9x6 Warning Placard; 18x24 Warning Notice
25	Paxton Creek	N. Cameron & Cumberland	2	9x6 Warning Placard; 18x24 Warning Notice
26	Paxton Creek	S. Cameron & Cumberland	2	9x6 Warning Placard; 18x24 Warning Notice
27	Paxton Creek	9th & Cumberland	2	9x6 Warning Placard; 18x24 Warning Notice
28	Paxton Creek	9th & Herr	1	9x6 Warning Placard
29	Paxton Creek	E. Cameron & North	2	9x6 Warning Placard; 18x24 Warning Notice
30	Paxton Creek	W. Cameron & North	2	9x6 Warning Placard; 18x24 Warning Notice
31	Paxton Creek	Cameron & State	2	9x6 Warning Placard; 18x24 Warning Notice
32	Paxton Creek	W. Cameron & Walnut	1	9x6 Warning Placard
33	Paxton Creek	E. Cameron & Walnut	1	9x6 Warning Placard
34	Paxton Creek	S. Market & Cameron	1	9x6 Warning Placard
37	Paxton Creek	10th & Market	1	9x6 Warning Placard
38	Paxton Creek	10th & Chestnut	2	9x6 Warning Placard; 18x24 Warning Notice
39	Paxton Creek	S. Mulberry & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
40	Paxton Creek	N. Mulberry & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
41	Paxton Creek	W. Mulberry & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
42	Paxton Creek	N. Kittatinny & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
43	Paxton Creek	S. Kittatinny & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
44	Paxton Creek	Cameron & Berryhill	2	9x6 Warning Placard; 18x24 Warning Notice
45	Paxton Creek	S. Paxton Street	2	9x6 Warning Placard; 18x24 Warning Notice
46	Paxton Creek	N. Paxton Street	2	9x6 Warning Placard; 18x24 Warning Notice
48	Paxton Creek	10th & Shannon	2	9x6 Warning Placard; 18x24 Warning Notice
49	Susquehanna River	Front & Schuylkill	1	9x6 Warning Placard
50	Susquehanna River	Front & Seneca	2	9x6 Warning Placard; 36x36 Warning Sign
51	Susquehanna River	Woodbine & Front	1	9x6 Warning Placard
52	Susquehanna River	Front & State	1	9x6 Warning Placard
53	Susquehanna River	Front & South	2	9x6 Warning Placard; 18x24 Public Notice
54	Susquehanna River	Front & Pine	1	9x6 Warning Placard
55	Susquehanna River	Front & Locust	2	9x6 Warning Placard; 18x24 Public Notice
56	Susquehanna River	Front & Walnut	1	9x6 Warning Placard
57	Susquehanna River	Cherry & Mulberry	1	9x6 Warning Placard
58	Susquehanna River	Front & Tuscarora	2	9x6 Warning Placard; 36x36 Warning Sign
59	Paxton Creek	E. Kittatinny & Cameron	2	9x6 Warning Placard; 18x24 Warning Notice
60	Paxton Creek	Salmon Street	2	9x6 Warning Placard; 18x24 Warning Notice
61	Paxton Creek	10th & Sycamore	1	9x6 Warning Placard
62	Paxton Creek	Shanois Street	2	9x6 Warning Placard; 18x24 Warning Notice
63	Paxton Creek	Cameron & Hanover	3	9x6 Warning Placard; 36x36 Warning Sign; 18x24 Warning Notice
64	Paxton Creek	Cameron & Magnolia	2	9x6 Warning Placard; 18x24 Warning Notice

Table 1: CSO Outfall Signage Inventory by Location

Public Notification Signage maps for the Susquehanna River and Paxton Creek are included, respectively, as Appendix B and Appendix C. The maps indicate the location of CSO outfalls to the receiving waters and the posted and/or proposed signs, including sign type and description. Because certain CSO outfall locations are very close together, residents and recreators on land and in water are often at or near multiple regulator structures and outfall locations at the same time. The geospatial display provides further information and context surrounding the Paxton Creek and Susquehanna River corridors.

Notification Protocol

Daily CSO Regulator Inspection

Inspections of the CSO regulator structures are completed daily by CRW staff to check and verify that they are operating properly, identify whether a combined sewer overflow has occurred since the last inspection, identify whether river intrusion has entered into the interceptor system since the last inspection, identify and correct operational problems, and identify and schedule required maintenance.

To identify combined sewer overflows that may have occurred between the daily inspections, CRW utilizes overflow detection devices (ODDs). The ODDs consist of small wooden blocks positioned on the weirs and tethered to the chamber walls. Movement of an ODD is indicative of a possible combined sewer overflow. For CSO regulator structures in which the weir is not easily visible from the manhole, the ODDs are positioned on a platform in the diversion chamber, which is mounted at the same height as the weir crest.

CSO regulator structures are inspected once per day, seven days per week. Daily inspections typically begin around 07:00 AM and are typically completed within four hours. Additional inspection time may be required during high flows within the sewers or receiving waters, during inclement weather, or when problems have been identified during inspections. On rare occasions, an executive decision may be made by the Field Operations Supervisor to forego individual CSO regulator structure inspections due to an emergency resulting in staff limitations (e.g., a dry weather overflow at another CSO regulator structure) or during severe flooding when overflows can be reasonably assumed. Further description of this daily activity can be found in the current version of Capital Region Water's Operation and Maintenance Manual for the Collection and Conveyance System.

Daily CSO regulator inspection activity is documented in Cityworks. Recorded information includes confirmation that the inspection was completed; start/stop times, duration, and volume of any CSOs; ODD codes; backflow codes; and information regarding the staff members who performed the inspections. Any required maintenance identified during inspections is noted.

CSO Monitoring/Activation

As required in the Modification to the Partial Consent Decree, specifically Paragraph V.B.10(f)iv,[8] Capital Region Water is committed to installing monitors that include real-time alert/notification systems at ten (10) selected locations. ADS ECHO monitors will be installed at the selected sites. This is an ultrasonic-based monitor, which includes a real-time alert/notification system. A similar ADS monitor was installed and tested as part of the 2016 CSO Activation Monitoring Pilot (CAMP) Study, which was found to perform well for monitoring CSO activity. To measure CSO activity, the ultrasonic monitors will be installed near the diversion chamber rim of each selected CSO regulator (i.e., the chamber where the diversion weir is located). The elevation of the water surfaces in the diversion chambers will be measured by the meter, and given the known diversion weir elevations, overflows will be determined to occur whenever the elevations of the water surfaces exceed the diversion weir elevations.

The following criteria were considered for selecting the CSO activity monitoring sites:

- **Geographic distribution** – To create a network for public notification, the sites should cover both the Susquehanna River and Paxton Creek, and be roughly evenly spaced apart (i.e., to avoid selecting CSO regulators with outfalls adjacent to each other).

- **Overflow frequency** – To be able to reliably notify the public when a CSO is occurring within the CRW system, those CSO regulators with the highest annual overflow frequencies are included; additionally, to achieve an accurate representation of the entire system, CSO regulators with moderate overflow frequencies are also included.

- **Overflow volume** – Given that large volume overflows can have a greater impact on water quality, CSO regulators with particularly large annual overflow volumes are included.

