

**Metropolitan Water Reclamation District of Greater Chicago
(District)**

MAINTENANCE AND OPERATIONS DEPARTMENT

COLLECTION SYSTEM OPERATION AND MAINTENANCE MANUAL

In accordance with:

NPDES No. IL0028088 – O'Brien WRP
NPDES No. IL0028053 – Stickney WRP
NPDES No. IL0028061 – Calumet WRP
NPDES No. IL0028070 – Lemont WRP
NPDES No. IL0047741 – Kirie WRP
NPDES No. IL0036137 – Hanover Park WRP
NPDES No. IL0036340 – Egan WRP

Pertaining to requirements for a:

Capacity, Management, Operations, and Maintenance Plan
Combined Sewer Overflow Operational and Maintenance Plan
Combined Sewer Overflow Pollution Prevention Plan
Combined Sewer Overflow Public Notification Plan

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List of Acronyms

AE	Aquatic Ecology
AL	Analytical Laboratory
AWQM	Ambient Water Quality Monitoring
CAMP	Collection Asset Management Plan
CAWS	Chicago Area Waterway System
CCD	Chicago City Datum
CDOM	Continuous Dissolved Oxygen Monitoring
CSF	Combined Sewage Flow
CSO	Combined Sewer Overflow
DO	Dissolved Oxygen
EM&R	Environmental Monitoring and Research
IDPH	Illinois Department of Public Health
IEPA	Illinois Environmental Protection Agency
I/I (CP)	Infiltration / Inflow (Control Plan)
IPCB	Illinois Pollution Control Board
IW	Industrial Waste
LIMS	Laboratory Information Management Systems
MMS	Maintenance Management System
MSLDP	Mainstream / Lower Des Plaines
NASSCO	National Association of Sewer Service Companies
NBPS	North Branch Pumping Station
NPDES	National Pollution Discharge Elimination System
PACP	Pipeline Assessment and Certification Program
PCMP	Post-Construction Monitoring Plan
QAM / QAPP / QA/QC	Quality Assurance (Manual / Project Plan / Quality Control)
RAPS	Racine Avenue Pumping Station
RL	Reporting Limit
SOG.....	Standard Operating Guidelines
SOP	Standard Operating Procedure
SSO	Separate Sewer Overflow
SWCO	Sewage and Waste Control Ordinance
TARP	Tunnel and Reservoir Plan
TGM	Technical Guidance Manual
UCO	User Charge Ordinance
WMO	Watershed Management Ordinance
WRP	Water Reclamation Plant

Introduction

The mission of the District is to protect the health and safety of the public in its service area, protect the quality of the water supply source (Lake Michigan), improve the quality of water in watercourses in its service area, protect businesses and homes from flood damages, and manage water as a vital resource for its service area. The District's service area is 882.1 square miles of Cook County, Illinois. The District is committed to achieving the highest standards of excellence in fulfilling its mission.

Flow within the Chicago Area Waterways System and Lake Michigan diversion flow are controlled by five structures: Wilmette Pump Station, Chicago River Controlling Works and Lock, O'Brien Controlling Works and Lock, Lockport Lock and Dam, and Lockport Controlling Works.

While exercising no direct control over wastewater collection and transmission maintained by cities, towns, and villages in Cook County, the District does control municipal sewer construction by permits in suburban Cook County. It also provides the main trunk lines for the collection of wastewater and treatment thereof. The District also provides facilities to store, treat, and release combined sewage and stormwater runoff within its jurisdiction.

The District is located primarily within the boundaries of Cook County, Illinois. The District's service area includes 882.1 square miles, which includes the City of Chicago and 128 suburban communities. The District serves an equivalent population of 12.72 million people; 5.19 million real people, a commercial and industrial equivalent of 5.29 million people, and a combined sewer overflow equivalent of 2.24 million people. The District's 560 miles of intercepting sewers and force mains range in size from 6 inches to 27 feet in diameter, and are fed by approximately 10,000 local sewer system connections.

The District's Tunnel and Reservoir Project (TARP) is one of the country's largest public works projects for pollution and flood control. One hundred and ten miles (110) of tunnels, 8 to 33 feet in diameter and 150 to 300 feet underground, have already been constructed and are in operation. The TARP tunnels are designed to capture 2.3 billion gallons of the first flush of sewage contaminated stormwater from combined sewers which had previously flowed into the area waterways. The three TARP flood control reservoirs serve as outlets for the tunnels and contain the CSOs until they can be cleaned at the water reclamation plants. The three reservoirs – Gloria Alitto Majewski, Thornton and McCook provide a combined 15.2 billion gallons of storage for CSOs that otherwise would spill into local waterways, degrading the water quality and causing flooding. The Gloria Alitto Majewski Reservoir, the smallest of the three, was completed in 1998; the Thornton Composite Reservoir became operational in 2015; and the first stage of the McCook Reservoir was completed in 2017 with the second stage anticipated to be operational in 2032, will add an additional 6.5 billion gallons of storage.

The District owns and operates one of the world's largest water reclamation plants, in addition to six other plants and 23 pumping stations. The District treats an average of 1.2 billion gallons of wastewater each day. The District's total wastewater treatment capacity is over 2.0 billion gallons per day.

The District controls approximately 76 miles of navigable waterways, which are part of a national system connecting the Atlantic Ocean and the Great Lakes with the Gulf of Mexico. In conjunction with its biosolids recycle and land reclamation program, the District owns over 13,500 acres of land in Fulton County, Illinois.

Beginning in 2005, the District was assigned responsibility for stormwater management for all of Cook County, including areas outside of the District's corporate boundaries. Activities have focused on organization and ordinance development, development of watershed plans and projects, as well as implementation of a small stream maintenance program.

1.0 Management

1.1 Purpose

The purpose of this manual is to describe the means by which the District accomplishes two of its primary objectives: to avoid contamination of the Chicago Area Waterways (CAWS) and to protect the health and safety of the public in its service area. The District serves an area of 882.1 square miles which includes the City of Chicago and 128 suburban communities. Of the total service area, approximately 360 square miles have combined sewers and 522.1 square miles have separate sewers. Managing combined sewer overflows (CSOs) within the combined areas and separate sewer overflows (SSOs) within the separate areas are key to the District accomplishing its above primary objectives. To this end, this manual describes the Infrastructure Management, End of Pipe Management, Public Outreach and Education, Technology Testing, and associated Standard Operating Practices necessary to achieve our stated objectives.

1.2 Organization

The District is governed by a nine-member Board of Commissioners. Commissioners are elected at large and serve on a salaried part-time basis. Three commissioners are elected every two years for six-year terms.

The Executive Director, who reports directly to the Board of Commissioners, manages the District's day-to-day operations. Eight appointed department heads report to the Executive Director.

Under the direction of the Executive Director, three departments undertake the primary responsibility for carrying out the objectives stated above: Maintenance and Operations, Engineering, and Monitoring and Research.

- Maintenance and Operations has four divisions: General, North Area, Stickney Area, and Calumet Area
- Engineering has three divisions: Infrastructure Management, Process Facilities Design, and Construction
- Monitoring and Research has three divisions: Environmental Monitoring and Research, Analytical Laboratories, and Industrial Waste

1.2.1 Maintenance and Operations (Relevant Division)

The General Division has three relevant sections:

- Waterways Control Section
 1. Administrative Unit
 2. Channels Operations Unit
 3. Channel Control Unit
 4. Lockport Powerhouse Unit
- Collection Systems Section
 1. Collection System Administration Unit

- 2. North Service Area Unit
- 3. Central Service Area Unit
- 4. South Service Area Unit
- Technical Administration Section
 - 1. Technical Administration Unit
 - 2. Technical Services Unit
 - 3. Contract Preparation Unit

1.2.2 Engineering (Relevant Division)

The Infrastructure Management Division consists of four relevant sections:

- Administrative Section
- Collection Facilities/TARP Section
- Local Sewer Systems Section
- Stormwater Management Section

1.2.3 Monitoring and Research (Relevant Divisions)

The Environmental Monitoring and Research Division consists of three relevant sections:

- Microbiology Section
- Aquatic Ecology Section
- Biosolids Section

The Analytical Laboratories Division consists of five relevant sections:

- Stickney Analytical Laboratory
- Industrial Waste Analytical Laboratory
- Calumet Analytical Laboratory
- Egan Analytical Laboratory
- Organic Compounds Analytical Laboratory

The Industrial Waste Division consists of three relevant sections:

- Technical Services
- Pretreatment and Cost Recovery
- Field Services (Central, South, North, and Northwest Area Offices)

The responsibilities of each division are described in further detail in subsequent sections of this manual. See the District's current Budget Book on the District's website for an organizational chart and additional information on the Relevant District Departments, Divisions, Sections and Units: mwr.org/what-we-do/budget

2.0 Infrastructure Management

2.1 Pollution Prevention Controls

2.1.1 Local Sewer Systems Section

The Local Sewer Systems Section administers the Watershed Management Ordinance (WMO) to protect public health and the environment by establishing uniform requirements for land development within suburban Cook County and sewer construction within the District's service area through the review and issuance of WMO permit applications. The WMO also requires compliance with the Infiltration/Inflow Control Program, described in Section 2.1.1.1 below.

To protect existing and new developments from increased stormwater runoff and flooding conditions, the WMO requires stormwater management facilities to be installed for new developments and redevelopments that exceed certain acreage limits. The WMO also regulates the design, construction, operation, and maintenance of all public and private sewers that discharge directly or indirectly into District collection and treatment facilities, or into waters within the boundaries of the District.

The Technical Guidance Manual (TGM) provides guidance on how to apply and meet the WMO's requirements for land development and sewer construction and promotes efficient and consistent permit application submittals and review procedures.

The WMO, TGM, and other related documents can be found on the District's website at: mwr.d.org/doing-business/watershed-management-ordinance-and-infiltrationinflow/watershed-management-ordinance-wmo-and-technical-guidance-manual-tgm

2.1.1.1 Infiltration/Inflow Control Program

In the District's service area, local sewer systems (satellite systems) are owned, operated, and maintained by local cities, villages, townships, local sanitary districts, and utility companies. These local systems convey flow to the District's intercepting sewers and water reclamation plants (WRPs) for treatment.

The local systems are comprised of both combined sewer areas and separate sanitary sewer areas. The separate sewer area includes separate storm and sanitary sewers. Stormwater runoff is collected and conveyed by a storm sewer or other conveyance system that discharges into a receiving waterway. Wastewater flows are collected and conveyed by a sanitary sewer to the District's WRPs. These sanitary sewer systems are designed and intended to collect and convey only wastewater flow and a limited amount of groundwater infiltration.

In many locations, excessive groundwater infiltration and stormwater inflow (I/I) enter into the sanitary sewer systems through system deficiencies. Sewer system defects that allow groundwater infiltration include pipe cracks, open or off-set joints, pipe-structure connections, and leaking manhole walls. Illegal connections that allow stormwater inflow include downspouts, yard and area drains, footing/foundation drains, sump pumps, driveway and window well drains, and storm sewer direct/indirect cross-connections.

When intense rain events occur, excessive I/I can overload sewers causing sanitary sewer overflows, damage to private property through basement backups, loss of conveyance capacity, as well as increased wastewater conveyance and treatment costs. To prevent this from occurring, the District is implementing the Infiltration/Inflow Control Program (IICP) that is applicable to all separate satellite systems that discharge directly and/or indirectly into the District's facilities.

The IICP provides a framework for asset management of separate sewer systems to meeting the following goals:

- Maintain infrastructure to prevent sanitary sewer overflows and basement backups due to sewer surcharging and other adverse sewer system conditions
- Comply with the District's NPDES permits and all other applicable federal, state, and local laws and regulations
- Minimize extraneous flows transported to the District's facilities due to defective system components or illegal connections

Through the implementation of the IICP all satellite entities (local sewer system owners) are required to identify and address I/I sources within the public and private sewer systems. To accomplish this, satellite entities will perform ongoing inspections and conduct maintenance and rehabilitation work on the sanitary sewer system. Additionally, all satellite entities must submit an annual report to the District that includes all work completed and progress made to meet the goals of the IICP.

The Technical Guidance Manual (TGM) provides guidance on how to apply and meet the IICP's requirements for I/I source identification and correction. The IICP, TGM, and other related documents can be found on the District's website at: mwrdd.org/doing-business/watershed-management-ordinance-and-infiltrationinflow/infiltrationinflow-control-program-iicp

2.1.2 Industrial Waste Division Programs

The Industrial Waste Division (IWD) of the Monitoring and Research Department consists of three sections: Administrative and Technical Services, Pretreatment and Cost Recovery, and Field Services. The primary responsibility of IWD is the enforcement of the District's Sewage and Waste Control Ordinance (SWCO) and the User Charge Ordinance (UCO) which can be found on the District's website at: mwrdd.org/doing-business/pretreatment-and-cost-recovery

IWD is also responsible for the collection, compilation and presentation of data pertaining to industrial user discharges to the District's sewerage system. IWD also carries out the District's responsibility as a primary response agency for hazardous materials emergencies in Cook County.

2.1.2.1 Technical Services Section

The Technical Services Section is responsible for assisting with the general administration of IWD. Additionally, they are responsible for the following activities:

- Preparation of interagency reports assessing the District's compliance with federal pretreatment regulations and calculation of User Charge Rates

- Maintaining the IWD database (iPACS)
- Administering the hauled waste programs under the Chemical Toilet Waste and Resource Recovery Ordinances

2.1.2.2 Pretreatment and Cost Recovery Section

The Pretreatment and Cost Recovery Section administers the District's federally approved User Charge program as authorized under the UCO. The Section receives and reviews reports from approximately 600 users annually containing calculations of their respective User Charge liabilities under the UCO and documentation corroborating their data. The costs for the administration of the SWCO and the UCO are recovered from industrial users through Minimum Pretreatment Requirements charges, Noncompliance Enforcement charges and User Charge Verification charges. The Pretreatment and Cost Recovery Section is also responsible for the routine administration and enforcement of the SWCO, which incorporates the federal categorical and non-categorical pretreatment regulations and specifies limits for contaminants and other wastes discharged into the sewer system and waterways within the District's boundaries.

2.1.2.3 Field Services Section

The Field Services Section (FSS) of IWD conducts inspections and sampling of wastewater discharges at various industrial and commercial facilities within the District's jurisdiction to determine compliance with the SWCO and for verification of user-provided data as required by the UCO. On average, approximately 700 locations are sampled, and 600 locations are inspected each year. Corrective compliance action is taken against facilities that are found in violation of the SWCO.

The FSS is on call 24 hours per day, 365 days per year, to respond to emergency situations or complaints. These calls originate from local municipalities, Police and Fire Departments, the EPA, the Coast Guard, private citizens, or as industrial self-reported incidents involving the discharge or potential discharge of harmful wastes into the sanitary sewers or the waterways of Cook County. The FSS responds to approximately 110 such calls each year.

Illegal dumping of waste into waterways or sewers or complaints of water pollution can be reported to the District's Hazardous Waste Dump Hotline by phone (800) 332-DUMP or through the District's website at: mwrdd.org/contact-us

The Monitoring and Research Department's Industrial Waste Division investigates reports of dumping into the sewers or waterways and responds to emergency complaints on a 24-hour, seven days-a-week basis. The Metropolitan Water Reclamation District Act (70 ILCS 2605/7g) (from Ch. 42, par. 326g) states:

Any person who takes or who knowingly permits his agent or employee to take industrial wastes or other wastes from a point of origin and intentionally discharges such wastes by means of mobile or portable equipment into any sewer, sewer manhole, or any appurtenances thereto, or directly or indirectly to any waters without possession of a valid and legally issued permit shall be guilty of a Class A misdemeanor. A second or subsequent offense shall constitute a Class 4 felony.

The District's Sewage and Waste Control Ordinance outlines Prohibited Wastes in ARTICLE III. Section 1 states:

It shall be unlawful for any person to discharge sewage, industrial wastes, or other wastes of any kind into any waters of the state of Illinois under the jurisdiction of the District, in the absence of a current and valid National Pollutant Discharge Elimination System Permit issued by the Illinois Environmental Protection Agency, or into any sewerage system under the jurisdiction of the District, which does not conform to the criteria or effluent quality standards established and/or adopted by the District, as set forth in Appendices A, B, and C hereto of this Ordinance.

Sewage and Waste Control Ordinance Appendices A and B govern Discharges to and Pollution of Waters and Sewerage Systems, respectively. Appendix F contains the District's Enforcement Response Procedure, which details the range of enforcement responses available to the District to effectively enforce the terms and conditions of the Ordinance. The Sewage and Waste Control Ordinance is available on the District's website at: mwrld.org/doing-business/pretreatment-and-cost-recovery

2.1.2.4 Sewage and Waste Control Ordinance

The SWCO was first adopted in 1969 and has been comprehensively amended to include technology-based local discharge limits and the District's USEPA-approved Pretreatment Program. Its purpose is the protection of the public health and safety by abating and preventing pollution. Through the administration of the SWCO and the Pretreatment Program, the District can control the quantity and quality of sewage, industrial wastes and other wastes discharged to the sewer system and waterways. The result is the protection of the treatment processes at the District's Water Reclamation Plants (WRP), the water quality of the receiving waterbody, and the quality of the biosolids generated at the District, while providing for worker safety. Administration of the SWCO allows the District to achieve compliance with its National Pollutant Discharge Elimination System permits, in addition to producing biosolids with below the lowest pollutant concentration limits of the Part 503 rule.

2.1.2.5 Pretreatment Program

In 1985, the USEPA granted its approval of the District's Pretreatment Program. Pursuant to the General Pretreatment Regulations that contain the requirements for an approved pretreatment program, the District must require compliance by industrial users with the applicable USEPA categorical pretreatment standards as well as the local limits. Under the provisions of Appendix D of the SWCO, the Pretreatment and Cost Recovery Section issues individual control mechanisms (Discharge Authorizations) to all Significant Industrial Users (SIUs) in order to establish conditions for their discharge of pollutants into the District's sewer system. SIUs are typically those that: a) are subject to categorical pretreatment standards; or b) discharge greater than 25,000 gallons per day of process wastewater. The Discharge Authorizations (DAs) establish pollutant-specific effluent limitations applicable to the specific industry. DA forms can be found on the District's website at:

mwrld.org/doing-business/pretreatment-and-cost-recovery/pretreatment-program

The DAs also establish self-monitoring, sampling, reporting, notification, and record-keeping requirements including identification of the pollutants to be monitored, sampling points, and sampling frequency. SIUs are required to submit Continued Compliance Reports twice per year. Continued Compliance Report forms can be found on the District's website at: mwrld.org/doing-business/pretreatment-and-cost-recovery/pretreatment-program

Under its Pretreatment Program, the District, at a minimum, must inspect and sample all industrial users subject to categorical pretreatment standards and other significant industrial users at least annually to verify compliance with the applicable standards. During the inspections, Environmental Specialists (ESs) from the FSS routinely make observations of discharge points, process areas, pretreatment systems, generation of sludge and other process residues, maintenance of records, and any other items required by the SWCO. Information is collected pertaining to chemical storage facilities, hazardous waste generation, spill control plans, industrial user self-monitoring techniques (when observed), and industrial user production rates. Wastewater samples are collected from industrial users' discharge points and analyzed for compliance with pollutant concentration limits.

The Enforcement Response Procedure (ERP) is detailed in Appendix F of the SWCO. The ERP has been developed to include a range of enforcement responses available to the District to effectively enforce the terms and conditions of the SWCO. The ERP establishes a framework, the Response Option Matrix, in which the District will assess the degree of noncompliance by an industrial user and may consider both mitigating and aggravating circumstances in determining the appropriate enforcement response. The ERP also establishes minimum response levels for incidents of noncompliance that are deemed critical in nature, including interference with and pass-through of the treatment processes. The following types of enforcement actions are available to the District in response to incidents of noncompliance:

- Notice of Noncompliance (NON)
- Cease and Desist Order (C&D)
- Show Cause Proceedings
- Court Proceedings
- Civil or Criminal Referrals

When the District determines that an industrial user is in violation of the SWCO, an enforcement action (NON or C&D) is issued against the non-complying industrial user. Industrial users found in noncompliance are required to submit a written compliance schedule containing specific measures that will be taken to attain compliance along with specific milestone dates for taking these actions. In each case, on-site inspection and sampling is performed by the District to verify an industrial user's claim of compliance. If the inspection and/or sampling confirms noncompliance, the District may determine that Show Cause action is warranted. Show Cause proceedings involve hearings conducted by a Hearing Officer appointed by the Board of Commissioners. At the conclusion of the hearings, the Hearing Officer makes a finding of fact and a recommendation to the Board for action regarding the noncomplying industrial user. The recommendation, upon adoption, becomes an Order of the Board (Board Order). An industrial user

in significant noncompliance with a Board Order may be recommended for legal action in the Circuit Court of Cook County, to halt the condition of noncompliance either by mandamus or by injunction. Pursuant to Chapter 70, Section 2605/7ah of the Illinois Compiled Statutes, the District may seek a penalty of not less than \$1,000.00 nor more than \$10,000.00 per day for each day the industrial user remains in noncompliance with a Board Order. The District may also seek to recover reasonable attorney's fees, court costs and other expenses of litigation, and costs for inspection, sampling, analysis, and administration relating to the enforcement action, beginning with the issuance of the initial Order. The SWCO also includes the following enforcement mechanisms, designed to elicit more decisive industrial user action in response to noncompliance issues:

- Administrative civil penalty authority, ranging from \$1000 to \$2,000 per day of violation
- Late filing fees for required reports, ranging from \$100 to \$1,000 per report
- Authority to impose liens on a user's property for nonpayment of penalties

2.1.3 Pollution Prevention Activities Required from Commercial/ Industrial Dischargers

2.1.3 Pollution Prevention Activities Required from Commercial/ Industrial Dischargers. The District's Industrial Waste Pretreatment Program encourages the industrial community under its regulatory purview to develop and implement pollution prevention (P2) to reduce, eliminate, or prevent pollution at its source. Examples of P2 practices may include use of "greener," or less toxic chemicals and reagents, water and energy conservation strategies, waste minimization, reuse or recycling of production materials, and implementation of Best Management Practices for operations and/or wastewater pretreatment. The District recommends that industrial users take full advantage of available P2 resources in the area including the Illinois Sustainable Technology Center (ISTC) and the University of Illinois - Chicago (UIC), Industrial Training and Assessment Center (ITAC). The ISTC provides training, outreach and technical assistance to Chicago area commercial and industrial businesses to promote P2 across all media. ISTC offers on-site technical assistance to industrial users with the primary goal of identifying P2 opportunities and solutions to optimize traditional waste treatment practices. ITAC provides energy, productivity, and waste assessments to small and medium-sized industrial facilities within 150 miles of UIC. The District actively promotes P2 in correspondence with industrial users regarding discharge authorizations and enforcement actions.

In addition, the District also actively encourages and promotes P2 in its technical communications with industrial users. Language that encourages P2 is included in appropriate correspondence regarding enforcement compliance issues.

2.1.4 Detection and Elimination of Illegal Connections

During routine inspections performed on District-owned interceptors by the Engineering Department, illegal connections are sometimes observed visually or through televised inspections. In the event an illegal connection is suspected, the information is forwarded to the Local Sewers Section, described in 2.1.1, for further investigation and corrective action.

2.1.5 Detection and Elimination of Dry Weather Overflows

Dry weather overflows are detected through routine interceptor sewer and control structure inspections (conducted by Sewer Maintenance Unit), activation of tide gate alarms, and from observations from other agencies and private citizens. The purpose of the frequent inspections is to be able to detect situations and problems before they cause overflows during dry weather. Sewer Maintenance Unit personnel are available 24 hours per day, 7 days per week to investigate reports of problems. As a result of an inspection, recommendations are made to implement corrective action and eliminate dry weather overflows as soon as possible. Upon verification, all such dry weather bypasses are reported immediately to the IEPA.

In situations where the problem is due to excessive flow from local lines, rather than the malfunction of the connection to the interceptor or TARP, the owner of the local sewer system and the Engineering Department's Local Sewer Systems representatives are notified.

2.1.6 Street Cleaning

The Metropolitan Water Reclamation District (MWRD) has a contract at the biosolids handling facilities for street sweeping. During the drying season, from April 1st to December 1st, street cleaners sweep the roads approximately 8-12 hours per week. The street sweepers clean any dust or accumulated solids resulting from the biosolids hauling operations during the drying process. Water trucks are also used to help suppress dust on the roadways. Local municipalities within the District boundaries often provide their own street cleaning services within their respective areas.

2.1.7 Waste Collection Procedures

The MWRD collects its waste in numerous waste receptacles throughout District facilities. Waste is collected and brought to dumpsters which is hauled away and processed per District contracts. Most municipalities within the boundaries of the District offer waste collection services to its residents, and some offer drop off locations for specific items such as recycling or old electronics.

2.1.8 Recycling Efforts

The MWRD collects recyclables throughout District facilities via recycling bins. The recycling is then collected and placed into recycling dumpsters which is hauled away and processed per District contracts. The maintenance shops also have specific scrap metal recycling areas to help sort and organize the waste efficiently.

2.1.9 Efforts to Ban or Control Products

The MWRD has partnered with the Lower Des Plaines River Watershed Group and CAWS Chloride Workgroup, and partners with the Salt Smart Collaborative to promote best practices when using salt to clear snow/ice to significantly reduce chlorides discharged to the Chicago Area Waterway Systems (CAWS). Workshops, trainings, and webinars are available to learn how to "Salt Smart." MWRD Maintenance and Operation staff participate and attend the workshops alongside personnel from municipalities to learn best management practices. More information can be found at:

mwrld.org/community-action/go-easy-salt

The MWRD, as the local publicly owned treatment works, enforces the categorical standard Dental Amalgam Rule (40 CFR 441), in the USEPA Pretreatment Program. Dental offices that discharge amalgam are required to implement pretreatment processes prior to discharging into the sewer system to prevent the flow of mercury and other metals into the environment. More information can be found at: mwrld.org/doing-business/pretreatment-and-cost-recovery/pretreatment-program

The MWRD's Enhanced Biological Phosphorus Removal (EBPR) Program aims to reduce the amount of harmful phosphorus levels entering the waterways. The District accepts nonhazardous high strength liquid organic material (HSOM) from local industry. The accepted HSOM helps provide readily biodegradable carbon to sustain the phosphorus accumulating bacteria in the treatment process. More information can be found at: mwrld.org/doing-business/resource-recovery-and-chemical-toilet-waste/resource-recovery-program

2.1.10 Efforts to Collect Bulk Refuse

The MWRD does not have a specific program for collecting bulk refuse. However, any bulk refuse generated during construction activities by our contractors are to be disposed of offsite following all regulatory requirements as per our contracts.

2.1.11 Hazardous Waste Collection Program

The MWRD partners with the IEPA for Household Hazardous Waste Collections periodically in coordination with local jurisdictions. Hazardous household chemicals such as cleaning products, solvents and fertilizers as well as electronics are collected and disposed of safely. The District offers easily accessible medicine disposal boxes outside of treatment plants to safely dispose of unused and expired medicine. More information can be found at: mwrld.org/medication-disposal

The District has an asbestos hazard awareness program and an asbestos hazardous waste contract in place with state licensed professionals for the removal of asbestos. In the event asbestos is encountered, the District works with contractors to follow all applicable rules and policies to ensure safe and proper disposal of asbestos to protect not only workers and employees but also the environment.

Throughout the treatment plants within the District, hazardous waste such as used oil, solvents, electronics, drums, batteries, and antifreeze are collected and disposed of properly by our Site Remediation Section.

2.1.12 Water Conservation Efforts in the Service Area

Water reclamation plant process water is utilized for various tasks within the treatment plants to conserve water. The water is used for cooling water for blowers, backflushing pumps, seal water, hosing water tanks, and general cleaning purposes. The following are approximate quantities of process water being used to conserve water in district facilities.

- Stickney Water Reclamation Plant – 4.5 MGD

- Hanover Park Water Reclamation Plant – 0.065 MGD
- Kirie Water Reclamation Plant – 0.49 MGD
- O’Brien Water Reclamation Plant – 0.613 MGD
- Egan Water Reclamation Plant – 0.8 MGD
- Calumet Water Reclamation Plant – 2.4 MGD

The MWRD has explored potential options to supply local commercial/industrial users with WRP effluent to help conserve water and reduce waste. In 2018, the District partnered with a directional boring company to supply water for their drilling operations. Limits on the Mean and Max flow are enforced in the Discharge Authorizations issued to industrial users by the District.

The District partners with Friends of the Chicago River to promote Overflow Action Days. During rainy days, this initiative urges residents to use less water to reduce the volume of water in sewers and help prevent CSOs. More information can be found at: mwrld.org/community-action/overflow-action

The District provides a Rain Barrel program, offering rain barrels at a reduced price to residents. Rain barrels are used to capture and store rainwater from roofs for numerous uses such as watering your lawn or garden. The barrels offer an environmentally friendly source of water and also reduce the amount of water entering the sewers during rain events, helping to mitigate flooding and CSO’s. More information can be found at: mwrld.org/community-action/rain-barrels

The MWRD participates in “Fix a Leak Week” which encourages residents to check for leaking or faulty household fixtures or irrigation systems to help promote water conservation. Many of the local municipalities within the MWRD’s boundaries participate in numerous other water conservation efforts.

2.2 Infrastructure and Facility Maintenance

2.2.1 Overview

The District’s interceptor system, extending 560 miles in length, services an area of 882.1 square miles which includes the City of Chicago and 128 Suburban Communities. Although relatively durable, sewers will deteriorate over time and regular inspections and maintenance schedules are imperative for protecting critical infrastructure and imperative to protecting public health. The 560 miles of District interceptors are inspected, maintained and rehabilitated with joint efforts between the M&O and Engineering Departments. The District sewer systems are constructed using the following materials:

- Vitrified Clay Pipe for smaller pipes (12 to 18 inch)
- Cast in Place Concrete (pre-1950) of various sizes
- Pre-Cast Concrete of various sizes (after 1950)
- Brick of various sizes
- Ductile iron or High-Density Polyethylene (Force Main)
- Various Liners (Rehabilitated Pipe)
- Glass-Fiber Reinforced Plastic (GRP) Pipe

In addition to the extensive network of sewers, the District also owns and maintains various pump and lift stations, reservoirs, outfall points and controlling structures within the Cook County boundaries. Maintenance and inspections of these structures are typically performed by the Collection Systems Section while capital improvement or large rehabilitation projects are administered by the Engineering Department.

Tables 2-1 and 2-2 illustrate the age of the District’s interceptor system and a list of physical assets by service basin.

Table 2-1 – Interceptor System Age

Installation Date	Percent of Total Interceptors
1900-1920	6.9
1921-1940	24.0
1941-1960	23.3
1961-1980	36.7
1981-Present	9.1

Table 2-2 – List of Physical Assets by Service Basin

	North	Central	South
Sewer Pipe 4” to 96”	178.5 miles	115.3 miles	167 miles
Sewer Pipe greater than 96”	15.9 miles	64.6 miles	27.9 miles
Local Sewer / Interceptor Connections	580+ units	900+ units	440+ units
Intercepting Structures	821 units	355 units	146 units
Tide Gates	111 units	273 units	81 units
TARP Control Structures	60 units	143 units	99 units
TARP Shafts (1)	72 units	135 units	52 units
Pumping Stations	8 units	6 units	9 units
Reservoirs (2)	21 units	8 units	8 units

(1) Excludes access or construction shafts

(2) Includes the 3.5-billion-gallon McCook Reservoir Stage 1. McCook Reservoir stage 2 is currently under construction and will add another 6.5 billion gallons of storage capacity.

2.2.2 Standard Inspections and Procedures

The Collection Systems Section within the M&O Department is responsible for routine inspections of the District’s collection system assets and various facilities. Routine inspections of the District’s structures are performed regularly to ensure the integrity of the infrastructure. The M&O Department performs inspections of the following structures and facilities:

- Pump and Lift Stations
- Reservoirs and Dam Structures
- TARP Control Structures
- Tide Gates

- Inverted Siphons
- Drop Manholes and Connecting Structures

Inspection methods and asset descriptions for the various structures examined by the Collection Systems Section are found in the Collection Asset Management Plan (Section 7) provided in Appendix A and described further in section 2.3 of this document.

The District utilizes a Maintenance Management System (MMS) for asset inventory, scheduling maintenance work performed by in-house staff and to track preventative maintenance schedules. Additionally, a GIS database is used as a geographical approach for identifying District assets and categorizing each asset in the District's service area. It is the intent of the District to transfer its maintenance management program to a GIS-enabled application to leverage the geographic tools with results from inspections and rehabilitation programs. This will allow field staff to enter notes, create work orders and document the condition assessment remotely while performing an inspection.

2.2.3 Intercepting System Cleaning

Sewer cleaning is the most routine maintenance performed on the District's intercepting system. Debris obstructions or blockages are revealed either through visual manhole inspections or through closed-circuit televising inspections (CCTV). Visual evidence will typically show whether the problem is localized or systematic while CCTV inspection can provide for a better overall condition assessment of the sewer. Typical cleaning methods for sewers include:

- Thorough cleaning by jetting or vacuuming (including man entry if necessary)
- Root removal and chemical treatment for prevention of root intrusion
- Repair or replacement of a section of sewer pipe

Sewer cleaning contracts are administered by the Collection Systems Section through multi-year agreements with a service contractor. If debris build-up, root intrusion or blockages are observed during routine inspections, the condition of the sewer is thoroughly evaluated, and cleaning may be necessary as a corrective action. More frequent sewer cleaning and maintenance of problematic areas and emergencies are made on an as-needed basis.

2.3 Collection Asset Management Plan (CAMP)

2.3.1 Overview

The District utilizes the Collection Asset Management Plan (CAMP) to assess the collection system. CAMP provides an updated framework using widely accepted NASSCO standards and other standardized inspection methods while utilizing a risk-based approach for prioritizing and scheduling rehabilitation. Under the CAMP, the program assesses District structures such as intercepting sewers, TARP collection structures, sludge and centrate lines, tide gates and other various passive and active structures surrounding District infrastructure.

2.3.2 CAMP

The main objective of the CAMP program is to accurately identify infrastructure rehabilitation needs by performing condition assessments on various structures and accurately prioritize rehabilitation work. Once a condition assessment is made on a structure, the initial conditions are used as a baseline against other structures for prioritization and for future inspections. Therefore, the thoroughness and inspection techniques used for the condition assessments are imperative. The District utilizes the following inspection methods when assessing collection system assets and other various structures:

- CCTV
- Digital Scanning
- Laser Profiling
- Sonar
- Multi-Sensored Technologies
- Pigging
- Manned Entry and Visual Inspections

The District's Collection Facilities/TARP Section administers multi-year sewer inspection contracts which employ a few of the technologies noted above to identify segments of interceptors that are in need of repair. The inspection results are inventoried to track the sewer's physical condition, repairs, and changes over time.

While the means and methods of obtaining inspection data are important at gathering initial information about the condition of the system, the proper interpretation of the data is even more important so that the condition assessments are consistent and rehabilitation can be correctly prioritized. As such, the District utilizes many standardization inspection programs including the National Association of Sewer Service Companies' (NASSCO) Pipeline Assessment and Certification Program (PACP). The NASSCO PACP is a program which standardizes condition categorization, inspection forms, coding of observations and defects found in pipelines. Also, the Manhole Assessment and Certification Program (MACP), provides similar training for the inspection of manholes. Several District employees are trained in both the NASSCO PACP, and MACP programs.

Once a condition assessment is properly categorized for a collection system asset, the asset is placed in a risk matrix and evaluated against other structures. The Collection Facilities/TARP staff prioritize the assets and employ one of the various rehabilitation methods for corrective action:

- Point Repair
- Full Structural Replacement
- Cure-in-Place Pipe (CIPP)
- Sliplining
- Spray Applied Products
- Open Cut Removal and Replacement

CAMP also addresses inspections for active and passive structures within the District's collection system. As previously noted, inspections for these assets are typically performed by the Collection Systems Section within the M&O Department. These assets are examined more frequently than sewer segments due to their vulnerability and inexpensive inspection techniques. The inspection of such assets also requires specialized training which many District staff members receive through a variety of sources including in-house training, seminars, conferences and webinars. Offering the appropriate training helps provide guidance for thorough, accurate and consistent visual inspections. Corrective and preventive maintenance schedules are recorded in the District's MMS and repairs are commonly performed by in-house trades. Items typically addressed as part of the corrective and preventive maintenance include:

- Gate/Stem and Mechanical Lubrication
- Replacement and Repair of Hardware
- Testing and Resetting of Communication Alarms
- Cleaning of Screens and Removal of Blockages
- Interior and Exterior Facility Maintenance

2.3.3 Underground Facilities

The District has an active program to protect its underground facilities from damage from excavation associated with utility, road, and other projects by participating in Illinois 811 programs (JULIE and DIGGER) and the CDOT Office of Underground Coordination (OUC) program, as well as coordinating with the Illinois Tollway, IDOT, Cook County, and municipalities.

3.0 End of Pipe Management

3.1 Water Quality Monitoring

3.1.1 Ambient Water Quality Monitoring - Quality Assurance Project Plan (AWQM-QAPP)

The goals and objectives of this plan are in part to:

- Monitor the waterways in the District service areas through the collection and analysis of water samples to determine water quality on an ongoing basis and establish a historical record.
- Provide data that will be usable by the IEPA for assessment of water quality.
- Provide data that will be usable to evaluate the impact of District operations and projects including:
 - Water Reclamation Plants (WRPs).
 - Pretreatment Program.
 - Flood and pollution control Tunnel and Reservoir Plan (TARP).
 - Sidestream Elevated Pool Aeration (SEPA) and Instream Aeration Stations.
- Provide a broad surveillance of significant discharges to the waterways.
- Evaluate the effects of intermittent stormwater releases.
- Evaluate pollutants released from bottom sediments in the waterways.
- Coordinate the waterway monitoring performed by the District with the waterway monitoring performed by the IEPA's Bureau of Water.

The monitoring program consists of 30 sites within 14 bodies of water that extend over 225 river miles. Routine monitoring occurs monthly on four separate weekly sampling events as follows:

- First Monday: Twelve sites in the Des Plaines watershed.
- Second Monday: Five sites on the North Branch and North Shore Channel.
- Third Monday: Six sites on the Chicago River, the South Branch, South Fork, and the Chicago and Sanitary Ship Canal.
- Fourth week: Six sites in the Calumet Watershed.
- Weekly: the Lockport Powerhouse Station on the Sanitary and Ship Canal.

When a holiday falls on a Monday, sampling is performed on Tuesday.

See Appendix B for the AWQM-QAPP.

3.1.2 Dissolved Oxygen

To comply with requirements in its National Pollution Discharge Elimination System (NPDES) permits, the District continuously monitors the dissolved oxygen (DO) levels at 15 locations in the Chicago Area Waterway System (CAWS). The Continuous Dissolved Oxygen Monitoring (CDOM) Program also covers six locations in wadeable Chicago area waterways. The District's Environmental Monitoring and Research (EM&R) Division maintains DO monitoring equipment and provides staff for the monthly retrieval of monitors. Monitors are retrieved by the District's

Pollution Control boats at thirteen monitoring stations. Housings for waterway-based meters are attached to bridge abutments and serviced from the bow of the boat. Monitors at eight land-based locations are retrieved by a team consisting of two Pollution Control Technicians (PCTs). Land based meter housings are usually attached to bridge abutments and serviced from the top of the bridge. See Appendix C for the CDOM-QAPP.

Monthly grab waterway samples are also analyzed for DO using a field meter at 15 locations in the CAWS, in accordance with NPDES permits for the O'Brien, Stickney, and Calumet WRPs. Measurements are performed at the designated locations by EM&R personnel.

3.1.3 Water Quality Monitoring from Pump Stations and Backflows to Lake Michigan

As specified in the NPDES permit for the O'Brien, Stickney and Calumet Water Reclamation Plants, the District is required to sample all discharges from specified major pumping stations into local waterways. The District additionally samples backflows to Lake Michigan at the Chicago River Controlling Works (CRCW), the Wilmette Pump Station, and the 95th Street and the 122nd Street Pump Stations. The pump stations and their respective receiving waterway are listed below:

- North Branch Pump Station, North Branch of the Chicago River
- Racine Avenue Pump Station, South Branch of the South Fork of the Chicago River
- 95th Street Pump Station, Calumet River
- 122nd Street Pump Station, Calumet River

Automatic sampling equipment as well as grab samples are taken during discharges and sampled for general chemistry parameters. The sampling protocols for discharges at area pump stations are included in Appendix D. The sampling protocols for reversals to Lake Michigan are included in Appendix E.

3.2 Combined Sewer Overflows (CSOs)

3.2.1 Tunnel and Reservoir Plan (TARP)

There are currently 393 active CSOs owned by the City of Chicago (186), suburban municipalities (169), and the District (38) within the District's 360 square mile combined sewer service area. The District's approved long-term control plan to address CSOs within its combined sewer service area is known as the Tunnel and Reservoir Plan (TARP). The most recent TARP Status Report is available on the District's website at: <https://mwrld.org/what-we-do/documents-and-data/tunnel-and-reservoir-plan-data-and-reports>

The District and the U.S. Department of Justice entered into a consent decree in 2014. The consent decree provides an enforceable schedule for implementing the District's Tunnel and Reservoir Plan, which will result in a significant decrease in the volume of water discharged to the waterways from combined sewer overflows in Cook County, along with dramatically reducing the potential for flooding. Appendix E of the consent decree is designed to foster the use of green infrastructure controls to reduce the amount of stormwater that flows into the sewer systems during a storm and required the District to develop a Green Infrastructure Program Plan, which was approved by the

Environmental Protection Agency in 2015. In 2014, the District partnered with Chicago Public Schools system (CPS) and the Chicago Department of Water Management (CDWM) to incorporate stormwater retention at four elementary schools while reconstructing substandard playgrounds under a program known as Space to Grow. The projects serve to educate the public on the importance of stormwater management and the value of green infrastructure to reduce basement backup flooding. The success of this project led the District, CPS, and CDWM to agree to partner on 30 more schools from 2015 through 2025 through subsequent agreements and are planning to construct three additional Space to Grow sites in 2026.

The District is committed to executing this work as quickly as possible. A copy of the District's Consent Decree is available on the District's website at:

mwrldgc.maps.arcgis.com/sharing/rest/content/items/79ae158825e5400a93e0b8d4f67b4448/data

3.2.2 CSO Monitoring and Reporting

The NPDES permits for the Stickney, Calumet, O'Brien, Kirie, and Lemont WRPs require that the District monitor the duration and frequency of each discharge from select outfalls through telemetry capabilities. These select outfalls authorized in the permits are representative of all CSOs connected to TARP. The District has the capability to monitor 219 CSOs (56 percent of all CSOs). Proximity switches on the monitored tide gates along with pump operation records are used to verify CSO discharges. On average, there is one monitored outfall for every 1.8 square miles of the combined sewer service area and for every half mile of TARP tunnel length. The list of the monitored and unmonitored CSOs is included in Appendix F. Additionally, the District's Representative Monitoring and Reporting plans are available on the District's website at:

geohub.mwrld.org/pages/cso

Monitoring of CSOs can be done either locally or remotely. However, it is typically accomplished remotely using the Remote Terminal Unit (RTU) system that communicates via radio, hard-wired telephone lines, or cellular communication to workstations at the Stickney, Calumet, and Kirie WRPs. Engineering Contract 19-856-3E will be replacing communication equipment in much of the TARP system and move to a cellular based system. When a CSO flow exits to the outfall, it pushes open a tide gate which triggers an alarm. The tide gate alarm signal is then transmitted to the workstation and recorded in the system with details such as location, open time, close time, and duration of alarm. Not every alarm is a confirmed CSO, however. Communication failure, sensor malfunction, obstruction, or power loss can cause a false tide gate alarm. The Treatment Plant Operator (TPO) typically notifies the Collection Systems Section to confirm any suspicious tide gate alarms unless maintenance personnel are known to be on-site testing communications, performing maintenance, or conducting repairs. Usually, these activities occur during dry weather. When a crew is on-site, the TPO is notified and records the date, time, and activity in a logbook. False dry weather alarms would therefore be confirmed.

Precipitation is monitored by a number of rain gauges located throughout the TARP watershed area. Precipitation readings are transmitted to a workstation at the Waterway Control Center located in the Main Office Building on Erie Street in Chicago. Because the network of telemetered CSOs operated by the District is representative of the entire TARP watershed and because the

District operates, maintains and monitors the telemetry, the IEPA has allowed the local municipalities, served by TARP, to use the District's monitoring and reporting data to fulfill the requirements of their respective NPDES permits.

CSO discharges and precipitation readings are initially reported as soon as possible. After verification, updates or revisions will be provided on the District's website. The District will continue to provide monitoring and reporting as specified in the NPDES permits.

When there is a CSO, an email and/or text message notification of the CSO discharge is sent to interested parties and directs them to pertinent web pages, including a map showing the location of the CSO discharge. Please refer to Section 4.2 for additional details on this topic.

3.2.3 Watershed Monitoring for Compliance with Consent Decree

Pursuant to the Consent Decree, the District submitted a post construction monitoring plan of the Calumet River Watershed basin for monitoring water quality when the Thornton Composite TARP reservoir became operational. The post construction monitoring plan was established to evaluate discharges from CSO outfalls in the Calumet TARP System. The post construction monitoring plan includes the following elements:

- i. CSO Outfall monitoring location, frequency, duration and estimated volume,
- ii. Identification of water quality standards parameters of concern,
- iii. In stream water quality monitoring relating to applicable water quality standards,
- iv. Determination of whether MWRD's CSOs are in compliance with the then effective Calumet NPDES Permit, including applicable water quality standards incorporated therein, and
- v. The minimum duration of such monitoring.

A report on the post construction monitoring for the Calumet TARP System can be found on the District's website at: mwrld.org/sites/default/files/documents/19-13_Post-Construction_Report_Calumet_TARP.pdf

The post construction monitoring plan for the Mainstream/Lower Des Plaines TARP System can be found on the District's website at: mwrld.org/sites/default/files/2025-02/PCMP_Mainstream_Lower_Des_Plaines_TARP_System_2021.pdf

3.2.4 Groundwater Monitoring for Compliance with TARP Operation Permit

In order to monitor any impact of the TARP operations on groundwater quality in the area, a network of 101 groundwater monitoring wells were installed adjacent to the four TARP tunnel segments. The wells are sampled and analyzed for water quality parameters as required based on the TARP groundwater monitoring program approved by the IEPA. Under the current monitoring plan, sampling of the tier 1 wells (75) is conducted annually. The sampling of the tier 2 wells (TARP priority wells - 26) is conducted semiannually, the first sampling following a fill event during the period from January through June, and the second sampling following a fill event during the period from July through December.

The TARP monitoring also includes the three reservoirs, which are used to store the combined sewage flow (CSF) from the TARP tunnels. At Gloria Alitto Majewski Reservoir, sampling of four monitoring wells was conducted twice at one and six weeks following each reservoir fill event in which the reservoir is used to store CSF from the Upper Des Plaines Tunnel or once per quarter if no fill event occurs in a quarter. The monitoring of Thornton Composite Reservoir (TCR) requires the sampling of seven wells and Main Quarry Sump following a fill event or once per quarter if no fill event occurs in a quarter. The sampling shall continue biweekly until the TCR water level is lower than -280 ft CCD (fill event threshold). The monitoring program for the TCR requires an annual sampling, which includes the reservoir. At McCook Reservoir (Stage I), sampling of five wells is required following a fill event that corresponds to a water elevation of -220 CCD or higher (high-stage operation), and biweekly while water elevation in the reservoir remains continuously at or above that threshold. Semiannual sampling of all seven wells surrounding the McCook Reservoir site is required in April-June and October-December of each year with the water elevation below -220 CCD (low-stage operation).

3.3 Waterway Maintenance

3.3.1 Boat Operations and Floatable Debris Removal in Waterways

The Channel Maintenance Unit, under the direction of an Administrative Unit, is primarily responsible for debris removal operations within 76 navigable miles of the Chicago Area Waterway System (CAWS). In addition to fulfilling Consent Decree requirements, the boat crews respond to service calls, assist other District facilities, and participate in special events and projects with other organizations. The Channel Maintenance Unit owns and operates the following specialized debris removal vessels:

- Debris Boat – 36’ diesel powered pusher boat with 50’ barge and crane
- Skimmer Boat # 1 – 23’ trash collection boat with removable basket
- Skimmer Boat #2 – 23’ trash collection boat with removable basket
- Work Boat – 22’ aluminum utility boat with hybrid hull
- Pontoon Boat – 28’ pontoon boat with heavy duty deck covering

3.3.1.1 Compliance with Consent Decree Floatables Control Plan

Pursuant to Appendix B of the District’s Consent Decree, the District is required to perform both “Routine” and “Special” boat operations.

Routine Operations consist of running two skimmer boats, during the day shift, Monday through Friday, mid-April through mid-October. Each skimmer boat generally has a two-member crew consisting of a pilot and a laborer. The type of debris removed by the skimmers consists of smaller floatables including but not limited to cans, bottles, plastic bags, and logs. If larger debris is encountered, it is tied to a safe location and the debris boat is notified for pickup. The area typically serviced by the boats is bordered by Goose Island (North Branch), the Amtrak Bridge (South Branch), and the Chicago River Controlling Works (Chicago River). On Tuesdays and Thursdays, one skimmer boat services the South Fork of the South Branch (a.k.a Bubbly Creek).

Special Operations are in response to rain events that result in CSO events throughout the year. The District determines which Zone(s) of the CAWS had CSO events and dispatches a boat to the necessary Zone(s). Special Operations shall start no later than 24 hours after the conclusion of the rain event, including on weekends, unless unsafe or infeasible. Up to four boats may be dispatched simultaneously if there are CSOs in multiple Zones. The debris to be removed includes floatables commonly found in raw sewage.

During Special Operations, the waterways are divided in the following CSO work zones:

- Zone 1: North Branch and North Shore Channel, Kinzie Street to Main Street
- Zone 2: Chicago River and South Branch of the Chicago River, Chicago River Lock to the Amtrak Bridge
- Zone 3: South Branch of the Chicago River and South Fork of South Branch of the Chicago River, Amtrak Bridge to Racine Avenue Pump Station
- Zone 4: Chicago Sanitary and Ship Canal, Damen Avenue to the Junction with the Cal Sag Channel
- Zone 5: Cal-Sag Channel and Little Calumet River, Bishop Ford Freeway Bridge to the Junction with the Chicago Sanitary and Ship Canal

Per Consent Decree, all floatable control activities must be recorded daily and reported annually. Each boat pilot is equipped with an iPad running the GIS “Floatable Log” application. The application documents the course of each boat, types and quantities of debris collected, and additional information required for Special Operations. Each pilot also maintains a daily paper hardcopy of the floatable log for redundancy.

3.3.2 Debris Boat Operations

The District also owns and operates a 36-foot diesel powered pusher boat equipped with a 50-foot barge and logging crane. It is operated by a crew of four workers (one pilot, one crane operator and two laborers). The boat operates year-round and is used to remove large debris such as trees, logs, portions of seawalls, dock sections, and other large debris from the waterways. It navigates the waterways from Wilmette (North Shore Channel) to the O'Brien Locks (Cal-Sag Channel). During the summer, it mostly services the North Shore Channel for homeowners and rowers. During the less recreationally active fall and spring, it clears the Cal-Sag for barge traffic. During winter, when most of the CAWS is frozen, it services the Sanitary and Ship Canal downstream of the Stickney Plant outfall. The activities of the debris boat are not directly mandated by Consent Decree, but its debris collection quantities are included in annual reporting.

3.3.3 Fish Kill Procedure

Whenever a CSO occurs at one of the North Branch Pumping Station (NBPS) or Racine Avenue Pumping Station (RAPS), WRP operations personnel contact Channel Maintenance Unit personnel. Two days following a pumping event (or on the Monday following a weekend), the Channel Maintenance supervisor will direct boat crews to initiate a fish kill reconnaissance. Inspections are conducted downstream of the pumping stations to determine if the CSO discharge has resulted in a fish kill. If a fish kill has been observed, the boat crews will perform a clean up

after M&R has inspected the site and released it for clean-up. The fish kill is also reported orally to the IEPA as soon as possible, with a written follow-up report on the results of the District's subsequent investigation, within five days. The fish kill response procedure is included in Appendix G.

3.3.4 Sidestream Elevated Pool Aeration (SEPA) and Instream Aeration Stations

SEPA Stations are used to provide additional aeration to the District waterways. The SEPA station concept involves pumping a portion of water from a stream into an elevated pool. The water is then aerated by flowing over a series of cascades or waterfalls, returning to the stream. At five separate sidestream elevated pool aeration (SEPA) stations, water from the channel is lifted 12 to 15 feet and allowed to drop over a series of weirs to create a waterfall and add oxygen to the waterway. The SEPA station can add 25 tons of oxygen to the waterway each day. The five SEPA stations range in size from 2 to 20 acres and are located along the Calumet River (1 station) in Chicago, Little Calumet River (1) in Chicago, and Calumet-Sag Channel (3) in Blue Island, Worth, and DuPage County.

Instream Aeration Stations are located at Devon Avenue and Webster Avenue to improve Dissolved Oxygen (DO) level in the North Shore Channel and the North Branch of the Chicago River, respectively. DO levels of the North Shore Channel used to control the Devon station are monitored by the O'Brien WRP by the DO probe installed at the Fullerton Avenue. Similarly, DO levels of the North Branch of the Chicago River used to control the Webster station are monitored at the O'Brien WRP by the DO probe installed at the Ohio Street Bridgehouse over the Chicago River.

The maintenance of the stations is performed by the M&O Department. Staff routinely inspect and monitor the lift pumps, DO probes, and checks for oil leaks and monitors the intake and exit screens for blockages. The stations are typically operated between April 1st and November 1st.

4.0 Public Education and Outreach

4.1 Combined Sewer Overflow (CSO) Public Notification Plan

The District has utilized various methods for educating the public about the occurrence and impacts of CSOs. Many of these were implemented in response to the requirement for a CSO Public Notification Plan as specified in the NPDES permits for the Stickney, Calumet, and O'Brien Water Reclamation Plants (WRPs).

It was important in developing the CSO Notification Plan to solicit input and feedback from the affected public. The District considered the affected public to be a variety of groups which included governmental organizations, civic groups, recreational groups and any public citizen with an interest in or responsibility for the condition of the Chicago Area Waterway System (CAWS). The District identified the following organizations to be among the affected public:

- USEPA
- IEPA
- The City of Chicago
- All municipalities located adjacent to the CAWS
- The Friends of the Chicago River
- NeighborSpace
- The Openlands Project
- The Sierra Club
- The Civic Federation
- The Prairie Rivers Network
- The Lake Michigan Federation (now the Alliance for the Great Lakes)
- Other environmentally based organizations

Other groups which were specifically identified include the recreational and commercial users of the CAWS such as canoe or kayak clubs, high school or collegiate rowing teams and owners of marinas. Interested parties of the Use Attainability Analysis that has been underway for the CAWS were also identified and included in the District's efforts to include the public in the development of the CSO Plan.

The identified affected public was invited to a public meeting held on January 20, 2004, where the District presented its CSO Public Notification Plan. The public was notified about this meeting via the District's webpage, through news media alerts to all local print and electronic media, and direct notification (email and mail) when possible. Comments and feedback were solicited at that time and were incorporated into the finalized CSO Notification Plan as appropriate. The CSO Notification Plan includes informing the public of CSO events via email and/or text message notification, the webpage, posting signage at CSO locations, and informing the appropriate agencies when river reversal to Lake Michigan occurred. See the District's website at: geohub.mwr.org/pages/cso

4.2 CSO Notification

The District has implemented an email and text message notification system whereby anyone who wants can receive an email and/or text message from the District of a CSO occurrence. An electronic “Address Book” has been developed which contains a list of email addresses and/or phone numbers of interested parties, i.e. previously identified stakeholders. Also, members of the public are able to sign up to receive email and/or text message notification of CSO discharges by accessing the District’s website at: apps.mwrd.org/CSORegistration/Register

These parties will be sent an email and/ or text alert in the event of a CSO or diversion to Lake Michigan. The email directs the recipient to the pertinent web pages, including a map showing the location of the CSO discharge. The Address Book will be updated on an as-needed basis as other members of the affected public are identified.

4.3 Signage at District CSO Locations

The District has installed signage at CSO outfall locations owned by the District and in public areas adjacent to the river on District property. These signs are two-sided and weatherproof. There are two types of signs that have been installed. One type has been posted near all of the 39 District-owned CSO outfalls, which identifies the outfall by number and cautions the public that the outfall may discharge sewage contaminated rainwater. The other sign has been installed approximately every 660 feet (+/- 40’) along the waterways. Installation locations also include streets which end at the waterways and obvious/easy access points such as bridge abutments and overpasses. These signs caution the public that the waterway is not suitable for activities such as wading, swimming, jet skiing, water skiing, tubing, or any activity which involves body contact with the water. Copies of the signs have been made available to the TARP municipalities, including the City of Chicago, for their use in producing their own signs as required. A copy of these signs may also be viewed on the District’s website at: mwrd.org/sites/default/files/documents/CSOsign_from_160614.pdf

4.4 Notification of Potable Water Supply Agencies

The District continues to notify suppliers of potable water of CSO occurrences that result in a reversal of the waterways into Lake Michigan at Wilmette Harbor, the Chicago River and Controlling Works, and the O’Brien Lock.

4.5 Direct Mailings

Upon acceptance of the CSO Public Notification Plan by the IEPA, the District informed various entities of this via a letter. The letter transmitted the approved CSO Notification Plan to the TARP municipalities, District property lessees, and Water, Health and Public Safety Government Organizations. The letter also informed these entities of the availability of the District’s notification process. It also encouraged the municipalities and government organizations to link to the District’s website.

4.6 Sanitary Sewer Overflows (SSOs)

Based on historical inspections/observations, the District is currently aware of one location within its collection system that is prone to the occurrence of SSOs (Village of Worth Manhole near the District's Palos Hills Pumping Station). District staff continuously monitors this location during wet weather, secures and cleans the area when SSOs occur, and notifies the IEPA and local municipalities (verbally and in writing) after the occurrence of a SSO event. SSOs have been reduced with the completion of the Calumet TARP System and the MWRD has initiated design on Contract 21-262-3S to make a new connection from the downstream interceptor to TARP, which should further help reduce the SSOs. If any other SSOs are observed within the District's collection system, they will be handled in a similar manner.

Additionally, see Section 2.1.1.1 for a description of the District's Infiltration/Inflow Control Program. The goal of this program is to minimize the occurrence of SSOs and basement backups in the District's separate sewer service area.

4.7 Telephone Hotline

The District has a telephone hotline number (1.800.332.DUMP) which the public can call when a CSO discharge during dry weather or any SSO is observed. District personnel are then able to investigate the CSO or SSO and determine and rectify the cause of the discharge. This hotline number is posted on the CSO signs that have been installed at the District's CSO outfall locations.

4.8 Public Education

The MWRD offers numerous educational opportunities for the public to gain a better understanding of how to help protect our environment. The District implements varying programs, seminars, publications, events, and campaigns such as the anti-flushable wipes campaign. More information on the anti-flushable wipes campaign can be found at:

mwrld.org/community-action/you-can-help-prevent-flooding-and-protect-water-quality/flush-care

The MWRD offers a speaker's bureau to educate Cook County residents, business owners, municipalities, non-profit organizations, students, colleges and universities about how and why the MWRD protects and manages the waterways and recovers valuable resources. Staff participate in community outreach events to educate the public, focusing on things like what is allowed to be flushed down the drain.

Facility tours are used to educate residents how wastewater is treated, stormwater is managed, and the role of the Tunnel and Reservoir Plan to protect our environment by capturing combined sewage overflows. In person tours as well as virtual tours are available. To find out more and schedule a tour, and for more information regarding public education provided by the District, please visit: mwrld.org/education

Collection System O&M Manual

Appendix A: Collection Asset Management Plan (CAMP)

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1 Introduction

The Metropolitan Water Reclamation District of Greater Chicago (District) is located primarily within the boundaries of Cook County, Illinois. The District serves an area of 882.1 square miles, which includes the City of Chicago and 128 suburban communities. The District serves an equivalent population of 12.72 million people, a population of 5.19 million people, a commercial and industrial equivalent of 5.29 million people, and a combined sewer overflow equivalent of 2.24 million people. The District's 560 miles of intercepting sewers and force mains range in size from 6 inches to 27 feet in diameter and are fed by approximately 10,000 local sewer system connections.

The District's first sewer system was built in 1906 and, since then, the District has expended billions of dollars on sewer construction. Although relatively durable, sewers will deteriorate over time and some of the District's sewers have been in service for more than a century. Failures of aging sewers have cost the District millions of dollars over the years as expensive emergency repairs are made to correct catastrophic failures. The District has gradually adopted a more economical preventive maintenance practice that seeks to rehabilitate aging sewers to prevent failures and simultaneously extend the expected service life of the sewer.

As the sewer systems continue to age, repair and rehabilitation costs will only increase. Since the District's collection system is composed of critical infrastructure crucial to protecting public health, it is imperative to continue on the path of preventive maintenance and avoid costly and potentially dangerous failures. Given that sewer systems are below grade structures, problems are not usually visible on the surface until it is much too late. In order to fully assess and rehabilitate the sewer system, a comprehensive inspection and rehabilitation program is required.

In 1991, the District adopted the Interceptor Inspection and Rehabilitation Program (IIRP) to address the inspection and rehabilitation needs of the aging infrastructure. The District's Collection Facilities/TARP Section administers multi-year sewer inspection contracts which primarily employ technologies of CCTV and visual inspections to identify segments of interceptors that are in need of repair. The inspection results are inventoried to track the sewer's physical condition, repairs and changes over time to address future inspection and rehabilitation needs of the aging infrastructure. The intent of this procedure is to provide an updated framework for a comprehensive inspection, condition assessment and rehabilitation plan for the collection system assets and various other structures discussed in this document. Mechanical and electrical components of the collection system, and their associated structures, are specifically excluded from this document and will continue to be addressed under current procedures by the M&O Department. The Engineering Department will assess conditions of the remaining assets and prioritize the rehabilitation based upon observed condition with consideration given to associated risk factors, such as public health and safety. The document will also outline the general guidelines for selection of rehabilitation methods for intercepting sewers, TARP tunnels, TARP connecting sewers, sludge and centrate lines, sewer force mains, and various structures described below. For

the purpose of this document, the terms sewers, sewer system, or collection facilities will be used to describe all of these assets.

2 Inventory of Assets

2.1 Background and Description of Assets

2.1.1 Interceptor Sewers

The District's intercepting sewer system consists of 560 miles of sewers ranging in size from 6 inches to 27 feet in diameter and originally constructed of various materials including, but not limited to, reinforced concrete, brick, and ductile iron pipe. Construction of the intercepting sewer system began in 1906 and continued throughout the following century. More than half of these intercepting sewers have been in service for over 50 years.

2.1.2 TARP Tunnels

Phase I of the Tunnel and Reservoir Plan (TARP) included construction of 110 miles of concrete lined tunnel excavated in rock. Construction of the TARP tunnels began in the late 1970s and was completed in 2006. While it is not expected that there would be significant wear in the newer tunnels, the oldest of tunnels is approaching the age at which condition assessments are justified. Manned entry into the live tunnels has been very limited since TARP has gone online, and remote inspections have not been performed due to cost and degree of difficulty; however, the limited experiences suggest that the condition of the tunnel liners are relatively good. Nonetheless, it is recommended to take a proactive approach to stay ahead of the inevitable deterioration of the tunnel system and include the TARP tunnels in the asset management plan.

2.1.3 TARP Connecting Sewers

TARP connecting sewers are typically high-level sewers that convey flow from TARP connecting structures or junction structures to the TARP drop shafts. These sewers are not part of the interceptor system but act as gravity sewers feeding the deep tunnel system. Previous inspection and rehabilitation plans have not included the TARP connecting sewers; however, as the early segments of TARP have now been in service in excess of thirty years, it is appropriate to begin including these sewers in the plan for inspection and preventive maintenance. Most of the TARP connecting sewers are short runs between the connecting structures and the drop shafts, but there are some sewers that are thousands of feet in length. Failures of these sewers could prevent an interceptor or outfall sewer from relieving to TARP, potentially causing flooding and combined sewer overflows.

2.1.4 Sludge and Centrate Lines

Sludge and centrate lines are force mains that convey sludge or centrate byproducts from one of the District's water reclamation plants (WRP) to another District location. These lines are unique for two reasons: 1) they are pressurized force mains and, as such, do not flow by gravity and 2)

they convey higher strength waste with higher solids content compared to the sanitary and combined sewers.

2.1.5 Sewer Force Mains

In addition to the aforementioned sludge and centrate lines, the District operates a number of sewer force mains that convey sanitary and combined sewage. While the District's network of force mains pales in comparison to the extensive network of gravity sewers, ensuring that the force mains are maintained in good condition is equally vital.

2.1.6 Various Structures

Various passive structures (manholes, drop structures, inverted siphons, etc.) and active control structures (contain gates, valves, pumps, etc.) are a part of the collection system. The inline, passive structures can be inspected concurrently with their associated sewer or tunnel and can be rehabilitated on an as needed basis or along with the associated sewer or tunnel, depending on the severity of the situation observed. Inspection procedures for tide gates structures, pump and lift stations and other structures that contain mechanical and electrical equipment are included in section 7 of the document. These structures require more specialized inspections and more frequent maintenance attention. As such, these assets are regularly inspected by the Maintenance & Operations Department (M&O).

2.2 Asset Management Tools

2.2.1 GIS Database

A systematic approach is used to identify and categorize each asset in the District's collection system and establish an inventory. The District has recently developed a comprehensive GIS system to catalog and locate assets District wide, which can be used to cross-check the inventory. The TARP computer models developed by the University of Illinois can also be used to cross-check the inventory. The GIS database inventories the majority of the District's assets and facilities.

It is intended to eventually utilize the GIS system for execution of the asset management plan and to document and record results from the inspection and rehabilitation program. The risk-based prioritization score assigned to each segment, discussed in Section 4, can be input in tabular form into GIS to allow for a graphical representation of the data. Such a graphical representation will assist in planning and timing of rehabilitation work and minimizing disruptions to residents by avoiding a concentrated construction effort in one area.

2.2.2 MMS Database

In 1996, installation of an M&O-wide computerized Maintenance Management System (MMS) was completed. Use of MMS has enabled the District's M&O Department to increase the focus on preventive maintenance, improve inventory control and availability, more effectively utilize trades

personnel, capture direct job/project costs, and overall, automate and improve the efficiency of the maintenance program for District assets.

Currently, all of the District's collection system assets are catalogued and identified in the District's MMS system which is administered by M&O. The database is used to identify previously repaired segments of sewers as well as repair prone sewer segments. This historical data can aid in the categorization and prioritization of the rehabilitation work.

Utilizing MMS, identification of maintenance issues and proper processing of work requests is done in a timely and efficient manner. Maintenance personnel, who have established rounds and are constantly working with the collection system, generate work requests on a regular basis. Work requests are reviewed by M&O personnel and converted to work orders. Planners review and plan the work orders, which are then scheduled. The workflow process facilitates task allocation and helps in work prioritization.

Preventative maintenance (PM) programs have been developed with significant input from inspectors, trades, and engineers. The PMs generally include cleaning, adjustments, replacements of wear items, and inspections. The comprehensive database is useful for tracking asset repair history and monitoring labor and material cost associated with each work order. Records of maintenance expenditures and frequency of repairs is used for prioritizing replacement and rehabilitation. Additionally, asset details such as specifications, drawings and O&M manuals items are documented in the software to facilitate parts replacement and expedite maintenance repairs.

3 Condition Assessment Program

3.1 Goals

The goal of the condition assessment program is to provide an accurate evaluation of the current condition of the District's collection facilities in order to adequately prioritize rehabilitation and repair work, while minimizing costs and service disruptions resulting from failures. Such failures are costly and disruptive and can also pose a real risk to public safety through exposure to sewage and the development of sink holes. Eliminating sudden and catastrophic failures through an effective asset management plan while also extending the service life of existing sewers is an economical way to protect the public interest and preserve the District's assets.

3.2 Inspections

3.2.1 Frequency of Inspection

In order to fully assess the condition of the sewer system, and to accurately prioritize rehabilitation work, it is necessary that a complete evaluation be done on the entire system. The initial evaluation will set the baseline conditions of the system, to be used in the initial condition assessment and for comparison with subsequent inspections.

Previous efforts have called for an aggressive initial inspection schedule but neglected the value of the existing information compiled from previous inspections. The District's sewers have proven to be relatively resilient with most defects deteriorating slowly. To the extent possible, recent video inspection data can be used for completing the new evaluation methods and classifications; thereby reducing the cost and effort of the initial evaluation. Since there is existing data documenting known problem sewers, those sewers previously marked as priorities, as well as those generally known to be in poor condition, will be inspected under an aggressive three-year inspection process. The remaining sewers requiring inspection will be prioritized based upon the age and construction type of each sewer.

Upon completion of the initial condition assessment and prioritization of required rehabilitation, the sewer system will be placed on a regular inspection cycle. Sewers that are marked as priorities due to potential failures will be inspected on a three-year cycle until such time that the defects are corrected or the entire sewer is lined. Sewers with minor defects or defects that are not expected to compromise the integrity or operation of the sewer in the foreseeable future will be inspected on a 5-to-10-year cycle.

Routine inspections performed on the various active and passive assets are handled in much of the same manner as those for the collection system. Upon completion of the initial inspection performed on these various assets, a condition assessment and prioritization of required maintenance is established and then placed on a regular inspection schedule. The schedule for inspection is dictated by the asset vulnerability. Preventative and corrective maintenance for repair or replacement of parts is addressed by District staff.

3.2.2 Inspection Methods

The most commonly used method for sewer inspections around the world is closed-circuit television (CCTV). CCTV is a relatively inexpensive inspection method with a high production rate and is satisfactory for most of the inspections that will be required during the initial assessment and follow-up inspections. For priority sewers, or those found to be in very poor condition via CCTV inspection, advanced inspection technologies may be appropriate. These technologies include digital scanning, laser profiling, sonar, electro-scanning, and multi-sensor technologies. Each advanced technology has advantages over CCTV for certain types of inspections and can be applied based upon the needs and concerns of each individual sewer. Due to access difficulties, the deep tunnels may require unique methods of inspection which will be discussed below.

3.2.2.1 CCTV

CCTV is the most common inspection method due to both its low cost and its versatility. CCTV allows for the inspection of virtually any size and material pipe greater than 6" in diameter. The technology allows the user to locate defects and create a video record of the inspection for permanent files and comparative use in subsequent inspections. CCTV can successfully locate sags and deflections, joint separations, root intrusion, sediment and debris build-up, cracks and leaks, and service connections. The drawback of CCTV is that it cannot observe the condition of the pipe below the waterline. While there are instances of corrosion and other problems below the water line, the majority of pipe failures occur in the upper portions of the pipe. A sewer found to be in very poor condition through CCTV inspection can be subsequently inspected with a supplementary technology if greater detail below the water line is required.

3.2.2.2 Digital Scanning

Digital scanning is a relatively new inspection method. The inspection is carried out the same way as CCTV, with the instrument being transported through the sewers on self-propelled crawlers. Rather than using a single lens video recorder, as is used in CCTV, digital scanning instruments use high resolution digital cameras with wide angle lenses. The instrument may contain one or two cameras, as needed, with one typically in the front and one in the back of the instrument. The wide-angle lenses take digital photographs on preset intervals that can be later viewed individually or digitally stitched together to provide a continuous view of a section of pipe. Viewing the photographs individually provides results comparable to CCTV while viewing the stitched photographs, also called the "unfolded" view, provides a continuous view of the length of the pipe. Like CCTV, digital scanning is limited to the pipe above the waterline.

In addition to the option for either standard or unfolded views, digital scanning is advantageous because it produces higher resolution images and can be performed with much greater rates of production than CCTV. The high production rate is due to the fact that there is no identification of defects on-site during the inspection. Defects are identified and coded later in the office using the associated software and a complete record of the entire pipe is stored electronically for viewing in

the future. CCTV records are limited to the operator's panning and tilting to inspect perceived defects and do not necessarily cover the entire pipe.

While digital scanning can be used with any pipe material, the quality of the digital results declines with pipe size. This technology is improving as manufacturers improve software and lighting technologies; however, the District should consider this technology for sewers no greater than 40 inches at this time. Additionally, since this technology is only an incremental improvement over traditional CCTV in terms of quality of results, it would not be an appropriate supplemental technology but can be used in place of CCTV.

3.2.2.3 Laser Profiling

Laser profiling is an inspection technology that can detect changes in shape of the sewer pipe. The laser scanner projects laser images on the pipe walls and those images are detected by a camera to create a profile of the pipe. Like CCTV and digital scanning, the laser profiling technology cannot scan portions of the pipe below the waterline.

There are two types of laser scanning: 2-D and 3-D (LADAR) technologies. The 2-D laser scans are the more common and basic types of laser scans, but this technology has drawbacks. Because the scanner typically projects a circular image on the pipe wall, the calibration of the laser and its position along the longitudinal axis of the sewer can affect the quality of the results. Poor calibration can yield inaccurate results and deviations from the axis can suggest pipe deformations that do not really exist. The 3-D or LADAR technology uses point lasers, rather than a circular image, and has a built-in receiver and two-way transmitter that can develop accurate profiles and cross sections regardless of the alignment on the longitudinal axis. It is generally recommended that the 2-D laser technology be limited to 36" diameter pipes.

This type of technology can be employed as a supplemental technology or performed in conjunction with other technologies (see multi-sensor technologies section) to obtain profiles of the sewers believed to be subject to deformation based upon CCTV results. Since CCTV does not yield profiles or cross sections, any perceived deformation can be verified and quantified using laser-based technology. This technology may also be appropriate for the verification and final inspection of newly lined sewer.

3.2.2.4 Sonar

Sonar, also called ultrasonic technology, is different from the previously described CCTV, digital scanning, and laser profiling inspection methods in that it is used to inspect those portions of pipe below the water line. Sonar is effective in sewers greater than 12" in diameter and provides information on pipe geometry, pipe wall deflections, pits, voids, and cracks.

Like CCTV, digital scanning, and laser profiling, this technology can be used on any material pipe but, unlike the others, this technology can also be used in force mains. The ability to deploy the

instrumentation without having to depressurize the force mains and take them out of service makes sonar technology a valuable tool for such inspections.

Fine tuning of the sonar technology for each individual sewer is required as there are various frequencies that can be used with sonar technologies. The varying frequencies can yield different information and should be selected depending on the type of information that is sought, pipe materials, pipe size, and levels of suspended solids in the pipe. For example, a higher frequency sensor, such as 2 MHz, will provide greater accuracy when depicting pipe geometry and/or sediment build up. The same high frequency sensor would provide less accurate information about pipe wall integrity since the high frequency signals do not penetrate the pipe walls as effectively as a lower frequency sensor, such as 650 KHz. One option that allows for a more complete sonar scan is to utilize instrumentation equipped with multiple sonar sensors each operating at different frequencies.

This type of technology is best suited for use in force mains, sewers that run full or nearly full and for which bypassing would be extremely difficult, and sewers expected to have high sedimentation levels. This technology may also be appropriate for use in conjunction with other technologies (see multi-sensor technologies section) to obtain information below the water line while other technologies examine the areas above the water line.

3.2.2.5 Multi-Sensor Technologies

In order to capitalize on the strengths of the various technologies, and to avoid their shortcomings, multi-sensor platforms have been established and combined technologies like CCTV, laser, and sonar scanning. Depending on the individual make-up of the sewer, as well as the desired result, these robotic platforms can be fitted with multiple technologies in order to provide the best possible results in a single inspection.

While the individual technologies commercially used in these multi-sensor units are not brand new, the combination of them into one unit has really only taken off in the past decade. These units, though innovative, still have the same challenges as other technologies and the District's experience with one application has had only limited success. The use of these systems is generally cost prohibitive as the large amount of data generated requires expensive post-processing efforts before the data is useful.

3.2.2.6 Pigging

For cases in which force mains cannot be diverted or shut down, the use of pigging can be an effective tool for force main inspections. Though "pigging" is a generic term, there are various types of pipeline inspection gauges (pigs), which can be run through a pipe to provide useful condition data. The types of pigs include simple cleaning pigs that scour the pipes, caliper pigs that detect deformation, ultrasonic pigs to detect leakage, and magnetic flux leakage pigs that detect cracks, pitting, and weld defects.

Despite the advance in pigging technologies, the use of pigging has physical limitations. Installing the pigs can be tricky if the pipelines contain only 90-degree cleanout ports. Wye connections or dedicated pigging ports are more appropriate. Also, force mains containing valves that do not maintain the clear opening of the full pipe diameter will interrupt the passage of the pigs and may make pigging impossible. A review of the condition of the force mains to be inspected will be required to determine if pigging is feasible and/or desired or if other means should be investigated.

3.2.2.7 Manned Entry

In the event that the previously described technologies do not provide sufficient information for an accurate assessment of the sewer's condition or in the event of inspecting the various active and passive structures associated with the collection system, it may be necessary to perform manned entry inspections. Manned entry inspections generally consist of a visual examination of the condition of a sewer or structure, looking for signs of deterioration or maintenance needs.

For manned entry sewer inspections, the use of a sounding hammer or other small tools is typically utilized but it may be necessary to employ more detailed testing. These tests can be either non-destructive, such as ground penetrating radar (GPR) or can be of the destructive nature, in which a sample of the sewer is taken by coring and then evaluated later in a laboratory.

While performing inspections on other structures, manned entry is used to offer a visual examination of the maintenance needs. For confined or unreachable inspection points, the use of manhole cameras is utilized to retrieve visual details about this inspection point. M&O staff members are trained on the techniques and procedure required for a thorough condition assessment for all structures.

3.3 Condition Assessment

While the means and methods of obtaining inspection data are the usual focus of sewer inspection discussions, the proper gathering, categorizing, and interpreting of data obtained are extremely important aspects of the sewer inspection process. Over the years many different means for categorizing and interpreting data have been developed, most of which are developed by and for specific utilities. Such fragmentation throughout the industry creates inefficiencies in the development of new technology as equipment manufacturers are developing repair methods that address specific needs of individual agencies rather than focusing their efforts on improving a single system. There are also inefficiencies as contractors who implement rehabilitation work identified by inspections are forced to operate with different information from different utilities operating in close proximity to one another.

Another problem with this fragmentation is that agency turnover ensures that each new generation of engineers and technicians will interpret data differently and categorize and prioritize it according to their interpretation. Understanding that these sewer systems are designed for 50-to-100-year life spans, the idea that the reviewers and interpretations of data from the inspections will change countless times over the facilities life should be a cause for concern. Standardized

categorization techniques and interpretation of inspection data will provide agencies with the ability to confidently evaluate historical information for use in evaluating trends and the current integrity of the sewer systems.

One such standardization that has been adopted across Europe and is being widely implemented across the United States is the National Association of Sewer Service Companies' (NASSCO) Pipeline Assessment and Certification Program (PACP). The NASSCO PACP is a program which standardizes condition categorization, inspection forms, and coding of observations and defects found in pipelines. There is also the MACP, or Manhole Assessment and Certification Program, which provides similar training for the inspection of manholes.

NASSCO offers training courses for the PACP and MACP in order to ensure that the reviewers of the inspection data know what to look for and catalog and categorize defects properly. It is recommended that two or three staff members, as well as the supervisor, obtain the required training, and maintain it current, to perform the condition assessments in order to ensure redundancy and to allow for rotation of staff into various responsibilities within the group. This type of redundancy and rotation prevents staff from becoming burned out due to continued observation of video tape and other inspection results.

The sewer inspection contractor will utilize NASSCO type inspection forms to document the defects and conditions identified during the inspection. The District's NASSCO trained staff will review the results of the various inspection methods and classify and categorize the observed defects per NASSCO guidelines in order to ensure a uniform and consistent review of inspection data. The results of this classification will be considered along with any prioritization information to develop a prioritization hierarchy for sewer rehabilitation. NASSCO addresses issues like prioritization by allowing for the introduction of modifiers when determining the overall needs of the pipeline/manholes. The District will use a means of prioritization as the "modifier" and this prioritization will be introduced in the following chapter.

4 Categorization and Prioritization

4.1 Categorization

For the purposes of categorizing both the severity of a defect and the condition of the pipe, NASSCO's PACP defect codes provide a good outline of the different conditions. The PACP defect coding includes five levels of defects: Immediate Action, Poor, Fair, Good, and Excellent. In addition to categorizing the severity of defects found, these codes also offer a glimpse into the expected remaining life of the sewers without some type of repairs or rehabilitation. The following are descriptions of the different defect codes and what can be expected for each category.

Immediate Action - Defects/pipelines identified for immediate action are generally scored a five (5) on the point scale. As the title suggests, these defects/pipelines require immediate attention to either correct a failure that has already occurred or an expected imminent failure. Often times these issues are discovered when it is too late and a visible failure has occurred.

Poor – Defects/pipelines identified as poor are those which are anticipated to deteriorate to Immediate Action status in the foreseeable future and are likely to fail within 5-10 years. These defects/pipelines require prompt attention to prevent further deterioration and eventual failure. A score of four (4) is generally given to these defects/pipelines.

Fair – Defects/pipelines identified as fair are generally in moderate condition. Failure to rehabilitate the sewer will allow the progression of defects and the overall condition to deteriorate to Poor and eventually Immediate Action status, with pipe failure expected to occur sometime within 10 to 20 years. These defects/pipelines should be addressed when possible but are not likely to immediately fail as a result of a lack of rehabilitation. A score of three (3) is generally given to these defects/pipelines.

Good – Defects/pipelines identified as good are generally in a good enough condition that defects and the overall condition are not anticipated to progress in the foreseeable future. Defects are present, but they have not begun to deteriorate and are not anticipated to pose a failure risk to the pipeline within the next 20 years. No immediate action is required on these sewers. A score of two (2) is generally given to these defects/pipelines.

Excellent – Defects/pipelines identified as excellent are generally in like-new condition. The pipeline may contain minor defects with failure of the pipe not anticipated within the foreseeable future. These sewers require no action. A score of one (1) is generally given to these defects/pipelines.

The categories and scores assigned to defects must be taken into context of the entire pipe segment. Where some pipelines may have a few immediate action defects, they may otherwise be in good condition. This is a stark contrast to a pipeline that is generally in poor condition throughout. The urgency and rehabilitation efforts for the two pipelines may vary significantly as a result of not

only the severity of the defects, but the extensiveness as well. NASSCO provides various ways to assign pipe ratings to overall segments to ensure that an accurate accounting of the entire segment is considered during investigation.

4.2 Prioritization

Categorizing pipelines by the observed condition is an important step in the development of a rehabilitation program, but it is only one of the factors that must be considered. In order to establish a reliable, economically feasible, and practical rehabilitation plan, one must utilize a risk-based approach to prioritize the pipelines as well. Each of the sewer segments will be evaluated and assigned a consequence of failure score based upon the consequences associated with a potential failure. The determined score will be based on a number of factors including, but not necessarily limited to, location of the sewer (proximity to major roads, waterways, passing beneath structures, etc.), visibility and impact of an eventual failure, public safety, accessibility for repairs and importance to the function of the overall system.

In considering the consequence of failure score associated with an individual sewer segment's failure, the user is allowed to assign either greater or lesser importance to the condition of a sewer based on the assigned score. Giving consideration to the sewer segments' consequence of failure scores will allow the District to prioritize rehabilitation work in a more practical manner. For instance, a sewer in very poor condition that runs beneath a stretch of undeveloped property may be given a lower overall priority than a sewer in slightly better condition that happens to run adjacent to residential properties. While the first sewer would score higher during the assessment phase, there would be less of an impact due to a failure of that sewer than the one adjacent to the residential properties. In a perfect world any sewer in poor condition would immediately be slated for rehabilitation; however, the reality of time and budget constraints often necessitate tough decision making. Considering the whole picture of condition versus consequences aids in that decision making and promotes economically and socially responsible decisions.

In a typical risk assessment, a matrix is developed that includes both the probability of failure of an asset and the consequence of such a failure. In this case, the probability of failure is established during the condition assessment phase, also taking into account factors such as age and construction type and is assigned a numerical score from one to five. The consequence of failure is determined by considering additional factors such as location, importance to the function of the overall system, public safety, accessibility for repairs, etc., and is also assigned a numerical score from one to five. Consideration of these two factors generates an overall risk score utilizing the following formula:

$$\text{Risk} = \text{Probability of Failure} \times \text{Consequence of Failure}$$

Use of such a risk-based system is consistent with other recent evaluations performed by the District for the TARP system and pump stations and would provide consistency in our approach towards inspection and evaluation of sewer system conditions.

5 Rehabilitation Methods

5.1 Point Repair Methods

For larger sewers, typically those greater than 60” in diameter, it may be necessary or desirable to perform point repairs in response to the identification of a problem. For sewers with a high consequence of failure, or in cases where sewer integrity problems have caused sink holes or settlement issues, there may not be sufficient time to allow for the development of a full rehabilitation project for the relevant section of sewer. In these instances, a temporary point repair is required in order to ensure that the sewer will maintain its integrity until a full rehabilitation can be performed on the affected section. The point repair method also allows for the prompt repair of any affected streets, sidewalks, landscaping, or other structure that may have been damaged or undermined by the sewer failure.