The following CSO regulators have been selected for CSO activity monitoring:

CSO Regulator	Water Body	CSO Regulator	Water Body
CSO-004	Susquehanna	CSO-024	Paxton Creek
CSO-051	Susquehanna	CSO-031	Paxton Creek
CSO-010	Susquehanna	CSO-042	Paxton Creek
CSO-054	Susquehanna	CSO-048	Paxton Creek
CSO-020	Susquehanna	CSO-061	Paxton Creek

[8] According to Paragraph V.B.10(f)iv, *To aid in notifying the public of CSO activity, CRW shall install monitors that include real-time alert/notification systems at 10 selected locations, in accordance with the Public Notification Plan. The monitors will be installed at CSO regulator locations near the diversion chamber rim of each selected CSO regulator (i.e., the chamber where the diversion weir is located). The elevation of the water surfaces in the diversion chambers will be measured by the meter, and given the known diversion weir elevations, the public and the City will be notified of possible CSO overflows whenever the elevations of the water surfaces exceed the diversion weir elevations.*

Within 180 days of submission of the Public Notification Plan, Capital Region Water will procure and install the ADS ECHO monitors. Note that the list of selected CSO regulators may need to be modified if it is determined during field installations that a particular site is not suitable for the monitoring technology. If this occurs, a replacement site will be selected using the same criteria previously defined. Within 12 months of submission of the Public Notification Plan, the selected CSO regulators and associated data will be integrated into the publicly available CSO Status Map and Website Landing Page as described above and represented in Figure 8 and Figure 9, providing the public with information and notification of possible CSO overflows whenever the elevations of the water surfaces exceed the diversion weir elevations.

Issuance of Public Notification

As required in the Modification to the Partial Consent Decree, specifically Paragraph V.B.10(f)v,[9] Capital Region Water is committed developing written procedures and providing the public and the City with information concerning CSO discharges and their impacts on water quality. Discharges from CSO outfalls consist, or likely consist, of untreated sewage containing harmful bacteria. The public is advised to avoid contact with impacted receiving waters during and following rainfall events.

Website and Mapping Notification

Initial and supplemental notification will be provided through Capital Region Water's website. As presented above, a link on the website displays a map showing daily CSO activation status using a color-coded system. If a user clicks on any CSO icon on the map, an informational window provides information about the CSO location and recent inspection date. The color coding represents the type of CSO activity that has occurred. Figure 9 below is a screenshot of the map taken from the website.

Access to the map and additional information regarding CSOs can be found at Capital Region Water's website or by way of the direct link provided here: https://capitalregionwater.com/resources/cso/.

[9] According to Paragraph V.B.10(f)v, *CRW shall develop written procedures and provide the public and the City with information concerning CSO discharge occurrences and their impacts on water quality in the Receiving Water(s) in accordance with the Public Notification Plan.* Furthermore, Paragraph V.B.10(f)ix states, *CRW shall consider implementation of email and/or text message public notification systems for CSO, DWO, and Unauthorized Release events.*

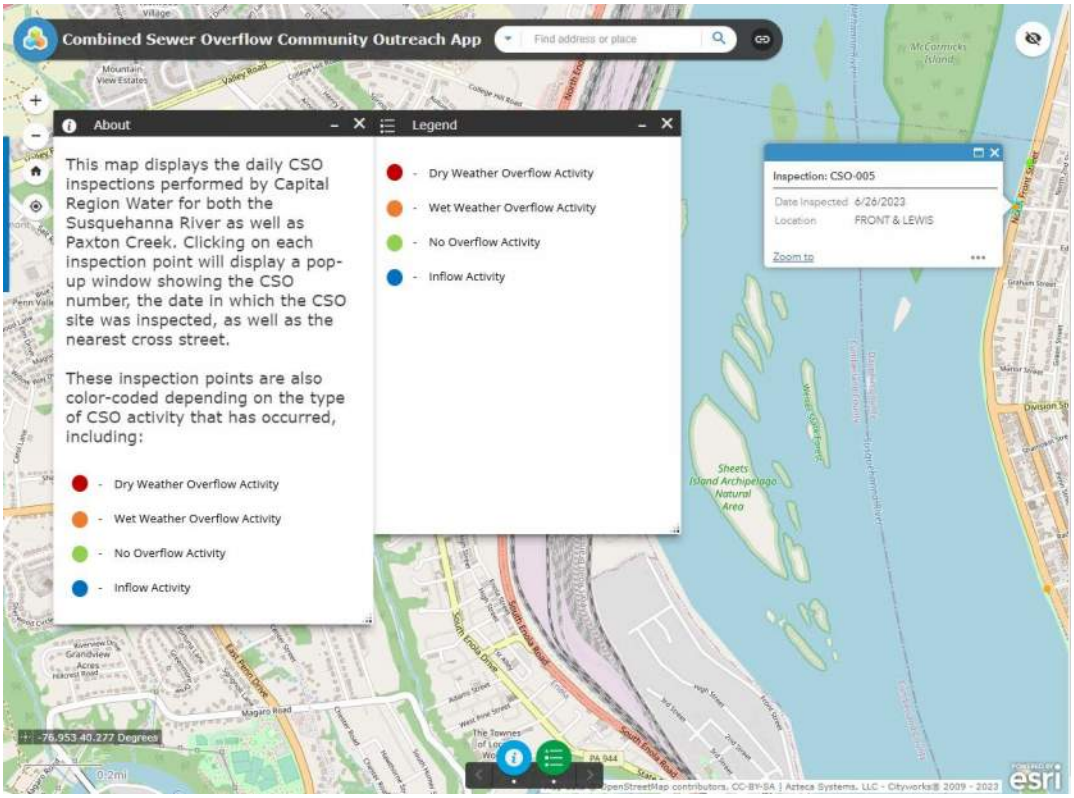


Figure 9: CSO Information Map with Sample Information

Audio and Subscription Notification

Capital Region Water utilizes the Everbridge emergency notification system (a critical event management system) to notify customers and subscribers about potential water concerns and critical service updates. In an emergency, an alert message or notification can be sent via telephone, text message, or email. The Everbridge system also provides for an audio bulletin board feature which enables an audience (e.g., customer, resident, recreator, etc.) to retrieve an audio message at their convenience.

Capital Region Water provides notifications that can be retrieved by calling the Customer Service Center anytime at 888-510-0606 to listen for the prompt and hear the message. This notification is utilized daily to provide an update/alert on CSO activity immediately following the daily CSO inspections completed by the Field Operations team. The audio information provides a summary of CSO activity within the last 24 hours. There are seven possible scenarios which represent potential CSO activity within the combined sewer system and impact on receiving waters. This includes the following potential system scenarios for CSO activity:

1) No CSO Observed – No CSO activity has been observed within the last 24 hours.
2) Single Active CSO Observed – A single active CSO event has been observed.

3) Single Non-Active CSO Observed – A single CSO event has been observed within the last 24 hours but is not active.
4) Multiple Active CSOs Observed – Two or more active CSO events have been observed.
5) Multiple Non-Active CSOs Observed – Two or more CSO events have been observed within the past 24 hours but are not active.
6) Active and Non-Active CSOs Observed – CSO event activity has been observed within the last 24 hours; there is a combination of active and non-active CSO activity.
7) Dry Weather Overflow/Unauthorized Release – CSO activity observed that cannot be attributed to a precipitation event.