While point repairs can take many forms, a typical point repair on a large sewer would consist of an application of chemical grout to the hole or crack, which would then be secured by a steel plate. See Table 1 for a more detailed list of repair methods for specific situations.

5.2 Full Structural Replacement

5.2.1 Cured in Place Pipe (CIPP)

Cured in place pipe, or CIPP, is a relatively non-invasive trenchless technology for rehabilitation of sewer and water pipes. The technology consists of inserting a resin impregnated felt tube, or bag, into the damaged pipe creating a pipe-within-a-pipe. The felt bag is typically installed in an upstream manhole or insertion pit and inverted, or pulled, downstream to another manhole or access point. The bag is inverted through the host pipe using either water or air pressure and is then cured by one of various methods including, steam, hot water, ambient air, or even UV light.

Aside from the non-invasive qualities of CIPP, other benefits of this method include a seamless and jointless installation, a range of application from 4” to approximately 72” in diameter, and full structural replacement of the host pipe. The structural properties of a CIPP liner can be designed for the desired application but are typically such that the liner itself can carry the full structural load of the original pipe, without assistance from the host pipe. Care must be taken during installation to prevent wrinkling of the bag, and it is often required that alternate lining methods be used on bends and turns, as the bag cannot turn corners without becoming wrinkled and misshapen. Full flow bypass is required during CIPP lining, which adds to the complexity of the installation.

5.2.2 Sliplining

Sliplining is another trenchless rehabilitation technology that is minimally invasive. The process consists of inserting a new smaller pipe into the existing host pipe. The annular space between the new and existing pipe is then grouted and the ends are sealed. This method can theoretically be used to rehabilitate any size pipe, provided sufficient access is available for the pipe’s insertion.

While this method is relatively cost effective and requires no specialized equipment or labor, a major drawback of this method is the significant reduction in cross-sectional area of the sewer upon completion. This technology is better suited to larger sewers with sufficient capacity to absorb the loss of cross-sectional area.

Sliplining can be performed either continuously or segmentally. Continuous sliplining requires the use of flexible pipes, such as HDPE or PVC, which can be fused together at the surface and pulled into the host pipe in one continuous length. For larger sections, segments of pipe can be installed within the host pipe. These segments can be made of various materials, including glass reinforced plastic (GRP) panels from companies like Channeline or centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) panels from Hobas Pipe.

5.2.3 Spray Applied Products

Another approach to trenchless rehabilitation is the use of spray applied materials. Various types of materials are available for this method including shotcrete, epoxy, and urethane resins. These materials can be hand applied or centrifugally cast by mechanical means. The optimal materials and application techniques depend on various factors such as the size of the sewer or structure, sewer conditions, and available access to the sewer. Spray applied materials are attractive in that they generally require less staging area and, as many of the technologies use truck-based installation, the staging areas are easily broken down at the end of a shift, minimizing the impacts to the public. Spray applied products are also particularly useful in rectangular or irregularly shaped sewer structures and in non-round sewer installations, as their use is not dependent upon any particular host pipe shape. However, design consideration shall be aware of the importance for properly trained contractors implemented in the rehabilitation specifications. Spray applied products can also be known for having a high variability of sensitivity due to site conditions, equipment applicators and laboratory testing protocols which can lead to non-compliant specification requirements

5.2.4 Open Cut Removal and Replacement

If a particular section of sewer is found to be in such condition that lining or other rehabilitation methods cannot be employed, the pipe may be excavated and replaced within the existing trench. It may be possible to construct new portions of pipe adjacent to the areas where the most damage exists, acting as a bypass around the original damaged section. Total replacement of the sewers will only be considered as the method of last resort when no other methods can be practically employed due to the high cost and disruptions created by the excavation.

6 Implementation of Rehabilitation Projects

6.1 Emergency Work / Spot Repairs

During the condition assessment phase, there may be times when a sewer defect is found that is so substantial and carries a high enough consequence of failure score that an emergency spot repair may be warranted. These instances may be discovered during CCTV or other types of inspections or may be identified by sink holes or other settlements above and adjacent to a particular sewer. The District's normal contracting procedure for sewer rehabilitation projects is not conducive to performing emergency repair work, as the lengthy process can span many months; therefore, it is imperative to maintain an avenue for the prompt performance of emergency spot repairs.

Emergency contracts or Job Order Contract (JOC) task orders are the most efficient means for addressing emergency repairs. Developing and awarding an emergency contract or JOC task order can be done relatively quickly. The District could simultaneously negotiate the emergency contract or JOC task order with the contractor and obtain ROW in order to save time. Most JOC work is pre-priced, so the costs for such work would be relatively stable; however, the uniqueness of each emergency repair or failure could potentially add significant dollars to pre-priced items. Emergency contracts are normally expensive and are not subject to receiving bids. A major disadvantage of utilizing JOC is that the District actually has to maintain a JOC contract. The District has maintained a JOC contract on and off over the past decade, but adopting this option as the plan for emergency work would require the District to maintain JOC contracts for the long-term.

6.2 Large Scale Rehabilitation Projects

The intent of the condition assessment program is to identify problem areas within the sewer and TARP system and have them addressed as soon as possible, with emergency repairs being made as necessary along the way. As the sewers are inspected and graded based upon both their condition and failure consequences, the risk score that is developed will provide a prioritization of rehabilitation projects. It is the District's intent to line entire sewer segments, where possible, rather than perform piecemeal repair work. While it may make sense logistically to focus on one particular area of the District at a time, utilizing the prioritization should also prevent the District from performing too much work in one area and burdening the local residents with extensive road closures and extended construction activities.

The projects will be developed in the normal long form contract format. The projects will be developed with the intent of rehabilitating entire sewer segments; however, consideration will be given to ensure that a single project's costs do not become so extensive as to create budgetary problems. In these cases, individual segments may be broken into separate projects to allow for multiple projects to be ongoing at once so that the worst sewer segments are always being worked on.

7 Asset Field Inspections

7.1 Overview

The District's Maintenance and Operations Department performs regular field inspections on District assets including various passive structures (manholes, drop structures, inverted siphons, etc.) and active control structures (sluice gates, valves, pumps, reservoirs, etc.) to ensure the integrity of the collection system. Preventative and corrective maintenance is performed on assets as required. If the structure requires extensive rehabilitation, the inspection information is evaluated, and repairs are typically performed under capital improvement projects.

Condition assessments and inspection schedules are assigned to each asset to better prioritize maintenance and rehabilitation needs. The condition assessment is used as a baseline for future inspections and also for comparison purposes while prioritizing rehabilitation and maintenance of other structures.

District staff members who regularly perform field inspections receive training through a variety of sources which includes in-house training, seminars, conferences and webinars. Offering the appropriate training helps provide guidance for thorough, accurate and consistent inspections. Additionally, since many inspections require a visual examination within confined spaces, staff is frequently trained in safety-related topics such as confined space entry and CPR.

Currently, the District requests and processes all repair work in the maintenance management system (MMS) as described in Section 2.2.2. After completing an inspection and if any repair or maintenance needs are required, inspectors will identify the components of the asset that needs repair and creates a work request in the MMS system for the maintenance to be performed.

The District has recently put into production an enhanced GIS system to catalog District infrastructure. The goal is to leverage the tools available with GIS and enhance the maintenance management system to help improve planning and tracking of maintenance activities in day-to-day operations. District staff is actively involved in providing updates to the GIS management teams as well as performing quality control and assurance checks of data submitted.

7.2 Tide Gates

Tide gates are used to prevent surface water from flowing into the collection system at an outfall. The flow that exits the tide gate is typically combined sewer overflow (CSO). Most of the District's tide gates are made of wood, but there are a few metal gates in the system. The gates open when the hydraulic head differential is greater on the interceptor side of the gate than the outfall side.

Tide gates associated with the collection system are inspected based on a condition assessment made for the asset. Inspections are then scheduled and prioritized accordingly. The inspection includes the gates associated with TARP control structures as well as gates located on outfall sewers owned and maintained by local municipalities. The condition of structural members and

timbers, depending on the gate construction, is visually inspected. Gates are exercised and lubricated to ensure proper operation.

Many of the tide gates have proximity switches to send a signal to alert operators when the gates are opened. Inspectors test the alarms to ensure that they are working properly. Since information from these alarms is used to quantitatively report CSOs and trigger mobilization of boats to remove floatables from the waterways, it is important that the alarms are working as designed. Repairs are made by trades if it is found that the alarms are not working properly.

Inspectors also examine the gate's hardware to look for signs of corrosion or defects. Corroded or damaged hinges will prevent the gate from opening and closing properly. The gate's alignment is also examined to make sure it is seated correctly. Misaligned gates or debris obstructions can prevent the gate from relieving a CSO. Since most gates are constructed from timber, it is also important to check the gates for leaks or signs of excessive deterioration.

Tide gate inspections are typically performed annually. Priority of inspection is usually given to tide gates with higher vulnerability of failure. Inspection results and maintenance findings are collected, and the asset is evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

7.3 Drop Manholes and Connecting Structures

Typical local sewer systems are at higher elevation than the District interceptor requiring a drop manhole to connect to the District interceptor. There are two types of drop connections: a drop manhole or a standard manhole with an external drop connection. A typical drop manhole has two discharge points, one that is at the same invert as the District interceptor and a second overflow at the higher elevation of the local system. The higher discharge serves as a relief if the drop pipe becomes plugged or restricted.

Identifying the specific components of the manhole and connecting structures through a comprehensive condition assessment is critical at examining the overall condition of the structure. Ensuring that manhole covers are properly aligned and sealed is important for preventing stormwater and other debris from entering the collection system. The supporting mechanism, the frame, must also be thoroughly inspected to ensure that the cover is properly supported and is not interfering with street traffic.

The chimney and cone section of the manhole are designed as the transitional portion between the manhole frame and the sewer barrel. Inspection of this portion of the manhole is especially important to look for signs of corrosion, infiltration and root intrusion. Concrete spalling and deterioration are common symptoms that a manhole and sewer are being exposed to high concentrations of hydrogen sulfide gases. Infiltration and root intrusion in the chimney or cone are introductory signs of deterioration. Manholes are often lined or coated if corrosion, infiltration or root intrusion are excessive.

Manhole rungs or steps are part of the chimney and cone section allowing structure access. Rungs and steps are also susceptible to hydrogen sulfide corrosion and require a thorough inspection to ensure that the rungs are safe to use. If corroded and deemed unsafe to use, manhole steps are removed, and new ones are epoxied into the manhole as a replacement.

Observing blockages in the drop pipe is also critical for a comprehensive drop manhole inspection. Obstructions in the drop pipe can cause hydraulic problems and inhibit flow conveyance. Obstructions also tend to cause higher odors, exposure to hydrogen sulfide and increase the chances of corrosion and erosion from flow out the relief pipe. If an inspector observes a blockage, the conditions are noted, and the obstruction is removed by either in-house crews or with assistance from a jetter truck.

Similar to drop manholes, connecting structures are used as a connection point between local sewers and the District's interceptors. Many of the District's connecting structures are regulated to manage local flow into the intercepting system. Inspection of connecting structures is important to ensure that flow is being conveyed into the District's interceptor as designed.

A visual inspection of the connecting structure is performed to make observations of flow obstructions, concrete deterioration and to ensure that regulating structures are working properly. After a storm event, rags, logs and other debris often collect and impede flow from the local sewers to the District's intercepting system. If an inspector observes a blockage, the conditions are noted, and the obstruction is removed by either in-house crews or with assistance from a jetter truck.

Some connecting structures are equipped with regulating gates to control flow into the District's intercepting system while others are equipped with weirs or orifices. Additional flow that cannot be conveyed into the District's interceptor is diverting to the TARP system for collection. If the structure contains a regulating gate, inspectors check the gates to make sure they are appropriately positioned and that dry weather flow is properly being conveyed into the system.

Inspection of drop manholes and connecting structures is typically performed annually. Priority of inspection is usually given to assets with higher vulnerability of failure. Inspection results are collected, and the asset is evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

7.4 Inverted Siphons

An inverted siphon is applied to pipes that must dip below an obstruction to form a "U" shaped flow path. Unlike sewers, siphons flow under pressure and must maintain a velocity of 3 ft/s to keep material suspended. To maintain adequate velocity, the inverted siphon uses a smaller diameter pipe than the main interceptor. Typical inverted siphons at the District consist of at least two barrels, one for dry weather flow and the second for wet weather flow. The specific design and number of pipes depends on the conditions at each location. There are locations that have three or more barrels, and, in some cases, a "V" pipe is used instead of the typical "U" pipe.

Since inverted siphons are designed to flow under pressure to convey flow under low areas, making sure that the siphon is operating properly is critical to maximize flow conveyance in the siphon. Assessing the conditions of upstream and downstream chambers will typically provide the inspector a good idea as to the state of the siphon. Blockages that are observed in the chambers suggest that the siphon flow conveyance within the siphon is hindered. If a blockage is suspected, the use of jetting is employed to remove debris within the siphon. If there is a TARP drop shaft associated with the siphon, inspectors will check the shaft for dry weather flow as this will offer an indication that there may be a blockage within the siphon.

Flow impediment does not necessarily preclude that a blockage is present within the structure or siphon; it may also be a result of a collapsed line. In such instances, the use of sonar can be used to identify potential defects in the pipe. This technology, as described in section 3.2.2.4, is utilized for inspection of fully or partially submerged sewer lines. Inspecting the siphon using traditional CCTV can also be performed by isolating the flow to the upstream and downstream chambers. The siphon is then dewatered, and televising can be used to identify defects or signs of a collapse.

Inspections of inverted siphons are typically performed annually. Priority of inspection is usually given to assets with higher vulnerability of failure. Inspection results are collected, and the asset is evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

7.5 TARP and Control Structures

The District maintains below grade structures that control flow from the sewer system into the 110 miles of tunnels that make up the four TARP systems: the Upper Des Plaines, Mainstream, Des Plaines and Calumet. Proper operation of the TARP system is vital to maximizing the capture of CSOs in the CSO communities. TARP structures are used to divert CSO flow that would otherwise overflow to the waterways. When the TARP system begins to fill, operators monitor the elevations of the tunnels to maximize conveyance to the tunnels preventing and reducing CSO occurrences while protecting public health and safety.

Since situated below grade, these structures require heaters and dehumidifiers to maintain climate conditions. Heaters are used to prevent freezing in the winter months while dehumidifiers are used to prevent excessive moisture from accumulating within the structure. Both types of equipment are inspected for proper operation. Additionally, many structures are equipped with sump pit systems to collect infiltration and act as a discharge point for the dehumidifiers. Sump pit pumps are also inspected and tested to ensure adequate operation.

Checking alarms is part of routine maintenance for each control structure. TARP control structures are equipped with entry alarms to notify operators when the access hatch is opened, adding security and alerting District personnel of any unauthorized entry. Inspectors also frequently test the communication signals between the TARP structures and the control rooms. Confirming that accurate information is relayed back to the control room is essential. Communication failures can

lead to misinformation about the position of sluice gate structures which may impact operations. The affirmation that the gate position and alarm are working properly is important to the overall operation of the TARP system.

In addition to entry alarms, inspectors verify that high water and vault flood alarms are working properly. These alarms are used to notify operation staff that the TARP or control structure is experiencing infiltration or sump pump failure. Alarm failure or neglect in maintenance will lead to miscommunication and significantly impact the operation of the controlling structure; restricting operation of control gates and requiring emergency dewatering. Therefore, it is important to ensure that the communication of high water and vault flood alarms are working properly.

A physical examination of the sluice gate mechanism, including the stem and actuator, is important during inspection. Since the sluice gates are remotely operated and frequently used, inspectors must examine the stem for adequate lubrication and alignment. Gate stems that are not properly lubricated or out of alignment can cause permanent defects in the stem and restrict the operation of the gate. The actuator, or operating motor used to adjust the gate position, is also examined during a condition assessment. Inspectors will typically test the actuator by exercising the gate during the inspection to ensure the system is working properly.

Preventive maintenance and corrective work orders are scheduled and documented in detail in the District's maintenance management system. TARP and control structure inspections are typically performed annually. Priority of inspection is usually given to structures with higher vulnerability of failure. Inspection results are collected, and the asset is evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

7.6 Pump and Lift Stations

Pump stations, also called lift stations, are used to move wastewater from lower to higher elevations to allow the collection system to operate by gravity. Most of the District's pump stations are used for the conveyance of dry weather flow while other pump stations reserve the capability to discharge combined sewer overflow to the waterways when all other systems are at capacity.

Inspection for pump and lift station requires a broad knowledge of electrical, mechanical and hydraulic components. Pump stations are usually situated within a dedicated facility which also requires a knowledge of general building maintenance such as landscaping, façade maintenance and pavement repair. However, more detail is usually dedicated to the operations of the facility which includes the alarms, controls and screen systems.

All of the outlying pump stations are unmanned and are equipped with entry alarms to notify District personnel of unauthorized entry. Inspectors commonly test these alarms as part of routine maintenance. Additionally, each pump or lift station is equipped with level sensors to monitor wet well or sewer elevations. High-level and low-level water alarms are required to trigger pump operation based on the elevations of the wet well. The inspection of these controls is important to ensure that pumps are operated appropriately to prevent flooding and pump cavitation.

Inspections on the main pumps and sump pumps are also regularly performed. Inspectors keep records in MMS of manufacturers' recommendations for parts replacement, oil changes and bearing lubrication as a reference for when maintenance needs are required for each component. Preventative maintenance schedules are enforced as a proactive approach for keeping the pumps fully functional. At many stations, pump activity and elevation log sheets are acquired at the time of inspection. This information is important so that historical operation data is available to District personnel. Finally, ancillary equipment such as heaters, dehumidifiers, compressors and emergency generators are stationed inside many of the pump station facilities. Such equipment is routinely tested during a normal inspection.

Inspectors will either test the pumps or investigate their run times to ensure adequate operation. The basic inspection will consist of verifying that the control system is operating properly. Inspectors may run the pumps, if idle, to check for signs of excessive vibrations and to verify that suction and discharge pressures are acceptable. Pumps in operation are examined for excessive heat and noise. If the inspector deems that corrective action is needed on the pump system, the information is entered in MMS and work is scheduled accordingly.

Many pump stations are equipped with influent screens installed at the intake to prevent floatables and coarse debris from entering the wet well. Some pump stations are equipped with collection rake systems that continuously or periodically clean the screens to preclude a buildup of debris. Keeping screens clean helps equalize the upstream and downstream sides of the screen which prevents suction lift complications for the main sewage pumps. Therefore, screens are physically examined to make sure they are free of debris.

A thorough inspection of pump stations is performed monthly while routine maintenance such as clearing blockages from intake screens is performed succeeding a storm event. Inspection results are collected, and the pump station assets are evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

7.7 Reservoir and Dams

The District maintains and operates flood reservoirs to alleviate overbank flooding in local streams. Stormwater spills into the reservoirs when streams are flowing full and the water is pumped to the streams, after storms, when stream capacity is available. The reservoirs capture water from natural streams and not CSO from tunnels. The District shares the responsibility for maintenance and inspections for many of the reservoirs with local municipalities. Inspections are jointly performed with local municipalities, the National Resources Conservations Service and the Army Corps of Engineers.

Typical reservoir inspections involve a comprehensive evaluation of the entire site which includes the principal spillways, diversion structures, pumping station and other ancillary components. Inspectors check the spillways for signs of seepage, joint or crack impairments and any blockages or obstructions. During inspections, the riprap surrounding the spillway is closely examined. Rip

rap is used for erosion prevention along the sidewalls of the spillway. Undesirable vegetation growth is also looked for and general conditions of the conduits and culverts are noted.

Some reservoirs are dewatered using excavated pumpout. These reservoirs are equipped with pump stations to convey the collected stormwater to the local stream when capacity is available. The pump stations are checked to make sure the inlet and screens are free of obstructions, and both the mechanical and electrical controls are functioning. Additionally, the pump station outlets are checked for joint repair needs and signs of erosion.

The District is responsible for the inspection of five dam structures located in the Cook County area. Inspections are performed annually with joint efforts between the M&O and Engineering Department along with representatives from the Natural Resources Conservation Service and local municipalities. Dam inspection follows much of the same protocol as those for reservoirs. Surface and structural cracks are examined as well as erosion, spalling and undesired vegetation growth. Maintenance needs are reported in MMS and repairs are made by trades. For more extensive rehabilitation work, the use of contracts is employed to address maintenance needs.

General conditions of the reservoir grounds and dam structures are also part of the semi-annual inspection performed by MWRD staff. Inspectors regularly check for potential safety hazards and signs of graffiti or vandalism. Entrance and service roads are checked for surface conditions.

There are 37 flood control reservoirs and dam structures within the District Boundaries. Reservoir inspections are typically performed semiannually. Inspection results are collected, and the reservoir's assets are evaluated for repair needs. Corrective actions are recorded in the District's maintenance management system.

Table 1: Typical Rehabilitation Methods for Various Sewer Defects

Sewer Defect	Repair Type	Description
Holes Found in Sewer	Hydraulic Cement and Steel Plate	The hole will be filled with hydraulic cement. A stainless-steel plate will cover the hole to prevent the cement from coming out.
	Hydraulic Cement and Lining	The hole will be filled with hydraulic cement and a liner will be installed in order to keep the cement in place.
H ₂ S Damage Requiring Structural Repair	Cured in Place Pipe Lining (CIPP)	A corrosion resistant liner will be designed to withstand the loads that a new pipe would encounter.
	Slip Lining	A pipe meeting direct bury strength requirements will be pushed into the existing sewer and grouted in place.
	Channel Lining	A multipiece fiberglass pipe is constructed inside the existing sewer and grouted in place. The channel line pipe can also be constructed for non-round pipe.
H ₂ S Damage, Non-Structural Repair	Cured in Place Pipe Lining (CIPP)	A thin liner can be installed to provide a corrosion resistant barrier.
	Hydraulic Cement and Spray on Products	The cement is used to restore cover over existing rebar, and the spray-on product provides a corrosion resistant barrier to the concrete.
Sewer Collapse	Open Cut Remove and Replace	When the sewer is completely collapsed, removal and replacement of the existing sewer is required.
	Mechanical Sleeve + CIPP	When the sewer is partially collapsed, a mechanical sleeve can be installed to restore the shape of the sewer. The sewer can be lined in order to restore the structural integrity of the sewer.

Collection System O&M Manual

Appendix B: Ambient Water Quality Monitoring Program Quality Assurance Project Plan (AWQM QAPP)

GROUP A: PROJECT MANAGEMENT

A1: Approval Sheet

Thomas Minarik

Date 3/4/26

Thomas Minarik
Project Manager
Principal Environmental Scientist
Environmental Monitoring and Research Division

Ashley Jesernik

Date 03/04/2026

Ashley Jesernik
Quality Assurance Coordinator
Supervising Environmental Chemist
Analytical Laboratories Division

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A3: Distribution List

A copy of this Quality Assurance Project Plan (QAPP) will be distributed to each person signing the approval sheet and each person involved with project tasking identified in Section A4. A copy of this QAPP shall be available on request to any person participating in the project from any of the personnel listed in Section A4. Persons not employed by the Metropolitan Water Reclamation District of Greater Chicago (District) may obtain a copy of this QAPP from the Director of the Monitoring and Research (M&R) Department.

As this document will be updated periodically, the reader is advised to check with the Project Manager for the latest revision if his copy is more than one year old. Revision 2.6 has been prepared following the United States Environmental Protection Agency (USEPA) guidance document EPA QA/R-5 titled "EPA Requirements for Quality Assurance Project Plans," March 2001.

A4: Project/Task Organization

The responsible persons for Project Management are:

Project Director:

Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

Project Manager:

Thomas Minarik
Principal Environmental Scientist
Environmental Monitoring and Research Division

Quality Assurance QA Coordinator:

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Supervising Environmental Chemist

Environmental Monitoring Manager:

Erica Spiess
Aquatic Biologist

Stickney Analytical Laboratory Manager:

Pawel Grunwald
Supervising Environmental Chemist

Calumet Analytical Laboratory Manager:

Cleophus Lewis
Supervising Environmental Chemist

Industrial Waste Analytical Laboratory (IWAL) Manager:

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Egan Analytical Laboratory Manager:

Anas Rabah
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Theresa Johnston
Principal Environmental Scientist

Organic Compounds Analytical Laboratory Manager:

Nataliya Starikov and Paul Poshyvanyk
Senior Environmental Chemists

Laboratory Information Management System (LIMS) Manager:

Melissa Amador
Senior Environmental Chemist

Illinois Environmental Protection Agency (IEPA) Project Manager:

Nicole Vidales
Surface Water Section Manager

IEPA QA Officer:

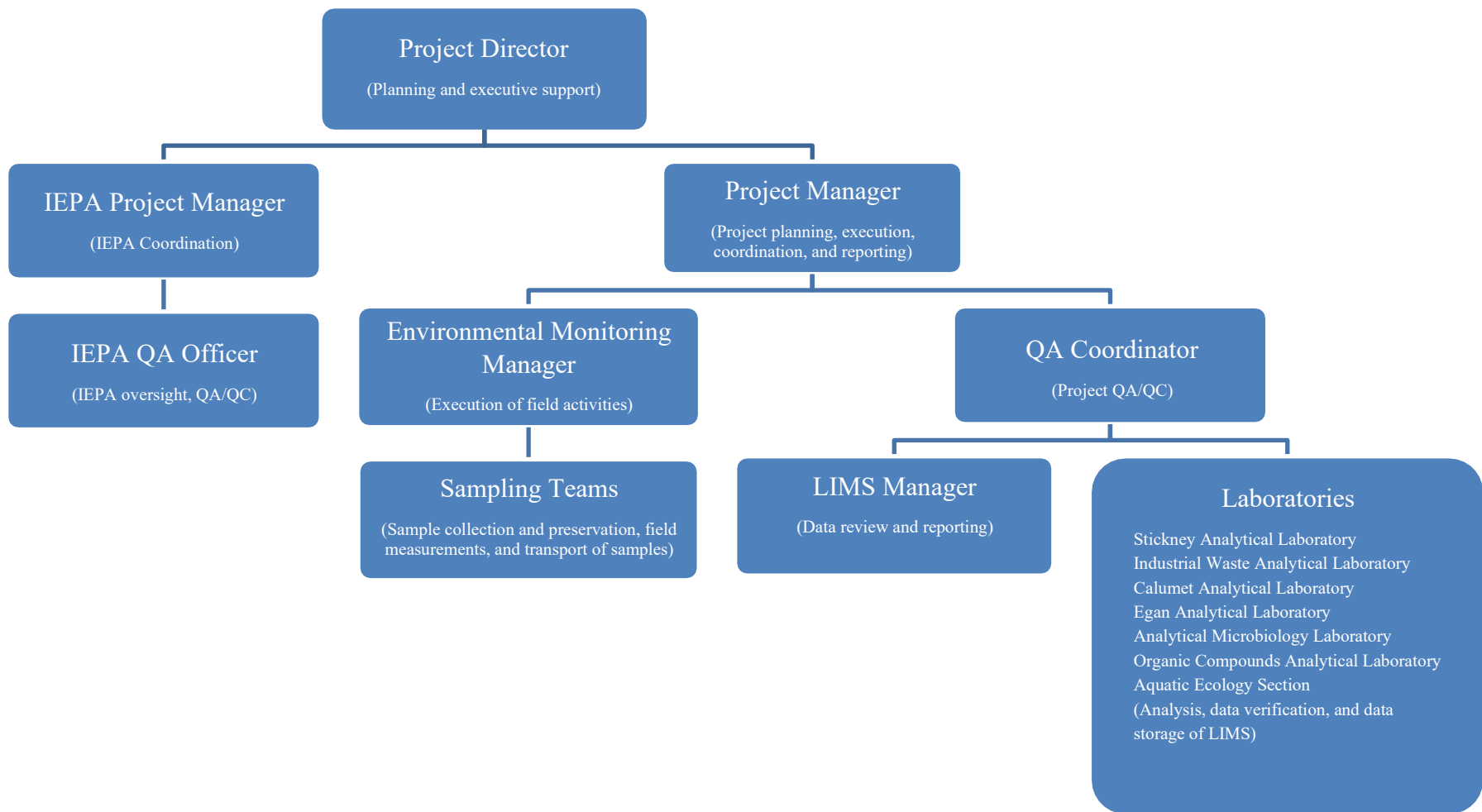
Michelle Rousey
Quality Assurance Officer, Bureau of Water

Figure 1 is the organization chart for the project. Primary lines of communication are shown as dashed lines. However, within the District, communication between any of the project participants may occur and is, in fact, encouraged as questions or issues arise.

The Project Director is responsible for executive oversight of the entire project and ensuring funding and resources are available to execute the project. The Project Manager plans and revises the scope of the project to ensure that it meets regulatory requirements and other objectives, evaluates and communicates the resources required to execute the project, reviews data submittals and reports, coordinates project activities, and completes QAPP revisions. The QA Coordinator is responsible for oversight of quality control (QC) for the project.

The IEPA Project Manager coordinates the efforts of both agencies to ensure that project data will be usable by the IEPA for assessment of water quality. The IEPA Project Manager is assisted by the IEPA QA Officer, who oversees project activities and project QC.

FIGURE 1: AMBIENT WATER QUALITY MONITORING PROJECT ORGANIZATION CHART



The Environmental Monitoring Manager is responsible for the execution of field activities and (LIMS) set-up and maintenance for the project. The Environmental Monitoring Manager also assists with data analysis and QAPP revisions. The sampling teams collect and preserve samples, take field measurements, and transport the samples to the District laboratories. Several District laboratories analyze project samples. Participant laboratories include SAL, the EAL IWAL, CAL) the Microbiology Laboratory (AML), OCAL, and the Aquatic Ecology (AE) Section.

The LIMS Manager is responsible for compiling project test results and data verifications for SAL, IWAL, EAL, and CAL data.

A5: Background

The District routinely collects and analyzes water samples from the District service area waterways. “Waterways” as used in this document will mean natural and modified rivers or streams, and man-made canals. This monitoring has been undertaken by the District to determine water quality on an ongoing basis and establish a historical record. A historical water quality database exists back to project inception in 1970.

The Illinois Pollution Control Board (IPCB) designates District service area waterways based on their recreational and aquatic life use potential. Recreational use designations in these waterways include: General Use, Primary Contact, Incidental Contact, Non-Contact, Non-Recreational, and Secondary Contact. Aquatic Life Uses are General Use, Chicago Area Waterway System (CAWS) Aquatic Life Use A, CAWS Aquatic Life Use B, and Indigenous Aquatic Life Use.

The IPCB has established separate water quality standards to support the designated uses for each waterway. Comprehensive assessments of the Ambient Water Quality Monitoring (AWQM) data from this project are made annually using all applicable water quality standards established by the IPCB.

The AWQM data collected from this project have been used, often in conjunction with data from other monitoring studies, to evaluate the impact of District operations and projects, including the water reclamation plants (WRPs), the pretreatment program, the flood and pollution control Tunnel and Reservoir Plan, the Sidestream Elevated Pool Aeration Stations, and the Instream Aeration Stations.

The AWQM data provide a broad surveillance of significant discharges to the waterways. The data also may have potential use for evaluation of other factors affecting water quality, including intermittent stormwater releases and release of pollutants from bottom sediment in the waterways.

Another goal of this project is to coordinate the waterway monitoring performed by the

District with the waterway monitoring performed by the IEPA's Bureau of Water. The District will review key aspects of its program, including sampling locations, sampling frequency, sampling methods, parameters analyzed, and analytical capability, to determine how to best provide water quality data usable by both agencies.

This QAPP will address how to conduct the monitoring of the waterways in a manner that will efficiently utilize available resources and produce water quality data that will meet or exceed the measurement quality objectives for all intended uses of the data.

A6: Project/Task Description

Monitoring is conducted on 14 waterbodies at 30 sampling stations. The total number of river miles monitored is approximately 225. The following rivers, creeks, man-made channels, and a canal are monitored for water quality.

Des Plaines River System:

- Weller Creek.
- Higgins Creek.
- Salt Creek.
- Des Plaines River.
- West Branch DuPage River.

Chicago River System:

- North Branch Chicago River.
- North Shore Channel.
- Chicago River.
- South Branch Chicago River.
- South Fork South Branch Chicago River.
- Chicago Sanitary and Ship Canal.

Calumet River System:

- Grand Calumet River.

- Little Calumet River.
- Calumet-Sag Channel.

Figure 2 is a map showing the waterways in the Chicago metropolitan area and the current sampling locations.

A description of the 30 monitoring stations is provided in Tables 1, 2, and 3. Table 1 lists all current and discontinued sampling locations with their station identification number and IPCB use classifications. Table 2 shows the latitude and longitude of each sampling station. Table 3 shows the United States Geological Survey quadrant, township, range, section, and quarter section of each sampling station.

All locations are sampled monthly, except Lockport Powerhouse and Lock (92) which is sampled weekly. Grab samples taken at the surface are collected at each sample location for the analysis of most measured analytes. These water samples are analyzed for a wide range of parameters, including alkalinity, solids, ammonia, nitrate, phosphorus, total or dissolved metals, cyanide, phenol, fecal coliform, and organic priority pollutants. A special sampling device is used to collect samples at a depth of 3 feet for bacterial analysis. Water temperature, pH, and dissolved oxygen are measured onsite at each sampling location.

Following collection, the samples are transported to the Lue-Hing Research and Development (R&D) Complex at the Stickney WRP and the OCAL at the John E. Egan WRP for login. After login, fluoride, chloride, alkalinity, and sulfate samples are transported to EAL, total and low-level mercury samples are transported to CAL, and the rest of the samples are analyzed at SAL. All project data are maintained in the District LIMS database.

A7: Quality Objectives and Criteria for Measurement Data

Many analytes measured for this project are present in low concentrations throughout the waterway systems. Analyte concentrations will vary as discharged effluents and stormwater runoff are introduced into the waterways. All analytes are subject to chemical, biological, and physical processes that will alter their presence in the waterway. It is the intent of this project to employ methods of measurement that will detect and quantify all analytes of interest wherever possible.

Although there are several intended and potential uses of the data, minimum measurement criteria will be established at the lowest analyte concentration required for actual uses of the measurement data. Where no minimum measurement criteria can be identified, the water samples will be analyzed to the lowest concentration readily achievable by District laboratories.

FIGURE 2: AMBIENT WATER QUALITY MONITORING PROGRAM WATERWAY
SAMPLE STATIONS

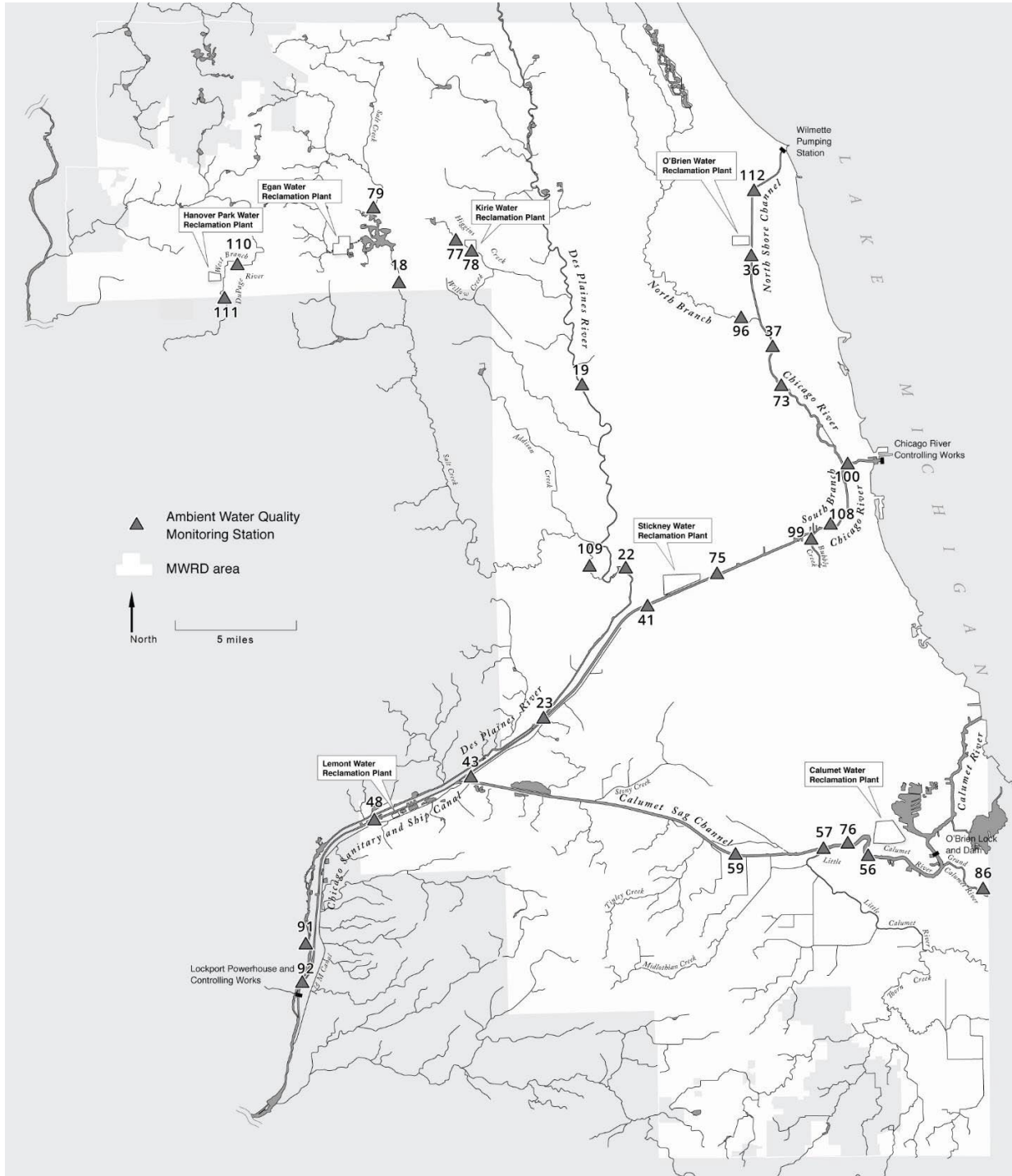


TABLE 1: SAMPLING LOCATIONS

Station	Location	IEPA Classification
<u>Chicago River System</u>		
106	Dundee Road, West Fork North Branch of Chicago River	General Use
103	Golf Road, West Fork North Branch of Chicago River	General Use
31	Lake-Cook Road, Middle Fork North Branch of Chicago River	General Use
104	Glenview Road, Middle Fork North Branch of Chicago River	General Use
32	Lake-Cook Road, Skokie River	General Use
105	Frontage Road, Skokie River	General Use
34	Dempster Street, North Branch of Chicago River	General Use
96	Albany Avenue, North Branch of Chicago River*	General Use
35	Central Street, North Shore Channel	CAWS A/ICR
112	Dempster Street, North Shore Channel*	CAWS A/ICR
102	Oakton Street, North Shore Channel	CAWS A/ICR
36	Touhy Avenue, North Shore Channel*	CAWS A/PC
101	Foster Avenue, North Shore Channel	CAWS A/PC
37	Wilson Avenue, North Branch of Chicago River*	CAWS A/PC
73	Diversey Parkway, North Branch of Chicago River*	CAWS A/PC
46	Grand Avenue, North Branch of Chicago River	CAWS A/PC
74	Lake Shore Drive, Chicago River	General Use
100	Wells Street, Chicago River*	General Use
39	Madison Street, South Branch of Chicago River	CAWS A/PC
108	Loomis Street, South Branch of Chicago River*	CAWS A/PC
99	Archer Avenue, South Fork South Branch of Chicago River*	IAL/SC
40	Damen Avenue, Chicago Sanitary and Ship Canal	CAWS B/ICR
75	Cicero Avenue, Chicago Sanitary and Ship Canal*	CAWS B/ICR
41	Harlem Avenue, Chicago Sanitary and Ship Canal*	CAWS B/ICR
42	Route 83, Chicago Sanitary and Ship Canal	CAWS B/ICR
48	Stephen Street, Chicago Sanitary and Ship Canal*	CAWS B/NR
92	Lockport Powerhouse Forebay*	CAWS B/NR
<u>Calumet River System</u>		
49	Ewing Avenue, Calumet River	CAWS A/NCR
50	Wolf Lake, Burnham Avenue	General Use
55	130th Street, Calumet River	CAWS A/ICR
86	Burnham Avenue, Grand Calumet River*	CAWS A/ICR

TABLE 1: SAMPLING LOCATIONS

Station	Location	IEPA Classification
<u>Calumet River System (Continued)</u>		
56	Indiana Avenue, Little Calumet River*	CAWS A/PC
76	Halsted Street, Little Calumet River*	CAWS A/PC
52	Wentworth Avenue, Little Calumet River	General Use
54	Joe Orr Road, Thorn Creek	General Use
97	170th Street, Thorn Creek	General Use
57	Ashland, Little Calumet River*	General Use
58	Ashland Avenue, Calumet-Sag Channel	CAWS A/PC
59	Cicero Avenue, Calumet-Sag Channel*	CAWS A/PC
43	Route 83, Calumet-Sag Channel*	CAWS A/PC
<u>Des Plaines River System</u>		
12	Lake-Cook Road, Buffalo Creek	General Use
13	Lake-Cook Road, Des Plaines River	General Use
17	Oakton Street, Des Plaines River	General Use
19	Belmont Avenue, Des Plaines River*	General Use
20	Roosevelt Road, Des Plaines River	General Use
22	Ogden Avenue, Des Plaines River*	General Use
23	Willow Springs Road, Des Plaines River*	General Use
29	Stephen Street, Des Plaines River	General Use
91	Material Service Road, Des Plaines River*	General Use
110	Springinsguth Road, West Branch of DuPage River*	General Use
89	Walnut Lane, West Branch of DuPage River	General Use
111	Arlington Drive, West Branch of DuPage River*	General Use
79	Higgins Road, Salt Creek*	General Use
80	Arlington Heights Road, Salt Creek	General Use
18	Devon Avenue, Salt Creek*	General Use
24	Wolf Road, Salt Creek	General Use
109	Brookfield Avenue, Salt Creek*	General Use
77	Elmhurst Road, Higgins Creek*	General Use
78	Wille Road, Higgins Creek*	General Use

TABLE 1: SAMPLING LOCATIONS

Station	Location	IEPA Classification
<u>Fox River</u>		
90	Route 19, Poplar Creek	General Use
127	Lincoln Street, Weller Creek	General Use

*Current sampling location as of April 2019.

PC = Primary Contact.

ICR = Incidental Contact Recreation.

NCR = Non-Contact Recreation.

NR = Non-Recreational.

SC = Secondary Contact.

IAL = Indigenous Aquatic Life.

TABLE 2: LATITUDE AND LONGITUDE OF CURRENT SAMPLING LOCATIONS

Station	Description	North Latitude	West Longitude
96	North Branch Chicago River @ Albany Ave.	41° 58.475'	87° 42.375'
112	North Shore Channel @ Dempster St.	42° 02.460'	87° 42.583'
36	North Shore Channel @ Touhy Ave.	42° 00.690'	87° 42.600'
37	North Branch Chicago River @ Wilson Ave.	41° 57.891'	87° 41.834'
73	North Branch Chicago River @ Diversey Ave.	41° 55.920'	87° 40.940'
100	Chicago River Main Stem @ Wells St.	41° 53.259'	87° 38.045'
108	South Branch Chicago River @ Loomis St.	41° 50.752'	87° 39.642'
99	South Fork, South Branch Chicago River @ Archer Ave.	41° 50.331'	87° 39.849'
75	Chicago Sanitary & Ship Canal @ Cicero Ave.	41° 49.169'	87° 44.616'
41	Chicago Sanitary & Ship Canal @ Harlem Ave.	41° 48.263'	87° 48.104'
48	Chicago Sanitary & Ship Canal @ Stephen St.	41° 40.750'	88° 00.683'
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse Forebay	41° 34.256'	88° 04.704'
86	Grand Calumet River @ Burnham Ave.	41° 37.870'	87° 32.352'
56	Little Calumet River @ Indiana Ave.	41° 39.136'	87° 35.828'
76	Little Calumet River @ Halsted St.	41° 39.440'	87° 38.476'
57	Little Calumet River @ Ashland Ave.	41° 39.099'	87° 39.633'
59	Calumet-Sag Channel @ Cicero Ave.	41° 39.282'	87° 44.284'
43	Calumet-Sag Channel @ Route 83	41° 41.790'	87° 56.480'
19	Des Plaines @ Belmont Ave.	41° 56.236'	87° 50.975'
22	Des Plaines River @ Ogden Ave.	41° 49.256'	87° 48.654'
23	Des Plaines River @ Willow Springs Rd.	41° 44.135'	87° 52.901'
91	Des Plaines River @ Material Service Rd.	41° 35.794'	88° 04.112'
110	West Branch DuPage River @ Springinsguth Rd.	42° 00.495'	88° 07.142'
111	West Branch DuPage River @ Arlington Drive	41° 58.500'	88° 08.316'
79	Salt Creek @ Higgins Rd.	42° 01.880'	88° 00.679'
18	Salt Creek @ Devon Ave.	41° 59.546'	87° 59.924'
109	Salt Creek @ Brookfield Ave.	41° 49.370'	87° 50.494'
77	Higgins Creek @ Elmhurst Rd.	42° 01.287'	87° 56.436'
78	Higgins Creek @ Wille Rd.	42° 01.120'	87° 56.201'
127	Weller Creek @ Lincoln St.	42° 03.327'	87° 57.246'

TABLE 3: QUADRANT, TOWNSHIP, AND RANGE OF CURRENT SAMPLING LOCATIONS

Station	Description	Quadrant	TWP	Range	Sec.	¼ Sec.
96	North Branch Chicago River @ Albany Avenue	Chicago Loop	40N	13E	12	SW
112	North Shore Channel @ Dempster Street	Evanston	41N	13E	14	SE
36	North Shore Channel @ Touhy Avenue	Evanston	42N	13E	26	SE
37	North Branch Chicago River @ Wilson Avenue	Chicago Loop	40N	13E	13	NE
73	North Branch Chicago River @ Diversey Avenue	Chicago Loop	40N	14E	30	SW
100	Chicago River Main Stem @ Wells Street	Chicago Loop	39N	14E	9	SW
108	South Branch Chicago River @ Loomis Street	Englewood	39N	14E	28	NW
99	South Fork, South Branch Chicago River @ Archer Avenue	Englewood	39N	14E	29	SW
75	Chicago Sanitary & Ship Canal @ Cicero Avenue	Englewood	38N	13E	3	NW
41	Chicago Sanitary & Ship Canal @ Harlem Avenue	Berwyn	38N	12E	7	NW
48	Chicago Sanitary & Ship Canal @ Stephen Street	Romeoville	37N	11E	20	NW
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse	Joliet	36N	10E	27	SW
86	Grand Calumet River @ Burnham Avenue	Lake Calumet	36N	15E	5	SW
56	Little Calumet River @ Indiana Avenue	Lake Calumet	37N	14E	34	SW
76	Little Calumet River @ Halsted Street	Blue Island	37N	14E	33	NW
57	Little Calumet River @ Ashland Avenue	Blue Island	37N	14E	32	SW
59	Calumet-Sag Channel @ Cicero Avenue	Blue Island	37N	13E	34	NW
43	Calumet-Sag Channel @ Route 83	Calumet-Sag Bridge	37N	11E	14	SE
19	Des Plaines @ Belmont Avenue	River Forest	40N	12E	22	SE
22	Des Plaines River @ Ogden Avenue	Berwyn	38N	12E	1	NE
23	Des Plaines River @ Willow Springs Road	Calumet-Sag Bridge	38N	12E	33	SW
91	Des Plaines River @ Material Service Road	Joliet	36N	10E	22	SW
110	West Branch DuPage River @ Springinsguth Road	Streamwood	41N	10E	26	SW
111	West Branch DuPage River @ Arlington Drive	West Chicago	40N	10E	6	SE
79	Salt Creek @ Higgins Road	Palatine	41N	11E	20	NW
18	Salt Creek @ Devon Avenue	Elmhurst	41N	11E	33	SW
109	Salt Creek @ Brookfield Avenue	Berwyn	39N	12E	35	SW
77	Higgins Creek @ Elmhurst Road	Arlington Hts.	41N	11E	25	NW
78	Higgins Creek @ Wille Road	Arlington Hts.	41N	11E	25	NW
127	Weller Creek @ Lincoln Street	Arlington Hts.	41N	11E	11	NW

Currently, except for the IPCB water quality standards, there are no other specified minimum measurement criteria for waterways monitoring data. Therefore, this project will use the most restrictive water quality standard applicable to waterways within the District's service area to establish the minimum measurement criteria for each parameter. The minimum measurement criteria will apply for all samples irrespective of the IPCB waterway designation in order to maintain uniform measurement objectives for the project.

The monitored parameters and the established minimum measurement criteria are shown in columns 1 and 3 of Attachment A. Analytes not subject to an IPCB water quality standard will not have specified minimum measurement criteria. The minimum measurement criteria will be adjusted accordingly when IPCB water quality standards are changed or as dictated by other planned uses of the data.

Column 2 of Attachment A gives the Reporting Limits (RLs) for the project, which are established by ALD. RLs are mathematically derived from Method Detection Limits (MDLs). For parameters where RLs are not applicable, such as pH, solids, temperature, and dissolved oxygen, the minimum measurement criteria shown in column 3 of Attachment A are the sensitivities, to be obtained by the measurement method. Sensitivity of a method shall be defined as the difference in concentration that can be distinguished by measurement.

A8: Special Training/Certification

1. Sample collection personnel shall be trained in proper sample collection methods by the Environmental Monitoring Manager.
2. Microbiological analyses are performed in the Illinois Department of Public Health (IDPH) certified Analytical Bacteriology Laboratory by analysts who have successfully completed the source water bacteria testing Demonstration of Capability.
3. Each section of ALD has successfully maintained accredited status as certified by the IEPA following The NELAC Institute (TNI) standard.

A9: Documents and Records

1. The District Project Manager and IEPA QA Officer shall retain copies of all updates and revisions of this QAPP.
2. The Analytical Laboratory Managers and QA Officer for the District shall retain copies of all analytical procedures used for analysis of project samples.
3. The Project Manager shall retain copies of all laboratory analytical reports and correspondence with the laboratories.

4. The Project Manager shall retain copies of all communications to and from outside agencies and other interested parties.
5. All the records and reports listed above will be retained for 10 years at the Lue-Hing R&D Complex located at the Stickney WRP.

GROUP B: DATA GENERATION AND ACQUISITION

B1: Sampling Process Design (Experimental Design)

Selection of Sampling Locations. The 30 sampling locations have been previously identified in Tables 1, 2, and 3. Criteria for selecting sampling locations include:

1. Downstream of the point at which major tributaries enter the District's service area.
2. Near the intake control structures where water is diverted into the waterways from Lake Michigan.
3. Upstream and downstream of District facilities, including WRPs, aeration stations, and pumping stations.
4. At the confluence of significant waterway branches.
5. At the Lockport control facility where most flow from the District service area leaves the waterways system.
6. Near the downstream end of a reach designated by the IEPA as a waterbody segment or assessment unit.

Sampling locations must be readily accessible and judged safe for all sampling activities. Bridges over the waterways have provided ideal sampling locations. For locations where bridge access or height will not allow for safe sampling, samples may be collected by boat. Occasionally, if a bridge is under construction or if the sampling schedule required it, water samples that are normally collected by bridge may also be sampled by boat, in accordance with the procedures described in Appendix I.

The IEPA utilizes water quality data to prepare its biannual water quality report as required by Section 305(b) of the Clean Water Act. For this purpose, the IEPA assesses conditions for waterbody segments and has defined these segments for all waters in the state.

Sampling locations may be added or removed from the monitoring network based upon periodic assessments of monitoring needs and resources available.

Sampling Frequency. All 30 sampling locations are monitored monthly, except Lockport Powerhouse and Lock (92), which is sampled weekly. The sampling frequency for each parameter is shown in Attachment B. This schedule provides sampling through seasonal changes and a sufficient number of samples to adequately characterize water quality annually and to identify long-term trends over many years. Monthly sampling may also detect an abrupt degradation of water quality, allowing the opportunity for the District to respond appropriately.

Water quality samples are collected weekly at the Lockport Powerhouse and Lock because this facility controls the release of water from the Chicago Sanitary and Ship Canal, which contains, at that location, the combined flow from the Chicago and Calumet River Systems. The treated wastewater from four District WRPs covering most of the District's service area flows through the Lockport Powerhouse and Lock.

Sampling frequency may be modified temporarily if there is a specific need to acquire additional data.

Selection of Parameters for Monitoring. Parameters selected for analysis are those that have IPCB water quality standards, and other parameters that have been used to characterize instream water quality. Certain parameters may only be analyzed in waterways with a particular designated use category. These are identified in Attachment A. Periodically, the parameters monitored are reviewed. A parameter may be removed from monitoring if the parameter is found to be non-essential for the goals of the project. If parameters are needed for a monitoring purpose, they will be added to the project.

B2: Sampling Methods

Manual sampling from a bridge or boat is conducted on each Monday of the month. When a Monday is a District paid holiday the sampling will be performed on the following Tuesday. Two person teams, each comprised of Pollution Control Technicians or available trained AE Section personnel, perform the sampling under the direction of the Environmental Monitoring Manager.

The twelve locations on the Des Plaines River System are sampled on the first Monday of each month. The five most northern sampling locations on the Chicago River System are sampled on the second Monday of each month. The remaining six locations on the Chicago River System are sampled on the third Monday of each month. The six sampling locations on the Calumet River System are sampled on the fourth Monday of each month. The Lockport sampling location on the powerhouse forebay catwalk is sampled weekly.

The surface water grab samples are collected using a stainless steel bucket. Before the samples are collected using the stainless steel bucket, a calibrated dissolved oxygen probe is lowered into the waterway to a depth of three feet on the upstream side of the bridge at the most central location of the waterway and a field measurement is taken and recorded on the sample collection sheet. The bucket is then lowered into the waterway at the same location as the dissolved oxygen probe. The sampling time is recorded on the sample collection sheet (Appendix II). The bucket is submerged, filled, and then raised to the top of the bridge. The water temperature and pH are measured immediately from the stainless steel bucket using a calibrated pH/temperature probe and recorded on the sample collection sheet. The contents of the bucket are then discarded and the bucket is lowered and refilled as necessary to acclimate the bucket and provide sample for the individual sample aliquots. The sterile sample container for bacterial analysis is filled separately

using a special sampling device in the waterway to prevent contact of the sample with non-sterile surfaces.

There are exceptions to sampling from bridges. Stephen Street (48) is sampled from the District's Pollution Control Boat in the center of the waterway, since the bridge no longer exists. Water samples are also routinely collected from the boat for safety reasons at Cicero Avenue (75) and Harlem Avenue (41) on the Chicago Sanitary and Ship Canal, Route 83 on the Cal-Sag Channel (43), and Ashland Avenue on the Little Calumet River (57). Occasionally, other stations may also be sampled by boat for logistical reasons, including bridge construction or coordination with other special sampling activities.

The individual sample containers are filled in accordance with the sampling procedures described in [Appendix I](#). The individual containers for sample collection are prepared by the laboratory performing the sample analysis. Chemical preservatives as necessary are placed in the containers by the laboratory of origin before sample collection. Specific information regarding sample containers and chemical preservatives is found in [Table 4](#).

Preprinted adhesive sample labels with unique LIMS identification numbers are placed on each container prior to filling. The sampling team completes the sample collection sheet ([Appendix II](#)) in the field as each sample is collected.

B3: Sample Handling and Custody

All sample containers are chilled in an ice-filled cooler immediately after collection and kept in ice during transport to the laboratories except for low level mercury samples.

All water samples are transported to the SAL after collection accompanied by sample collection sheets. An Environmental Chemist, or a Laboratory Technician under the direct supervision of an Environmental Chemist, "receives" the samples into the District's LIMS using a barcode scanner. Each sample is inspected against the laboratory's sample receiving checklist for proper container, proper labeling, sufficient volume, and general appearance. Any missing samples or aliquots are noted on the sample receiving checklist. Sample arrival temperatures are measured using an infrared thermometer calibrated against a NIST traceable certified thermometer ("NIST" is the National Institute of Standards and Technology, United States Department of Commerce), and recorded. Since the time between sampling and arrival at the laboratory is only a few hours, samples may not always reach the 0.1 to 6 degrees Celsius ($^{\circ}\text{C}$) required for thermal preservation. Samples are acceptable if "evidence of chilling" has begun. Samples that require thermal preservation are refrigerated after sample acceptance in the laboratory. Samples for biological and metals analyses are then routed to the appropriate laboratories at the Lue-Hing R&D Complex. Samples for organics analysis are transported to the OCAL at the John E. Egan WRP. The remaining samples for inorganic analysis are received by the SAL. Following sample transfer in LIMS at the SAL, the samples for fluoride, chloride, alkalinity, and sulfate analyses are transported to the Egan Laboratory, and the aliquot for low level mercury analysis is transported to the CAL within 24 hours.

TABLE 4: SAMPLE CONTAINERS AND FIELD PRESERVATION

Parameter	Container and Field Preservation
1. Fecal coliform	125-mL square polypropylene bottle, sterilized and sealed with 0.45 mL of 15% disodium salt of EDTA adjusted to pH of 6.5, and 0.15 mL of 10% sodium thiosulfate. Chill sample with ice. See Appendix I page AI-4 and AI-5 for the correct procedure.
2. General chemistry ¹ (see footnote for parameters)	1-gallon polyethylene bottle. Chill sample with ice.
3. Metals, total	250-mL polyethylene bottle with 2.5 mL conc. HNO ₃ to adjust pH < 2.
4. Metals, dissolved	250-mL polyethylene bottle. Chill sample with ice. (Sample filtered in laboratory with 0.45 μm membrane filter into a 250-mL certified clean polyethylene bottle and acidified with 2.5 mL of conc. HNO ₃ .)
5. Chromium, hexavalent	900-mL certified clean polyethylene bottle. Chill sample with ice.
6. Mercury (low level)	Four 40-mL vials, each with 200 μL BrCl. Do not put sample on ice.
7. Cyanide, total and chlorine amenable	½-gallon plastic bottle with 5 mL 50% NaOH to adjust pH > 12. Chill sample with ice.
8. Phenol	1-quart glass bottle with 2 mL of conc. H ₂ SO ₄ to adjust pH < 2. Chill sample with ice.
9. n-Hexane extractable materials	Two 1-quart glass bottles. Chill sample with ice.
10. Alkalinity	250-mL polyethylene bottle. Chill sample with ice.
11. Sulfate, chloride, and fluoride	250-mL polyethylene bottle. Chill sample with ice.
12. Total phosphorus, total Kjeldahl nitrogen	250-mL polyethylene bottle with 0.5 mL of concentrated 50% sulfuric acid to acidify sample. Chill sample with ice.

TABLE 4 (Continued): SAMPLE CONTAINERS AND FIELD PRESERVATION

Parameter	Container and Field Preservation
13. Ammonia, NO ₂ +NO ₃	250-mL polyethylene bottle, preserved with 0.5 mL of concentrated 50% sulfuric acid upon collection.
14. Carbon, total organic	250-mL polyethylene bottle with 1 mL HCl to adjust pH < 2. Chill sample with ice.
15. Chlorophyll <i>a</i>	1-liter HDPE Nalgene amber, wide-mouth bottle. Chill sample with ice.
16. Volatile organics, BETX (benzene, ethyl benzene, toluene, and xylenes)	Three 40-mL vials with Teflon-lined septum screw caps, each with 25 mg ascorbic acid, filled to top with minimal overflow and no air bubbles. Chill sample with ice.
17. Base/neutral and acid extractable compounds, pesticides, PCBs, OPPs	1-gallon glass with 0.7 mL of 50% sodium thiosulfate solution. Chill sample with ice.

¹General chemistry parameters include total dissolved solids, total suspended solids.

Each laboratory receives the samples by logging them into the laboratory logbook and/or laboratory LIMS. Maximum holding times before analysis, as stated in applicable laboratory method standard operating procedures (SOPs), are adhered to. Parameters of particular concern, because of short maximum holding times, include: bacterial analysis (six hours) and hexavalent chromium (must be preserved within 24 hours).

The sample collection sheets, along with the sample receiving checklist, are retained by the SAL. The pH, temperature, and dissolved oxygen for each field sample are entered into the LIMS by AE Section personnel.

Copies of the sample collection sheets are turned in to the Environmental Monitoring Manager for review. The Environmental Monitoring Manager is responsible for the execution of field operations and corrective actions for field related quality control problems or other nonconformance issues.

B4: Analytical Methods

The analytical methods shown in Table 5 have been selected to meet the minimum measurement criteria presented in Attachment A. Column 1 of Table 5 gives the analytes to be measured, column 2 shows the method to be used by the laboratory, and column 3 the method reference. Except for chlorophyll *a*, all methods used by the District are USEPA approved methods listed in 40 CFR Parts 136, 141, and 145. Approved USEPA methods are not available for the determination of chlorophyll *a*.

Table 6 shows laboratory preservation and maximum holding time from the time of sampling for each analyzed parameter. Column 2 of Table 6 gives the laboratory preservation requirements. The maximum holding time for each parameter is given in column 3 of Table 6. Refrigeration of samples that require thermal preservation is maintained at 4°C, but temperatures in the range of 0.1 to 6°C are considered acceptable. Preservation and maximum holding times are in accord with those given in 40 CFR Part 136.

The laboratory where each analysis will be performed is identified in column 2 of Table 7. Column 3 of Table 7 identifies the laboratory method SOP. The analytical method SOPs are incorporated into this QAPP by reference in column 3 of Table 7. SOPs for analytical methods are available from the responsible Laboratory Manager identified in Section A4.

Attachment A compares the minimum measurement criteria against the RL achieved by the designated District laboratory. All analytes meet the minimum measurement criteria.

All data collected for this project will be reported to the analyte RL. Test results less than the RL will be reported as either zero or as less than the numerical value of the RL.

TABLE 5: ANALYTICAL METHODS

Parameter	Method	Method Reference
Dissolved oxygen	Electrode	SM 4500-O H
Temperature	Electrode	SM 2550 B
pH	Electrode	SM 4500-H ⁺ B
Ammonia nitrogen	Colorimetric	EPA 350.1R.2.0
Ammonia nitrogen, un-ionized ¹	Calculation	
Nitrate and nitrite nitrogen	Colorimetric	EPA 353.2 R.2.0
Kjeldahl nitrogen	Colorimetric	EPA 351.2 R.2.0
Phosphorus, total	Colorimetric	EPA 365.4
Sulfate	Ion Chromatography	EPA 300.0
Total dissolved solids	Gravimetric	SM 2540 C
Suspended solids	Gravimetric	SM 2540 D
Volatile suspended solids	Gravimetric	SM 2540 E
Alkalinity	Titration	SM 2320 B
Chloride	Ion Chromatography	EPA 300.0
Fluoride	Ion Chromatography	EPA 300.0
Organic carbon, total	UV-Oxidation	SM 5310 C
Phenol	Colorimetric	EPA 420.2
Cyanide, total	Colorimetric	EPA Kelada-01
Cyanide, chlorine amenable	Colorimetric	SM 4500-CN G
Barium, total	ICP-MS	EPA 200.8
Boron, total	ICP-MS	EPA 200.8
Calcium, total	ICP-OES	EPA 200.7
Chromium, trivalent ²	ICP-MS	EPA 200.8
Chromium, hexavalent	Colorimetric	EPA 218.6
Magnesium, total	ICP-OES	EPA 200.7
Manganese, total	ICP-MS	EPA 200.8
Mercury, low-level, total; General Use	Cold vapor AFS	EPA 1631 E
Selenium, total	ICP-MS	EPA 200.8
Silver, total	ICP-MS	EPA 200.8
Arsenic, dissolved	ICP-MS	EPA 200.8
Cadmium, dissolved	ICP-MS	EPA 200.8
Chromium, dissolved	ICP-MS	EPA 200.8
Copper, dissolved	ICP-MS	EPA 200.8
Iron, dissolved	ICP-MS	EPA 200.8
Lead, dissolved	ICP-MS	EPA 200.8
Nickel, dissolved	ICP-MS	EPA 200.8
Silver, dissolved	ICP-MS	EPA 200.8
Zinc, dissolved	ICP-MS	EPA 200.8
Fecal coliform	Membrane	SM 9222 D

TABLE 5 (Continued): ANALYTICAL METHODS

Parameter	Method	Method Reference
n-Hexane extractable materials	Gravimetric	EPA 1664, Rev. A
Chlorophyll <i>a</i>	Colorimetric	SM 10200 H
BETX (benzene, ethyl benzene, toluene, xylenes)	Purge and trap GC/MS	EPA 624
Organic Priority Pollutants		
Volatile organic compounds	Purge and trap GC/MS	EPA 624
Base/neutral and acid-extractable compounds	GC/MS	EPA 625
Pesticides	GC/ECD	EPA 608
PCBs	GC/ECD	EPA 608

¹Calculated from pH, temperature, and ammonia nitrogen.

²Trivalent chromium measured as total chromium.

TABLE 6: LABORATORY PRESERVATION AND
MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation ^{1,2}	Maximum Holding Time
Dissolved oxygen	NA	NA ³
Temperature	NA	0.25 hours
pH	NA	0.25 hours
Ammonia nitrogen	(a) Refrigerate, (b) with H ₂ SO ₄ to pH < 2	24 hours, 28 days
Ammonia nitrogen, un-ionized ⁴	NA	NA
Nitrate and nitrite nitrogen	(a) Refrigerate, (b) with H ₂ SO ₄ to pH < 2	24 hours, 28 days
Kjeldahl nitrogen	(a) Refrigerate, (b) with H ₂ SO ₄ to pH < 2	24 hours, 28 days
Phosphorus, total	(a) Refrigerate, (b) with H ₂ SO ₄ to pH < 2	24 hours, 28 days
Sulfate	Refrigerate	28 days
Total dissolved solids	Refrigerate	7 days
Suspended solids	Refrigerate	7 days
Volatile suspended solids	Refrigerate	7 days
Alkalinity	Refrigerate	14 days
Chloride	None required	28 days
Fluoride	None required	28 days
Organic carbon, total	Refrigerate, HCl to pH < 2	28 days
Phenol	Refrigerate, H ₂ SO ₄ to pH < 2	28 days
Cyanide, total	Refrigerate, NaOH to pH > 12	14 days
Cyanide, chlorine amenable	Refrigerate, NaOH to pH > 12	14 days
Chromium, hexavalent	(a) Refrigerate, (b) with (NH ₄) ₂ SO ₄ + NH ₄ OH solution and NaOH to pH 9.3–9.7	24 hours, 28 days
Metals, total (excluding mercury)	HNO ₃ to pH < 2	6 months
Mercury, low-level, total	BrCl	90 days
Metals, dissolved (excluding mercury)	Filter, HNO ₃ to pH < 2	6 months
Fecal coliform	Refrigerate	6 hours
n-Hexane extractable materials	Refrigerate, H ₂ SO ₄ to pH < 2	28 days
Chlorophyll <i>a</i>	Refrigerate	30 days

TABLE 6 (Continued): LABORATORY PRESERVATION AND
 MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation ^{1,2}	Maximum Holding Time
BETX (Benzene, ethyl benzene, toluene, xylenes)	Refrigerate	7 days
Organic priority pollutants	Refrigerate	7 days

NA = Not applicable.

¹All samples stored in ice after collection and in transport to laboratory except for low-level mercury.

²Refrigeration at 4°C.

³Dissolved oxygen measured in situ.

⁴Calculated from pH, temperature, and ammonia nitrogen.

TABLE 7: RESPONSIBLE LABORATORIES AND METHOD STANDARD OPERATING PROCEDURE IDENTIFICATION

Parameter	Laboratory	Method SOP ID
Dissolved oxygen	Field measurement	HQd Oper. Instr.
Temperature	Field measurement	YSI Pro10 Oper. Instr.
pH	Field measurement	YSI Pro10 Oper. Instr.
Ammonia nitrogen	SAL	ST-EPA 350.1
Ammonia nitrogen, un-ionized ¹	Calculation	NA
Nitrate and nitrite nitrogen	SAL	ST-EPA 353.2
Kjeldahl nitrogen	SAL	ST-EPA 351.1
Phosphorus, total	SAL	ST-EPA 365.4
Sulfate	EAL	JE-EPA 300.0
Total dissolved solids	SAL	ST-SM 2540 C
Suspended solids	SAL	ST-SM 2540 D, E
Volatile suspended solids	SAL	ST-SM 2540 D, E
Alkalinity	SAL	ST-SM 2320 B
Chloride	EAL	JE-EPA 300.0
Fluoride	EAL	JE-EPA 300.0
Organic carbon, total	IWAL	IW-SM5310B
Phenol	IWAL	IW-EPA 420.4
Cyanide, total	IWAL	IW-EPA-Kelada-01 & SM4500-CN G
Cyanide, chlorine amenable	IWAL	IW-EPA-Kelada-01 & SM4500-CN G
Chromium, hexavalent	IWAL	IW-EPA 218.6
Metals, total and dissolved (except mercury)	SAL	ST-EPA 200.8 & ST-EPA 200.7
Mercury, Low-Level	CAL	CA-EPA 1631E
Fecal coliform	AML	IW-EPA 1664-A
n-Hexane extractable materials	IWAL	SOPEPA624
Chlorophyll <i>a</i>	AE	SOPEPA624 ²
Benzene, ethyl benzene, toluene, xylenes	OCAL	SOPEPA625 ³
Organic priority pollutants	OCAL	SOPEPA608 ⁴

¹Calculated from pH, temperature and ammonia nitrogen.

²Volatile organic compounds.

³Base/neutral and acid extractable compounds.

⁴Pesticides and PCBs.

B5: Quality Control

Field blanks will be used to evaluate the potential for contamination from a source not associated with the sample collected. Each sampling team will prepare field blanks for the appropriate parameters at a sampling location on the day of sampling. AE will review the field blank test results. Whenever significant contamination (greater than twice the reporting limit of any constituent) is found, AE will initiate an investigation and implement the necessary corrective actions.

The individuals responsible for verification that proper procedures are followed in matters concerning sampling methods, sample preservation, and sample custody to the delivery of samples to the SAL will be the Environmental Monitoring Manager and his/her supervisor. For more information please see sections B2: Sampling Methods, B3: Sample Handling and Custody, and C1: Assessment and Response Actions. For any quality control or other nonconformance issue, the Environmental Monitoring Manager will submit an investigation and corrective action report to the Project Manager, who will send copies to the persons listed on the approval page.

It shall be understood that all measurements, regardless of the sample concentration, must have known and satisfactory accuracy and precision. Because various analytical procedures will be employed for sample analysis, specific criteria for accuracy and precision will not be provided in this document. Rather, satisfactory accuracy and precision shall be considered to be that which is consistent with the USEPA approved methods used to analyze the samples. All measurements must be derived in an environment of an adequate quality control program including statistical process control wherever applicable. The laboratory Quality Assurance Manuals (QAMs) and laboratory SOPs should be referred to for specific information relating to quality control. The AML and each section of ALD have successfully maintained accredited status as certified by the IDPH and/or the IEPA following TNI standards.

The individuals responsible for verification that analytical methods and other laboratory procedures are being properly executed are the Laboratory Managers. The Laboratory Managers are also responsible for the reliability of project analytical data. For any quality control or other nonconformance issue that may have affected the reliability of project data, the responsible Laboratory Manager will submit an investigation and corrective action report to the Project Manager, who will send copies to the persons listed on the approval page.

B6: Instrument/Equipment Testing, Inspection, and Maintenance

All instrumentation and equipment used in the laboratory are maintained as required by the manufacturer's manuals and the laboratory SOPs.

Each laboratory is responsible for maintaining an adequate supply of spare parts to perform normal maintenance procedures. The three regional WRPs, at which the participating laboratories are located, maintain storerooms where frequently used supplies and consumables are inventoried. Major laboratory instrumentation is covered by maintenance/service contracts with qualified

service representatives. Each laboratory also has an account to purchase any needed parts or consumables not inventoried in the WRP storeroom or in an emergency or other unforeseen situation.

The YSI Model Pro10 handheld pH/temperature meters and HACH Model HQ30d handheld dissolved oxygen meters (or similar model) used for field measurements are maintained by the AE Section and routine maintenance is performed as needed. These instruments are calibrated for pH and dissolved oxygen in the laboratory before use. Calibration records are kept by the AE laboratory. Sample collection personnel sign out a calibrated instrument on the day of sampling and return it on the same day after sampling. The meter operation and calibration are checked when each instrument is returned to the laboratory. The temperature calibration is verified at least annually against a NIST traceable thermometer. The SAL is responsible for securing service from qualified service representatives as needed.

B7: Instrument Calibration and Frequency

All instrumentation used for testing shall be calibrated each day of use as directed by manufacturer's manuals and laboratory SOPs. General guidelines and requirements regarding calibration of laboratory equipment are contained in the laboratory SOPs. Laboratories that participate in an accreditation program also will comply with the requirements for calibration maintained by the accreditation program.

All instrumentation is uniquely identified by serial number or other means. Wherever possible, NIST traceable standards are used for calibration of instruments. Calibration records are kept each time laboratory instrumentation and equipment are calibrated, and the calibration records and quality control samples are unmistakably identified for each batch of test results.

B8: Inspection/Acceptance of Supplies and Consumables

Supplies and consumables shall be inspected by the laboratories and accepted in accordance with all laboratory procedures and specifications contained in laboratory QAMs or SOPs. The laboratory section supervisors are responsible for verifying that supplies and consumables meet the specifications contained in the method SOPs.

B9: Non-direct Measurements

Non-direct measurements are not required for this project.

B10: Data Management

The District maintains several networked servers. The network may be accessed by personal computers and workstations from any District facility. Computer software used for this

project includes a fully networked LIMS and Excel[®] software and SAS[®] software on selected workstations. The Thermo LabSystems SMW (SampleManager for Windows) version 10.2.0.0 is customized to incorporate procedures employed at District laboratories. The District LIMS supports numerous features including: barcode usage, prelogging of samples by either the sample submitter or laboratory personnel, label generation, sample login, sample receiving of prelogged samples, sample batching, instrument interfacing, manual data entry, automated calculations, control limit checking for each laboratory control sample, control chart maintenance, National Pollutant Discharge Elimination System (NPDES) limit checking, industrial waste limit checking, facilitated data handling, and data reporting. The LIMS is utilized by all laboratories participating in this project.

Most Ambient Water Quality Monitoring (AWQM) analytical data have resided in the District LIMS since 1996. Historical data back to 1970 are stored in Excel[®] spreadsheet files and SAS[®] files.

As the waterways are sampled routinely, the samples are prelogged into the District's LIMS. The Environmental Monitoring Manager generates sample labels for sample containers before sample collection. The labels contain information including sample location, sample type, and unique sample ID with barcode. Each sample container has a unique sample ID comprised of the sample number and aliquot designation.

The AML, AE, and the OCAL follow documented procedures for sample login, sample acceptance, analysis, and data verification. Test data from the AML and AE are manually entered into LIMS, while OCAL data is automatically uploaded from instrument to LIMS.

While the SAL employs the most computerized system for sample tracking and data handling, all participating laboratories follow similar procedures. The analyst assigned to receive the samples in the SAL uses a barcode scanner to log as received the "general chemistry" samples. All samples are checked and any missing sample containers are noted in the sample log. The analyst checks to make certain that sample acceptance criteria, including appropriate sample containers and thermal preservation, are satisfactory.

After the laboratory receives the samples, sub-samples are poured as required. The samples are then distributed to the appropriate analytical sections for analysis. As analyses are completed, the test results are entered into the LIMS generally by data file upload from the laboratory instrument. Test results are reviewed and verified by each analytical section supervisor.

Retesting for analytes is only done for a confirmed Quality Assurance/Quality Control (QA/QC) problem in the execution of analysis. No retesting will be performed on the basis of exceeding regulatory limits without consulting first with the sample submitter for information about any unusual conditions that would corroborate the test results. When such information is not available and a retest is requested, the sample submitter's authorization to conduct the retest should be in writing for documentation purposes. In those instances where retesting is performed for reasons other than a QC failure, then the highest confirmed value is reported unless otherwise

specified above.

As sample analyses in the AML and ALD Laboratories are completed, the approved test data are collected from the LIMS database and transferred into an Excel[®] spreadsheet on a monthly basis. The Excel[®] spreadsheet includes all parameters, except for organics data, which are compiled in separate spreadsheets. Generally, analytical data from any month is expected to be completed and available to data users within 30 days after the end of that month.

The quarterly spreadsheet from the AML and ALD laboratories is checked by the LIMS Manager for completeness and atypical test data. When atypical test data are found, they are reported to the Project Manager for further investigation.

Annually, following final approval of all project data from the previous year, an Excel[®] spreadsheet file is sent to the SAS[®] Database Manager who creates a SAS[®] file from the Excel[®] spreadsheet. SAS[®] is the statistical analysis software used to analyze the data.

The Project Manager will ensure that an Excel[®] spreadsheet containing all approved project data from the previous year will be posted on the District's website by April 1 of the following year. The IEPA Division of Water Pollution Control Permit Section Manager will be notified by letter when this data is available online.

Project data will also be submitted on a biannual basis to the IEPA Quality Assurance Officer for their 305b Integrated Water Quality Report analysis. The Project Manager will consult the IEPA's website in order to comply with the data submittal due date and format requirements.

GROUP C: ASSESSMENT AND OVERSIGHT

C1: Assessment and Response Actions

Random surveillance of a sampling team is conducted by the Environmental Monitoring Manager to verify that water samples are being collected properly and sampling procedures are followed. The results of each surveillance are documented by the Environmental Monitoring Manager. As stated in Section B5, the Environmental Monitoring Manager and his/her supervisor will submit investigation and corrective action reports for all quality control and other nonconformance problems dealing with field procedures to the Project Manager with copies to the persons listed on the approval page of this QAPP.

All laboratories maintain internal quality control programs that are described in their QAMs. The ALD Laboratories maintain statistical process control for most analytical procedures. Laboratory assessment activities require investigation and corrective actions for all quality control problems and other nonconformance issues. As stated in Section B5, when the reliability of project data may have been affected by a quality control problem or other nonconformance issue, the responsible Laboratory Manager will submit a copy of the investigation and corrective action report to the Project Manager with copies to the persons listed on the approval page of this QAPP.

Also, the responsible Laboratory Manager shall make certain that the project data associated with any quality control or other nonconformance issue is made available to data users with the appropriate data qualification. When data previously released to data users may have been affected by a quality control problem or other nonconformance issue, the Manager shall notify data users of the problem and put in the appropriate data qualifiers in databases used by the District for storage of project data.

The SAL, CAL, EAL, and IWAL participate in two proficiency-testing studies each year. These proficiency studies are the semi-annual Water Pollution Study where data from the first study is combined with the National Pollutant Discharge Elimination System (NPDES) Discharge Monitoring Report Quality Assurance (DMR-QA) Study. The AML participates in Water Supply (WS) performance test samples that are analyzed every 12 months for fecal coliform bacteria to maintain IDPH certification and as part of the NPDES permit required DMR-QA microbiology study. Systematic investigations are conducted for all unacceptable results. The investigation and corrective action reports prepared by the Laboratory Manager and his/her staff are reviewed by the Assistant Director of M&R, by the QA Coordinator, and often by the Director of M&R.

The Organic Compounds Analytical Laboratory participates in two proficiency-testing studies each year and conducts investigations for unacceptable results in a manner similar to that followed by the other ALD Laboratories.

The AML is certified by the IDPH and must successfully pass a biannual on-site audit conducted by the IDPH.

All ALD laboratories as a requirement of their accreditation are audited annually by their Quality Assurance Coordinator and biannually by the IEPA.

C2: Reports to Management

The Project Manager will receive all investigation and corrective action reports concerning quality control problems and other nonconformance issues from field personnel and participating laboratories.

Project-related systems audits or special data quality assessments are undertaken on a random basis.

GROUP D: DATA VALIDATION AND USABILITY

D1: Data Review, Verification, and Validation

The laboratory data are reviewed and verified as described in Section B10, Data Management. The SAS[®] Database Manager also reviews the data after it is transferred into the SAS[®] software. If errors are discovered, he reports them to the Project Manager for investigation and resolution.

D2: Verification and Validation Methods

Sample collection records can be verified by the Environmental Monitoring Manager identified in Section A4. Laboratory data shall be verified as necessary by the LIMS Manager identified in Section A4 and the Laboratory Manager of the laboratory that produced the data. All field and laboratory records will be kept for a minimum of five years. Laboratory records that are stored include calibration data, raw data, bench records, and data for quality control samples.

When verification of data results in a change to the project-related data, the Project Manager shall inform data users of the problem and make certain that all databases known to contain the affected data are corrected as necessary.

The person designated as the Project Manager (Section A4) has all calculations used for checking applicable IPCB water quality standards. She should be consulted regarding any questions pertaining to compliance with water quality standards and the reporting of data.

The Project Manager and the QA Officer shall be informed of all situations where data integrity has been found compromised by errors including storage of incorrect data or the corruption of stored data. All responsible persons identified in Section A4 and all known data users shall be informed of data problems when they are discovered and the corrective action taken. The QA Officer shall prepare the disclosure report for distribution.

D3: Reconciliation with User Requirements

The QAPP shall govern the operation of the project at all times. Each responsible person shall adhere to the procedural requirements of the QAPP and ensure that subordinate personnel do likewise.

This QAPP shall be reviewed annually by the Project Manager to ensure that the project will achieve all intended purposes. The annual review shall address every aspect of the program including:

1. The adequacy and location of sampling stations.
2. The adequacy of sampling frequency at each location.
3. Sampling procedures.
4. The appropriateness of parameters monitored.
5. Changes in data quality objectives and minimum measurement criteria.
6. Whether the data obtained met minimum measurement criteria.
7. Analytical procedures.
8. Annual data submittal to IEPA and posting on-line.
9. Corrective actions taken during the previous year for field and laboratory operations.
10. Coordination of the project with the IEPA.
11. Review of other user requirements and recommendations.

It is expected that from time to time, ongoing and perhaps unexpected changes will need to be made to the project. Significant changes or deviations in project operation shall not be made without authorization by the Project Director. The Project Manager should be consulted if an operational change is necessary. Data users and other interested persons may also suggest changes to the project to the Project Manager.

The Project Manager shall evaluate the need for the change, consult with other responsible persons as appropriate, and make a recommendation to the Project Director for approval of significant changes (such as changes in sampling locations or frequency). The Project Manager shall, in a timely manner, inform the appropriate project personnel of approved changes in project operation. The Project Manager shall be responsible for the implementation of changes to the project and shall document the effective date of all changes made.

Following Project Director approval, a memorandum documenting each authorized significant change shall be prepared by the Project Manager and distributed to those on the approval list, as well as the Assistant Directors of the M&R Department. Approved changes shall be considered an amendment to the QAPP and shall be incorporated into the QAPP when it is updated.

The Project Manager will prepare a QAPP update if major changes have taken place.

REFERENCES

Standard Methods for the Examination of Water and Wastewater. Prepared jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation. Published online at <https://smww.aphapublications.org/>. Accessed October 26, 2018.

State of Illinois Rules and Regulations, Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter I: Pollution Control Board. Published online at <https://pcb.illinois.gov/SLR/PCBandIEPAEnvironmentalRegulationsTitle35>. Accessed November 1, 2018.

AMBIENT WATER QUALITY MONITORING PROJECT QUALITY ASSURANCE
PROJECT PLAN

APPENDIX I: SAMPLING PROCEDURES

WATERWAY SAMPLING

Bridge Sampling Procedures

1. Before sample collection day, scrub the stainless steel sampling bucket, stirrers, and DO sampling device with a solution of noninterfering residue-free critical cleaning liquid detergent and water. Rinse with de ionized water.
2. Samples should be collected from the upstream side of the bridge.
3. Before lowering any object such as a probe or bucket into the waterway, look both upstream and downstream to ensure there are no recreators, boats, or other obstructions below or approaching the bridge.
 - a. When encountering recreators on the water, wait for them to pass. Allow them to clear the area with enough space so there is no risk of collision before attempting to take a sample.
 - b. Give a warning blast with the provided air horn to alert possible recreators that you will be lowering an object into the waterway.
4. Samples may be collected from the District's Pollution Control (PC) boats if approved by the Environmental Monitoring Manager, when circumstances deem necessary. Boat sampling should not be performed in areas where sediment could be disturbed. When sampling from a District PC boat, the following steps should be followed:
 - a. Ensure the PC boat is in the correct location and the engines/motors are in idle.
 - b. Communicate with the Patrol Boat Operator to ensure it is safe to collect the sample.
 - c. Collect the sample from the side of the PC boat, away from the propellers and exhaust.
5. Take the samples from a representative location at the center of the river at the deepest point. DO NOT SAMPLE FROM THE BANK OF THE WATERWAY.
6. If boat traffic is encountered when sampling from a navigable body of water, delay sampling until the unnatural turbulence caused by the vessel's wake subsides. Indicate in the "Remarks" section of the sample collection sheet that sampling was interrupted due to a passing vessel.
7. Upon arrival at each prescribed sampling location, the following steps should be followed:
 - a. Collect samples routinely collected from pail. See Section A.