Each of the above scenarios requires public notification and has an associated message template that can be updated and posted as an audio notification. Appendix D includes the seven notification templates, and an associated example, utilized by Capital Region Water. Each notification message includes the following content/information:

- Date/time of recent CSO system inspection/observation;
- Status of observed CSO event activity;
- Description of discharge or overflow locations(s), and outfall number(s) (as applicable; would not apply if no activity);
- Impacted receiving waters (as applicable; would not apply if no activity); and
- Precautionary language to avoid contact with waterways and/or further direction (as applicable; would not apply if no activity).

In addition to the current audio notifications and consistent with the Modification to the Partial Consent Decree, specifically Paragraph V.B.10(f)ix,[10] Capital Region Water is implementing a subscription notification option utilizing Everbridge, the automated messaging system. This allows a user to opt-in to receiving direct text messages or email alerts regarding CSO activity. Any interested user would create a portal profile and then select the option to subscribe to receive updates and/or alerts when a CSO has been observed. Similar to the audio bulletin board notification, subscription notifications will correspond to the daily CSO inspections completed by the Field Operations team and reflect the information available through the audio bulletin feature. Subscription alerts will not be utilized if overflow activity has not been observed (i.e., no CSO observed). Subscription alerts shall reflect the following potential system scenarios for CSO activity:

1) Single Active CSO Observed – A single active CSO event has been observed.
2) Single Non-Active CSO Observed – A single CSO event has been observed within the last 24 hours but is not active.
3) Multiple Active CSOs Observed – Two or more active CSO events have been observed.

[10] According to Paragraph V.B.10(f)ix, *CRW shall consider implementation of email and/or text message public notification systems for CSO, DWO, and Unauthorized Release events.*

4) Multiple Non-Active CSOs Observed – Two or more CSO events have been observed within the past 24 hours but are not active.
5) Active and Non-Active CSOs Observed – CSO event activity has been observed within the last 24 hours; there is a combination of active and non-active CSO activity.
6) Dry Weather Overflow/Unauthorized Release – CSO activity observed that cannot be attributed to a precipitation event.

Capital Region Water is committed to maintaining the audio bulletin board notification feature and providing for subscription notifications within 12 months of submission of the Public Notification Plan. This 12-month schedule provides adequate time for system setup/implementation, staff training, and an associated outreach campaign.

Educational Outreach & Public Engagement

As required in the Modification to the Partial Consent Decree, specifically Paragraph V.B.10(f)vi-vii,[11] Capital Region Water is committed to ensuring that the public and any potentially affected stakeholder has access to information regarding a combined sewer system and impact of CSO discharge (both occurrences and impact on receiving waters) as well as information on how to learn more, receive notification, and provide comment to Capital Region Water.

Educational Information

Capital Region Water utilizes various methods of communication with the public. This includes, but is not limited to: a website, CapitalRegionWater.com, an 888-telephone number, an email mailing list, social media, bill stuffers, direct mailings, educational flyers, door hangers, event participation, earned media/press, and an Everbridge emergency notification system. An integrated outreach and education program ensures that customers and stakeholders are provided with information concerning CSO discharge occurrences and impacts on water quality in the receiving waters.

The following methods of routine outreach and communication are identified for annual use:

- Capital Region Water includes a bilingual educational insert in each hard copy mailing of the monthly bill. An e-newsletter with similar content is distributed to customers electing to receive electronic monthly bills as well as interested partners and stakeholders that have signed up to receive this monthly

[11] According to Paragraph V.B.10(f)vi, *CRW shall distribute CSO pamphlets for education of the general public.* Furthermore, Paragraph V.B.10(f)vii states, *CRW shall evaluate and document any CSO public education programs and the community's response to such programs and any follow-up plans addressing public education based on public response.* Paragraph V.B.10(f)viii states, *CRW shall investigate and document any public involvement including any concerns expressed, and comments or suggestions made by the public concerning CSOs, and take any corrective measures warranted.*

communication. No less than one bill insert and corresponding electronic newsletter per year shall serve to notify stakeholders about the combined sewer system and alert the public to avoid contact with water near or downstream of outfalls during and immediately after wet weather events. See Appendix E for a recent example of outreach material and bilingual messaging.

- Capital Region Water's website (CapitalRegionWater.com and specifically About CBH2O – Capital Region Water) is maintained and enhanced to provide educational materials, information about the combined sewer system and CSO events, and regulatory and compliance documents and updates. On or before May 1 of each year, Capital Region Water will post information on its website regarding CSO activity for the previous year. This will include information from the Semi-Annual Report related to capture/discharge metrics. This information also serves to provide the public and the City information concerning CSO discharge occurrence and the impact on water quality in the receiving waters.
- Written communications such as fact sheets, pamphlets, and door hangers.
- Social media, including Facebook, Twitter, Instagram, and Nextdoor.com are continually utilized to provide education, encourage public participation, and interact with customers and stakeholders.
- Participation in community events provides critical opportunities to share information and provide educational resources.
- Meetings include both presentations and attendance at community-wide meetings, with neighborhood associations and community groups, convened meetings with Community Ambassadors, and facilitated stakeholder and town hall meetings. PowerPoint presentations, oral remarks, and educational materials are utilized during these meetings.

Publicly available information as provided by Capital Region Water is translated into Spanish or access is provided for Spanish translation to ensure English language proficiency is not a barrier to receiving information.

Capital Region Water will evaluate and document any CSO public education programs and the community's response to such programs and any follow-up plans addressing public education based on public response. Capital Region Water will also investigate and document any public involvement including any concerns expressed, and comments or suggestions made by the public concerning CSOs, and take any corrective measures warranted. Community engagement activity, along with stakeholder interactions, are logged within the Cityworks management system. Similar to a maintenance work order, community engagement work orders capture relevant details on events, meetings, notifications, etc. designed to inform and involve the public in Capital Region Water's work stewarding the wastewater and stormwater systems in and around Harrisburg.

Potentially Affected Stakeholders

Capital Region Water has identified the following key audiences and stakeholders which may be affected by the occurrence of CSO events:

- Customers, including tenants and multi-dwelling residents
- Recreators
- Community Groups and NGOs
  - Neighborhood Associations and Action Councils
  - Faith-based Organizations
  - Environmental NGOs
  - Community Improvement Organizations
- Volunteers
  - Board of Directors
  - Community Ambassadors: Community Ambassadors are neighborhood residents and representatives that have become leading voices and advocates in their communities. Capital Region Water works with these super volunteers on an ongoing basis. Meetings are hosted monthly to discuss matters and empower them with the education and knowledge to reach out to their own neighbors and communities. Ambassadors also serve to provide direct input to Capital Region Water on issues affecting their constituencies.
  - Event Volunteers
- Local Government Partners
  - City of Harrisburg
  - Dauphin County
  - Dauphin County Conservation District
- Elected Officials
  - City of Harrisburg Mayor and Administration
  - City Council
  - County Commissioners
  - State Representative
  - State Senator
  - Members of Congress
- Regulatory Agencies
  - PADEP
  - USEPA
  - Susquehanna River Basin Commission

This list is routinely maintained by and available through Capital Region Water's Community Relations staff.