- b. Collect DO and bacterial samples with modified DO sampler. See Section B.
 - c. When required, collect field blanks from pail. See Section C.
 - d. When required, collect organics samples from pail. See Section D.
8. Complete the sample collection sheet as appropriate at each sampling location.
- a. Sample collection date.
 - b. Sampler's name(s).
 - c. Weather conditions during sampling (Example: Clear, Cloudy, Rain, Snow, Air Temperature, if possible).
 - d. Type of aliquots obtained.
 - e. Time aliquots were obtained.
 - f. Sample dissolved oxygen as obtained with the handheld meter.
 - g. Sample pH as obtained with the handheld meter.
 - h. Sample temperature as obtained with the handheld meter.
 - i. Sample storage temperature.
 - j. In the "Remarks" column, describe visual observation of sample (Clear, Semi Clear, Lt. Sed., etc.), indicate if there was any passing boat traffic and any unusual observations of the waterway quality, such as oil, discoloration, or debris. Also provide the LIMS number.
 - k. At the bottom of the collection sheet, a space is available for additional remarks.
9. Upon completion of the sampling assignment, immediately transport the samples to the laboratory for analysis.
10. Upon relinquishing the samples to the laboratory analyst, record the following pertinent information on the sample collection sheet to complete chain of custody requirements (Appendix II).
- a. Signature of transporter.
 - b. Signature of the person who relinquished the sample.
 - c. Signature of the laboratory analytical staff member who received the sample.
 - d. Time sample relinquished.

Section A: Routine Samples Collected in Pail

1. Using the handheld dissolved oxygen meter, lower the probe into the river/stream. Allow the probe to acclimate for one minute before obtaining a dissolved oxygen reading.
2. Properly identify (label) each sample container and arrange in order specified on sample trays.
3. Lower the clean stainless steel bucket into the river/stream water. Retrieve the bucket and immediately obtain a pH and temperature reading with the handheld meter.
4. Empty the bucket, lower and retrieve it two more times rinsing thoroughly to acclimate it to the waterway.
5. When sampling during precipitation events (rain or snow), cover the sample bucket at all times with the lid provided, except when the bucket is being raised or lowered from the bridge.
6. Whenever the sampling bucket is being raised or lowered from the bridge, give special attention to ensure there is no contact with the bridge structure. If there is contact, discard the sample and start over. Also, make sure that the rope does not come in contact with the ground. Place the rope into the gray, plastic container.
7. Only after acclimating the sampling bucket three times should the actual sample be obtained. After the sample is obtained, stir the sample with the stirring rod 5x in one direction and then 5x in the other direction. Pour it into the individual sample aliquot bottles filling the aliquot bottles half way from right to left. Then stir the sample water in the bucket with the same procedure as above to ensure a homogeneous distribution of suspended solids and finish filling the bottles from left to right.
8. Samples to be collected and order in trays:
 - a. General chemistry sample: 1 gallon (wide mouth plastic) container.
 - b. Alkalinity, chloride sample: plastic 250 mL container, fill to shoulder.
 - c. Cyanide sample: fill the plastic half gallon container (containing 5 mL of 50% NaOH preservative) to shoulder.
 - d. Phenol sample: fill the glass sample bottle to the shoulder; exercise CAUTION as bottle contains 2 mL of sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative.
 - e. Dissolved metals sample: fill a 250 mL clean, plastic bottle.
 - f. Total organic carbon: fill a 250 mL plastic bottle.
 - g. Trace metals sample: fill 8 oz. plastic bottle. Leave approximately 1/4 inch air space at top of bottle. NOTE: The bottle contains 2 mL of nitric acid. (Overfilling may cause a loss of preservative.)
 - h. Sulfate: fill a 250 mL square plastic bottle.

- i. Total Phosphorus, Total Kjeldahl Nitrogen: fill a 250 mL plastic bottle to the shoulder; exercise CAUTION as bottle contains 0.5 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative
 - j. Fluoride: fill a 250 mL plastic bottle to the shoulder.
 - k. Ammonia, NO₂+NO₃: fill a 250 mL polyethylene bottle to the shoulder; exercise CAUTION as bottle contains 0.5 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative.
 - l. Chlorophyll *a*: fill an opaque, brown 1 liter bottle (obtained from Room LE213). Leave approximately 1/2 inch air space at top of bottle.
 - m.n-Hexane extractable materials sample: fill two glass quart jars.
8. After all the sample aliquots have been poured off, rinse the sample bucket and stirring rod with deionized water.
 9. Place each sample aliquot into the 72-quart thermal ice chest filled from 1/3 to 1/2 full of ice cubes. Ensure the sample bottles are surrounded in ice.

Section B: Bacterial Samples

The bacterial sample is collected using a specialized sampler that has been modified to hold the bacterial sample container. The bacterial sample is collected as follows:

1. The bacterial container is a sterilized 4 oz. plastic bottle with foil covered plastic screw cap.
2. Do not open bacterial bottle until sampling, and replace foil covered plastic cap as soon as possible.
3. Care should be taken not to touch the neck or the mouth of the bacterial bottle, or the inside of the plastic cap to prevent contamination of the sample.
4. Insert bacterial bottle into the compartment attached to the outside of the sampling device making sure not to allow the top of the bottle to touch any part of the sample can.
5. Slowly lower the sampling device with the bacterial bottle into the waterway to the depth of approximately 3 feet from the surface.
6. Raise the sampling device when all the air bubbles have stopped rising.
7. Remove the bacterial bottle from the sampling device.

8. Obtain a second bacterial bottle, label, and then remove the foil-covered cap without removing the foil from the cap.
9. Care should be taken not to touch the neck or the mouth of the bottle, or the inside of the plastic cap to prevent contamination of the sample.
10. Pour the aliquot obtained with the sampling device into the second bacterial bottle. Fill the bottle approximately 80 percent full. DO NOT OVERFILL.
11. Close the bottle with the foil-covered cap and place the sample into the cooler on ice
12. Return the bacterial bottle used to collect the sample to the Microbiology Laboratory.
13. Place the sample into the cooler on ice.
14. Complete appropriate entries on sample collection sheet.

Section C: Field Blanks

Field blank assessments will be conducted on a quarterly basis at sampling locations at the end of each sampling trip as determined by the Environmental Monitoring Manager. A minimum of one sample for each sampling trip will be collected. Field blanks are used to verify the proper decontamination of field sampling equipment between sampling locations. Field blanks will be analyzed, and any sample result that is greater than twice the reporting limit will be considered to have significant contamination. Following a result of significant contamination, an investigation to determine the source of the contamination will be conducted by the Environmental Monitoring Manager, and corrective action will be taken. Field blanks are prepared as follows:

1. Properly identify (label) each sample container and arrange in order specified on sample trays.
2. Fill the stainless steel bucket two-thirds full with reagent water obtained from the laboratory.
3. Proceed with the filling of the sample containers as is done in Section A, refilling the bucket as necessary to fill all sample containers.
4. Place samples into cooler on ice.
5. Complete sample collection sheet as appropriate.

Section D: Organics Samples

Organic priority pollutants (OPP) and BETX (benzene, ethylbenzene, and total xylenes) samples are collected as follows:

1. The amber-colored glass containers provided by the OCAL must be used for BETX and OPP samples. These containers contain a preservative and should not be rinsed prior to filling.
2. OPP samples require one (1) gallon bottle and three (3) vials per sampling location.
3. BETX samples require three (3) vials per sampling location.
4. Each sampling team will transport a clearly marked, "Trip Blank" sample, consisting of two (2) amber vials filled with Milli-Q de-ionized water, with the other organic samples collected during the sampling trip.
5. Obtain a water sample in the stainless steel pail and fill sample containers.
6. When filling the containers care should be taken to minimize air bubbles in the sample container. Gallons and vials are to be filled to the top with minimal overflow. A slight bulge of water at the neck of the container caused by surface tension should be evident at the time the cap is tightened to ensure elimination of excess air.
7. Place samples into cooler on ice.
8. Complete sample collection sheet as appropriate.
9. After transport to the laboratory, store the samples in the laboratory cooler for later transportation to the Organic Compounds Analytical Laboratory.

Section E: Low Level Mercury Samples

Low level Mercury (LLHg) samples and equipment blanks are collected as follows:

1. Obtain the labeled LLHg sampling kit provided by CAL. The sampling kit contains two pairs of clean gloves, three 40 mL empty sample vials, two empty 40 mL equipment blank vials, and two 40 mL equipment blank vials filled with reagent water.
2. Do not expose the sample to anything that may contain significant amounts of mercury. Potential contamination sources: Sampling equipment, bailers, sampling tubing (including peristaltic pump tubing), gloves, clothing, bottles, exhaled breath from mercury amalgam fillings, precipitation, dirt, dust and airborne vapor.
3. Collect LLHg samples according to the following procedure:
 - a. Obtain a water sample in the stainless steel pail.
 - b. Sampler #1: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample.
 - c. Sampler #2: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample. Do not touch anything that may contaminate your gloves.
 - d. Sampler #1: Set up sampling equipment, open cooler, remove double bagged bottle kit from cooler and its bubble pack bag, open outer bag and hold it open so sampler #2 can reach inside.
 - e. Sampler #2: Do not touch the outer bag. Open the inner bag, remove one 40 mL vial from the bag, remove the cap and fill with water sample to the top, screw cap onto vial and return filled vial to the innermost bag. There is no need to rinse the bottle or add a preservative. Repeat until 4 vials have been filled from the same sampling point. Close the zip lock seal most of the way, squeeze the inner bag to expel most of the air, complete the seal, push the inner bag inside the outer bag.
 - f. Sampler #1: Close the outer bag zip lock seal most of the way, squeeze the bag to expel most of the air, complete the seal. Place the double bagged bottle kit in the bubble pack bag, remove the adhesive strip cover and seal the bubble bag closed. Place the kit in the cooler. NOTE: LLHg samples should not be placed on ice.
4. Collect LLHg equipment blanks according to the following procedure:
 - a. Sampler #1: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample.

- b. Sampler #2: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample. Do not touch anything that may contaminant your gloves.
 - c. Sampler #1: Open cooler, remove double bagged kit labeled equipment blank bottle kit from cooler and its bubble pack bag, apply client label to the outer zip lock bag, open outer bag and hold it open so the clean hands person can reach inside.
 - d. Sampler #2: Do not touch the outer bag. Open the inner bag, remove one full 40 mL vial from the bag, and one empty 40 mL vial, remove the caps and pour the reagent water from one vial into the other under the same conditions to which regular samples were exposed, screw caps onto vials and return filled vial to the innermost bag discard the empty vial. There is no need to rinse the bottle or add a preservative. Repeat until 2 vials have been filled. There is an extra filled reagent water vial in case a spill occurs, discard if not needed. Close the zip lock seal most of the way, squeeze the inner bag to expel most of the air, complete the seal, push the inner bag inside the outer bag.
 - e. Sampler #1: Close the outer bag zip lock seal most of the way, squeeze the bag to expel most of the air, complete the seal. Place the double bagged bottle kit in the bubble pack bag, remove the adhesive strip cover and seal the bubble bag closed. Place the kit in the cooler. NOTE: LLHg equipment blanks should not be placed on ice.
5. Complete sample collection sheet as appropriate.

Materials Required for Sampling

- 1. Labels: generated adhesive-backed labels with identifying LIMS barcode.
- 2. Bottles (per station; note: a field blank will require an additional set of sample containers a through l).
 - a. Gallon (polyethylene) – General chemistry.
 - b. 250 mL rectangular (polyethylene) – Alkalinity, chloride.
 - c. 1/2 Gallon (polyethylene) – Cyanide.
 - d. Quart (glass) – Phenol.
 - e. 250 mL regular (polyethylene) – Dissolved metals.
 - f. 250 mL rectangular (polyethylene) – Total organic carbon.
 - g. 8 oz. (polyethylene) – Trace metals (total).

- h. 250 mL rectangular (polyethylene) – Sulfate and Fluoride.
 - i. Two quarts (glass) – n Hexane extractable materials (2).
 - j. 250 mL rectangular (polyethylene) Total Phosphorus, Total Kjeldahl Nitrogen, Ammonia, NO₂+NO₃.
 - k. Mercury Kit (General Use waters only; see Appendix I, Section E).
 - l. 1 liter brown, opaque (plastic) – Chlorophyll *a*.
 - m. Two 4 oz. (polypropylene w/foil covered stopper) – Fecal coliform.
 - n. Three 40 mL vials (amber colored glass) – BETX.
 - o. Three 40 mL vials (amber colored glass); and 1 gallon (glass) – Organic priority pollutants.
3. Sampling Devices.
- a. 13-quart stainless steel bucket and lid.
 - b. Stainless steel special sampling device. Attached to this device is a stainless steel holder for a bacti bottle.
 - c. Portable handheld electronic dissolved oxygen meter.
 - d. Portable handheld electronic pH and temperature meter.
 - e. Sufficient length of 3/8 inch nylon rope (approximately 100 feet).
4. Miscellaneous.
- a. Waterway Field Collection Sheet, for locations to be sampled.
 - b. 72 quart ice chests as needed.
 - c. Ice.
 - d. Gray plastic container for storage of sampling rope during sampling events.
 - e. Wood tray to hold sample bottles with each compartment labeled with name of the sample bottle in the order the aliquot will be poured off.
 - f. Stainless steel stirring rod.
 - g. Two carboys of reagent water.

Safety

1. Always wear appropriate personal protective equipment while sampling such as:
 - a. Gloves, eye protection, long pants, closed-toed shoes, personal flotation device, and high-visibility vest.
2. Use proper lifting technique to avoid injury. Take breaks when necessary and work as a team to distribute work evenly.
3. Be prepared for the weather conditions and dress appropriately.
 - a. Drink plenty of water
 - b. Apply sunscreen.
 - c. Wear light clothes during hot weather and dress in warm layers during cold weather (District-issued uniform).
 - d. Wear rain gear during wet weather.
4. Be aware of road conditions and take necessary precautions to avoid accidents.
5. When sampling during winter months, do not attempt to sample if the waterway is frozen. Do not walk on the ice. Indicate the circumstances on the sample collection sheet.
6. When sampling from a bridge, be aware of the following safety concerns:
 - a. DO NOT park District vehicle on a bridge. Attempt off-road parking, if possible.
 - b. Use rotating lights on the vehicle when stopped.
 - c. When parking on the road, use safety cone markers.
7. When sampling from one of the District's Patrol boats, be aware of the following safety concerns:
 - a. Adhere to all the Section 126 rules regarding PC boat crew safety.
 - b. Wear the issued personal floatation device.
 - c. Be aware of deck conditions. Spray from the boat can cause the deck to become wet and slippery in during warm weather and icy during cold weather.
8. Sampling may be cancelled due to road/bridge closures or if weather conditions are determined to be dangerous such as: extreme heat, extreme cold, icy conditions, excessive fog, or any other conditions determined by the Environmental Monitoring Manager.

AMBIENT WATER QUALITY MONITORING PROJECT QUALITY ASSURANCE
PROJECT PLAN

APPENDIX II: SAMPLE COLLECTION SHEET

#1 WEEK 4

Calumet, Little Calumet, Cal-Sag Watershed

DATE COLLECTED: _____

COLLECTED BY: _____

WEATHER: _____

WW Number	LOCATION	TIME	TEMPERATURE °C	GEN. CHEM. (pH only)	TDS (2000L, not)	FOG (2000L, not)	ALK (2000L, not)	CYN. (100, not)	PHEN. (5000L, not)	T.M. (5000L, not)	SOL. T.M. (2000L)	Cr+6 (2000L)	BACT. (2000L, not)	D.O. (HACH, not)	RAD. (5000L)	TOC (2000L, not)	PRIORITY POLL. (2000L, not)	F, Cl, SO ₄ (2000L, not)	CHLOROPHYLL: a (2000L, not)	LACHAT (2000L, not)	LOW LEVEL Hg (2000L, not)	pH	REMARKS	
43	Cal - Sag Channel at Route # 83 Bridge																					6.5-9.0		
																								LIMS#
59	Cal - Sag Channel at Cicero Avenue (near 131st St)																					6.5-9.0		
																								LIMS #
57	Little Calumet River at Ashland Avenue (near 135th St)																					6.5-9.0		
																								LIMS#
76	Little Calumet River at Halsted St. Downstream Calumet WRP, Riverdale																					6.5-9.0		
																								LIMS #
56	Little Calumet River at Indiana Ave. Upstream of Calumet WRP, Chicago																					6.5-9.0		
																								LIMS#
	EQUIPMENT BLANK																							LIMS#

Analysis (Preservative): FOG (sulfuric acid); Cyanide (sodium hydroxide); Phenol (sulfuric acid); Metals (nitric acid); Mercury (nitric acid); COD (sulfuric acid); Nutrients (sulfuric acid).

STORED AT 4°C YES _____ NO _____ IN CUSTODY OF _____ METER # _____
 TRANSPORTED BY: _____ VEHICLE # _____
 RELINQUISHED BY: _____ DATE: _____ TIME: _____
 RECEIVED BY LABORATORY: _____ DATE: _____ TIME: _____
 RELINQUISHED BY SAL LAB: _____ RECEIVED BY: _____

ATTACHMENT A: LABORATORY REPORTING LIMITS AND ILLINOIS POLLUTION
CONTROL BOARD MINIMUM MEASUREMENT CRITERIA 2022

Parameter	Reporting Limit (RL)	Minimum Measurement Criteria
Dissolved oxygen	NA	0.1 mg/L ¹
Temperature	NA	0.1 degree C ¹
pH	NA	0.1 pH unit ¹
Ammonia nitrogen	0.3 mg/L	15.0 mg/L
Ammonia nitrogen, un-ionized ²	NA	0.1 mg/L ³
Nitrate and nitrite nitrogen	0.50 mg/L	No standard
Kjeldahl nitrogen	1 mg/L	No standard
Phosphorus, total	0.15 mg/L	No standard
Sulfate	1.0 mg/L	500 mg/L
Total dissolved solids	25 mg/L	No standard
Suspended solids	4 mg/L	No standard
Volatile suspended solids	NA	No standard
Alkalinity	20 mg/L	No standard
Chloride	0.50 mg/L	500 mg/L
Fluoride	0.1 mg/L	15 mg/L ⁴
Organic carbon, total	5 mg/L	No standard
Phenol	0.005 mg/L	0.1 mg/L
Cyanide, total	0.005 mg/L	0.1 mg/L ³
Cyanide, chlorine amenable	0.001 mg/L	0.022 mg/L
Arsenic, total	0.050 mg/L	0.36 mg/L ³
Barium, total	0.020 mg/L	5.0 mg/L ³
Boron, total	NA mg/L	40.1 mg/L ⁵
Calcium, total	0.5 mg/L	No standard
Chromium, trivalent ⁶	0.005 mg/L	1.0 mg/L ³
Chromium, hexavalent	0.003 mg/L	0.016 mg/L
Magnesium, total	0.5 mg/L	No standard
Manganese, total	0.005 mg/L	1.0 mg/L ³
Mercury, total	0.0002 mg/L	0.0005 mg/L ³
Mercury, low level, total	0.0005 µg/L	0.012 µg/L ⁷
Selenium, total	0.05 mg/L	1.0 mg/L
Silver, total	0.005 mg/L	0.005 mg/L

ATTACHMENT A (Continued): LABORATORY REPORTING LIMITS AND ILLINOIS
POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA

Parameter	Reporting Limit (RL)	Minimum Measurement Criteria
Fecal coliform	10 cfu/100 mL	200 cfu/100 mL ⁵
n-Hexane extractable materials SPE	5 mg/L	15 mg/L ³
Chlorophyll <i>a</i>	1 µg/L	No standard
Benzene	2 µg/L	310 µg/L
Ethyl benzene	2 µg/L	150 µg/L
Toluene	2 µg/L	2,000 µg/L
Xylenes	3 µg/L	920 µg/L
Organic priority pollutants ¹⁰	Variable ¹¹	No standards

NA = Not applicable.

¹Required sensitivity.

²Calculated from pH, temperature, and ammonia nitrogen. Significant figures for pH, temperature, and ammonia nitrogen allow calculation to 0.01 mg/L.

³Indigenous Aquatic Life Use water quality standard only.

⁴Calculated standard based on a minimum water hardness of 200 mg/L as CaCO₃.

⁵General Use water quality standard only.

⁶Trivalent chromium measured as total chromium.⁷Human Health Standard.

⁸CAWS A and B Aquatic Life Use water quality standard only.

⁹RL varies with total solids concentration of the sample

¹⁰Organic priority pollutants are identified in 40 CFR Part 122, Appendix D, Table II as amended.

¹¹The RLs will be provided in the data report.

ATTACHMENT B: SAMPLING FREQUENCY

Station	Description	General Sampling ¹	n-Hexane Extractable Materials	BETX ²	OPPs
96	Albany Avenue, North Branch Chicago River	Monthly 2 nd Mon.		Bimonthly	Semiannually
112	Dempster Street, North Shore Channel	Monthly 2 nd Mon.		Bimonthly	Semiannually
36	Touhy Avenue, North Shore Channel	Monthly 2 nd Mon.		Bimonthly	Semiannually
37	Wilson Avenue, North Branch Chicago River	Monthly 2 nd Mon.		Bimonthly	Semiannually
73	Diversey Parkway, North Branch Chicago River	Monthly 2 nd Mon.		Bimonthly	Semiannually
100	Wells Street, Chicago River	Monthly 3 rd Mon.		Bimonthly	Semiannually
108	Loomis Street, South Branch Chicago River	Monthly 3 rd Mon.		Bimonthly	Semiannually
99	Archer Avenue, South Fork South Branch Chicago River	Monthly 3 rd Mon.	Monthly 3 rd Mon.	Bimonthly	Semiannually
75	Cicero Avenue, Chicago Sanitary & Ship Canal	Monthly 3 rd Mon.		Bimonthly	Semiannually
41	Harlem Avenue, Chicago Sanitary & Ship Canal	Monthly 3 rd Mon.		Bimonthly	Semiannually
48	Stephen Street, Chicago Sanitary & Ship Canal	Monthly 3 rd Mon.		Bimonthly	Semiannually
92	Lockport Powerhouse Chicago Sanitary & Ship Canal	Weekly Every Mon.		Bimonthly	Semiannually

ATTACHMENT B (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling ¹	n-Hexane Extractable Materials	BETX ²	OPPs
86	Burnham Avenue, Grand Calumet River	Monthly 4 th Mon.		Bimonthly	Semiannually
56	Indiana Avenue, Little Calumet River	Monthly 4 th Mon.		Bimonthly	Semiannually
76	Halsted Street, Little Calumet River	Monthly 4 th Mon.		Bimonthly	Semiannually
57	Ashland Avenue, Little Calumet River	Monthly 4 th Mon.		Bimonthly	Semiannually
59	Cicero Avenue, Calumet-Sag Channel	Monthly 4 th Mon.		Bimonthly	Semiannually
43	Route 83, Calumet-Sag Channel	Monthly 4 th Mon.		Bimonthly	Semiannually
19	Belmont Avenue, Des Plaines River	Monthly 1 st Mon.		Bimonthly	Semiannually
22	Ogden Avenue, Des Plaines River	Monthly 1 st Mon.		Bimonthly	Semiannually
23	Willow Springs Road, Des Plaines River	Monthly 1 st Mon.		Bimonthly	Semiannually
91	Material Service Road, Des Plaines River	Monthly 1 st Mon.		Bimonthly	Semiannually
110	Springinsguth Road, West Branch DuPage River	Monthly 1 st Mon.		Bimonthly	Semiannually
111	Arlington Drive, West Branch DuPage River	Monthly 1 st Mon.		Bimonthly	Semiannually

ATTACHMENT B (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling ¹	n-Hexane Extractable Materials	BETX ²	OPPs
79	Higgins Road, Salt Creek	Monthly 1 st Mon.		Bimonthly	Semiannually
18	Devon Avenue, Salt Creek	Monthly 1 st Mon.		Bimonthly	Semiannually
109	Brookfield Avenue, Salt Creek	Monthly 1 st Mon.		Bimonthly	Semiannually
77	Elmhurst Road, Higgins Creek	Monthly 1 st Mon.		Bimonthly	Semiannually
78	Wille Road, Higgins Creek	Monthly 1 st Mon.		Bimonthly	Semiannually
127	Lincoln Street, Weller Creek	Monthly 1 st Mon.		Bimonthly	Semiannually

¹The parameters included in the general sampling performed monthly include temperature, pH, dissolved oxygen, fecal coliform, total metals, soluble metals, hexavalent chromium, ammonia nitrogen, combined nitrate and nitrite nitrogen, Kjeldahl nitrogen, total phosphorus, total cyanide, cyanide amenable to chlorination, phenol, alkalinity, chloride, fluoride, turbidity, total dissolved solids, total suspended solids, total organic carbon, and chlorophyll *a*. General sampling excluded oil and grease, *E. coli*, BETX, and priority organics.

²BETX = benzene, ethyl benzene, toluene, and xylenes.

Collection System O&M Manual

Appendix C: Continuous Dissolved Oxygen Monitoring Program Quality Assurance Project Plan (CDOM QAPP)

CONTINUOUS DISSOLVED OXYGEN MONITORING
QUALITY ASSURANCE PROJECT PLAN

Revision 2.2

Effective Date: December 31, 2023

Organization: Metropolitan Water Reclamation District of Greater Chicago
Department of Monitoring and Research

Address: 100 East Erie Street
Chicago, Illinois 60611-2803

Telephone: (312) 751-5190

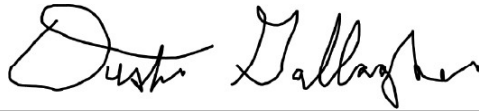
GROUP A: PROJECT MANAGEMENT

A1: Approval Sheet:




Edward Podcerwinski
Director of Monitoring and Research

Date 12/20/23



Dustin Gallagher
Senior Aquatic Biologist
Monitoring and Research

Date 12/12/23



Ashley Jesernik
Quality Assurance Coordinator
Monitoring and Research

Date 12/20/23

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A3: Distribution List

A copy of this Quality Assurance Project Plan (QAPP) will be distributed to each person signing the approval sheet and each person involved with project tasking identified in Section A4. A copy of this QAPP shall be available on request to any person participating in the project from any of the personnel listed in Section A4. Persons not employed by the Metropolitan Water Reclamation District of Greater Chicago (District) may obtain a copy of this QAPP from the District website under the “Education and Water Quality” section.

As this document will be updated periodically, the reader is advised to check with the Network Coordinator for the latest revision if the version is more than one year old. Revision 2.2 has been prepared following the United States Environmental Protection Agency (EPA) guidance document EPA QA/R-5 titled “EPA Requirements for Quality Assurance Project Plans,” March 2001.

A4: Project/Task Organization

The responsible persons for project management are:

Project Director:

Edward Podczerwinski
Director of Monitoring and Research

Project Manager:

Dustin Gallagher
Senior Aquatic Biologist

Quality Assurance Officer:

Ashley Jesernik
Quality Assurance Coordinator

Network Coordinator:

Thomas Minarik
Principal Environmental Scientist

Field Operations Manager:

Erica Spiess
Aquatic Biologist

Figure 1 is the organization chart for the project. Primary lines of communication are shown as dashed lines. However, within the District, communication between any of the project participants may occur and is in fact encouraged as questions or issues arise.

Overall, project planning, including the selection of monitoring locations, is performed jointly by the Project Director, the Project Manager, and the Network Coordinator. The Project Director is responsible for project staffing, funding, and the proper execution of the entire project. The Network Coordinator oversees the execution of routine project activities, resolves major deviations from procedures, and assists in the final review of project reports and the QAPP.

The Project Manager coordinates day-to-day project activities, resolves minor deviations from procedures and ordinary quality control problems; supervises the data review, statistical analysis, management of the project database, and preparation of project reports; and prepares and updates the QAPP.

The Field Operations Manager is responsible for the execution of field activities. A field team deploys the monitors, makes field measurements, and transports the retrieved monitors to the Aquatic Ecology (AE) Section. These activities are primarily done by boat, but certain monitoring stations require a land-based team. Two days each week are scheduled to retrieve and deploy the monitors at various monitoring stations.

The AE Section maintains and calibrates the water quality monitors, downloads collected data from the monitors, and assists in the cross-sectional dissolved oxygen (DO) profiling performed at each monitoring location each spring, summer, and fall. The Project Manager oversees the fabrication, installation, and maintenance of the protective housing needed for field deployment of the water quality monitors. The Field Operations Manager oversees field deployment and retrieval of the water quality monitors. An aquatic biologist (biologist) reviews monitoring data for abnormalities and directs the laboratory's quality control program.

The Quality Assurance (QA) Officer is responsible for oversight of quality control for the project and reviewing the QAPP.

A5: Problem Definition/Background

The Chicago Area Waterway System (CAWS) was designed in the 19th century to convey Chicago's sewage and stormwater away from Lake Michigan, Chicago's primary source of drinking water. This was accomplished by the construction of the Chicago Sanitary and Ship Canal (CSSC) and the reversal of the flow in the Chicago River and South Branch Chicago River (SBCR). Instead of flowing into Lake Michigan, the Chicago River and SBCR now flow into the CSSC. The CSSC collects the area's treated sewage effluents and stormwater runoff and carries it into the Des Plaines River (DPR) at the canal juncture south of Lockport. Major waterways in the CAWS include the North Shore Channel (NSC), the Chicago River, the North and South Branches of the Chicago River, the CSSC, Calumet River, Grand Calumet River (GCR), Little Calumet River (LCR), and the Calumet-Sag Channel (CSC).

The DPR System originates in Wisconsin and flows southward and eventually turns to the southwest and joins with the CSSC below the Lockport Lock and Dam. Salt Creek is a tributary of the DPR that originates in northwest Cook County and flows southeast through DuPage County into the Des Plaines River. The District service area, including the CAWS and DPR System, is shown in Figure 2.

The data from this project will be used in conjunction with other District projects to determine overall water quality of the waterway system. These other projects include the Ambient Water Quality Monitoring project, which analyzes inorganic and organic parameters at 30 monitoring locations, and a biological survey project that assesses biological health by monitoring the diversity of biological species and their abundance at various locations in the waterway system.

The continuous DO monitoring data from the CAWS are also provided to the Illinois Environmental Protection Agency (IEPA) on a quarterly basis, as required by the District's National Pollutant Discharge Elimination System permits for the Terrence J. O'Brien (O'Brien) and Calumet Water Reclamation Plants (WRPs).

A6: Project/Task Description

Currently, DO, specific conductivity, and water temperature are monitored at 20 locations in ten waterways in the District service area. The monitored waterways include the following rivers, man-made channels, and canals:

Chicago Waterway System

- Chicago River
- NSC
- NBCR
- SBCR
- South Fork South Branch Chicago River (Bubbly Creek)
- CSSC

Calumet Waterway System

- LCR
- CSC

Des Plaines Waterway System

- DPR
- Salt Creek

The CDOM program was initiated at 20 locations during the summer of 1998. These monitoring locations were concentrated on the NSC, the NBCR, the Chicago River, the SBCR, Bubbly Creek, the CSSC, and the CSC. The monitoring location on the DPR at Jefferson Street, Joliet, and the location on the Chicago River at the Chicago River Lock and Michigan Avenue were

added in 2000. An additional 11 monitoring locations were added in 2001. These included additional locations on the CSC and locations on the Grand Calumet River (GCR), the LCR, and the Calumet River. An additional Bubbly Creek monitoring location at 36th Street was added in 2002. During 2004, a monitoring location was added at Foster Avenue on the NSC. During 2005, an additional 11 monitoring locations were added. These locations monitor Salt Creek and additional reaches of the DPR, GCR, LCR, and NBCR. During 2011, the CDOM program was reassessed and reduced to a total of 18 stations, 13 in the deep draft and five in wadeable locations. In 2014, the deep-draft location at Cicero Avenue on the CSC was reactivated. Ogden Avenue on the DPR was reactivated in 2016, and a new location at Church Street on the NSC was activated. In 2018, Central Park on the NBCR and J. F. Kennedy Boulevard on Salt Creek were deactivated. In 2019, Clark Street on the Chicago River was deactivated, and Michigan Avenue on the Chicago River was reactivated. In 2020, Busse Woods Main Dam on Salt Creek was deactivated.

Descriptions of all monitoring locations, both active and inactive, are provided in [Tables 1, 2, and 3](#). [Table 1](#) lists all monitoring locations and service history. [Table 2](#) shows the latitude and longitude of each monitoring location. [Table 3](#) gives the Illinois Pollution Control Board (IPCB) waterway classification and IPCB DO water quality standard at each monitoring location. [Figure 2](#) is a map showing the active monitoring locations.

In 2020, telemetry equipment was installed at a portion of the monitoring locations to promote real-time reporting of water quality information, and additional telemetry locations were added in 2023. Water quality monitors that are deployed to telemetry locations are connected to dataloggers via a data cable, and the equipment is powered by a battery that is charged via solar panel. Hourly data are automatically uploaded to the AQUARIUS Time-Series database from a secure file transfer protocol site that receives data from the telemetry equipment via cellular transmission.

The locations of the monitoring stations are reviewed at least annually. Monitoring location changes may occur over time for logistical or safety reasons, or to respond to different monitoring objectives that may arise.

A7: Quality Objectives and Criteria for Measurement Data

Measurement data must be accurate enough to determine compliance with the applicable IPCB DO water quality standards. The DO standards are stated to tenths of a milligram per liter (mg/L). Therefore, measurements of DO should be accurate to ± 0.1 mg/L.

The IPCB water quality standards for temperature specify the maximum allowable water temperature and maximum allowable temperature rises resulting from, for example, the discharge of heated effluents. These standards are stated in degrees Fahrenheit (°F) or to tenths of degrees Celsius (°C) following conversion of the standard from Fahrenheit to Celsius. While these standards are presently not a primary concern of this project, temperature measurements to $\pm 0.1^\circ\text{C}$ are necessary to ensure the accuracy of the recorded DO measurements, as these measurements are affected by temperature.

A8: Special Training/Certification

The tasking of the project has been assigned to the personnel with appropriate job classifications. The project personnel are trained on the job to perform their assigned technical activities. No additional special training or certifications are required for the project.

A9: Documents and Records

Project Data and Reports

The Network Coordinator maintains the following project records and reports:

1. Monitoring data are stored in a cloud-based AQUARIUS Time-Series database.
2. Field observations performed during monitor retrieval and deployment are stored electronically as portable document format (PDF) documents and in the AQUARIUS Time-Series database.
3. Laboratory calibration and maintenance records are stored electronically in Excel® spreadsheets.
4. Seasonal cross-sectional DO surveys at each monitoring station are stored electronically in an Excel® spreadsheet.

Other Reports and Communications

1. The Network Coordinator shall retain copies of all correspondence related to the transmittal of project data to the IEPA and retain electronic copies of data transmittals.
2. The Project Manager and Network Coordinator shall retain copies of annual Monitoring and Research (M&R) Department reports pertaining to continuous DO monitoring.
3. The Network Coordinator and QA Officer shall retain copies of all annual updates and revisions of this QAPP.
4. The Network Coordinator shall retain copies of all procedures.
5. The Network Coordinator and Project Manager shall retain copies of all laboratory analytical reports and correspondence with other laboratories.
6. The Project Manager and Network Coordinator shall retain copies of all management reports pertinent to continuous DO monitoring.

7. The Project Manager and Network Coordinator shall retain copies of all communications pertinent to continuous DO monitoring to and from outside agencies and other interested parties.

All hard copies of the records and reports listed above will be retained for a minimum of ten years at the Cecil Lue-Hing Research and Development Complex located at the Stickney WRP.

GROUP B: DATA GENERATION AND ACQUISITION

B1: Sampling Process Design (Experimental Design)

Selection of Monitoring Locations

There have been forty-nine locations selected for DO monitoring in the District service area waterways (Table 1) since the inception of this project. Of these, 20 are currently actively monitored. The criteria used to select these locations were:

1. A history of low DO levels.
2. Location above and below the confluence of major waterways.
3. Proximity to an artificial aeration station.
4. Location above and below the major WRPs.
5. Location below pumping stations, such as the North Branch and Racine Avenue, and below discretionary Lake Michigan diversion locations.
6. Proximity to ambient biological and or water quality monitoring locations.

To examine the suitability of a sampling location, cross-sectional DO profiles are made at each site to verify the uniformity of DO concentrations. Uniform cross-sectional DO at a monitoring location is necessary to ensure that representative DO measurements can be obtained from a single DO monitor. Cross-sectional DO profiles are routinely repeated three times each year (spring, summer, and fall) at each monitoring location to verify that cross-sectional uniformity of DO concentrations exists.

Monitoring locations may be added to or removed from the monitoring network based upon periodic assessments of monitoring needs and available resources. Table 1 shows the monitoring history of monitoring locations used for this project.

Measurement Frequency

The DO concentration at any point in a waterway is subject to many influences. Measurements taken at infrequent intervals, such as weekly or even daily, may be insufficient to adequately characterize fluctuations that may occur during wet-weather events or diurnal fluctuations that may occur in wadeable waterways. Previous monitoring has shown that hourly measurements will record these changes and allow for a more comprehensive understanding of

DO behavior in the District service area waterways. After CDOM has been conducted for a suitable amount of time at a given station, it may not be necessary to continue such intensive monitoring until conditions change in that waterway due to operational upgrades, completion of reservoirs, or changes in lake diversion amounts, for instance.

Parameters Measured and Information Monitored

When DO measurements are taken, it is important to record water temperature since the DO saturation concentration will increase as temperature decreases. Currently, specific conductivity is also measured at continuous monitoring locations. Available information related to lake water diversions, precipitation, and recorded combined sewer overflows (CSOs) into the waterways is also used to interpret the collected DO data.

B2: Sampling Methods

The water quality monitors used for this project are programmed to record DO, specific conductivity, and temperature measurements at hourly intervals. The alkaline batteries used by the monitors (C cells) generally allow field deployment for a period of at least four weeks. At locations where telemetry equipment is installed, monitors can be deployed for extended periods of time because an external battery powers the monitors and dataloggers and that battery is charged by solar energy. If the external battery or equipment fails, the sonde will continue to log hourly measurements using alkaline batteries. The monitors are exchanged in prescheduled batches, on Tuesdays and Wednesdays. Rarely, usually because of inclement weather, monitors are in the field for extended periods during which they will continue to collect measurement data until the batteries are exhausted.

The monitors are secured in eight-inch stainless steel or polyvinyl chloride pipes to protect them from marine vessels, debris, and vandalism. The monitors are typically deployed inside a 12- to 15-foot pipe vertically mounted on the side of a suitable bridge abutment, dolphin, or seawall. The monitors are generally positioned two to three feet below the water surface. These pipes have numerous two-inch openings in the pipe wall to allow water to flow freely through the housing and around the monitor, thereby ensuring representative water quality measurements.

B3: Sample Handling and Custody

The newly prepared and calibrated monitors are transported to the monitoring stations in coolers that contain enough tap water to saturate the air inside the cooler with humidity. The monitors that are retrieved from the waterway are placed in the same coolers for transport back to the laboratory. When the monitors arrive in the AE Section Laboratory, they are suspended vertically in a water-filled tank referred to as the “receiving tank.”

When a monitor is deployed at a sampling location, a calibrated hand-held DO meter is used to measure DO and temperature in situ just prior to deployment at the same depth and location. The results are recorded on the field data sheet that is provided in the standard operating procedure (SOP).

B4: Analytical Methods

Each water quality monitor utilizes a DO probe, conductivity probe, and a thermistor to measure water temperature. The DO probes utilize optical DO sensors. The optical DO sensor measures the lifetime of the luminescence, which is inversely proportional to the amount of DO present. The DO probe calibration is performed with a single-point adjustment to 100 percent DO saturation following manufacturers' and EPA guidelines. The conductivity sensor measures the voltage drop between the electrodes and converts it to specific conductance. Temperature is measured with a thermistor that changes in proportion to resistance with temperature variation.

For this project, the water in the monitor storage tank is used as the reference sample for monitor performance evaluations. The DO of the storage tank water is determined using a calibrated handheld DO meter. The use of monitors to obtain in situ DO measurements eliminates errors associated with sample handling and storage when grab samples are collected for wet chemistry DO analysis.

Independent DO readings are taken with a handheld, calibrated DO meter at each monitoring location when freshly calibrated monitors are deployed for corroborating DO analysis in the laboratory.

B5: Quality Control

Daily performance checks of the DO probes are made while the monitors are maintained in a ready state in the laboratory prior to field deployment.

Monitors are recalibrated whenever the monitor DO is not within ± 0.2 mg/L of the DO concentration of the storage tank water as determined by a calibrated handheld DO meter.

The automatic collection of DO and temperature data does not lend itself to the use of quality control measures that would normally be employed in the laboratory analysis of samples. Therefore, great care is exercised in the calibration of monitors and verification that each monitor has maintained its calibration after deployment.

To verify that data collected by each monitor is accurate, the following quality control measures are employed:

1. Verification of the accuracy of each monitor after retrieval against a 100 percent DO saturation check.
2. Checking the last field DO measurement made by each monitor against a calibrated handheld portable DO meter reading taken in the waterway next to the deployed monitor.

If acceptance criteria for these measurement verifications are not met, the data collected by that monitor may be rejected. Sections B10 and D1 detail these verification procedures.

B6: Instrument Testing, Inspection, and Maintenance

In addition to the monitors that are deployed at all times at the active monitoring sites, several monitors are kept in controlled storage in the laboratory after being prepared for deployment the following week. Other monitors that are not deployed, or are not being prepared for deployment, are available to replace those monitors that require servicing that cannot be performed in the laboratory.

The monitors are maintained as required by the manufacturers' manuals and the laboratory SOPs (Vick, 2018; Manta, 2015). Inventoried parts and supplies include batteries, O-rings, wiper assemblies, calibration standards for the conductivity sensors, and temperature/conductivity sensors.

When the monitors are returned to the laboratory, the field data is downloaded (see Section B10), and the monitors are cleaned of surface debris. Data from telemetry locations is transmitted to the AQUARIUS Time-Series database via cellular transmission, a secure file transfer protocol site, and AQUARIUS Connect, but data logged by the monitors is also uploaded to fill any gaps in telemetry data. The monitor probes are cleaned and inspected for damage.

The thermistor in each monitor is checked annually against a certified thermometer traceable to a National Institute of Standards and Technology standard. When the error of the thermistor exceeds 0.5°C, the temperature/conductivity sensor is changed. If the temperature measurement is still beyond the acceptance range, the monitor is returned to the manufacturer for service.

The voltage of the on-location batteries used to power the data loggers and monitors at telemetry locations is checked via the review of AQUARIUS Time-Series voltage data on the Monday of the week that monitor exchanges are scheduled, to determine if batteries will need to be replaced. Batteries for the telemetry equipment are sent along with the water quality monitors, for locations that have steady decreases in voltage and little to no recharge within a 72-hour period. Before a telemetry battery is exchanged, the solar panel is inspected for damage or debris. Faulty batteries are replaced when the monitors are exchanged, or independent of sonde exchanges if needed.