Public Feedback & Reporting

Within seven days of submission of this Public Notification Plan, a copy of the Plan will be made available at Capital Region Water's website for public review.

Any amended and successive versions of the Plan will be made publicly available. Subsequent implementation of this Public Notification Plan and the procedures set forth in the NMC Plan and the CSO Policy will be documented in the Semi-Annual Reports submitted under Section VII of the Consent Decree.

CAPITAL REGION™

WATER

USEPA EJScreen Report

EJScreen Report (Version 2.11)

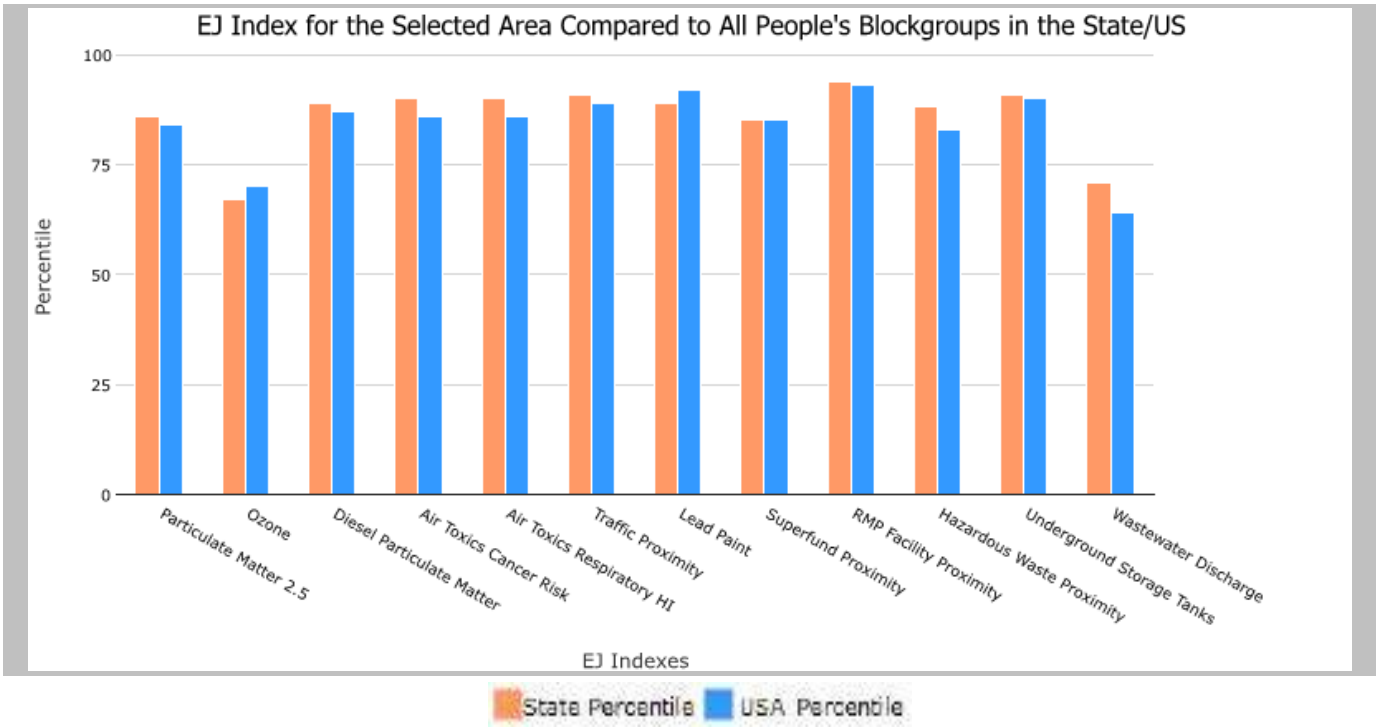
City: Harrisburg, PENNSYLVANIA, EPA Region 3

Approximate Population: 49,247

Input Area (sq. miles): 11.86

Selected Variables	State Percentile	USA Percentile
Environmental Justice Indexes		
Particulate Matter 2.5 EJ index	86	84
Ozone EJ index	67	70
Diesel Particulate Matter EJ index*	89	87
Air Toxics Cancer Risk EJ index*	90	86
Air Toxics Respiratory HI EJ index*	90	86
Traffic Proximity EJ index	91	89
Lead Paint EJ index	89	92
Superfund Proximity EJ index	85	85
RMP Facility Proximity EJ index	94	93
Hazardous Waste Proximity EJ index	88	83
Underground Storage Tanks EJ index	91	90
Wastewater Discharge EJ index	71	64

EJ Indexes - The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.



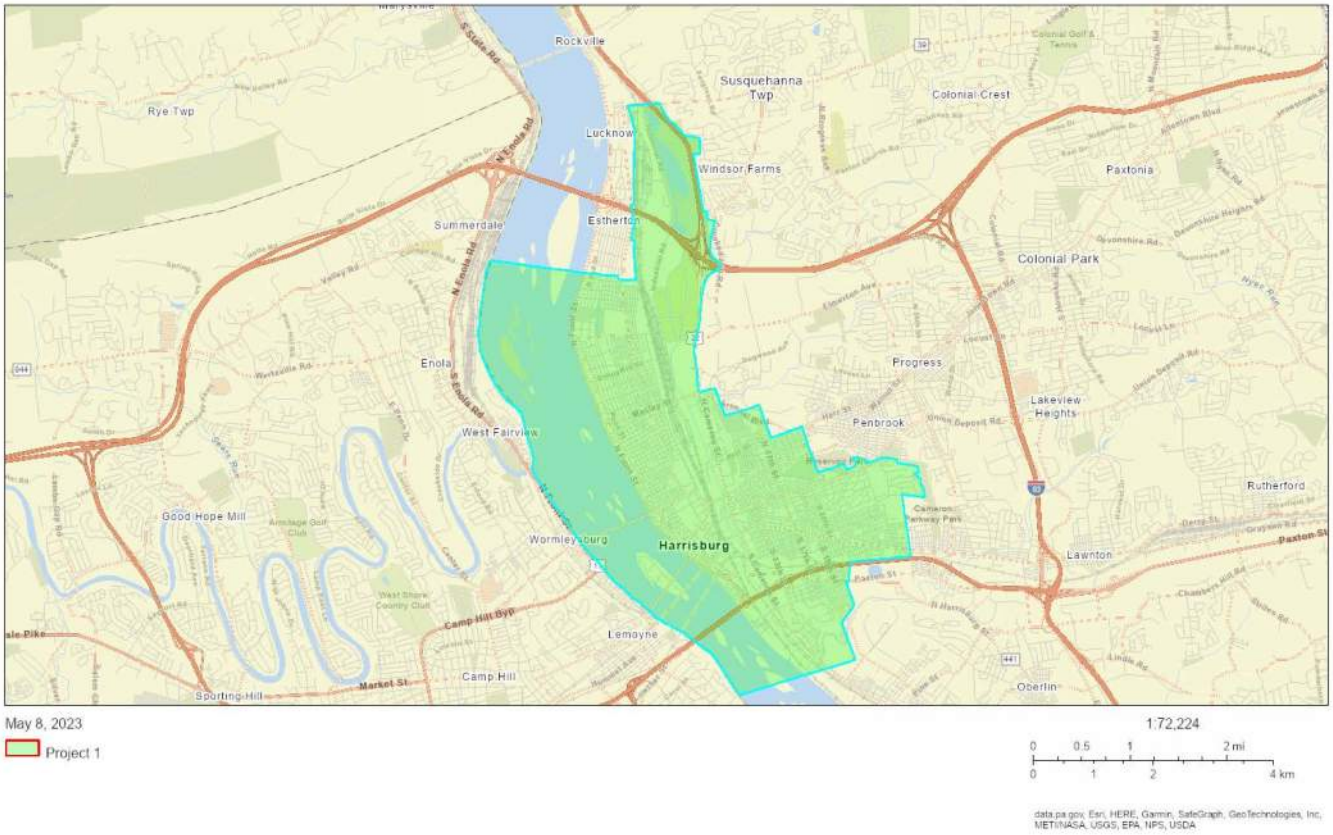
*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