B7: Instrument Calibration and Frequency

Monitors awaiting field deployment are stored in the AE Section Laboratory in water- filled stainless steel holding tanks. While suspended vertically in these tanks, each DO sensor is checked at least once daily, Monday through Friday, against a calibrated meter DO measurement of the water in the holding tank. A monitor is recalibrated to 100 percent DO saturation whenever the sensor DO is more than ± 0.3 mg/L from the DO measured by a handheld calibrated meter.

Monitors that are scheduled for deployment are checked twice on the day before deployment. On the day of scheduled deployment, the DO sensor is calibrated to 100 percent DO saturation.

B8: Inspection/Acceptance of Supplies and Consumables

Supplies and consumables shall be inspected by the field operations manager or her/his designee in the AE Section and accepted only if they satisfy all specifications for the intended use.

B9: Non-Direct Measurements

Non-direct measurements are not required for this project.

B10: Data Management

Every four weeks the 20 deployed water quality monitors are exchanged with cleaned and newly calibrated monitors. The retrieved monitors are brought back to the AE Laboratory and placed in the receiving tank. The following morning, each monitor is checked for accuracy by verification to a 100 percent DO saturation check. While still in the receiving tank, the DO, temperature, and conductivity data collected during the deployed period are downloaded from each monitor and then uploaded to the AQUARIUS Time-Series database by a technician. The uploaded data automatically fills in any missing hourly data that was not successfully transmitted or captured at the monitoring sites that have telemetry. After the data is uploaded into the database, the DO measurements are corrected for initial error and instrument drift using the observed errors from the 100 percent DO saturation calibration taken on the morning of deployment and the 100 percent DO saturation check taken the morning after retrieval (Wagner, 2006). Sensor drift is assumed to be linear over the deployment period, and the DO correction is calculated for each hourly measurement and updated in AQUARIUS where there is a raw data set and a corrected data set for each deployment.

A biologist reviews graphs of the hourly DO, percent DO saturation, temperature, and specific conductance data, on a per-deployment basis, in the AQUARIUS Time-Series database

(Appendix I). The biologist checks for inconsistent measurements and highlights them for later review by a second biologist and then designates the approval status of the data as “In Review.” A second biologist will then review the data and change the approval status to “Approved” if there is agreement with the first biologist.

Rainfall data from the United States Geological Service (USGS) gages at O’Hare International Airport and Bedford Park are available for viewing in the AQUARIUS Time- Series database and can be overlaid with CDOM data to assist with the DO data review. For a specific CDOM location, if more refined rainfall data is needed, other USGS rainfall gages will be used. Additionally, the Maintenance and Operations (M&O) Department reports CSO activity and backflows to Lake Michigan at mwrld.org, which will also be used, if necessary, following the data review procedures

The M&O Department personnel compile the daily flow information for Lake Michigan discretionary diversion. The discretionary diversion data is transmitted to the AE Section on a monthly basis. A biologist reviews the daily discretionary diversion flows at the Wilmette Pumping Station, Chicago River Controlling Works, and O’Brien Lock when reviewing the CDOM data at the monitoring stations on the NSC (above the O’Brien WRP outfall), SBCR, and the LCR, respectively.

After this, a biologist reviews and verifies the field DO data following the guidance provided in the IEPA’s Standard Operating Procedure for Continuous Monitoring of Water Quality (IEPA, 2014). The criteria used to review and validate the DO data are stated in Section D1. The biologist also considers the rain and flow information as well as best professional judgment when verifying the DO data. All DO data that fail the review criteria or are considered to be erroneous are marked as “Raw” data in the database and are not published.

GROUP C: ASSESSMENT AND OVERSIGHT

C1: Assessment and Response Actions

Routine assessments are not used in this project.

C2: Reports to Management

The Project Manager and all those on the approval list will receive from the Network Coordinator all investigative and corrective action reports concerning quality control problems and other non-conformance issues from field personnel and participating laboratories.

Project related systems audits or special data quality assessments are not undertaken.

GROUP D: DATA VALIDATION AND USABILITY

D1: Data Review, Verification, and Validation

A biologist reviews and verifies the field DO data. The field data from any water quality monitor may be rejected following review of these quality control checks:

1. Accuracy of Retrieved Monitors

The monitor in the laboratory receiving holding tank is given a post-calibration check to 100 percent DO saturation. A difference of more than 0.4 mg/L is used as a rejection criterion for the batch of field collected data. This check is done to evaluate inaccuracies due to calibration drift.

2. Comparison of Monitor DO Measurement with Meter Measurement

A DO meter reading is taken in close proximity to the protective enclosure during the exchange of monitors using a calibrated handheld DO meter. The DO measured from the meter is compared with the last DO measurement of the retrieved monitor. The relative percent difference is calculated, and if it is greater than 20 percent and the absolute magnitude is greater than 0.3 mg/L, this will alert the biologist to a possible problem and may result in the rejection of the entire batch of field data. If evidence suggests that there were conditions in the waterway at the time of the meter measurement that can explain a difference greater than 20 percent, the reviewers may accept the data. This check is done to evaluate total inaccuracies attributed to fouling drift and calibration drift.

3. Inspection of Possible Erroneous Data

Additional review of the field data is necessary to verify continuous monitoring data. Situations can arise where portions of a batch of data may need to be rejected if, for example, the equipment malfunctioned in the middle of a deployment, there was a technician error (such as deploying a sonde that was not activated), the monitor experienced a period of time out of the water due to a draw down or vandalism (which can be indicated by a sudden drop in specific conductance), or the monitor recorded momentary spikes in the data that are not naturally occurring. The reason for rejection is recorded in a separate spreadsheet.

The reviewers will use best professional judgement, the rain data, diversion data, and CSO data to help make these decisions. An electronic file is kept to record all deployment dates and justifications for lost data which is reviewed and approved by the project manager.

D2: Verification and Validation Methods

The Project Manager and the QA Officer shall be informed of all situations where data integrity has been found to be compromised by errors, including storage of incorrect data or the corruption of stored data. All responsible persons identified in Section A4 and all known data users shall be informed of data problems when they are discovered and the corrective action taken. The QA Officer shall prepare the disclosure report for distribution.

D3: Reconciliation with User Requirements

The QAPP shall govern the operation of the project at all times. Each responsible person listed in Section A4 shall adhere to the procedural requirements of the QAPP and ensure that subordinate personnel do likewise.

This QAPP shall be reviewed annually to ensure that the project will achieve all intended purposes. All the responsible persons listed in Section A4 shall participate in the review of the QAPP. The annual review shall address every aspect of the program including:

1. The accuracy of the information contained in the QAPP and incorporation of changes made since its completion.
2. The adequacy and location of monitoring stations.
3. The adequacy of measurement frequency at each location.
4. Sampling procedures.
5. Analytical procedures.
6. The appropriateness of parameters monitored.
7. Changes in data quality objectives and minimum measurement criteria.
8. Whether the data obtained met minimum measurement criteria.
9. Corrective actions taken during the previous year for field and laboratory operations.

10. The adequacy of quality control procedures.
11. All interim reports and annual project report.
12. Review of other user requirements and recommendations.

The project will be modified as directed by the Project Director. The Project Manager shall be responsible for the implementation of changes to the project and shall document the effective date of all changes made.

It is expected that from time to time ongoing and perhaps unexpected changes will need to be made to the project. Significant changes or deviations in the operation of the project shall not be made without authorization by the Project Director. The need for a change in project operation should be conveyed to the Network Coordinator. Data users and other interested persons may also suggest changes to the project to the Network Coordinator.

The Network Coordinator shall evaluate the need for the change, consult with the Project Manager and others as appropriate, and make a recommendation to the Project Director for approval. The Network Coordinator shall inform the appropriate project personnel of approved changes in project operation in a timely manner.

Following approval, a memorandum documenting each authorized change shall be prepared by the Network Coordinator and distributed to all the responsible persons listed in Section A4. Approved changes shall be considered an amendment to the QAPP and shall be incorporated into the QAPP when it is updated.

Following the annual QAPP review, the Project Manager will prepare an updated version of the QAPP with the assistance of the QA Officer.

REFERENCES

Illinois Environmental Protection Agency, Bureau of Water. Document Control number 202. Standard Operating Procedure for Continuous Monitoring of Water Quality. Revision No. 1. June 26, 2014.

Manta 2, Sub 2, and Sub 3, Water Quality Multiprobe Manual, Eureka Water Probes, February, 2015.

Vick, J.A., Laboratory Servicing Procedures for Continuous Dissolved Oxygen Monitors, Environmental Monitoring and Research Division Laboratory, MWRDGC, May 8, 2018.

Wagner, R.J., R.W. Boulger Jr., C.J. Oblinger, and B.A. Smith. 2006. Guidelines and Standard Operating Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting. Techniques and Methods 1-D3. United States Geological Survey. Reston, VA.

FIGURE 1: CONTINUOUS DISSOLVED OXYGEN MONITORING PROJECT ORGANIZATION CHART

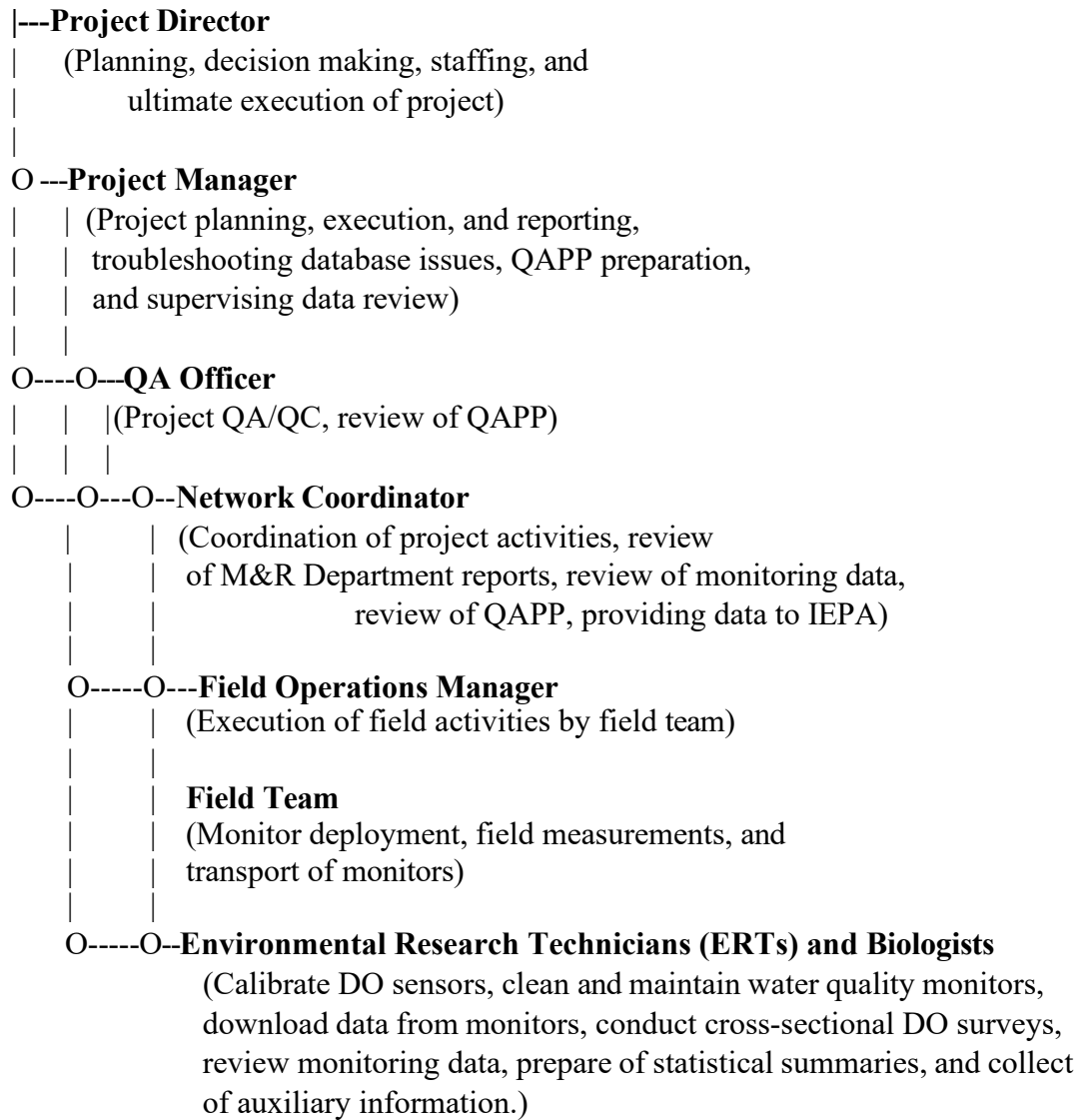


FIGURE 2: CURRENTLY ACTIVE CONTINUOUS DISSOLVED OXYGEN MONITORING

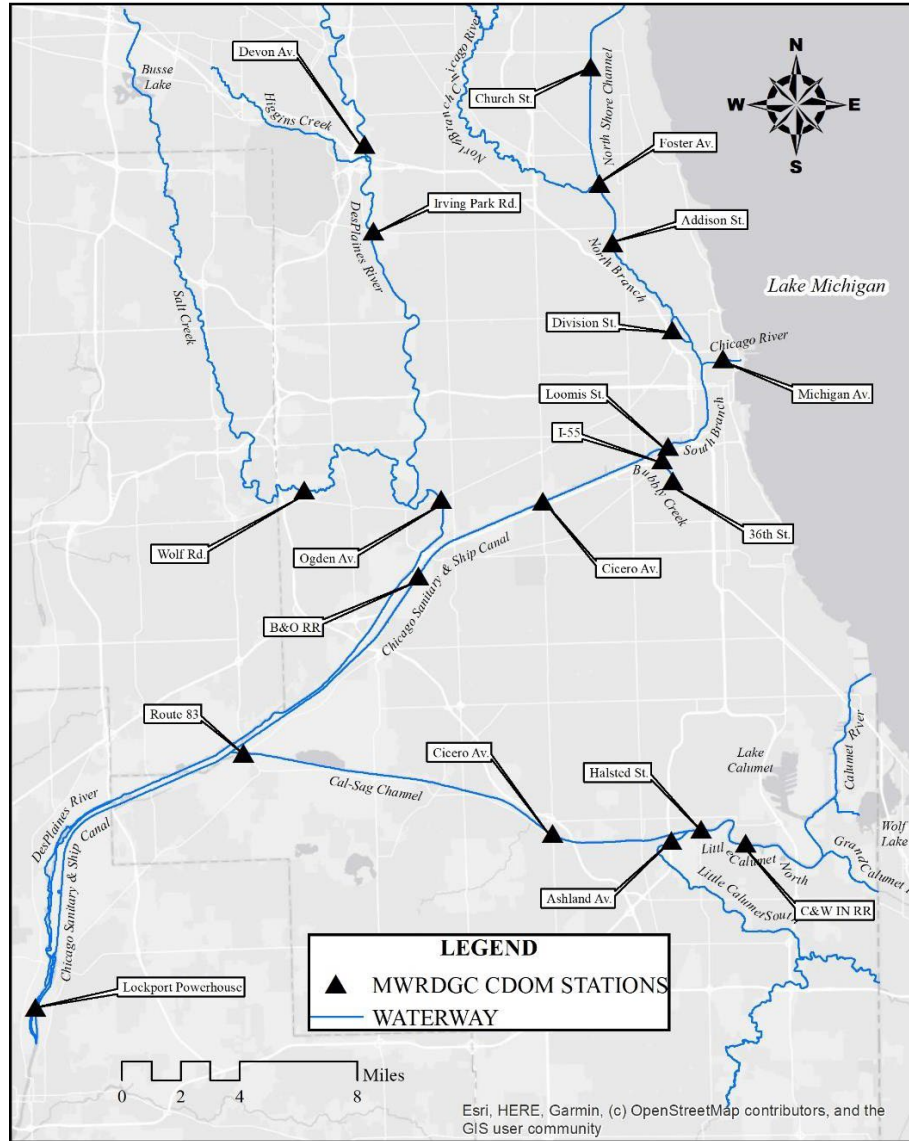


TABLE 1: SAMPLING HISTORY AT EACH MONITORING LOCATION

Loc. ID	Continuous DO Monitoring Location	Time Period DO Measured Hourly at Location	Status
1	Linden St., North Shore Channel	August 1998 – March 2004	Inactive
2	Simpson St., North Shore Channel	August 1998 – March 2004	Inactive
72	Church St., North Shore Channel	November 2016 - Present	Active
3	Main St., North Shore Channel	August 1998 – Dec. 2010	Inactive
4	Devon Ave., North Shore Channel	August 1998 – January 2001	Inactive
57	Foster Ave., North Shore Channel	August 2004 – Present	Active
66	Central Park Ave., North Branch Chicago River	July 2005 – April 2013	Inactive
5	Lawrence Ave., North Branch Chicago River	August 1998 – January 2001	Inactive
6	Addison St., North Branch Chicago River	August 1998 – Present	Active
7	Fullerton Ave., North Branch Chicago River	August 1998 – Dec. 2010	Inactive
8	Division St., North Branch Chicago River	August 1998 – March 2004, June 2013 – Present	Active
9	Kinzie St., North Branch Chicago River	August 1998 – June 2013	Inactive
21	Chicago River Controlling Works, Chicago River	March 2000 – March 2004	Inactive
22	Michigan Ave., Chicago River	March 2000 – March 2004, May 2019 – Present	Active
10	Clark St., Chicago River	August 1998 – Dec. 2010, May 2012 – June 2019	Inactive
11	Jackson Blvd., South Branch Chicago River	August 1998 – March 2004	Inactive
12	Loomis St., South Branch Chicago River	August 1998 – January 2001, April 2003 – Present	Active
49	36th St., Bubbly Creek	June 2002 – Present	Active
13	I-55, Bubbly Creek	August 1998 – January 2001 April 2002 – Present	Active
14	Cicero Ave., Chicago Sanitary & Ship Canal	August 1998 – Present	Active
15	B&O Central RR, Chicago Sanitary & Ship Canal	August 1998 – Present	Active
16	Route 83, Chicago Sanitary & Ship Canal	August 1998 – Dec. 2010	Inactive
17	River Mile 302.6, Chicago Sanitary & Ship Canal	August 1998 – March 2004	Inactive
18	Romeoville Rd., Chicago Sanitary & Ship Canal	August 1998 – March 2004	Inactive
19	Lockport Powerhouse, Chgo. Sanitary & Ship Canal	August 1998 – Present	Active
58	Devon Ave., Des Plaines River	October 2005 – Dec. 2010, May 2011 – Present	Active
62	Irving Park Rd., Des Plaines River	July 2005 – May 2011, Sep- tember 2020	Active
63	Ogden Ave., Des Plaines River	July 2005 – Dec. 2010, March 2016 – Present	Active
64	Material Service Rd., Des Plaines River	October 2005 – Dec. 2010	Inactive
23	Jefferson St., Des Plaines River	March 2000 – Dec. 2010	Inactive
31	130th St., Calumet River	July 2001 – March 2004	Inactive
67	Hohman Ave., Grand Calumet River	July 2005 – April 2008	Inactive
32	Torrence Ave., Grand Calumet River	July 2001 – Dec. 2010	Inactive
33	Conrail RR, Little Calumet River	July 2001 – March 2004	Inactive
34	C&W Indiana RR, Little Calumet River	July 2001 – Present	Active

TABLE 1 (Continued): SAMPLING HISTORY AT EACH MONITORING LOCATION

Loc. ID	Continuous DO Monitoring Location	Time Period DO Measured Hourly at Location	Status
35	Halsted St., Little Calumet River	July 2001 – Present	Active
65	Wentworth Ave., Little Calumet River	July 2005 – Dec. 2010	Inactive
36	Ashland Ave., Little Calumet River	July 2001 – Present	Active
37	Division St., Calumet-Sag Channel	July 2001 – March 2004	Inactive
38	Kedzie Ave., Calumet-Sag Channel	July 2001 – March 2004	Inactive
39	Cicero Ave., Calumet-Sag Channel	July 2001 – Dec. 2010, March 2014 – Present	Active
40	River Mile 311.7, Calumet-Sag Channel	July 2001 – November 2004	Inactive
41	Southwest Hwy., Calumet-Sag Channel	July 2001 – March 2004	Inactive
42	104th Ave., Calumet-Sag Channel	July 2001 – October 2010	Inactive
20	Route 83, Calumet-Sag Channel	August 1998 – Present	Active
68	Busse Woods Main Dam, Salt Creek	October 2005 – September 2020	Inactive
59	J. F. Kennedy Blvd., Salt Creek	July 2005 – February 2018	Inactive
60	Thorndale Ave., Salt Creek	July 2005 – March 2009	Inactive
61	Wolf Rd., Salt Creek	July 2005 – Present	Active

TABLE 2: LATITUDE AND LONGITUDE OF MONITORING

Loc. ID	Continuous DO Monitoring Location	Latitude	Longitude
1	Linden St., North Shore Channel	42° 04.390'	87° 41.140'
2	Simpson St., North Shore Channel	42° 03.350'	87° 42.400'
3	Main St., North Shore Channel	42° 02.010'	87° 42.570'
72	Church St., North Shore Channel	42° 02.890'	87° 42.583'
4	Devon Ave., North Shore Channel	41° 59.820'	87° 42.610'
57	Foster Ave., North Shore Channel	41° 58.5660'	87° 42.2860'
66	Central Park Ave., North Branch Chicago River	41° 58.3790'	87° 42.0882'
5	Lawrence Ave., North Branch Chicago River	41° 58.100'	87° 42.020'
6	Addison St., North Branch Chicago River	41° 56.790'	87° 41.720'
7	Fullerton Ave., North Branch Chicago River	41° 55.520'	87° 40.450'
8	Division St., North Branch Chicago River	41° 54.210'	87° 39.430'
9	Kinzie St., North Branch Chicago River	41° 53.440'	87° 38.330'
21	Chicago River Lock, Chicago River	41° 53.280'	87° 36.580'
22	Michigan Ave., Chicago River	41° 53.340'	87° 37.370'
10	Clark St., Chicago River	41° 53.241'	87° 37.893'
11	Jackson Blvd., South Branch Chicago River	41° 53.911'	87° 38.135'
12	Loomis St., South Branch Chicago River	41° 50.747'	87° 39.662'
49	36th St., South Fork South Branch Chicago River	41° 49.071'	87° 39.437'
13	I-55, South Fork South Branch Chicago River	41° 50.648'	87° 39.878'
14	Cicero Ave., Chicago Sanitary & Ship Canal	41° 49.169'	87° 44.616'
15	B&O RR Bridge, Chicago Sanitary & Ship Canal	41° 46.990'	87° 49.540'
16	Route 83, Chicago Sanitary & Ship Canal	41° 42.420'	87° 55.750'
17	River Mile 302.6, Chicago Sanitary & Ship Canal	41° 41.240'	87° 58.470'
18	Romeoville Rd., Chicago Sanitary & Ship Canal	41° 38.450'	88° 03.549'
19	Lockport Powerhouse, Chicago Sanitary & Ship Canal	41° 34.277'	88° 04.711'
58	Devon Ave., Des Plaines River	41° 59.7633'	87° 51.5629'
62	Irving Park Rd., Des Plaines River	41° 57.1905'	87° 51.2461'
63	Ogden Ave., Des Plaines River	41° 49.2501'	87° 48.6311'
64	Material Service Rd., Des Plaines River	41° 35.7913'	88° 04.1275'
23	Jefferson St., Des Plaines River	41° 31.489'	88° 05.155'
31	130th St., Calumet River	41° 39.619'	87° 34.195'
67	Hohman Ave., Grand Calumet River	41° 37.4546'	87° 31.0777'
32	Torrence Ave., Grand Calumet River	41° 38.652'	87° 33.542'
33	Conrail RR, Little Calumet River	41° 38.345'	87° 33.955'
34	C&W Indiana Harbor Belt RR, Little Calumet River	41° 39.026'	87° 36.695'
35	Halsted St., Little Calumet River	41° 39.431'	87° 38.450'
65	Wentworth Ave., Little Calumet River	41° 35.1058'	87° 31.7625'
36	Ashland Ave., Little Calumet River	41° 39.110'	87° 39.625'
37	Division St., Calumet-Sag Channel	41° 39.160'	87° 40.250'

TABLE 2 (Continued): LATITUDE AND LONGITUDE OF MONITORING LOCATIONS

Loc. ID	Continuous DO Monitoring Location	Latitude	Longitude
38	Kedzie Ave., Calumet-Sag Channel	41° 39.120'	87° 41.920'
39	Cicero Ave., Calumet-Sag Channel	41° 39.345'	87° 44.313'
40	River Mile 311.7, Calumet-Sag Channel	41° 40.626'	87° 47.532'
41	Southwest Hwy., Calumet-Sag Channel	41° 40.812'	87° 48.642'
42	104th Ave., Calumet-Sag Channel	41° 41.352'	87° 53.052'
20	Route 83, Calumet-Sag Channel	41° 41.810'	87° 56.480'
68	Busse Woods Main Dam, Salt Creek	42° 01.0089'	88° 00.0289'
59	J. F. Kennedy Blvd., Salt Creek	42° 00.3152'	87° 59.7498'
60	Thorndale Ave., Salt Creek	41° 59.0307'	87° 59.4212'
61	Wolf Rd., Salt Creek	41° 49.5759'	87° 54.0781'

TABLE 3: ILLINOIS POLLUTION CONTROL BOARD USE CLASSIFICATION AND DISSOLVED OXYGEN STANDARD AT EACH MONITORING LOCATION

Loc. ID	Continuous DO Monitoring Location	IPCB Classification	DO Standard
1	Linden St., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
2	Simpson St., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
72	Church St., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
3	Main St., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
4	Devon Ave., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
57	Foster Ave., North Shore Channel	CAWS ALU A	3.5-5.0 ¹
66	Central Park Ave., North Branch Chicago River	General Use	3.5-6.0 ²
5	Lawrence Ave., North Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
6	Addison St., North Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
7	Fullerton Ave., North Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
8	Division St., North Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
9	Kinzie St., North Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
21	Chicago River Lock, Chicago River	General Use	3.5-6.0 ²
22	Michigan Ave., Chicago River	General Use	3.5-6.0 ²
10	Clark St., Chicago River	General Use	3.5-6.0 ²
11	Jackson Blvd., South Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
12	Loomis St., South Branch Chicago River	CAWS ALU A	3.5-5.0 ¹
49	36th St., South Fork South Branch Chicago River	Indigenous ALU	4.0
13	I-55, South Fork South Branch Chicago River	Indigenous ALU	4.0
14	Cicero Ave., Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
15	B&O RR, Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
16	Route 83, Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
17	River Mile 302.6, Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
18	Romeoville Rd., Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
19	Lockport Powerhouse, Chicago Sanitary & Ship Canal	CAWS ALU B	3.5-4.0 ³
58	Devon Ave., Des Plaines River	General Use	3.5-6.0 ²
62	Irving Park Rd., Des Plaines River	General Use	3.5-6.0 ²
63	Ogden Ave., Des Plaines River	General Use	3.5-6.0 ²
64	Material Service Rd., Des Plaines River	General Use	3.5-6.0 ²
23	Jefferson St., Des Plaines River	CAWS ALU B	3.5-4.0 ³
31	130th St., Calumet River	CAWS ALU A	3.5-5.0 ¹
67	Hohman Ave., Grand Calumet River	CAWS ALU A	3.5-5.0 ¹
32	Torrence Ave., Grand Calumet River	CAWS ALU A	3.5-5.0 ¹
33	Conrail RR, Little Calumet River	CAWS ALU A	3.5-5.0 ¹
34	C&W Indiana Harbor Belt RR, Little Calumet River	CAWS ALU A	3.5-5.0 ¹
35	Halsted St., Little Calumet River	CAWS ALU A	3.5-5.0 ¹
65	Wentworth Ave., Little Calumet River	General Use	3.5-6.0 ²
36	Ashland Ave., Little Calumet River	General Use	3.5-6.0 ²

TABLE 3 (Continued): ILLINOIS POLLUTION CONTROL BOARD USE CLASSIFICATION AND DISSOLVED OXYGEN STANDARD AT EACH MONITORING LOCATION

Loc. ID	Continuous DO Monitoring Location	IPCB Classification	DO Standard
37	Division St., Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
38	Kedzie Ave., Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
39	Cicero Ave., Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
40	River Mile 311.7, Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
41	Southwest Hwy., Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
42	104th Ave., Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
20	Route 83, Calumet-Sag Channel	CAWS ALU A	3.5-5.0 ¹
68	Busse Woods Main Dam, Salt Creek	General Use	3.5-6.0 ²
59	J. F. Kennedy Blvd., Salt Creek	General Use	3.5-6.0 ²
60	Thorndale Ave., Salt Creek	General Use	3.5-6.0 ²
61	Wolf Rd., Salt Creek	General Use	3.5-6.0 ²

¹The Chicago Area Waterway System Aquatic Life Use A (CAWS ALU A) waters require that during the period of March through July, DO shall not be less than 5.0 mg/L at any time, and that during the period of August through February, DO shall not be less than 4.0 mg/L as a daily minimum averaged over seven days, or less than 3.5 mg/L at any time.

²The General Use Standard requires that during the period of March through July, DO shall not be less than 5.0 mg/L at any time, or less than 6.0 mg/L as a daily mean averaged over seven days, and that during the period of August through February, DO shall not be less than 3.5 mg/L at any time, or less than 4.0 mg/L as a daily minimum averaged over seven days, or less than 5.5 mg/l as a daily mean averaged over 30 days.

³The Chicago Area Waterway System Aquatic Life Use B (CAWS ALU B) waters require that DO shall not be less than 4.0 mg/L as a daily minimum averaged over seven days, or less than 3.5 mg/L at any time.

CONTINUOUS DISSOLVED OXYGEN MONITORING
QUALITY ASSURANCE PROJECT PLAN

APPENDIX I: EXAMPLE OF AN HOURLY DATA REVIEW PLOT

TABLE AI-1: DISSOLVED OXYGEN VALUES IN THE CHICAGO SANITARY AND SHIP CANAL DURING THE PERIOD OF NOVEMBER 23, 2022, THROUGH JANUARY 25, 2023



Collection System O&M Manual

Appendix D: NBPS, RAPS, 95th St PS, and 122nd St PS Sampling Protocols

PROTOCOL FOR SAMPLING THE NORTH BRANCH PUMPING STATION (NPDES PERMIT REQUIREMENTS)

Purpose of Sampling Program

As part of its National Pollutant Discharge Elimination System (NPDES) permit for the O'Brien Water Reclamation Plant (OWRP), the Metropolitan Water Reclamation District of Greater Chicago (District) is required to sample all discharges from the North Branch Pumping Station (NBPS) into the North Branch of the Chicago River.

Personnel from the Industrial Waste Division (IWD) North Office will be assigned to sample these discharges.

Program Start Date and Duration

This program commenced March 1, 2002, and continues, year-round, until further notice.

Notification of a Sampling Event

Upon activation of the first storm pump at NBPS, the OWRP Operating Engineer will notify the Systems Dispatcher. The Systems Dispatcher will notify the Area Supervisor, or his/her designee, who will assign IWD-North personnel to sample the NBPS.

NBPS Sampling Point

A District Medeco key must be taken from the North office key box to gain entry to the NBPS.

Samples will be obtained from the automatic sampler unit located at the south wall of the lower level of the NBPS building.

A silent intrusion alarm will be activated upon entry to NBPS. Contact the OWRP Operating Engineer at (847) 568-8380 or -8381 (x88380 or x88381) to identify the sampling crew and your purpose at the NBPS.

The automatic sampler tubing is purged for at least 20 seconds after the sampler is triggered by the first storm pump, subsequently, the NPDES sample will then be pulled through the sampling unit into the sample bottle. The sampler must be reset for the next storm after use.

Samples Obtained

Sampling consists of a one-gallon composite for general chemistry, a composite for trace metals, and a grab sample for pH for every 24 hours when discharging. The grab sample for pH must *not be obtained any earlier than 30 minutes*, nor later than 2 hours, after activation of the first storm pump. The pH will be analyzed on site with an electronic meter, and the result recorded and authorized in LIMS by IWD personnel.

Composite samples for general chemistry and trace metals will be collected for each 24-hour period of an event. If an event continues for more than 24 hours, additional composite samples will be obtained to document the next 24-hour period of the event. Subsequent sampling will be conducted as close to the start of each 24-hour period as practical. The pH will also be measured in a grab sample for each 24-hour period of an event.

Information regarding this sample will be recorded on an IWD log sheet, a copy of which is attached.

LIMS

The samples will be identified with two LIMS labels, one for the composite label and one for the grab label. The labels are created via use of Sample Manager: Sample / Log in / Template. The NBPS composite template is identified as “NPD-NBPS.” The NBPS grab template is identified as “NPD-NBPS_G.”

Sample Analyses

Monitoring and Research Department (M&R) Analytical Laboratory Division personnel at the Lue-Hing R&D Complex will report the composite sample results for BOD₅ or TOC and SS, Cd, and Hardness to the M&O Technical Services Section as required by the OWRP NPDES permit.

Report Completion of Sampling

Prior to departing the NBPS, notify the OWRP Operating Engineer (telephone number listed above) and advise that the NPDES sample has been obtained and to reset the intrusion alarm upon departure of the sampling crew.

Sample Transport

The samples must be refrigerated until it is received at the Lue-Hing R&D Complex Analytical Laboratories. The samples must arrive within 24 hours of collection.

Reporting

Submit the completed sample log sheet to the Area Supervisor. Following each event, the Area Supervisor will send an e-mail to the Field Services Section Supervisor indicating the date/time/location of the samples obtained.

Program Number

All costs associated with this sampling program shall be documented under Program Number 4681—Assistance to M&O Department.

Metropolitan Water Reclamation District of Greater Chicago

Discrete Sample Log

Company: NBPS **Station:** NPD-NBPS **Start Date & Time:**
Address: 4840 - 60 N. Francisco Ave. **Pipe Size:** _____ **Weather Finish:** _____
City: Chicago **User #:** 14026 **Section:** 194 **Date & Time Finish:**
Study: _____ **NPDES:** _____ **Weather:** _____

ES(s) & PCT(s): _____

AUTOMATIC SAMPLER #:	<u>SMPL0100</u>	NOTE: Each bottle represents 1/2 hour OR 2 bottles equal one hour.
SAMPLES PER BOTTLE:	<u>2</u>	
SAMPLE FREQUENCY (MINUTES)	<u>15</u>	
SAMPLE VOLUME (ml)/pH	<u>500 ml.</u>	
TOTAL SAMPLES COLLECTED:		

BOTTLE NUMBER	SAMPLE TIME	SAMPLE DESCRIPTION	% FULL	pH	BOTTLE NUMBER	SAMPLE TIME	SAMPLE DESCRIPTION	% FULL	pH
1					13				
2					14				
3					15				
4					16				
5					17				
6					18				
7					19				
8					20				
9					21				
10					22				
11					23				
12					24				

SAMPLE DATE:		Notes
LAB I.D. #		
COMMENTS:		
Storm Pumps	#4, #5, #6, #7, #8	
BOTTLE #S / HRS	___ TO ___ HOURS	
COMPOSITE SAMPLE DESCRIPTION:		
	°C pH inches	
LAB DATA:	GC <input type="checkbox"/> TM <input type="checkbox"/> Hardness <input type="checkbox"/>	

Sampling Protocol for Racine Avenue Pumping Station (RAPS)

The station is manned by Operating Engineers.

A one-gallon RAPS CSO grab sample is to be collected at the start of the CSO and another at 12am and each 12am for the duration of the event. This would result in two samples being collected in the first 24hrs of each event.

For example:

- 12/29/22 start of CSO @ 11:15pm – Collect a one-gallon sample
- 12/30/22 @ 12am – Collect a one-gallon sample
- 12/31/22 @ 12am – Collect a one-gallon sample
- Event ends at 2am on 12/31/21.

All CSO samples must be stored in the sample refrigerator immediately.

Samples must be delivered to Cooler E in the lab along with the completed C.O.C. as soon as practical. Also, include DO and pH readings.

PROTOCOL FOR SAMPLING THE 95th STREET PUMPING STATION NPDES PERMIT REQUIREMENTS

Purpose of Sampling Program

The sampling program is required by the NPDES permit for the Calumet Water Reclamation Plant (CWRP) to monitor discharges from the 95th Street Pumping Station (95SPS) into the Howard Slip on the Calumet River.

Sampling Personnel: IWD-South Office personnel will collect daily grab samples, while M&O CWRP personnel will collect daily composite samples. A CWRP M&O Operating Engineer will ensure the storm pumps are activated before sample collection. IWD personnel will transport the samples.

Program Start Date and Duration

The program started on March 1, 2002, and will continue year-round until further notice.

Notification of a Sampling Event

When the first storm pump at the 95SPS is activated, the CWRP Operating Engineer will inform the Systems Dispatcher, who will then notify the Area Supervisor, or his/her designee. IWD- South personnel will be assigned to obtain grab samples at the 95SPS.

95SPS Sampling Point

Samples will be obtained from the pump diversion channel at the 95SPS. The floor of the men's washroom and the adjacent room to the west at the 95SPS forms the ceiling over the diversion channel. Access for sampling the channel is provided by a marked 18-inch square, hinged cover in the floor at the southeast corner of the described room west of the men's washroom. The area is located between 2 large (approx. 24-inch diameter) curved pump discharge pipes on the east wall of the room.

If the Operating Engineer is not available, access to the pump station is achieved by using a District hydraulic key. Contact the CWRP Operating Engineer prior to entry at (773) 256-3540 or -3539 (x63540 or x63539) to identify the sampling crew and your purpose at the 95SPS. This will also prevent the District Police from responding to an intrusion alarm.

A silent intrusion alarm will be activated upon entry to the 95SPS when it is unmanned.

Samples Obtained

Sampling consists of a single, one-gallon composite sample for general chemistry (BOD5, TSS) and three grab samples, one for fecal coliform (125-mL square polypropylene bottle, prepared by Analytical Bacteriology Laboratory (ABL)), one for chlorine residual (unpreserved plastic quart), and one for pH (measured in field). The grab samples must not be obtained within the first 30 minutes of pumping nor later than 2 hours after the pumps have been activated.

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PROTOCOL FOR SAMPLING THE 95th STREET PUMPING STATION NPDES PERMIT REQUIREMENTS

Grab and composite samples will be collected for each pumping event. If a pumping event continues from one calendar day to the next, one sample set will be obtained for each day. If the pumping event ceases and starts again on the same day, no further sampling is required. However, if the pumping event starts the next calendar day, additional samples are required.

Daily grab samples will be collected by IWD personnel. Information regarding the grab sample will be recorded on a standard IWD grab log sheet. The log sheet must contain the temperature (C°) and pH of each sample obtained. The pH from each day's grab sample will be analyzed on site with an electronic meter, and the result recorded and authorized in LIMS by IWD personnel.

Multiple manual grab samples will be collected by M&O personnel to constitute a composite sample. A time composite sample consists of equal volume sample aliquots collected at constant time intervals into one container. For the manual composite sample, a grab of equal volumes of at least 100 mL shall be collected at least once every 3 hours and composited for each calendar day in a gallon container which will remain refrigerated at 0.0° C - 6.0° C. M&O will have an ice chest cooler available for sample storage and IWD will supply ice and a gallon collection container when they arrive to collect grab samples. The composite sample must indicate the total amount of compositing hours. For example, a 23-hour composite will be indicated by C-23. The CWRP Operating Engineer on site will notify IWD-South Area Supervisor when the composite sample is ready to be picked up.

LIMS

The sample will be identified with a LIMS label. The label is created via use of option "\$TLS" (Create Sample Using Template). The 95SPS template is identified as "NPD-95PS", the sampling point in LIMS is designated "NPD-95PS", and the test schedules are NPD-95PS_L for composite samples and NPD-95PS_G for grab samples. IWD will generate labels and provide them to M&O.

Sampling Analyses

The composite sample will be analyzed for BOD5 or TOC, TSS, hardness, and cadmium while the grab samples will be analyzed for fecal coliform, pH, and chlorine residual. Sample results will be reported to M&O Technical Services Section by ALD personnel.

Report Completion of Sampling

Prior to departing the 95SPS, notify the CWRP Operating Engineer on duty at the pump station (or telephone number listed above) and advise that the NPDES permit grab samples have been obtained. Ask to reset the intrusion alarm upon departure of the sampling crew if the station was unmanned during the sampling event.

PROTOCOL FOR SAMPLING THE 95th STREET PUMPING STATION NPDES PERMIT REQUIREMENTS

Sample Transport

Composite Samples

The composite sample must be packed on ice and/or refrigerated to 0.0°C – 6.0°C and delivered by IWD personnel within 24 hours of collection to the M&R Analytical Laboratory Division Calumet Lab. Calumet Lab personnel will aliquot the composite sample to send to Stickney Analytical Lab for analysis of cadmium and hardness.

Grab Samples

The grab sample for fecal coliform analysis must be packed on ice and/or refrigerated at <10°C until it is received at the Stickney ABL at the Cecil Lue- Hing Research and Development Complex. The sample must arrive within 6 hours of being collected. The **IWD-South staff who collect the grab samples will notify the ABL** when they are notified of the event, prior to taking the sample (ABL call list will be provided annually).

The grab sample for chlorine residual should be delivered to the Calumet Lab as soon as practical.