EJScreen Report (Version 2.11)

City: Harrisburg, PENNSYLVANIA, EPA Region 3

Approximate Population: 49,247

Input Area (sq. miles): 11.86



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	2

EJScreen Report (Version 2.11)

City: Harrisburg, PENNSYLVANIA, EPA Region 3

Approximate Population: 49,247

Input Area (sq. miles): 11.86

Selected Variables	Value	State Avg.	%ile in State	USA Avg.	%ile in USA
Pollution and Sources					
Particulate Matter 2.5 (µg/m^3)	9	8.7	55	8.67	62
Ozone (ppb)	40.3	42.1	21	42.5	33
Diesel Particulate Matter* (µg/m^3)	0.365	0.27	76	0.294	70-80th
Air Toxics Cancer Risk* (lifetime risk per million)	30	31	83	28	80-90th
Air Toxics Respiratory HI*	0.39	0.32	95	0.36	70-80th
Traffic Proximity (daily traffic count/distance to road)	1400	660	89	760	86
Lead Paint (% Pre-1960 Housing)	0.71	0.47	72	0.27	86
Superfund Proximity (site count/km distance)	0.088	0.18	48	0.13	62
RMP Facility Proximity (facility count/km distance)	2.5	0.82	92	0.77	93
Hazardous Waste Proximity (facility count/km distance)	1.5	1.5	70	2.2	65
Underground Storage Tanks (count/km^2)	7.7	3.6	84	3.9	85
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0014	77	44	12	52
Socioeconomic Indicators					
Demographic Index	63%	26%	90	35%	85
Supplemental Demographic Index	22%	13%	89	15%	83
People of Color	76%	24%	90	40%	81
Low Income	50%	28%	84	30%	80
Unemployment Rate	8%	5%	78	5%	77
Limited English Speaking Households	8%	2%	90	5%	81
Less Than High School Education	19%	9%	87	12%	78
Under Age 5	9%	5%	84	6%	80
Over Age 64	11%	18%	23	16%	32
Low Life Expectancy	24%	20%	85	20%	85

EJScreen Report (Version 2.11)

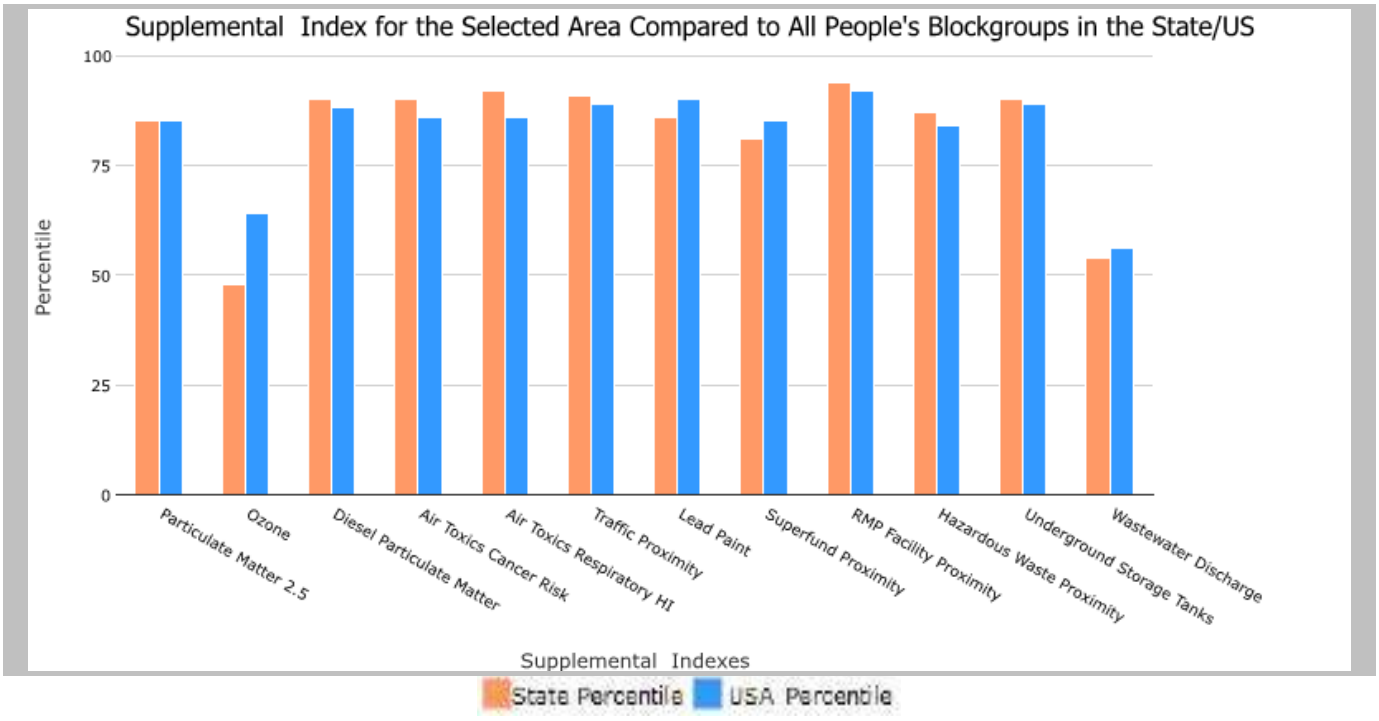
City: Harrisburg, PENNSYLVANIA, EPA Region 3

Approximate Population: 49,247

Input Area (sq. miles): 11.86

Selected Variables	State Percentile	USA Percentile
Supplemental Indexes		
Particulate Matter 2.5 Supplemental Index	85	85
Ozone Supplemental Index	48	64
Diesel Particulate Matter Supplemental Index*	90	88
Air Toxics Cancer Risk Supplemental Index*	90	86
Air Toxics Respiratory HI Supplemental Index*	92	86
Traffic Proximity Supplemental Index	91	89
Lead Paint Supplemental Index	86	90
Superfund Proximity Supplemental Index	81	85
RMP Facility Proximity Supplemental Index	94	92
Hazardous Waste Proximity Supplemental Index	87	84
Underground Storage Tanks Supplemental Index	90	89
Wastewater Discharge Supplemental Index	54	56

Supplemental Indexes - The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on low-income, limited English speaking, less than high school education, unemployed, and low life expectancy populations with a single environmental indicator.



This report shows the values for environmental and demographic indicators, EJScreen indexes, and supplemental indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. For additional information, see: www.epa.gov/environmentaljustice.

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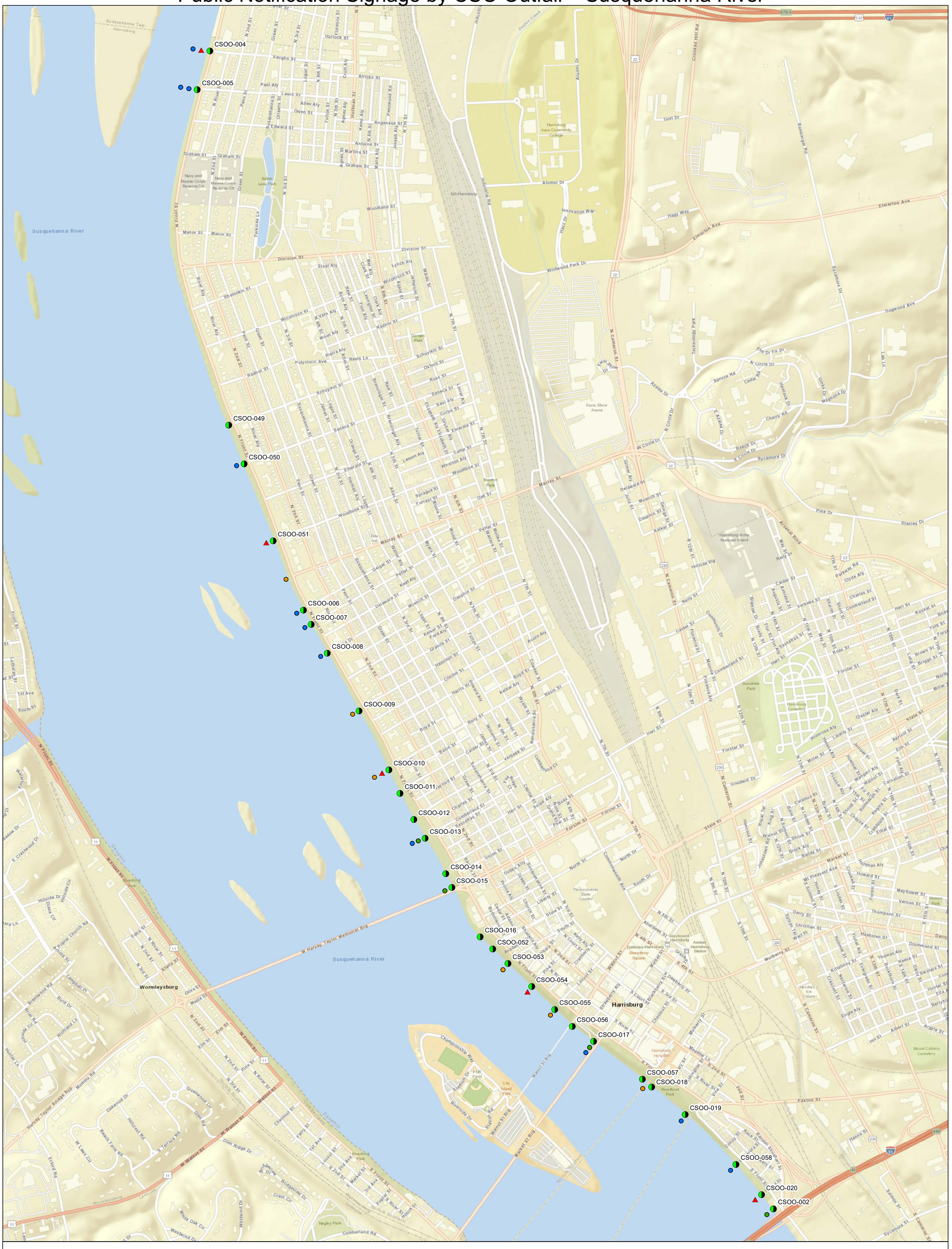
Public Notification Signage by CSO Outfall - Susquehanna River

Public Notification Signage by CSO Outfall – Susquehanna River



Legend

- CSO Outfall
- CSO Activity Monitoring Site
- 18 x 24 Public Notice
- 36 x 36 Warning Sign
- 60 x 36 Educational Sign

A 9 x 6 Warning Placard and CSO outfall identification placard are posted at each outfall location.

Points plotted on this map do not necessarily represent the exact geographic locations of combined sewer overflow signs along Capital Region Water's system in Susquehanna River.

However, points are intended to provide clarity on the number of related signs posted along the waterway.

0 700 1,400 2,800 Feet

1 inch equals 700 feet

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CAPITAL REGION WATER

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Path: N:\CRW\GIS\Maps\zzz_Misc_Maps\Susquehanna River CSO Map.mxd

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Public Notification Signage by CSO Outfall - Paxton Creek

Public Notification Signage by CSO Outfall – Paxton Creek

CSOO-021
CSOO-022
CSOO-023
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CSOO-027
CSOO-025
CSOO-028
CSOO-030
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CSOO-043
CSOO-059
CSOO-042
CSOO-044
CSOO-046
CSOO-045
CSOO-048
CSOO-060
CSOO-061
CSOO-062
CSOO-063
CSOO-064
CSOO-003

Legend

- CSO Outfall
- CSO Activity Monitoring Site
- 18 x 24 Warning Notice
- 36 x 36 Warning Sign

A 9 x 6 Warning Placard and CSO outfall identification placard are posted at each outfall location.

Points plotted on this map do not necessarily represent the exact geographic locations of combined sewer overflow signs along Capital Region Water's system in Paxton Creek.

However, points are intended to provide clarity on the number of related signs posted along the waterway.

0 620 1,240 2,480 Feet

1 inch equals 620 feet

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Path: N:\CRW\GIS\Maps\zzz_Misc_Maps\Paxton Creek CSO Map.mxd

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Public Notification Templates

Notification Templates for Everbridge:

There are seven templates available for use to ensure that the Everbridge CSO audio bulletin (i.e., hotline) is updated every day. Similar templates will be deployed for subscription notifications. Each template includes a description of its application for use as well as a completed example as it should appear for publishing. The highlighted text represents the information that must be updated.

The daily update to the Everbridge notification system is completed after the daily inspection of the CSO regulator structures.

Template language and notifications are subject to change.

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1 - No CSO Observed; No CSO activity observed within the last 24 hours

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

As of **weekday, month day** at **_: __ AM**, there were no active combined sewer overflows observed within the last 24 hours. This status will not change until a combined sewer overflow is observed.

> *Example:*
> *Thank you for your interest in Capital Region Water's Combined Sewer System.*
>
> *As of **Friday, May 7** at **9:30 AM**, there were no active combined sewer overflows observed within the last 24 hours. This status will not change until a combined sewer overflow is observed.*

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2 - Single Active CSO Observed; A single active CSO has been observed

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

A single active combined sewer overflow was observed on **weekday, month, day** at **_: __ AM** at outfall number __ near the cross streets of **_____ & _____** along the **waterway**.

Avoid contact with waterways when there are active combined sewer overflows.