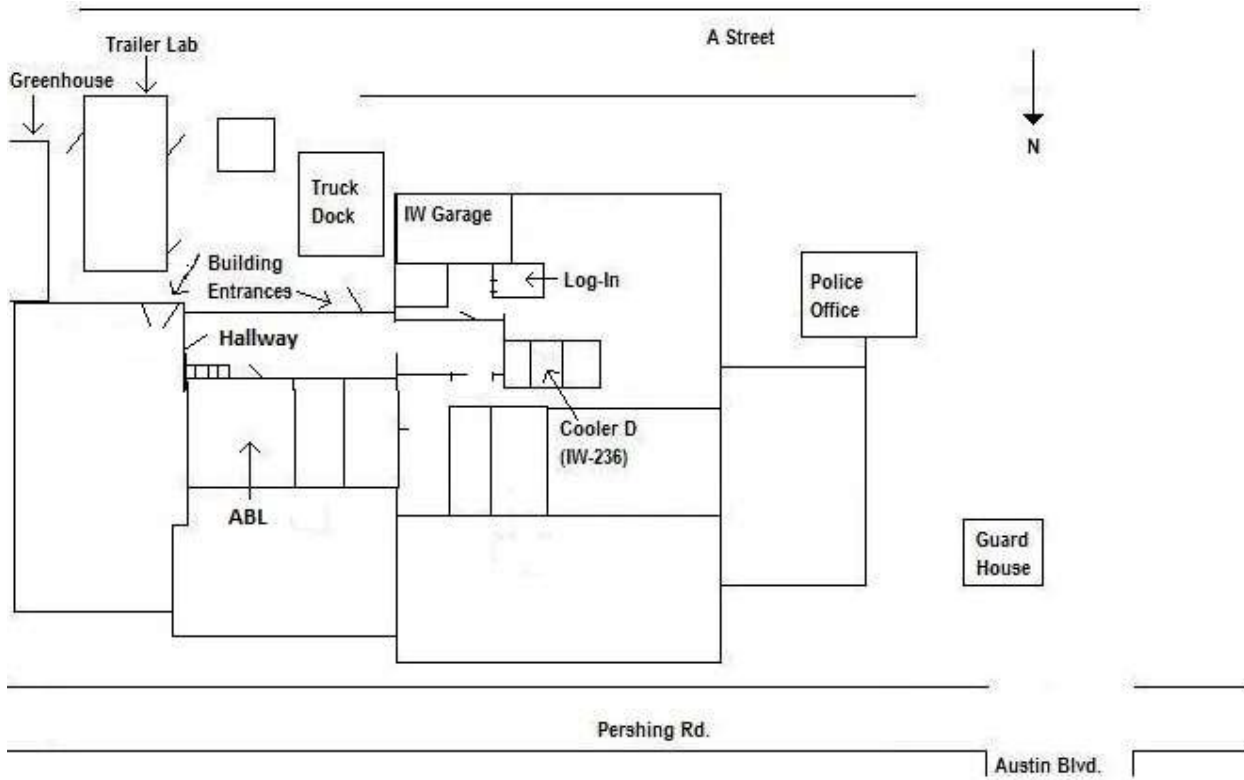
Reporting

Submit completed sample log sheets to the Area Supervisor. The Area Supervisor will email the Field Operations Supervisor with details of each sampling event (date/time/location of the samples obtained). This information gets passed up the chain of command to be shared with ABL and ALD teams for inclusion in M&O's monthly Discharge Monitoring Report to the IEPA.

Program Number

All costs associated with this sampling program shall be documented under Program Number 4681 - Assistance to M&O Department.

PROTOCOL FOR SAMPLING THE 95th STREET PUMPING STATION NPDES PERMIT REQUIREMENTS



PROTOCOL FOR SAMPLING THE 122ND STREET PUMPING STATION NPDES PERMIT REQUIREMENTS

Purpose of Sampling Program

As part of the NPDES permit for the Calumet Water Reclamation Plant (CWRP), the District must sample all discharges from the 122nd Street Pumping Station (122SPS) into the Calumet River.

Sampling Personnel: IWD-South Office personnel will collect daily grab samples, while M&O CWRP personnel will collect daily composite samples. A CWRP M&O Operating Engineer will ensure the storm pumps are activated before sample collection. IWD personnel will transport the samples.

Program Start Date and Duration

This program commenced January 1, 2014, and continues, year-round, until further notice.

Notification of a Sampling Event

Upon activation of the first storm pump at the 122SPS, the CWRP Operating Engineer will notify the Systems Dispatcher. The Systems Dispatcher will notify the Area Supervisor, or his designee, who will assign IWD-South personnel to obtain grab samples at the 122SPS.

122SPS Sampling Point

Samples will be obtained from the 122SPS pump discharge wet well. The 122SPS is located at 12205 S. Burley, Chicago, Illinois. Access to the station is made by taking 126th Place east from Torrence Avenue to Burley. Drive north on Burley until the pavement ends, then continue north on the unpaved gravel surface for approximately another 1000 feet. Samples will be obtained from the 122SPS wet well. An orange, vertical, sodium hypochlorite tank is located on the grating directly over the wet well. A small steel plate covers an access hole in the grating large enough to obtain the necessary sample.

A CWRP Operating Engineer will staff the 122SPS whenever the pumps are activated. If the Operating Engineer is not available, access to the pump station is achieved by using a District hydraulic key. Contact the CWRP Operating Engineer prior to entry at (773) 256-3540 or -3539 (x63540 or x63539) to identify the sampling crew and your purpose at the 122SPS. This will also prevent the District Police from responding to an intrusion alarm.

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PROTOCOL FOR SAMPLING THE 122ND STREET PUMPING STATION

NPDES PERMIT REQUIREMENTS

Samples Obtained

Sampling consists of a single, one-gallon composite sample for general chemistry and two grab samples for fecal coliform (125-mL square polypropylene bottle, prepared by Analytical Bacteriology Laboratory (ABL)) and chlorine residual (plastic quart). The grab samples must not be obtained within the first 30 minutes of pumping nor later than 2 hours after the pumps have been activated.

Grab and composite samples will be collected for each pumping event; if a single pumping event continues from one day to the next, one sample set (one composite, one grab for chlorine residual, and one grab for fecal coliform) will be obtained for each day of the event. If the pumping event ceases, then begins again within the same day, no further sampling is required. If the pumping event ceases, then begins the next calendar day, an additional set of composite and grab samples are required, representative of a separate pumping event.

Daily grab samples will be collected by IWD personnel. Information regarding the grab sample will be recorded on a standard IWD grab log sheet. The log sheet must contain the temperature (C°) and pH of each sample obtained. The pH from each day's grab sample will be analyzed on site with an electronic meter, and the result recorded and authorized in LIMS by IWD personnel.

Multiple manual grab samples will be collected by M&O personnel to constitute a composite sample. A time composite sample consists of equal volume sample aliquots collected at constant time intervals into one container. For the manual composite sample, a grab of equal volumes of at least 100 mL shall be collected at least once every 3 hours and composited for each calendar day in a gallon container which will remain refrigerated at 0.0° C - 6.0° C. M&O will have an ice chest cooler available for sample storage and IWD will supply ice and a gallon collection container when they arrive to collect grab samples. The composite sample must indicate the total amount of compositing hours. For example, a 23-hour composite will be indicated by C-23. The CWRP Operating Engineer on site will notify IWD-South Area Supervisor when the composite sample is ready to be picked up.

LIMS

The sample will be identified with a LIMS label. The label is created via use of option "\$TLS" (Create Sample Using Template). The 122SPS template is identified as "NPD-122PS", the sampling point in LIMS is designated "NPD-122PS", and the test schedules are NPD-122PSG for grab samples and NPD-122PSL for composite samples.

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PROTOCOL FOR SAMPLING THE 122ND STREET PUMPING STATION NPDES PERMIT REQUIREMENTS

Sampling Analyses

The composite sample will be analyzed for BOD5 or TOC and SS, while the grab samples will be analyzed for fecal coliform and chlorine residual. Analytical Laboratory personnel at the Stickney Water Reclamation Plant will report the sample results to M&O for permit reporting purposes.

Report Completion of Sampling

Prior to departing the 122SPS, notify the CWRP Operating Engineer on duty at the pump station (or telephone number listed above) and advise that the NPDES permit grab samples have been obtained. Field personnel are to ask to reset the intrusion alarm upon departure of the site if the station was unmanned during the sampling event.

Sample Transport

The composite sample must be packed on ice and/or refrigerated to 4C° and delivered by IWD personnel within 24 hours of collection to the M&R Analytical Laboratory Division Calumet Lab.

The grab sample for fecal coliform analysis must be packed on ice and/or refrigerated at <10°C until it is received at the Stickney ABL at the Cecil Lue- Hing Research and Development Complex. The sample must arrive within 6 hours of being collected. The IWD-South staff who collect the grab sample will notify the ABL when they are notified of the event, prior to taking the sample (ABL call list will be provided annually).

The grab sample for chlorine residual should be delivered to the Calumet Lab as soon as practical.

Reporting

Submit the completed sample log sheet to the Area Supervisor. Following each event, the Area Supervisor, or his/her designee, will send an email to the Field Operations Supervisor indicating the date/time/location of the samples obtained.

Program Number

All costs associated with this sampling program shall be documented under Program Number 4681 - Assistance to M&O Department.

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Collection System O&M Manual

Appendix E: Lake Michigan Backflow Sampling Protocols

WILMETTE GATES BACKFLOW PROCEDURES

The Systems Dispatcher will notify the IWD-O'Brien Area Supervisor that a backflow event is imminent at the Wilmette Gates. The IWD-O'Brien personnel will be assigned upon notification that an Electrical Operator has been dispatched to the site to confirm and oversee the remote operation of the sluice gates.

A minimum of two persons is required for backflow sampling. The sampling crew will report to the IWD-O'Brien Office and obtain two vehicles, two MWRD hydraulic keys (old one and Y1 key) to open the entry gate at the Wilmette Gates, and an MWRD Medeco key to open the Pumping Station building and adjacent gate. These keys are in the IWD- O'Brien key box outside the Area Supervisor's office. All other safety and sampling equipment is stored in lockers within the pump station. The lockers are secured with an IWD "507" key, the same key used in other IWD sampling operations and has been issued to all personnel.

Entry into the Wilmette Pumping Station will trigger a silent intrusion alarm with the Systems Dispatcher. The sampling crew must notify O'Brien WRP Electrical Operators (EO's) at 847-568-8375 of their entry, otherwise District Police will be dispatched to investigate the alarm. Call the Dispatcher at (312) 787-3575 and report the IWD personnel on site and your purpose (backflow sampling). The telephone number to the Wilmette Pumping Station office is (847) 256-0435.

- I. Sampling during the backflow will be conducted at the Wilmette sluice gates (Station LD-WILHBR1) and Wilmette Harbor Mouth (Station LD-WILHBR2). See attached sketch ([Figure 4D.3](#)). One General Chemistry and one bacteria (fecal coliform if the backflow has ended at the time of sampling or *E. coli* if the backflow is ongoing) sample in Sterile BacT bottle will be collected within 24 hours of the onset of the backflow on the nearest workday ([Table 1](#)). The first sample to be collected with a backflow event for the season should include Field Blank for bacteria (see page 6 for collection procedures). Follow the latest bacteriological sampling procedures. Record the temperature (°C) of all samples on the log sheet. Notify the M&R Stickney Analytical Laboratory and the Microbiology Laboratory Supervisor of the total number of samples and the anticipated time of delivery. (Contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112) Bacteria samples need to be transported on ice to room LC-243 (Stickney Microbiology Laboratory) as soon as possible (i.e., within 6 hours). The sample for general chemistry shall be kept on ice and delivered to the Industrial Waste Analytical Laboratories (IWAL) at Stickney.

If the backflow event is still in progress, record the sluice gate opening measurement at the time of samples collection, in addition to the measurements at the onset of the event. This information will be made available from the Electrical Operator on site. Also note that the closure of the sluice gates does not guarantee that the event has ended. If the sluice gates are closed, the Systems Dispatcher or the Area Supervisor can tell you whether the event has ended.

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WILMETTE GATES BACKFLOW PROCEDURES

The sampling crew will return to the IWD-O'Brien Office to prepare LIMS labels and receipts for all samples (Table 1). Note that the **LIMS template is LD-WIL** for the gates and **LD-WIL-FB** for the Field Blank. Please note that due to separate receipts, (general chemistry and bacteria), use the LIMS template and test schedules as listed in Table 1.

One Field Blank (provided by the Microbiology Laboratory) should be collected at the first location per season for bacteria. The LIMS label can be printed from the LD-WIL2 template. Sterile BacT bottles will be provided to IWD staff. Contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112 for sterile bottles.

- II. The IWD-O'Brien Office will conduct post-backflow beach sampling after approximately 24 hours of the cessation of the event. The sample collection should be scheduled in the morning post (~ 24 hours) backflow event for samples to arrive in the Microbiology Laboratory before noon to avoid overtime. Obtain bacteria samples for *E. coli* parameters at the following locations:

- | | |
|---|-------------------|
| • Kenilworth Beach | LD-WILHBR3 |
| • Wilmette Beach | LD-WILHBR4 |
| • Gillson Beach | LD-WILHBR5 |
| • Lighthouse Beach | LD-WILHBR6 |
| • Northwestern (Lincoln St.) Beach (If accessible) | LD-WILHBR7 |
| • Dempster Street Beach | LD-WILHBR8 |

Again, notify the Microbiology Laboratory Supervisor (8-4225) of the number of samples and the anticipated time of delivery. The IWD-O'Brien Office will prepare LIMS labels and receipts for all samples. Note that the LIMS template is **LD-WIL2** and use the **LAKE-DIV3** test schedule for bacteria analyses only.

This updated sampling plan calls for conducting sampling during the regular working periods, i.e., Monday through Friday between the hours of 7:00 a.m. and 3:30 p.m. except for holidays. For holiday, weekend or late-night storm related backflow, the sampling will be scheduled on the following regular workday.

LIMS labels and receipts:

Use this procedure to create labels for backflow and post-backflow samples.

- Log into Sample Manager (LIMS)
- At the top tool bar, click on "Samples" tab
- Place cursor over "Login," then over "Template" and click
- In the "Samples Logged In" window, type "**LD-WIL**" in the "Sample Template" box (see table on page 5 for all sample templates)
- Enter the number of samples needed to be logged in the "Repeat Count" box

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WILMETTE GATES BACKFLOW PROCEDURES

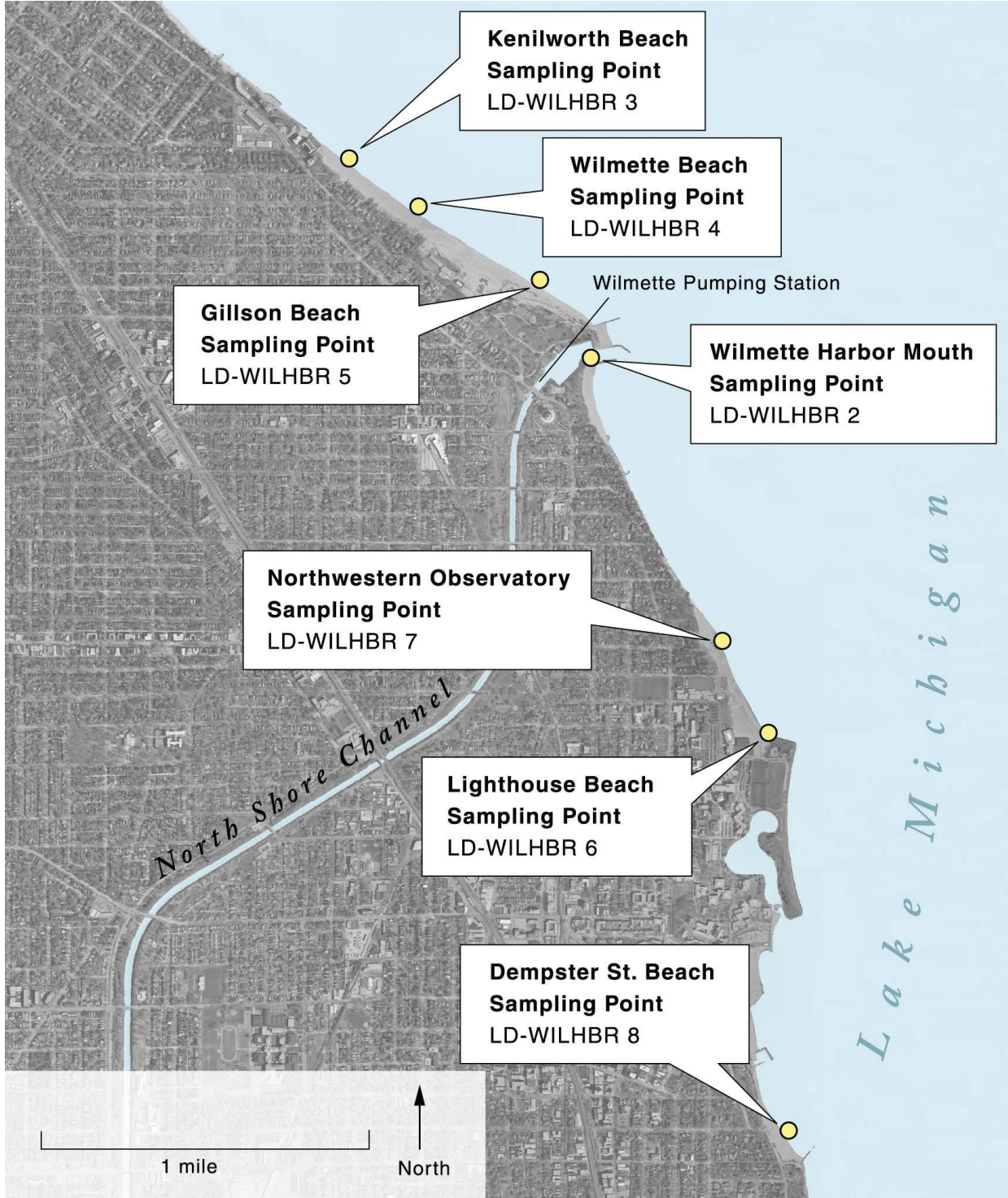
- Click on the “Login...” button
- Fill in the appropriate field for the sample point, collector’s name, sample ID, time collected, etc. The test schedules are listed on page 4. Sample labels will print automatically.
- To print a receipt, go to Sample Manager main page. At the top tool bar, click on the “MWRDGC” tab. Then place cursor over “IWD,” then “Field Office,” then click on “Print Sample Receipt.” Enter the dates, your name, and click in the drop- down box for “sample schedule” to indicate, “yes”, you wish to print a sample receipt.

Please note that the backflow beach sampling is performed only during the Chicago Park District’s Beach Recreation Season - Memorial Day through Labor Day.

A report must be submitted to the Assistant Directors of Environmental Monitoring and Research, Industrial Waste Division by the Area Supervisor, or his/her designee, within two weeks following backflow and post-backflow sampling. It must contain a brief summary narrative, event chronology, and the sampling log sheets.

WILMETTE GATES BACKFLOW PROCEDURES

FIGURE 4D.3: SAMPLING LOCATIONS FOLLOWING BACKFLOW TO LAKE MICHIGAN FROM WILMETTE PUMPING STATION



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WILMETTE GATES BACKFLOW PROCEDURES

TABLE 1: PROPOSED MONITORING PLAN FOR WILMETTE GATES BACKFLOW RELATED SAMPLING

Location	Frequency ¹	Parameters
Wilmette Locks	Grab samples	BOD ₅
Wilmette Sluice Gates:	from the Sluice Gates within	Suspended Solids
LD-WILHBR1	24-h of the onset of the	Bacteria (Fecal
LD-WILFBLK	backflow during weekdays	coliform or <i>E. coli</i>)
²	or the first work day after	
Wilmette Harbor Mouth	weekend/holiday (one for	
LD-WILHBR2	Gen Chem and one for	
	Bacteria for each location)	
<u>Beaches</u>	One Grab sample for	Bacteria (<i>E. coli</i>)
Kenilworth Beach: LD-WILHBR3	bacteria from the beaches	
Wilmette Beach: LD-WILHBR4	approximately 24 hours ³	
Gillson Beach: LD-WILHBR5	after the cessation of the	
Lighthouse Beach: LD-WILHBR6	backflow	
Northwestern Beach: LD-		
WILHBR7 Dempster St. Beach:		
LD-WILHBR8		

Wilmette Backflow LIMS Information:

Wilmette Locks

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
Wilmette Sluice Gates	LAKE-DIV	LD-WILHBR1	LD-WIL
Wilmette Sluice Gates Field Blank	LAKE-DIV3	LD-WILFBLK	LD-WIL-FB
Wilmette Harbor Mouth	LAKE-DIV	LD-WILHBR2	LD-WIL

Beaches

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
Kenilworth Beach:	LAKE-DIV3	LD-WILHBR3	LD-WIL2
Wilmette Beach:	LAKE-DIV3	LD-WILHBR4	LD-WIL2
Gillson Beach:	LAKE-DIV3	LD-WILHBR5	LD-WIL2
Lighthouse Beach:	LAKE-DIV3	LD-WILHBR6	LD-WIL2
Northwestern Beach:	LAKE-DIV3	LD-WILHBR7	LD-WIL2
Dempster Beach:	LAKE-DIV3	LD-WILHBR8	LD-WIL2

¹ Sampling should be conducted during the regular work week (Monday through Friday) between 7:00 a.m. to 3:30 p.m. For any weekend or late-night storm related backflow, sampling should be conducted on the following regular workday.

² One field blank for the entire season.

³ Sample collection should be scheduled in the morning post (~ 24 hours) backflow event for samples to arrive in the Microbiology Laboratory before noon to avoid over time.

WILMETTE GATES BACKFLOW PROCEDURES

Subject: Backflow Required Field Blank Sample Collection for Bacteria Analyses

The Microbiology Laboratory will be sending sterile water for the **Quality Control and Assessment (QCA) measures**. The QCA is detail for your reference in the latest Bacteriological Sampling Procedures (Page 5). A sealed bottle of sterile water (preparation date will be stamped on the bottle label and will expire one year after preparation) will be submitted to IWD Area Supervisor. The first sample to be collected with a backflow event for the season per year should include Field Blank for bacteria. The “Field Blank” sample bottle should be stored in a refrigerator. Record the temperature (°C) of all samples on the log sheet.

The following instructions will be sealed in the transport bag with the sterile water sample supplied by the Microbiology Laboratory:

- Take the sterile water bottle (Keep it sealed) and a fresh sample (BacT) bottle from your stock. (Note only one Field Blank is required for the season).
- LIMS Labels for the Field Blank sample bottle can be printed. Affix the proper LIMS Label to this sample bottle on the first backflow sample collection trip.
- At the sampling location, before collecting the backflow sample, gently break the seal on the sterile water bottle and carefully pour about 100 mL from the sterile water bottle into the (BacT) sample bottle marked with the field blank label.
- Avoid touching the neck or the mouth of the container, or inside of the plastic cap to prevent contamination.
- Carefully reseal the Field Blank sample bottle and the sterile water bottle.
- Record data on Field Blank label (sampler name, sample date & time).
- Finally send the Field Blank sample and the sterile water bottle, along with the backflow samples to the bacteriology laboratory as usual.

The Microbiology Laboratory will analyze the Field Blank sample along with the backflow samples. The purpose of Field Blank analyses is to check and determine the validity of sampling procedures established for on-site sampling, the suitability of sample preservatives, equipment and rinse water, and sample transport and storage conditions.

For additional information on Bacteriological sample collection or any questions, please contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112.

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CHICAGO RIVER BACKFLOW PROCEDURES

When the Field Services Section receives a call from the Systems Dispatcher that backflow to Lake Michigan at the Chicago River Controlling Works (CRCW) has commenced, one general chemistry and one bacteria (*E. coli*) sample will be collected from the lakeside backflow sampling points within 24 hours. The Sterile BacT will be provided to IWD staff. (Contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112 for sterile bottles.)

The bacteria samples need to be transported to the Stickney Microbiology Laboratory as soon as possible (i.e., within 6 hours). Transporter personnel must be ready to pick up the samples and transport them to the laboratory. During beach season (Memorial Day to Labor Day), and after 24 hours of the cessation of backflow, one bacteria sample will be collected from nearby beaches by land-based crews to identify the extent of the bacterial contamination and the pollution that were caused by the backflow event. Record collection time and temperature (°C) of all samples on the log sheet.

- I. Samples will be collected from the following locations during the backflow or 24 hours during a workday after the end, as shown in [Figure 4D.1](#). Contact the Systems Dispatcher to determine which gates are being used. The first sample to be collected with a backflow event for the year should include a Field Blank (See page 6). Follow the latest bacteriological sampling procedure.

- **DuSable Harbor Sluice Gates (CRCW South): LD-CHGHBR1.** This site is accessed by entering the Chicago Yacht Club at Lake Shore Drive and Monroe Street. Drive north along the lakeside bike path. The sluice gates and gatehouse are adjacent to the path approximately 1/4 mile north of Randolph Street and the Columbia Yacht Club. Park the vehicle on the sluice gate walkway.
- **Inner Harbor Sluice Gates (CRCW North): LD-CHGHBRH.** This site is accessed by driving east on Illinois Street from Lake Shore Drive. Turn right on Streeter Drive. Pass through two (2) gates with intercoms before reaching the sluice gates and gatehouse.

- II. Post-backflow beach samples will be collected by land-based crews 24 hours after the backflow ends at the following locations, which are highlighted on the attached map ([Figure 4D.2](#)). These samples will only be collected during Chicago Park District's Beach Recreation Season (Memorial Day to Labor Day).

- **North Avenue Beach** **LD-CHGHBR3**
- **Oak Street Beach** **LD-CHGHBR4**
- **Monroe Harbor** **LD-CHGHBR5**
- **12th Street Beach (Adler Planetarium)** **LD-CHGHBR6**
- **31st Street Beach** **-CHGHBR7**

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CHICAGO RIVER BACKFLOW PROCEDURES

These samples are to be collected at "mid-beach" locations, 10' to 20' from the water's edge at a 1' to 2' depth. Monroe Harbor samples should be collected at the east edge of the harbor bike path as there is no "beach" at this location.

III. IWD personnel performing backflow sampling should work in teams of two at each sluice gate site. Life vests must be worn while sampling. Four life vests are stored in the IWD storeroom, and more are available in the safety office. Contact the Microbiology Laboratory at 8-3637 and notify them of the number of bacteria samples to be delivered. Consult the latest storm event call-out listing of Environmental Monitoring and Research Division personnel for available personnel. If no one is in the Microbiology Laboratory (LC243 – LC245) to receive bacteria samples, store them in the white laboratory refrigerator or in the designated blue bin for the Microbiology Laboratory in Log-In Cooler D. Leave a copy of the LIMS receipts and sample receipt page. The sample for general chemistry shall be kept on ice and delivered to the Industrial Waste Analytical Laboratories (IWAL) at Stickney.

This updated sampling plan calls for conducting sampling during the regular working periods, i.e., Monday through Friday between the hours of 7:00 a.m. and 3:30 p.m. except for holidays. For any holiday, weekend or late-night storm related backflow, the sampling will be scheduled on the following regular workday.

LIMS labels and receipts:

Use this procedure to create labels for backflow and post-backflow samples.

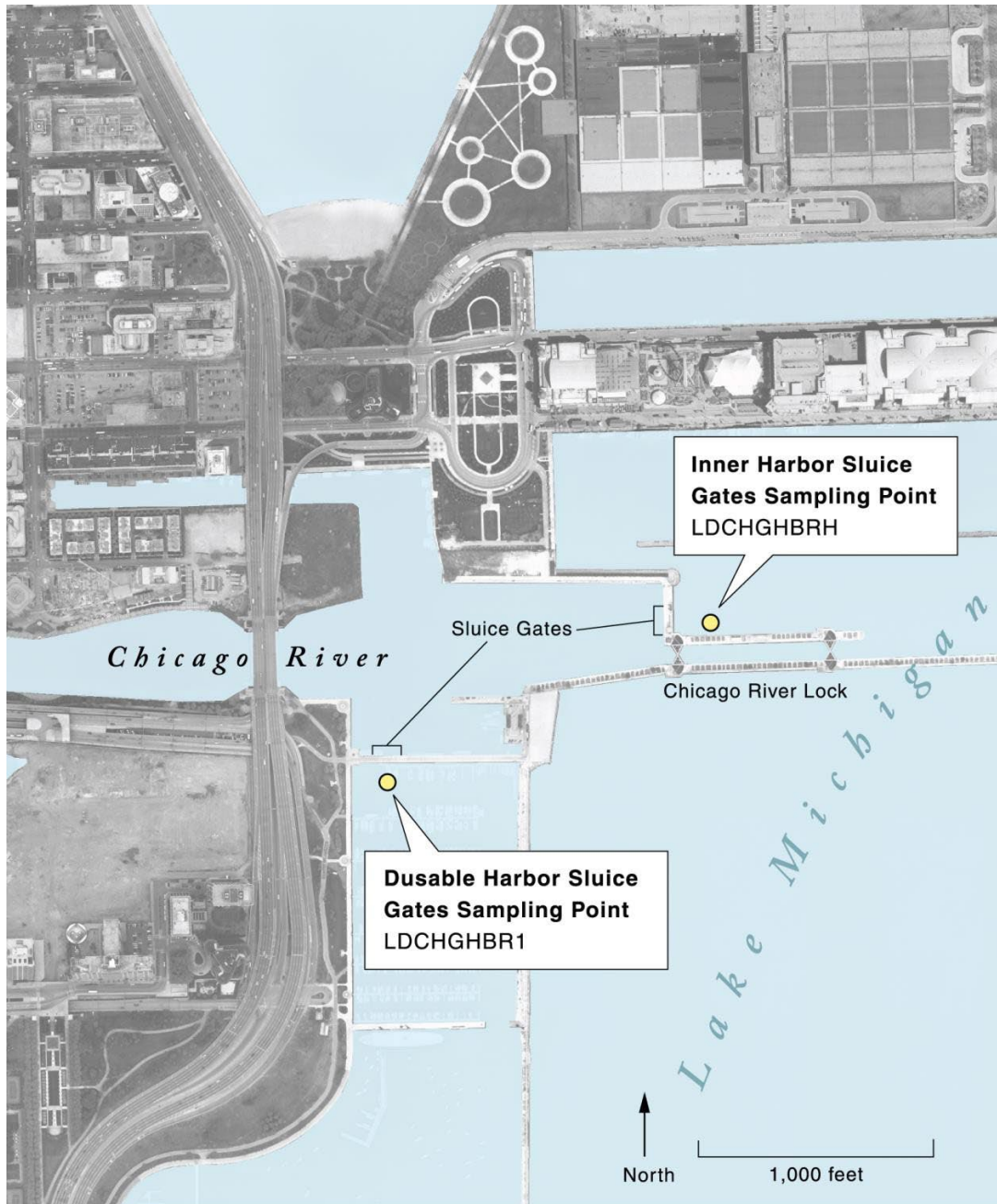
- Log into Sample Manager (LIMS)
- At the top tool bar, click on the "Samples" tab
- Place cursor over "Login," then over "Template" and click
- In the "Samples Logged In" window, type "**LD-CRL**" in the "Sample Template" box (see table on page 6 for all sample templates)
- Enter the number of samples needed to be logged in the "Repeat Count" box
- Click on the "Login..." button
- Fill in the appropriate field for the sample point, collector's name, sample ID, time collected, etc. The test schedules are listed on page 4. Sample labels will print automatically.
- To print a receipt, go to Sample Manager main page. At the top tool bar, click on the "MWRDGC" tab. Then place cursor over "IWD," then "Field Office," then click on "Print Sample Receipt." Enter the dates, your name, and click in the drop down box for "sample schedule" to indicate, "yes", you wish to print a sample receipt.

A report must be submitted to the Assistant Directors of Environmental Monitoring and Research and Industrial Waste Divisions by the Area Supervisor, or their designee, within two weeks following the backflow and post-backflow sampling. It must contain a brief summary narrative, event chronology, and the sampling log sheets.

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CHICAGO RIVER BACKFLOW PROCEDURES

FIGURE 4D.1: SAMPLING LOCATIONS FOLLOWING BACKFLOW TO LAKE MICHIGAN FROM CHICAGO RIVER SLUICE GATES



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CHICAGO RIVER BACKFLOW PROCEDURES

FIGURE 4D.2: LAKE MICHIGAN BEACH SAMPLING LOCATIONS FOLLOWING CHICAGO RIVER BACKFLOW



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CHICAGO RIVER BACKFLOW PROCEDURES

TABLE 1: PROPOSED MONITORING PLAN FOR CHICAGO RIVER BACKFLOW RELATED SAMPLING

Location	Frequency ¹	Parameters
Chicago River Sluice Gates		
<ul style="list-style-type: none"> • DuSable Harbor LD-CHGHBR1 • Field Blank: LD-CHGFBLK² • Inner Harbor LD-CHGHBRH 	Grab samples from the Sluice Gates within 24-hours of the onset of the backflow during weekdays or the first work day after weekend/holiday (One for Gen Chem and one for Bacteria)	BOD ₅ Suspended Solids Bacteria (<i>E. coli</i>)
<u>Beaches</u>		
North Avenue Beach LD-CHGHBR3 Oak Street Beach LD-CHGHBR4 Monroe Harbor LD-CHGHBR5 12th Street Beach (Adler Planetarium) LD-CHGHBR6 31st Street Beach LD-CHGHBR7	One Grab sample for bacteria from the beaches approximately 24 hours ³ after the cessation of the backflow	Bacteria (<i>E. coli</i>)

Backflow LIMS Information:

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
DuSable Harbor	LAKE-DIV	LD-CHGHBR1	LD-CRL
DuSable Harbor Field Blank	LAKE-DIV3	LD-CHGFBLK	LD-CRL-FB
Inner Harbor	LAKE-DIV	LD-CHGHBRH	LD-CRL

Beaches

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
North Avenue Beach	LAKE-DIV3	LD-CHGHBR3	LD-CRL2
Oak Street Beach	LAKE-DIV3	LD-CHGHBR4	LD-CRL2
Monroe Harbor	LAKE-DIV3	LD-CHGHBR5	LD-CRL2
12th Street Beach (Adler Planetarium)	LAKE-DIV3	LD-CHGHBR6	LD-CRL2
31st Street Beach	LAKE-DIV3	LD-CHGHBR7	LD-CRL2

¹ Sampling should be conducted during regular work week (Monday through Friday) between 7:00 a.m. to 3:30 p.m. For any weekend or late-night storm related backflow, sampling should be conducted on the following regular workday.

² One Field Blank for the entire season.

³ Sample collection should be scheduled in the morning post (~ 24 hours) backflow event for samples to arrive in the Microbiology Laboratory before noon to avoid overtime.

CHICAGO RIVER BACKFLOW PROCEDURES

Subject: Backflow Required Field Blank Sample Collection for Bacteria Analyses

The Microbiology Laboratory will be sending sterile water for the **Quality Control and Assessment (QCA) measures**. The QCA is detailed for your reference in the latest Bacteriological Sampling Procedures (Page 5). A sealed bottle of sterile water (preparation date will be stamped on the bottle label and the bottle expires after one year) will be submitted to IWD Area Supervisor. The first sample to be collected with a backflow event for the year should include one Field Blank for bacteria. The “Field Blank” sample bottle should be stored in a refrigerator until use to prevent evaporation, however if no refrigerators are available room temperature will be sufficient. Record the temperature (°C) of all samples on the log sheet.

The following instructions will be sealed in the transport bag with the sterile water sample supplied by the Microbiology Laboratory:

- Take the sterile water bottle (Keep it sealed) and a fresh sample (BacT) bottle from your stock. (Note only one Field Blank is required for the season).
- LIMS Labels for the Field Blank sample bottle can be printed. Affix the proper LIMS Label to this sample bottle on the first backflow sample collection trip.
- At the sampling location, before collecting the backflow sample, gently break the seal on the sterile water bottle and carefully pour about 100 mL from the sterile water bottle into the (BacT) sample bottle labeled for the Field Blank.
- Avoid touching the neck or the mouth of the container, or inside of the plastic cap to prevent contamination.
- Carefully reseal the Field Blank sample bottle and the sterile water bottle.
- Record data on Field Blank label (sampler name, sample date & time).
- Finally send the Field Blank sample and the sterile water bottle, along with the backflow samples to the Microbiology Laboratory as usual.

The Microbiology Laboratory will analyze the Field Blank sample along with the backflow samples. The purpose of Field Blank analyses is to check and determine the validity of sampling procedures established for on-site sampling, the suitability of sample preservatives, equipment and rinse water, and sample transport and storage conditions.

For additional information on Bacteriological sample collection or any questions, please contact the Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112.

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95th STREET BACKFLOW PROCEDURES

A backflow from the Calumet River into Lake Michigan occurs when the storm pumps at the 95th Street Pumping Station are activated. The Field Services Section will receive a call from the Systems Dispatcher when the pumping begins. The pumps discharge into the Howard Slip on the river. Samples are obtained upstream of the Howard Slip at the Ewing Avenue Bridge and downstream at the 95th Street Bridge.

One general chemistry grab sample and one bacteria (*E. coli* for post-backflow beach samples, or fecal coliform for samples collected from the Calumet River) sample will be collected during the regular work week (Monday through Friday) between 7:00 a.m. to 3:30 p.m. For any weekend or late- night storm related backflow, sampling should be conducted on the following regular workday of the onset of the backflow. The temperature (°C) must be taken and logged for each sample obtained. Bacteria samples need to be transported to the Microbiology Laboratory as soon as possible (i.e., within 6 hours). Sterile BacT bottles will be provided to IWD staff. (Contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112 for sterile bottles.) The sample for general chemistry shall be kept on ice and delivered to the Industrial Waste Analytical Laboratories at Stickney.

Samples will be collected from the following sample points during the backflow. Contact the Systems Dispatcher to determine when the pumps have been deactivated. Follow the latest bacteriological sampling procedures. The first sample to be collected with a backflow event for the year should include a Field Blank.

- **Ewing Avenue Bridge: LD-CALHBR1**
- **Ewing Avenue Bridge Field Blank: LD-CALFBLK**
- **95th Street Bridge: LD-CALHBR2**

I. One post-backflow bacteria beach sample will be collected by the land-based crews after 24 hours of the cessation of the backflow during a workday at the following locations, which are highlighted on the attached map ([Figure 4D.4](#)). (Note: These samples will only be collected during the Chicago Park District's Beach Recreation Season - Memorial Day through Labor Day).

- **Rainbow Beach: LD-CALHBR5**
- **Calumet Beach: LD-CALHBR4**
- **Iroquois Landing: LD-CALHBR3**

These samples are to be collected at “mid-beach” locations, 10’ to 20’ from the water’s edge at a 1’ to 2’ depth. Iroquois Landing samples should be collected at the south edge of the mouth of the Calumet River at the Lake as there is no “beach” at this location.

95th STREET BACKFLOW PROCEDURES

IWD personnel performing backflow sampling should work in teams of two at each bridge. Contact the Microbiology Laboratory at 8-3637 and notify them of the number of bacteria samples that will be delivered. Consult the latest storm event call-out listing of Environmental Monitoring and Research Division personnel and the Microbiology Laboratory personnel for available personnel. If no one is present in the Microbiology Laboratory (LC243 – LC245) to receive bacteria samples, they should be stored in the laboratory refrigerator or in the designated blue bin in Log-In Cooler D with a copy of the LIMS receipts. Sample receipts should be date and time stamped.

This sampling plan calls for conducting sampling during the regular working periods, i.e., Monday through Friday between the hours of 7:00 a.m. and 3:30 p.m. except for holidays. For holiday, weekend or late-night storm related backflow, the sampling will be scheduled on the following regular workday.

LIMS labels and receipts:

Use this procedure to create labels for backflow and post-backflow samples.

- Log into Sample Manager (LIMS)
- At the top tool bar, click on the “Samples” tab
- Place cursor over “Login,” then over “Template” and click
- In the “Samples Logged In” window, type “LD-CAL” in the “Sample Template” box (see table on page 4 for all sample templates)
- Enter the number of samples needed to be logged in the “Repeat Count” box
- Click on the “Login...” button
- Fill in the appropriate field for the sample point, collector’s name, sample ID, time collected, etc. The test schedules are listed on page 4. Sample labels will print automatically.
- To print a receipt, go to Sample Manager main page. At the top tool bar, click on the “MWRDGC” tab. Then place cursor over “IWD,” then “Field Office,” then click on “Print Sample Receipt.” Enter the dates, your name, and click in the drop-down box for “sample schedule” to indicate “yes” you wish to create a sample receipt.

A report must be submitted to the Assistant Directors of Environmental Monitoring and Research and Industrial Waste Divisions by the Area Supervisor, or his/her designee, within two weeks following backflow and post-backflow sampling. The report must contain a brief summary narrative, event chronology, and sampling log sheets.

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95th STREET BACKFLOW PROCEDURES

FIGURE 4D.4: SAMPLING LOCATIONS FOLLOWING BACKFLOW TO LAKE MICHIGAN FROM 95th STREET PUMPING STATION



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95th STREET BACKFLOW PROCEDURES

TABLE 1: PROPOSED MONITORING PLAN FOR CHICAGO RIVER BACKFLOW RELATED SAMPLING

Location	Frequency ¹	Parameters
<u>95th Street Pumping Station</u>		
<ul style="list-style-type: none"> • Ewing Avenue Bridge: LD-CALHBR1 • Field Blank: LD-CALFBLK² • 95th Street Bridge: LD-CALHBR2 	Two Grab samples from the Sluice Gates within 24-hours of the onset of the backflow during weekdays or the first workday after weekend/holiday (One for Gen Chem and one for Bacteria)	BOD ₅ Suspended Solids Bacteria (<i>fecal coliform</i>)
<u>Beaches</u>		
<ul style="list-style-type: none"> • Rainbow Beach: LD-CALHBR5 • Calumet Beach: LD-CALHBR4 • Iroquois Landing: LD-CALHBR3 	One Grab sample for bacteria from the beaches, approximately 24 hours ³ after the cessation of the backflow	Bacteria (<i>E. coli</i>)

Backflow LIMS Information:

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
Ewing Avenue Bridge	LAKE-DIV2	LD-CALHBR1	LD-CAL
Ewing Avenue Bridge Field Blank	LAKE-DIV4	LD-CALFBLK	LD-CALFB
95 th Street Bridge	LAKE-DIV2	LD-CALHBR2	LD-CAL

Beaches

LOCATION	TEST SCHEDULE	SAMPLING POINT	SAMPLE TEMPLATE
Rainbow Beach	LAKE-DIV3	LD-CALHBR5	LD-CAL2
Calumet Beach	LAKE-DIV3	LD-CALHBR4	LD-CAL2
Iroquois Landing	LAKE-DIV3	LD-CALHBR3	LD-CAL2

¹ Sampling should be conducted during regular work week (Monday through Friday) between 7:00 a.m. to 3:30 p.m. For any weekend or late-night storm related backflow, sampling should be conducted on the following regular workday.

² One Field Blank for entire season.

³ Sample collection should be scheduled in the morning post (~ 24 hours) backflow event for samples to arrive in the Microbiology Laboratory before noon to avoid overtime.

95th STREET BACKFLOW PROCEDURES

Subject: Backflow Required Field Blank Sample Collection for Bacteria Analyses

The Microbiology Laboratory will be sending sterile water for the **Quality Control and Assessment (QCA)** measures. The QCA is a detail for your reference in the latest Bacteriological Sampling Procedures (Page 5). A sealed bottle of sterile water (preparation date will be stamped on the bottle label and will expire one year after preparation) will be submitted to IWD Area Supervisor. The first sample to be collected with a backflow event for the year should include Field Blanks – one for bacteria. The Field Blank sample bottles should be stored in a refrigerator. Record the temperature (°C) of all samples on the log sheet.