> *Example:*
> *Thank you for calling Capital Region Water's Combined Sewer Overflow hotline.*
>
> *A combined sewer overflow was observed on **Friday, May 7** at **9:30 AM** at outfall number **4** near the cross streets of **Front & Vaughn** along the **Susquehanna River**.*
>
> *Avoid contact with waterways when there are active combined sewer overflows.*

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3 - Single Non-Active CSO Observed; A single CSO has been observed within the last 24 hours but is not active

Notification Template:

Thank you for your interest in Capital Region Water's Combined Sewer System.

A combined sewer overflow occurred within the last 24 hours before **weekday, month, day** at **_: __ AM** at outfall number __ near the cross streets of _____ **&** _____ along the **waterway** but is not active.

Avoid contact with waterways when there are active combined sewer overflows.

Example:
Thank you for calling Capital Region Water's Combined Sewer Overflow hotline.

*A combined sewer overflow occurred within the last 24 hours before **Friday, May 7** at **9:30 AM** at outfall number **4** near the cross streets of **Front & Vaughn** along the **Susquehanna River** but is not active.*

Avoid contact with waterways when there are active combined sewer overflows.

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4 - Multiple Active CSOs Observed; Two or more active CSOs have been observed*

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

Active combined sewer overflows were observed on **weekday, month, day** at **_: __ AM**, between outfall number __ near the upstream cross streets of _____ **&** _____ and outfall number __ near the downstream cross streets of _____ **&** _____ along the Susquehanna River. Also, at outfall numbers ___ & ___ near the cross streets of _____ **&** _____ and the cross streets _____ **&** _____ along the Paxton Creek.

Avoid contact with waterways when there are active combined sewer overflows.

Example:
Thank you for calling Capital Region Water's combined sewer overflow hotline.

*Active combined sewer overflows were observed on **Friday, May 7** at **9:30 AM** between outfall number **4** near the upstream cross streets of **Front & Vaughn** and outfall number **17** near the downstream cross streets of **Front & Market** along the Susquehanna River. Also, at outfall **numbers 23 & 37** near the cross streets of **Cameron & Calder** and cross streets **Tenth & Market** streets along the Paxton Creek.*

Avoid contact with waterways when there are active combined sewer overflows.

*** Please Note**: If CSOs have only been observed along either the Susquehanna or the Paxton Creek, any additional text may need to be deleted.

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5 - Multiple Non-Active CSOs Observed; Two or more CSOs have been observed within the past 24 hours but are not active*

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

Combined sewer overflows occurred within the last 24 hours before **weekday, month, day** at **_: __ AM**, between outfall number __ near the upstream cross streets of _____ **&** _____ and outfall number __ near the downstream cross streets of _____ **&** _____ along the Susquehanna River, but are not active. Also, at outfall numbers ___ **&** ___ near the cross streets _____ **&** _____ and the cross streets _____ **&** _____ along the Paxton Creek, but are not active.

Avoid contact with waterways when there are active combined sewer overflows.

> *Example:*
> *Thank you for calling Capital Region Water's combined sewer overflow hotline.*
>
> *Combined sewer overflows occurred within the last 24 hours before **Friday, June 4** at **8:45 AM**, between outfall number **11** near the upstream cross streets of **Front & Calder** and outfall number **14** near the downstream cross streets of **Front & Boas** along the Susquehanna River, but are not active. Also, at outfall numbers **60 & 61** near the cross streets of **Salmon & Cameron** and the cross streets **10th & Sycamore** along the **Paxton Creek**, but are not active.*
>
> *Avoid contact with waterways when there are active combined sewer overflows.*

*** Please Note**: If CSOs have only been observed along either the Susquehanna or the Paxton Creek, any additional text may need to be deleted.

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6 - Active and Non-Active CSOs Observed; CSOs have been observed within the last 24 hours but are not active and there is at least one active CSO

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

Combined sewer overflows occurred within the last 24 hours before **weekday, month, day at _: __ AM**, at outfall number __ near the cross streets of _____ **&** _____along the Susquehanna River and at outfall number __ near _____ **&** _____ streets along the Paxton Creek but are not active.

An active combined sewer overflow was observed on **weekday, month, day** at **__: __ AM** at outfall number __ near the cross streets of _____ **&** _____ along the **waterway.**

Avoid contact with waterways when there are active combined sewer overflows.

Example:
Thank you for calling Capital Region Water's combined sewer overflow hotline.

Combined sewer overflows occurred within the last 24 hours before, ***Friday, June 4*** *at* ***8:45 AM****, at outfall number* ***13*** *the cross streets* ***Front & Cumberland*** *along the Susquehanna River and at outfall number* ***40*** *near* ***N. Mulberry & Cameron*** *streets along the Paxton Creek but are not active.*

An active combined sewer overflow was observed on ***Friday, June 4*** *at* ***9:30 AM****, at outfall number* ***28*** *near the cross streets of* ***9th & Herr*** *along the* ***Paxton Creek****.*

Avoid contact with waterways when there are active combined sewer overflows.

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7 - Unauthorized Release; Dry Weather Overflow or unauthorized discharge

Notification Template:
Thank you for your interest in Capital Region Water's Combined Sewer System.

An unauthorized combined sewer discharge occurred within the last 24 hours before **weekday, month, day** at **__: __ AM** at outfall number **__** near the cross streets of **_____ & _____** along the **waterway.**

Avoid contact with waterways when there is an unauthorized sewer discharge.

Example:
Thank you for calling Capital Region Water's combined sewer overflow hotline.

An unauthorized sewer overflow was observed on ***Monday, June 7*** *at* ***9:30 AM*** *at outfall number* ***56*** *near the cross streets of* ***Front & Walnut*** *along the* ***Susquehanna River****.*

Avoid contact with waterways when there is an unauthorized sewer discharge.

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What's on Tap, Monthly Newsletter for Capital Region Water, May 2023

May 2023 | Vol. 17

What's on Tap

Monthly Newsletter for Capital Region Water Customers and Stakeholders

WHAT IS A COMBINED SEWER AND WHY DOES IT OVERFLOW?

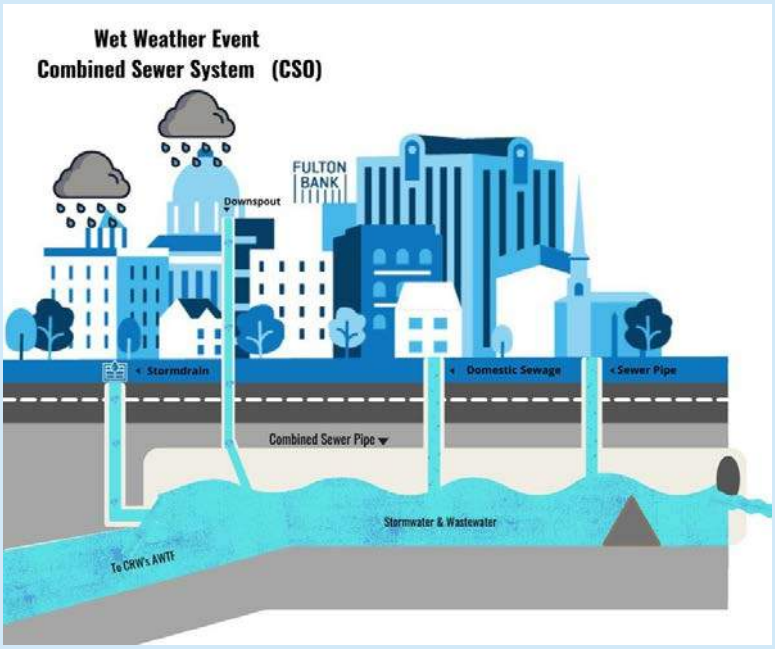
About 60 percent of Capital Region Water's sewer system is combined, meaning it carries a combination of wastewater and stormwater in the same pipes. Under normal circumstances, that mixture is conveyed to CRW's Advanced Wastewater Treatment Facility. However, during wet weather, the volume of stormwater flowing into inlets and drains can sometimes exceed the system's capacity. The increased flow then triggers a combined sewer overflow, commonly called a CSO, discharging the untreated mixture of stormwater and wastewater through outfalls directly into the Susquehanna River and Paxton Creek. CRW's system has a total of 58 outfalls.

The combined system and its outfalls predate CRW (formed in 2013) by many decades, dating back to a time when combined pipes were common in sewer design. In fact, about 800 U.S. cities have combined systems.

WHAT IS THE PROBLEM WITH COMBINED SEWERS, AND WHAT IS THE SOLUTION?

Now, we know that CSO discharge can be harmful, threatening public health and polluting local waterways, as well as those downstream. For those reasons, Capital Region Water is committed to reducing CSOs and has been making system improvements to achieve that goal. CRW also is required to capture and control CSOs by law and through a legal agreement with state and federal regulators called a Partial Consent Decree.

Earlier this year, CRW submitted an update to that agreement, planning to implement $200 million worth of system improvements over the next decade to drastically increase CSO capture. The plan, called City Beautiful H2O, includes traditional sewer upgrades and repairs, as well as the increased implementation of green infrastructure — engineered combinations of plants and detention infrastructure that capture and slow the release of stormwater into the combined system. CRW will continue to work with state and federal regulators to meet water quality targets.



WHERE ARE THE CSO OUTFALLS?

Warning signs have been posted at CSO outfall locations along the Susquehanna River and Paxton Creek as part of a public notification strategy stipulated by CRW's agreement with regulators. The purpose of the signs is to alert members of the public to avoid contact with water near or downstream of outfalls during and immediately after wet weather events. CRW is in the process of developing a plan to install additional signs along the river with hopes of further educating the public about CSOs.

Mayo 2023 | Vol. 17

Qué hay en Tap

Capital Region Water Boletín mensual
para clientes y partes interesadas

¿QUÉ ES UNA ALCANTARILLA COMBINADA Y POR QUÉ SE DESBORDA?

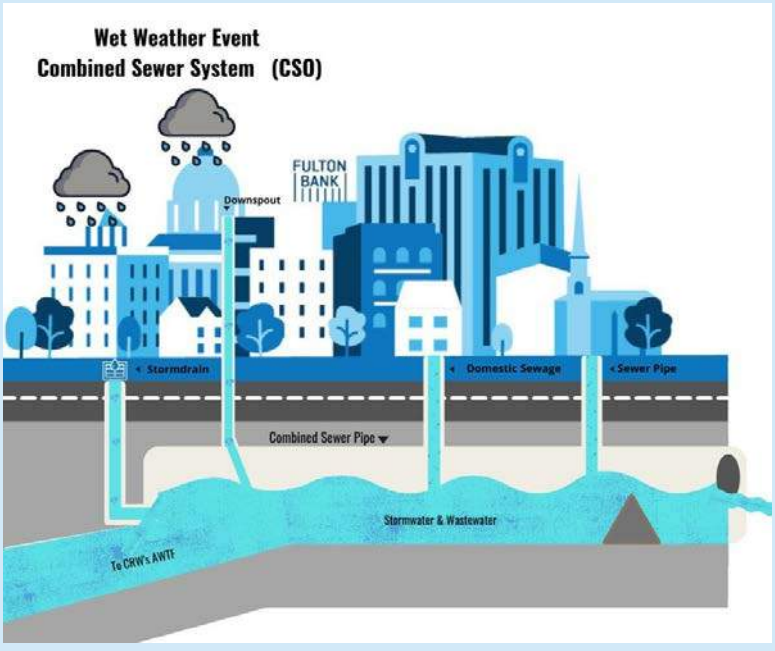
Alrededor del 60 por ciento del sistema de alcantarillado de Capital Region Water está combinado, lo que significa que transporta una combinación de aguas residuales y aguas pluviales en las mismas tuberías. En circunstancias normales, esa mezcla se transporta a la Instalación de Tratamiento de Agua Avanzada de CRW. Sin embargo, durante el clima lluvioso, el volumen de aguas pluviales que fluyen hacia las entradas y desagües a veces puede exceder la capacidad del sistema. El aumento del flujo luego desencadena un desbordamiento combinado de alcantarillado, comúnmente llamado CSO, descargando la mezcla no tratada de aguas pluviales y aguas residuales a través de los desagües directamente en el río Susquehanna y riachuelo Paxton. El sistema de CRW tiene un total de 58 desaguadero.

El sistema combinado y su desaguadero son anteriores a CRW (fundada en 2013) por muchas décadas, que se remonta a una época en que las tuberías combinadas eran comunes en el diseño de alcantarillado. De hecho, alrededor de 800 ciudades estadounidenses tienen sistemas combinados.

¿QUÉ ES EL PROBLEMA CON ALCANTARILLADO COMBINADO Y CUÁL ES LA SOLUCIÓN?

Ahora, sabemos que la descarga de CSO puede ser dañina, amenazar la salud pública y contaminar las vías fluviales locales, así como el rio más abajo. Por esas razones, Capital Region Water se compromete a reducir el CSO y ha estado realizando mejoramientos en el sistema para lograr ese objetivo. CRW también está obligado a capturar y controlar el CSO por ley y a través de un acuerdo legal con los reguladores estatales y federales llamado Decreto de Consentimiento Parcial (Partial Consent Decree).

A principios de este año, CRW presentó una actualización de ese acuerdo, planeando implementar mejoras del sistema por valor de $ 200 millones durante la próxima década para aumentar drásticamente la captura de CSO. El plan, llamado City Beautiful H2O, incluye mejoras y reparaciones tradicionales de alcantarillado, así como una mayor implementación de infraestructura verde: combinaciones de ingeniería de plantas e infraestructura de detención que capturan y ralentizan la liberación de aguas pluviales en el sistema combinado. CRW continuará trabajando con los reguladores estatales y federales para cumplir con los objetivos de calidad del agua.



¿DÓNDE ESTÁN LOS DESAGÜES DEL CSO?

Se han colocado señales de advertencia en los desagües de CSO a lo largo del río Susquehanna y riachuelo Paxton como parte de una estrategia de notificación pública estipulada por el acuerdo de CRW con los reguladores. El propósito de las señales es alertar a los miembros del público para evitar el contacto con el agua cerca o aguas abajo de los desagües durante e inmediatamente después de los eventos de clima lluviosos. CRW está en el proceso de desarrollar un plan para instalar letreros adicionales a lo largo del río con la esperanza de educar aún más al público sobre el CSO.

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