The following instructions will be sealed in the transport bag with the sterile water sample supplied by the Microbiology Laboratory:

- Take the sterile water bottle (keep it sealed) and a fresh sample (BacT) bottle from your stock. (Note only one Field Blank is required for the season).
- LIMS Labels for the Field Blank sample bottle can be printed. Affix the proper LIMS Label to this sample bottle on the first backflow sample collection trip.
- At the sampling location, before collecting the backflow sample, gently break the seal on the sterile water bottle and carefully pour about 100 mL from the sterile water bottle into the (BacT) sample bottle marked for sample blank.
- Avoid touching the neck or the mouth of the container or the inside of the plastic cap to prevent contamination.
- Carefully reseal the Field Blank sample bottle and the sterile water bottle.
- Record data on Field Blank label (sampler name, sample date & time).
- Finally, send the Field Blank sample and the sterile water bottle, along with the backflow samples to the Microbiology Laboratory as usual.

The Microbiology Laboratory will analyze the Field Blank sample along with the backflow samples. The purpose of the Field Blank analyses is to determine the validity of the sampling procedures established for on-site sampling, the suitability of sample preservatives, the equipment and rinse water procedures, and the sample transport and storage conditions.

For additional information on Bacteriological sample collection or any questions, please contact Environmental Microbiologist at 8-4225 or Senior Environmental Microbiologist at 8-4112.

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Collection System O&M Manual

Appendix F: List of Monitored and Unmonitored CSOs

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Arlington Heights	Weller Creek	M	001	UDP-DS1 (K1) & UDP-DS1A (K1A)	AH001
Blue Island	CSC	M	002	CDS-7	BI002
Blue Island	CSC	M	003	CDS-8	BI003
Blue Island	CSC	U	004	CDS-9	BI003
Blue Island / Posen	CSC	M	005 / 001	CDS-6	BI005/PO001
Brookfield	SC	M	001	DS-D37,38	BF001
Brookfield	SC	M	003	DS-D40	BF003
Brookfield	SC	M	004	DS-D39,42,46	BF004
Brookfield	SC	M	005	DS-D39,42,46	BF005
Brookfield	SC	M	006	DS-D47,50,51	BF006
Brookfield	SC	M	007	DS-D39,42,46	BF007
Brookfield	SC	M	008	DS-D62	BF008
Brookfield	SC	M	009	DS-D47,50,51	BF009
Brookfield	DPR	U	NP	DS-DA6	BF006
Burnham	GCalR	M	001	CDS-21	BM001
Burnham	GCalR	M	002	CDS-22	BM002
Burnham	GCalR	M	003	CDS-23	BM003
Calumet City	GCalR	U	001	CDS-24	BM003
Calumet City	LCalR	M	002	CDS-53	CA002
Calumet City	LCalR	M	003	CDS-53	CA003
Calumet City	LCalR	M	004	CDS-55	CA004

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Calumet City	LCalR	M	005	CDS-55	CA005
Calumet City	LCalR	M	006	CDS-55	CA006
Calumet City	LCalR	M	007	CDS-55	CA007
Chicago	NSC	U	001	DS-M98	CG002
Chicago	NSC	M	002	DS-M97	CG002
Chicago	NSC	M	003	DS-M97	CG003
Chicago	NSC	U	004	I-95	CG003
Chicago	NSC	U	005	DS-M96	CG002
Chicago	NSC	U	006	DS-M95	CG010
Chicago	NSC	U	007	I-94	CG010
Chicago	NSC	U	008	I-93	CG010
Chicago	NSC	U	009	I-92	CG010
Chicago	NSC	M	010	TG-M94	CG010
Chicago	NSC	U	011	DS-M93	CG010
Chicago	NSC	U	012	I-91	CG010
Chicago	NSC	U	014	I-89	CG010
Chicago	NBCR	M	016	DS-N10A	CG016
Chicago	NBCR	M	017	DS-N10B	CG017
Chicago	NBCR	M	018	DS-N09	CG018
Chicago	NBCR	U	019	DS-N08	CG020
Chicago	NBCR	M	020	DS-N08	CG020

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	NBCR	M	021	DS-N07	CG021
Chicago	NBCR	U	023	Indirect (DS-N04)	CG026
Chicago	NBCR	M	024	DS-N05	CG024
Chicago	NBCR	M	026	DS-N04	CG026
Chicago	NBCR	M	029	DS-N03	CG029
Chicago	NBCR	M	030	DS-N02	CG030
Chicago	NBCR	U	035	I-88	CG042
Chicago	NSC	U	038	I-116	CG010
Chicago	NSC	U	039	DS-M99	EV010
Chicago	NBCR	U	040	I-88	CG042
Chicago	NBCR	U	041	I-87	CG042
Chicago	NBCR	M	042	DS-LAT	CG042
Chicago	NBCR	U	043	I-86	MWRD107
Chicago	NBCR	U	044	I-85	CG042
Chicago	NBCR	U	046	I-82	MWRD107
Chicago	NBCR	U	047	I-83	MWRD107
Chicago	NBCR	U	048	I-81	CG057
Chicago	NBCR	U	049	I-80	CG057
Chicago	NBCR	U	050	I-79A	CG057
Chicago	NBCR	U	051	DS-M89	CG057
Chicago	NBCR	U	052	I-78	CG057

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	NBCR	M	057	DS-M88	CG057
Chicago	NBCR	U	058	DS-M87	CG057
Chicago	NBCR	U	059	I-77	CG057
Chicago	NBCR	U	060	Indirect (DS-M90)	CG231
Chicago	NBCR	M	061	DS-M85	CG061
Chicago	NBCR	U	062	I-76	CG061
Chicago	NBCR	M	063	DS-M84	CG063
Chicago	NBCR	M	064	DS-M82	CG064
Chicago	NBCR	M	065	TG-M81	CG065
Chicago	NBCR	M	067	DS-M80	CG067
Chicago	NBCR	M	068	DS-M79	CG068
Chicago	NBCR	U	069	DS-M78	CG070
Chicago	NBCR	M	070	DS-M79	CG070
Chicago	NBCR	U	072	DS-M77	CG073
Chicago	NBCR	M	073	DS-M76	CG073
Chicago	NBCR	M	074	DS-M75	CG074
Chicago	NBCR	U	075	I-75	CG077
Chicago	NBCR	U	076	I-75	CG077
Chicago	NBCR	M	077	DS-M73	CG077
Chicago	NBCR	U	078	I-74	CG077
Chicago	NBCR	U	079	I-73	CG077

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	NBCR	U	080	I-72	CG077
Chicago	NBCR	U	081	DS-M72	CG082
Chicago	NBCR	M	082	TG-M71	CG082
Chicago	NBCR	M	083	DS-M70	CG083
Chicago	NBCR	M	084	DS-M66	CG084
Chicago	NBCR	U	085	DS-M69	CG084
Chicago	NBCR	U	086	I-71	CG083
Chicago	NBCR	U	087	I-70	CG084
Chicago	NBCR	U	088	DS-M65	CG092
Chicago	NBCR	U	090	DS-M67R	CG092
Chicago	NBCR	U	091	I-68B	CG092
Chicago	NBCR	M	092	DS-M64	CG092
Chicago	NBCR	U	093	DS-M64	CG092
Chicago	NBCR	U	094	I-68A	CG092
Chicago	NBCR	U	095	DS-M63	CG092
Chicago	NBCR	U	096	I-67	CG092
Chicago	NBCR	U	097	I-66	CG103
Chicago	NBCR	U	098	I-65(A&B)	CG103
Chicago	NBCR	U	099	I-64	CG103
Chicago	NBCR	U	100	I-63	CG103
Chicago	NBCR	U	101	I-62	CG103

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	NBCR	M	103	DS-M61A	CG103
Chicago	CR	U	104	DS-M59	CG106
Chicago	CR	U	105	DS-M60	CG106
Chicago	CR	M	106	TG-M60	CG106
Chicago	CR	M	107	DS-M55	CG107
Chicago	CR	U	109	I-59	CG107
Chicago	CR	U	110	I-58	CG107
Chicago	CR	U	111	I-56	CG107
Chicago	CR	U	112	I-55	CG107
Chicago	CR	U	113	I-54	CG107
Chicago	CR	U	114	I-53	CG107
Chicago	CR	U	115	I-52	CG107
Chicago	CR	U	116	I-51	CG107
Chicago	CR	U	117	I-49 & I-50	CG107
Chicago	CR	U	118	I-48	CG107
Chicago	CR	U	119	I-47A & I-47B	CG107
Chicago	CR	U	120	I-46	CG107
Chicago	CR	M	121	DS-M54	CG121
Chicago	SBCR	U	123	I-44 & I-45	CG129
Chicago	SBCR	U	124	I-44	CG129
Chicago	SBCR	M	125	Indirect (TG-M53)	CG125

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	SBCR	U	126	I-42	CG129
Chicago	SBCR	U	127	I-41	CG129
Chicago	SBCR	U	128	I-39	CG129
Chicago	SBCR	M	129	DS-M52	CG129
Chicago	SBCR	U	130	I-38	CG129
Chicago	SBCR	U	131	I-35	CG129
Chicago	SBCR	M	132	DS-M51	CG132
Chicago	SBCR	U	133	I-33	CG132
Chicago	SBCR	M	134	TG-I32	CG134
Chicago	SBCR	M	136	TG-I28 & I29	CG136
Chicago	SBCR	U	137	DS-M50	CG134
Chicago	SBCR	M	138	DS-M49	CG138
Chicago	SBCR	M	140	DS-M47	CG140
Chicago	SBCR	U	141	DS-M46	CG143
Chicago	SBCR	M	143	DS-M45	CG143
Chicago	SBCR	U	144	DS-M44	CG143
Chicago	SBCR	U	145	DS-M43	CG143
Chicago	SBCR	U	146	I-25	CG143
Chicago	SBCR	U	147	DS-M42	CG143
Chicago	SBCR	U	148	I-24	CG151
Chicago	SBCR	U	149	I-23	CG151

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Chicago	SBCR	U	150	Indirect (DS-M41)	CG151
Chicago	SBCR	M	151	DS-M41	CG151
Chicago	SBCR	U	152	I-123	CG151
Chicago	SBCR	U	153	I-21	CG151
Chicago	SBCR	M	154	DS-M40	CG154
Chicago	SBCR	U	155	DS-M39	CG154
Chicago	SBCR	M	156	DS-M38	CG156
Chicago	SBCR	U	157	DS-M37	CG156
Chicago	SBCR	U	158	I-20	CG156
Chicago	SBCR	U	159	I-19	CG156
Chicago	SBCR	U	160	I-18	CG156
Chicago	SBCR	U	163	I-15	CG166
Chicago	SBCR	U	165	DS-M36	CG166
Chicago	SBCR	M	166	DS-M35	CG166
Chicago	SBCR	U	167	DS-M34	CG166
Chicago	SBCR	M	168	DS-M25	CG168
Chicago	SBCR	U	169	DS-M23	CG168
Chicago	SBCR	U	170	DS-M23	CG168
Chicago	CSSC	M	172	TG-M22	CG172
Chicago	CSSC	M	173	DS-M21	CG173
Chicago	CSSC	M	174	DS-M20	CG174

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #</u>	<u>TARP Connection</u>	<u>Representative Outfall</u>
Chicago	CSSC	M	176	DS-M19	CG176
Chicago	CC	M	178	TG-I12	CG178
Chicago	CSSC	U	179	DS-M18	CG180
Chicago	CSSC	M	180	DS-M17	CG180
Chicago	CSSC	U	181	I-10	CG184
Chicago	CSSC	M	182	TG-M16	CG182
Chicago	CSSC	M	183	TG-I9	CG183
Chicago	CSSC	M	184	TG-I8	CG184
Chicago	CSSC	M	185	DS-M15	CG185
Chicago	CSSC	M	186	TG-I5	CG186
Chicago	CSSC	M	187	DS-M12	CG187
Chicago	CSSC	M	188	DS-M08	CG188
Chicago	CSSC	M	189	TG-NASH	CG189
Chicago	SFSBCR	U	190	DS-M33	CG194
Chicago	SFSBCR	U	191	DS-M32	CG194
Chicago	SFSBCR	U	192	DS-M31	CG194
Chicago	SFSBCR	U	193	DS-M31	CG194
Chicago	SFSBCR	M	194	DS-M30	CG194
Chicago	SFSBCR	U	195	I-119	CG194
Chicago	SFSBCR	U	196	I-117	CG198
Chicago	SFSBCR	M	198	DS-M26	CG198

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #</u>	<u>TARP Connection</u>	<u>Representative Outfall</u>
Chicago	CalR	M	206	CDS-20	CG206
Chicago	LCaIR	U	209	CI-9	CG239
Chicago	LCaIR	M	210	CDS-15-5	CG210
Chicago	LCaIR	M	211	CDS-14	CG211
Chicago	LCaIR	U	214	CI-8	RV002
Chicago	LCaIR	U	215	CI-7	RV002
Chicago	LCaIR	U	216	CI-6	RV002
Chicago	DPR	M	226	DS-D10	CG226
Chicago	DPR	M	227	DS-D11	CG227
Chicago	NBCR	U	230	DS-M67R	CG092
Chicago	NBCR	M	231	DS-M86	CG231
Chicago	NSC	U	233	DS-M92	CG010
Chicago	NBCR	M	234	DS-N06	CG234
Chicago	NBCR	U	235	DS-N01	CG030
Chicago	NBCR	U	237	I-67	CG092
Chicago	NBCR	M	238	DS-M83	CG238
Chicago	LCaIR	M	239	CDS-16	CG239
Chicago	LCaIR	M	241	CDS-12	CG241
Chicago / Calumet Park	CSC	M	218/001	CDS-10	CG218
Chicago / Niles	NBCR	U	NP	DS-N15	NI003
Des Plaines	DPR	M	001	DS-D01	DP001

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #</u>	<u>TARP Connection</u>	<u>Representative Outfall</u>
Des Plaines	DPR	U	002	DS-D02	PR005
Des Plaines	DPR	U	003	DS-D02	PR005
Des Plaines	DPR	U	004	DS-D03R	DP005
Des Plaines	DPR	M	005	DS-D03R	DP005
Des Plaines	DPR	U	006	None	
Des Plaines	Weller Creek	M	007	Indirect (UDP-DS5) (K27)	DP007
Dixmoor	LCalR	M	001	CDS-39	DM001
Dolton	LCalR	M	001	CDS-17	DT001
Dolton	LCalR	M	002	CDS-18	DT002
Dolton	LCalR	M	003	CDS-51	DT003
Evanston	NSC	U	003	I-109	MWRD102
Evanston	NSC	U	004	DS-M110	MWRD102
Evanston	NSC	U	005	DS-M106W	EVA07 (DS-M107-2)
Evanston	NSC	U	006	DS-M107-2	SK003 (DS-M107-1)
Evanston	NSC	M	009	TG-M105E	EV009
Evanston	NSC	M	010	DS-M104E	EV010
Evanston	NSC	U	011	DS-M103	SK005 (DS-M104W)
Evanston	NSC	U	012	DS-M102	SK005 (DS-M104W)
Evanston	NSC	U	013	DS-M101	EVA13
Evanston	NSC	M	A04	DS-M109S	EVA04
Evanston	NSC	U	A06	DS-M108	SK003 (DS-M107-1)

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Evanston	NSC	M	A07	DS-M107-2	EVA07
Evanston	NSC	U	A08	DS-M106E	SK002 (DS-M105W)
Evanston	NSC	U	A10	DS-M104E	EV010
Evanston	NSC	M	A13	DS-M101	EVA13
Evanston	NSC	U	NP	I-108	MWRD102
Forest Park	DPR	M	001	DS-D30,28	FP001
Forest Park	DPR	M	002	DS-D28	FP002
Forest View	CSSC	U	001	DS-M07	CG189
Franklin Park	DPR	M	001	DS-D13	FK001
Franklin Park	DPR	U	003	DS-D14	FK004
Franklin Park	DPR	M	004	DS-D14	FK004
Golf	WF-NBCR	U	001	Indirect (DS-N20)	MG002
Harvey	LCalR	M	001	CDS-41	HV001
Harvey	LCalR	M	002	CDS-41	HV002
Harvey	LCalR	M	003	CDS-42	HV003
Harvey	LCalR	M	004	CDS-43	HV004
Harvey	LCalR	M	005	CDS-43	HV005
Harvey	LCalR	M	006	CDS-45	HV006
Harvey	LCalR	M	007	CDS-45	HV007
LaGrange	SC	M	001	DS-D47,50,51 & DS-13A-1	LG001
LaGrange Park	SC	U	001	DS-13A-53	LP003

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
LaGrange Park	SC	U	002	DS-13A-53	LP003
LaGrange Park	SC	M	003	DS-D37,38	LP003
LaGrange Park	SC	U	004	DS-13A-54	LP003
LaGrange Park	SC	U	005	DS-13A-54	LP003
LaGrange Park	SC	U	006	DS-13A-54	LP003
Lansing / Calumet City	LCalR	M	002 / 005CDS-55		LS002
Lemont	I&M Canal	U	002	None	
Lemont	CSSC	U	003	None	
Lincolnwood	NSC	U	002	I-96	CG003
Lyons	DPR	M	001	DS-D49	LY001
<u>Lyons</u>	DPR	M	002	DS-D48	LY002
Lyons	DPR	M	003	DS-13A-4 (TG137)	LY003
Markham	CUDD	M	001	CDS-57	MH001
Maywood	DPR	M	001	DS-D22,24,25	MW002
Maywood	DPR	M	002	DS-D22,24,25	MW002
Maywood	DPR	M	003	DS-D21,25	MW003
Maywood	DPR	M	004	DS-D27I	MW004
Maywood	DPR	M	005	DS-D27I	MW005
Maywood	DPR	M	006	DS-D31	MW006
Maywood	DPR	M	007	DS-D32	MW007
Maywood	DPR	M	008	DS-D33	MW008

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Maywood	DPR	M	NP	DS-D21,25	MW NP (DS-D21,25)
Maywood	DPR	M	NP	DS-D21,25	MW NP (DS-D21, 25)
Maywood	DPR	M	NP	DS-D22,24,25	MW NP (DS-D22, 24, 25)
Maywood	DPR	M	NP	DS-D27I	MW NP (DS-D27I)
Maywood	DPR	M	NP	DS-D31	MW NP (DS-D31)
Melrose Park	DPR	M	001	DS-D52	MP001
Methodist Campground	DPR	U	NP	DS-D02	PR005
Morton Grove	NBCR	U	001	DS-N20	MG002
Morton Grove	NBCR	M	002	DS-N19	MG002
Mt. Prospect	Weller Creek	M	001	UDP-DS3 (K11)	MP001
Mt. Prospect	Weller Creek	M	002	UDP-DS3 (K14)	MP002
Mt. Prospect	Weller Creek	M	003	UDP-DS4 (K20)	MP003
Mt. Prospect	Weller Creek	M	004	UDP-DS6 (K22)	MP004
Mt. Prospect	Feehanville Ditch	M	005	UDP-DS8 (K25-1&K25-2)	MP005
Mt. Prospect	Feehanville Ditch	M	006	UDP-DS8 (K26)	MP006
Mt. Prospect	Weller Creek	U	NP	None (K3)	MP None (K3)
MWRD	CSSC	M	002	None	MWRD002
MWRD	CSC	U*	006	Indirect	
MWRD	CSC	U*	007	Indirect	
MWRD	NSC	M	101	DS-M114N	MWRD101

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
MWRD	NSC	M	102	DS-M109N	MWRD102
MWRD	NSC	U	103	DS-M108	SK003 (DS-M107-1)
MWRD	NSC	M	104	DS-M106E	MWRD104
MWRD	NSC	M	105	DS-M100	MWRD105
MWRD	NBCR	M	107	DS-M90 & DS-M91 (NBPS)	MWRD107
MWRD	DPR	U	109	Indirect (DS-D03R)	DP001
MWRD	NSC	U	110	I-102	SK005 (DS-M104W)
MWRD	Weller Creek	M	111	UDP-DS1 (K2-1&K2-2)	MWRD111
MWRD	DPR	M	131	DS-D07	MWRD131
MWRD	DPR	M	132	DS-D08	MWRD132
MWRD	DPR	M	133	DS-D09	MWRD133
MWRD	DPR	M	134	DS-D19,23	MWRD134
MWRD	DPR	M	135	DS-D63	MWRD135
MWRD	DPR	U	136	DS-D34-DI	MW008
MWRD	SFSBCR	M	142	DS-M27,DS-M28,& DS-M29 (RAPS)	MWRD142
MWRD	CSSC	M	143	DS-M13	MWRD143
MWRD	CSSC	M	144	DS-M10	MWRD144
MWRD	CSSC	M	145	DS-M09	MWRD145
MWRD	CSSC	M	146	TG-13A	MWRD146
MWRD	CSSC	M	147	DS-M03	MWRD147
MWRD	CSSC	U	148	DS-M01	MWRD147

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
MWRD	CSSC	U	149	DS-M02	MWRD147
MWRD	Addison Creek	M	150	DS-D34-AI	MWRD150
MWRD	CalR	M	151	cds34	MWRD151
MWRD	CalR	M	152	CDS-28	MWRD152
MWRD	LCalR	M	153	CDS-13	MWRD153
MWRD	CSC	M	154	CDS-11	MWRD154
MWRD	CSC	M	157	CDS-2	MWRD157
MWRD	CSC	M	158	18E PS	MWRD158
MWRD	CSC	U*	160	Indirect	
MWRD	CSC	M	163	CDS-4	MWRD163
MWRD / Blue Island	CSC	M	156 / 001CDS-5		MWRD156
MWRD / Lincolnwood	NSC	U	106 / 001I-97		CG003
Niles	NBCR	M	001	DS-N18	NI001
Niles	NBCR	M	002	DS-N17	NI002
Niles	NBCR	M	003	DS-N16	NI003
Niles	NBCR	U	006	DS-N15	NI003
Niles	NBCR	U	007	DS-N15	NI003
Niles	NBCR	M	009	DS-N11	NI090
Niles	NBCR	M	010	DS-N12	NI010
Niles	NBCR	U	NP	Indirect (DS-N16)	NI003
Niles / Chicago	NBCR	M	008 / 236DS-N13R		CG236

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
North Riverside	DPR	M	001	DS-D36	NR001
North Riverside	DPR	M	002	DS-D35	NR002
Park Ridge	DPR	M	002	DS-D05	PR002
Park Ridge	DPR	M	003	DS-D06	PR003
Park Ridge	DPR	M	004	DS-D07	PR004
Park Ridge	DPR	M	005	DS-D02	PR005
Park Ridge	DPR	M	006	DS-D05	PR006
Park Ridge	DPR	M	007	DS-D06	PR007
Park Ridge	DPR	M	008	DS-D07	PR008
Phoenix	LCalR	M	001	CDS-45	PO001
River Forest	DPR	M	003	DS-D26	RF003
River Forest	DPR	M	004	DS-D29,64	RF004
River Grove	DPR	M	002	DS-D16	RG002
River Grove	DPR	M	003	DS-D17	RG003
River Grove	DPR	M	004	DS-D17	RG004
River Grove	DPR	M	005	DS-D18	RG005
River Grove	DPR	M	006	DS-D20I	RG006
River Grove / Franklin Park	DPR	M	001 / 002	DS-D15	FK002
Riverdale	LCalR	M	002	CDS-15-1	RV002
Riverdale	LCalR	M	003	CDS-15-2	RV003
Riverdale	LCalR	M	004	CDS-42	RV004

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #TARP Connection</u>		<u>Representative Outfall</u>
Riverdale	LCalR	M	005	CDS-15-4	RV005
Riverdale	LCalR	U	NP	CDS-15	RV003
Riverdale	LCalR	M	NP	CDS-15-3	RV NP (CDS-15-3)
Riverside	DPR	U	007	None	
Riverside	DPR	M	009	DS-D43	RS009
Riverside	DPR	M	010	DS-D44,45	RS010
Riverside	DPR	M	011	DS-D44,45	RS011
Riverside	DPR	M	012	DS-D41	RS012
Riverside	DPR	M	013	DS-D66	RS013
Riverside	DPR	M	NP	DS-D44,45	RS NP (DS-D44, 45)
Riverside	DPR	U	NP	None	
Robbins	CSC	U	NP	CI-1	BI005/PO001
Robbins	CSC	U	NP	CI-2	BI005/PO001
Robbins	CSC	U	NP	CI-3	BI005/PO001
Schiller Park	DPR	M	001	DS-D12I	SL001
Skokie	NSC	U	001	I-99	EV010
Skokie	NSC	M	002	DS-M105W	SK002
Skokie	NSC	M	003	DS-M107-1	SK003
Skokie	NSC	U	004	I-104	SK002 (DS-M105W)
Skokie	NSC	M	005	DS-M104W	SK005 (DS-M104W)
Skokie	NSC	U	NP	DS-M100	EV010

<u>Owner</u>	<u>Waterway</u>	<u>Monitored or Unmonitored</u>	<u>Outfall #</u>	<u>TARP Connection</u>	<u>Representative Outfall</u>
South Holland	LCalR	M	001	CDS-C-1	SH001
South Holland	LCalR	M	002	CDS-C-1	SH002
South Holland	LCalR	M	003	CDS-48	SH003
South Holland	LCalR	M	004	CDS-45	SH004
South Holland	LCalR	U	005	Indirect (CDS-47)	SH003
South Holland	LCalR	M	NP	CDS-45	SH NP (CDS-45)
South Holland	CUDD	U	NP	Indirect (CDS-47)	MH001
Stickney	CSSC	M	001	DS-M09	ST001
Summit	CSSC	U	001	DS-M5B	MWRD146
Summit	CSSC	M	002	TG-M05	SU002
Summit	CSSC	U	003	Indirect (DS-M03)	MWRD147
Western Springs	SC	U	001	DS-13A-55	LP003
Western Springs	SC	U	002	DS-13A-56	LP003
Wilmette	NSC	M	001	DS-M114N-2	WM001
Wilmette	NSC	U	002	DS-M113	MWRD101

Collection System O&M Manual

Appendix G: Fish Kill Response Procedure

Fish Kill and Other Water Pollution Emergency Reporting Procedure

All notifications of a fish kill or other water pollution emergency incident to any District office shall be reported immediately to the Systems Dispatcher at (312) 751-5133. The Systems Dispatcher will then notify the Assistant Director, Maintenance and Operations Department (M&O), General Division. The Systems Dispatcher should also notify the appropriate Monitoring & Research (M&R) Department, Industrial Waste Division (IWD) Senior Environmental Specialist.

M&O will be responsible for immediate telephone notification of the Illinois Environmental Protection Agency (IEPA) at (847) 294-4000 during normal work hours, or at (800) 782-7860, the IEPA 24-hour emergency number. The IWD Senior Environmental Specialist will initiate an investigation of the incident and notify the IWD Assistant Director and the M&R Director. IWD will ensure that M&O notified the IEPA.

If the incident involves a possible fish kill, the IWD Senior Environmental Specialist shall also notify M&R's Aquatic Ecology (AE) Section (8-4223 or 8-4219 during business hours). If AE determines that it is a bona fide fish kill, IWD will prepare a report of the fish kill incident using the Fish Kill Report Form. Water temperature, pH, and dissolved oxygen will be measured and recorded in the field by IWD. IWD will collect water quality samples. If possible, IWD will take photographs to document the extent of the fish kill and the types of fish present. The AE Section can provide a boat for the inspection if required and requested by IWD.

The incident shall be reported on the IWD Special Investigation Report Form.

Copies of the Fish Kill Report, Special Investigation Report, and any other pertinent information will be provided to the AE Section staff as soon as possible. Depending on the nature and severity of the incident, staff from the AE Section may conduct a field investigation in a timely manner. The Environmental Monitoring and Research Division will then compile and review the available data to determine the probable cause of the fish kill. AE staff will save all data and information relevant to fish kill events in the following shared folder, which is accessible to all departments: Fish Kill Events in the M&R Other Department Shared Folder

If a waterway cleanup is needed, IWD shall notify the M&O Channel Maintenance Unit (8-3171) upon conclusion of a fish kill investigation.

Industrial Waste Division

Procedure for Reporting Fish Kills and Other Water Pollution Emergencies

Version 4.2 effective 12/13/24

Page 2 of 2

On the next business day, the responder shall complete the electronic Emergency Response Report (ERR) and send it to the Assistant Director of M&R, IWD and copy the Supervising Environmental Specialist. The ERR number can be obtained by going to Emergency Response Report in the M&R Outlook Public Folder. Select the next number in the sequence for the particular year. The Assistant Director of M&R, IWD will save the ERR to this list once it has been sent to the Executive Director, Director of M&O, Director of Engineering and the Director of M&R for District internal notification. Within five days of the District being notified of the fish kill, M&O will send IEPA a notification letter briefly describing the fish kill and the potential cause, if known.

If IEPA requests additional information about the fish kill investigation after receiving their notification letter, M&O will combine the M&R reports with other pertinent operational data for transmittal to the IEPA. In that case, copies of the complete transmittal report shall be sent to the Executive Director, Chief Engineer, and the Director of M&R.

TO: , EXECUTIVE DIRECTOR

MONITORING & RESEARCH DEPARTMENT

INDUSTRIAL WASTE DIVISION

EMERGENCY RESPONSE REPORT

Report No.

REPORTED BY:

TYPE: .

SPECIAL
INVESTIGATION
NUMBER:

DATE AND TIME REPORTED:

DATE AND TIME OF INCIDENT:

INCIDENT CATEGORY: WATERWAY SPILL ROADWAY SPILL FISH KILL
 RAILWAY SPILL INDUSTRIAL SOURCE SPILL
 ILLEGAL SEWER DISCHARGE FROM MOBILE SOURCE
 OTHER:

DISTRICT ON-SITE COORDINATOR:

LOCATION: WATERWAY SEWER WRP:

DESCRIPTION:

ACTION TAKEN:

FOLLOW-UP CONCLUSION:

AGENCIES NOTIFIED:

<input type="checkbox"/> U.S. COAST GUARD 630-986-2155 1-800-424-8802	<input type="checkbox"/> STATES ATTORNEY'S OFFICE 312-443-5489 312-443-6366
<input type="checkbox"/> IEPA 847-294-4000 800-782-7860	<input type="checkbox"/> OTHER:

APPROVED: _____ PREPARED BY: _____
ASSISTANT DIRECTOR OF M&R

cc: Public Affairs

Attachment

Description:

Action Taken:

EMERGENCY RESPONSE REPORT PROCEDURES AND INSTRUCTIONS

The purpose of the Emergency Response Report (ERR) is to quickly notify District officials of an emergency situation which may affect District facilities or the waterways within the District's jurisdiction. To ensure the ERR is prepared in the timeliest manner, some flexibility in responsibility is required. The determination that an ERR is required can be made by Environmental Specialists (ES)/ Senior Environmental Engineers (SES), or above. Ideally, the ES/SES most familiar with the situation will prepare the ERR and forward the report through the supervisory chain of command.

1. Upon notification that an ERR is required, the responsible SES will obtain the required information and prepare the report. The determination that an ERR is required may originate from any supervisor in the ES/SES chain of command. If the ES/SES is unavailable, the responsibility for preparing the ERR moves up the chain of command. Once informed that an ERR is required, the form will be completed immediately.
2. The ERR will be prepared using the ERR form found in the Monitoring and Research folder in the Public Folders of the District's Microsoft Outlook system or in the Enforcement Section's Forms Library. Once completed, the ERR will be forwarded through the proper chain of command to the Assistant Director of the Monitoring & Research Department, Industrial Waste Division, or his designee, who will then forward the ERR to the Executive Director, with a copy also placed in the Emergency Response Report folder within the M & R Outlook folder. The ERR will be forwarded utilizing the Microsoft Outlook messaging system. The importance of the message containing the ERR will be designated as HIGH.

RR/SSP 10/26/2017 ver. 4

SSP/HS 2/22/2019 ver 4.1 (Fillable form)

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

INDUSTRIAL WASTE DIVISION

SPECIAL INVESTIGATION / INCIDENT REPORT

2. PROGRAM NUMBER 4673		3. DATE COMPLAINT RECEIVED		4. TIME COMPLAINT RECEIVED		5. AREA		1. SPECIAL INVESTIGATION NUMBER	
6. TYPE		7. MAIN OFFICE (NAME TITLE)		8. DISPATCHER		9. IWD (NAME TITLE)		<input type="checkbox"/> DNA	
INITIAL CONTACT		10. OTHER <input type="checkbox"/> DNA		11. RECEIVED BY (NAME TITLE)		12. DISPATCHED TO (NAME TITLE)		<input type="checkbox"/> DNA	
IWD ROUTING		13. DATE DISPATCHED <input type="checkbox"/> DNA		14. TIME DISPATCHED <input type="checkbox"/> DNA		15. PERSON WHO REPORTED INCIDENT		16. AGENCY <input type="checkbox"/> DNA <input type="checkbox"/> UNKNOWN	
COMPLAINANT <input type="checkbox"/> UNKNOWN		17. ADDRESS <input type="checkbox"/> DNA <input type="checkbox"/> UNKNOWN		18. PHONE <input type="checkbox"/> DNA <input type="checkbox"/> UNKNOWN		19. DATE INCIDENT OCCURRED <input type="checkbox"/> UNKNOWN		20. TIME INCIDENT OCCURRED <input type="checkbox"/> UNKNOWN	
TYPE OF POLLUTION OR INCIDENT		21. SEWER (STORM OR SANITARY) <input type="checkbox"/> DNA		22. WATERWAY (DESCRIBE) <input type="checkbox"/> DNA		23. OTHER <input type="checkbox"/> DNA		24. LOCATION OF INCIDENT	
		25. TYPE OF POLLUTION <input type="checkbox"/> UNKNOWN		26. QUANTITY <input type="checkbox"/> UNKNOWN		27. GIVE NAME, ADDRESS, PHONE AND SPECIFY INDIVIDUAL OR BUSINESS		SOURCE <input type="checkbox"/> UNKNOWN	
WITNESSES AND OTHER PERSONS INTERVIEWED <input type="checkbox"/> DNA		28. NAME		ADDRESS		AGENCY		PHONE NUMBER	
		29. NAME <input type="checkbox"/> DNA		ADDRESS		AGENCY		PHONE NUMBER	
		30. NAME <input type="checkbox"/> DNA		ADDRESS		AGENCY		PHONE NUMBER	
EVIDENCE OBTAINED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		31. STATION SAMPLED <input checked="" type="checkbox"/> DNA		DATE	TIME	SAMPLER	SPECIFY PARAMETERS OBTAINED		34. PHOTOS <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
		32. STATION SAMPLED <input checked="" type="checkbox"/> DNA		DATE	TIME	SAMPLER	SPECIFY PARAMETERS OBTAINED		35. TYPE <input type="checkbox"/> 35MM <input type="checkbox"/> POL
		33. STATION SAMPLED <input checked="" type="checkbox"/> DNA		DATE	TIME	SAMPLER	SPECIFY PARAMETERS OBTAINED		36. ATTACHED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
AREAS AND ITEMS INSPECTED <input type="checkbox"/> CONTINUED ON NEXT PAGE		37. NARRATIVE							
38. REVIEWED				39. SIGNED				1/28/22	
40. FIELD REPORT NUMBER									

Fish Kill Investigation and Sampling Procedures IWD

Put safety first. Wear a life jacket.

Holding Time in Field: Samples to be delivered to Stickney as soon as possible

Temperature/Transportation Requirements: <6° C/transport on ice.

Sample Type: Grabs

Containers/Preservation/Tests: All containers should be in “Fish Kill Kit”

Bottle(s) Needed	Tests
3 - 8 oz. plastic trace metals (preserved with HNO ₃)	Trace Metals and Hg
2 plastic gallon bottles (unpreserved)	General Chemistry (solids and N-series, conductivity, Cl, turbidity, BOD ₅)
1 boron bottle (8 oz. pH type bottle, unpreserved)	SO ₄
1 boron bottle (unpreserved)	Fluoride
1 boron bottle (recorded in field)	pH (not to be submitted to ALD)
1 Qt. plastic bottle (certified clean)	Cr+6
1 – ½ gallon plastic bottle (preserved with NaOH)	CN
2 glass Qt. bottles (preserved with H ₂ SO ₄)	FOG
1 glass Qt. bottle (preserved with H ₂ SO ₄)	Phenol
1 brown glass BNA gallon + 3 vials (+2 additional trip blanks) (gallon preserved with Sodium Thiosulfate, vials preserved with Ascorbic Acid)	Organic series (collect only if warranted). (Grabs) (deliver to Egan (EAL))
1 boron bottle (250 ml) (unpreserved)	*Alkalinity (deliver to Egan (EAL))
1 boron bottle (250ml) (preserved with H ₂ SO ₄)	Nutrients

***FISH-ALK boron bottle must be delivered to Egan Analytical Laboratory (EAL). Analysis only conducted at EAL. Replace bottles in fish kill kit after use.**

Methodology/Sampling

Fill a large cooler with ice before leaving the plant. All samples must be refrigerated after collection. Use a stainless steel bucket to collect samples as close to the dead fish as safely possible. Record activity and flow conditions on a logsheet.

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Equipment

Stainless steel bucket
Calibrated pH probe or pH paper
Thermometer
Cooler (ice)
D.O. Probe (D.O. SOG is located in the SOG shared folder.)

Paperwork

SOG
Logsheets

PPE

Life Jacket
Reflective Vest (if necessary)
Gloves

Investigation

Once all samples have been obtained and placed on ice in the cooler, conduct an investigation as to the possible cause for the fish kill.

Notifications

Notify the Supervising Environmental Specialist.
-Notify EM&R, ALD, and OCAL staff of incoming samples (Reference Lab Call-Out List in the Fish Kill shared folder.
-Upon conclusion of a Fish Kill investigation, IWD shall notify the M&O Channel Maintenance Unit (708-588-4040) if a waterways cleanup is needed.

LIMS Labels

In LIMS, go to SAMPLES – LOGIN – TEMPLATE.
Sample template is FISH_KILL. Select this template, press OK.

Press the LOGIN button
Fill in Sample Date and Time, Sampler, Collector, and Field Office information – Then press LOGIN

Labels will automatically print to your designated label printer.
For receipt, go to MWRDGC – IWD – FIELD OFFICE – PRINT SAMPLE RECEIPT
Obtain receipt as you would any IW receipt. Receipt will not have any company information on top. Write in FISH KILL and location of incident.

The test schedule for Fish Kill is Fish-1. For organic samples, the test schedule is FISH_ORG.

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Transportation

Samples must be delivered on ice to the Stickney Lab.

Reporting

-Fill out a Fish Kill Report

-Submit a Special Investigation report

-Coordinate with the Senior or Supervising Environmental Specialist to determine if the ES or the SES will submit an Emergency Response Report. The ERR and instructions can be found in 3 places:

-R&D_IWD shared folder for SOGs

-District Portal: District Portal -> Tools and Resources -> Departmental Forms -> M&R

-Outlook; Click “More Apps” (icon on left of screen [box with four squares]) /Click “Folders” Emergency Response Report in the M&R Outlook public folder.”

Notify M&O Technical Administration Section (641) to trigger a report to IEPA.

Standard Operating Guideline

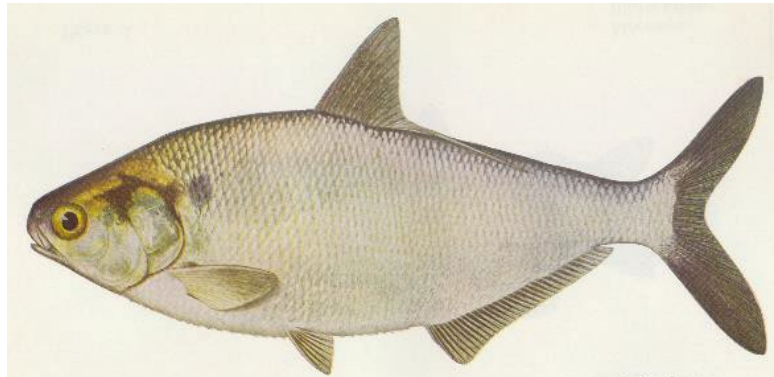
Industrial Waste Division

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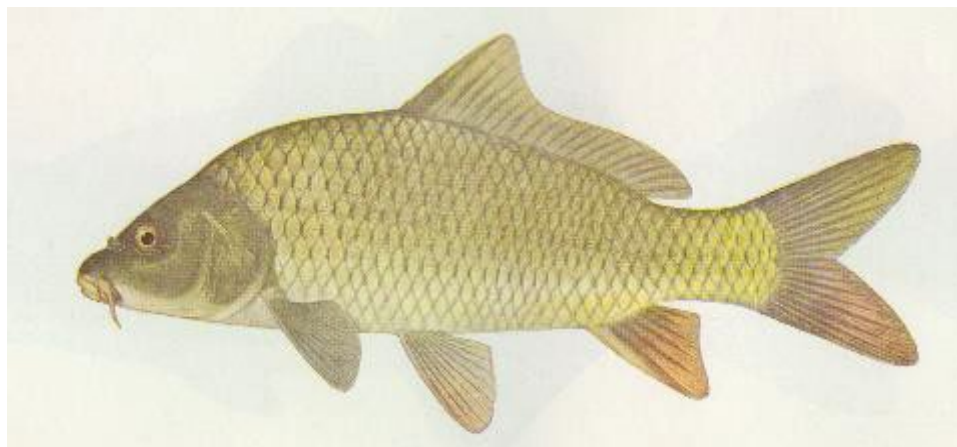
Fish Identification Guide for Fish Kill Investigations

GIZZARD SHAD



- white or silvery in color up to 14 inches long
- large purple-blue spot near upper edge of gill cover in young and small adults but faint or absent in large adults

COMMON CARP



- compressed body, bronze or olive colored with orange caudal fin
- up to 40 inches long

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CHANNEL CATFISH



- pale blue or greenish on top and whitish or silvery below
- usually discrete black spots scattered over the sides

LARGEMOUTH BASS



- pale olive or greenish color with black or brown lateral band
- large mouth, end of upper jaw extending behind eye in adults

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BLUEGILL



- bluish or yellow-green color with 6 to 8 vertical bands down the sides

GREEN SUNFISH



- large mouth, upper jaw reaches to middle of eye in adults

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Lab Call Out List

AQUATIC ECOLOGY SECTION

Principal Environmental Scientist

Tom Minarik 708-588-4223 (w)

MinarikT@mwr.org 708-710-2277 (c)

Senior Aquatic Biologist

Dustin Gallagher 708-588-4219 (w)

GallagherD@mwr.org 773-744-7379 (c)

Fish Kill Notifications (ALD)

Charles Hanlin

Lara Kraus

Sean Salmi

Marvin Banal

Pawel Grunwald

Kevin Kozak

Paula Michaels

Anjana Patel

Tiffany Poole

Gosia Kokoszka

John Szafoni

Organic Lab (if obtained)

Anas Rabah

Natasha Starikov

Paul Poshyvanyk

Verified Nov 2024 by LM and DG