AMBIENT WATER QUALITY MONITORING
QUALITY ASSURANCE PROJECT PLAN

Revision 2.3
Effective Date: September 19, 2011

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

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GROUP A: PROJECT MANAGEMENT

A1: Approval Sheet:

____ Date_________________

Thomas C. Granato
Director of Monitoring and Research

____ Date_________________

Thomas Liston
Assistant Director of Monitoring and Research
Analytical Laboratories Division

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Catherine O'Connor
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division

____ Date_________________

John McNamara
Quality Assurance Coordinator
Environmental Monitoring and Research 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 Monitoring and Research (M&R).

As this document will be updated annually, the reader is advised to check with the Project Manager for the latest revision if his copy is more than one year old. Revision 2.1 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:

<u>Project Director</u>:
Thomas Granato
Director of Monitoring and Research

<u>Project Manager</u>:
Catherine O'Connor
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division

<u>IEPA Project Manager</u>:
Gregg Good
Surface Water Section Manager

<u>Project Coordinator</u>:
Jennifer Wasik
Supervising Aquatic Biologist

<u>Field Operations Manager</u>:
Sharon Sopcak-Phelan
Pollution Control Officer III

<u>Stickney Analytical Laboratory Manager</u>:
Donna Coolidge
Supervising Environmental Chemist

Industrial Waste Analytical Laboratory Manager:
Robert Polis
Supervising Environmental Chemist

Analytical Microbiology Laboratory Manager:
Auralene Glymph
Senior Environmental Microbiologist

Organic Compounds Analytical Laboratory Manager:
Anna Liao
Supervising Instrumentation Chemist

Environmental Monitoring Manager:
Thomas Minarik, Jr.
Senior Aquatic Biologist

Data Review and Reporting Manager:
Catherine O'Connor
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division

Quality Assurance Officer:
John McNamara
Quality Assurance Coordinator

IEPA Quality Assurance 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 the execution of the entire project. The Project Manager has many responsibilities including planning the scope of the project, execution, and preparing project reports. The Project Coordinator coordinates project activities and prepares project reports. The Quality Assurance (QA) Officer is responsible for oversight of quality control for the project, and preparing and updating the QAPP.

The Illinois Environmental Protection Agency (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. He is assisted by the IEPA QA Officer, who oversees project activities and project quality control.

The Field Operations Manager is responsible for the execution of field activities. The sampling teams collect and preserve samples, make field measurements, and transport the samples to the District laboratories. Several District laboratories analyze project samples. Participant laboratories include the Stickney Analytical Laboratory (SAL), the Industrial Waste Analytical Laboratory (IWAL), the Calumet Analytical Laboratory (CAL), the Analytical Microbiology Laboratory, the Organic Compounds Analytical Laboratory (OCAL), and the Aquatic Ecology and Water Quality Section. All project data is maintained in the District laboratory information management system (LIMS) database.

The SAL Manager is responsible for collection of project test results and data verification for SAL and IWAL data. The Data Review and Reporting Manager maintains the District project database in SAS® software, reviews project data, checks and reports violations of water quality standards, prepares quarterly water quality exceedance reports, and prepares annual summary reports for the project.

A5: Problem Definition/Background

The District routinely collects and analyzes water samples from Chicago area waterways within its service area. “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) has designated the waterways within the jurisdiction of the District as either General Use or Secondary Contact Waters. The treated effluents from the District's three largest water reclamation plants (WRPs) discharge into secondary contact waters.

For General Use Water and public water supply, the IPCB has established water quality standards. Separate standards have been established for secondary contact water. Generally, less stringent water quality standards are applied to secondary contact water. Comprehensive assessments of the water quality data from this project are made annually using all applicable water quality standards established by the IPCB.

The water quality 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 WRPs, the pretreatment program, the flood and pollution control Tunnel and Reservoir Plan, and the Sidestream Elevated Pool Aeration Stations.

The water quality 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 21 waterbodies at 59 sampling stations. The total number of river miles monitored is approximately 225. The following rivers, creeks, man-made channels, a canal, and a lake are monitored for water quality.

<u>Fox River</u>
- Poplar Creek

<u>DuPage River</u>
- West Branch DuPage River

<u>Des Plaines Waterway System</u>
- Buffalo Creek
- Higgins Creek
- Salt Creek
- Des Plaines River

<u>Chicago Waterway System</u>
- West Fork North Branch Chicago River
- Middle Fork North Branch Chicago River
- Skokie River
- North Branch Chicago River
- North Shore Channel
- Chicago River
- South Branch Chicago River
- South Fork South Branch Chicago River
- Chicago Sanitary and Ship Canal

<u>Calumet Waterway System</u>
- Calumet River
- Wolf Lake
- Grand Calumet River
- Thorn Creek
- Little Calumet River
- Calumet-Sag Channel

Figure 2 is a map showing the waterways in the Chicago metropolitan area and the current sampling locations. Also shown on Figure 2 are the waterway reaches that have been classified as secondary contact waters.

A description of the 59 monitoring stations is provided in Tables 1, 2, and 3. Table 1 lists the current sampling locations with their project location number and IPCB use classification. 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 at least monthly. Surface grab samples 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 metals, dissolved metals, cyanide, phenol, fecal coliform, organic priority pollutants, nonylphenols, gross alpha radioactivity, and gross beta radioactivity. A special sampling device is used to collect samples for dissolved oxygen analysis and bacterial analysis. Water temperature and pH are measured onsite at each sampling location.

Following collection, the samples are transported to the Cecil Lue-Hing Research and Development (R&D) Complex at the Stickney WRP and the Organic Compounds Analytical Laboratory at the John E. Egan WRP for analysis. The waterways monitoring data are maintained in computer databases. Exceedances of water quality standards are reported quarterly. Annual summary reports are prepared that assess compliance with applicable IPCB water quality standards and identify long-term trends in water quality.

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 runoffs 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.

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 2 of Table 4. 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 3 of Table 4 gives the minimum measurement objectives for the project. The minimum measurement objectives will be set at approximately one-fifth of the minimum measurement criteria shown in column 2 to ensure that analytes will be measured with reasonable accuracy at the minimum measurement criteria concentrations and measured to reasonable levels below the minimum measurement criteria.

The minimum measurement objective for any analyte will be achieved when the analytical procedure selected for sample analysis can be shown to have a method detection limit (MDL) at or below the minimum measurement objective.

Analyte MDLs shall be determined by the USEPA method given in the Code of Federal Regulations (CFR), Volume 40, Part 136, Appendix B. The MDL is defined as the minimum constituent concentration that can be distinguished from a sample with no analyte at a 99 percent confidence level. Since the MDL procedure is based upon precision obtained for a standard greater than the MDL, it also is a measure of method sensitivity at concentrations near the MDL.

For analytes without minimum measurement criteria, the minimum measurement objectives will be understood to be the MDL level that is readily achievable using analytical methods generally employed in environmental laboratories. Reporting limits (RLs) are mathematically derived from MDLs. The relationships between MDLs and RLs can be referenced in the Quarterly Interlaboratory Database Report. The actual RLs for the participating laboratories are presented in Section B4, "Analytical Methods." For parameters where RLs are not applicable, such as pH, temperature, and dissolved oxygen, the minimum measurement objectives shown in column 3 of Table 4 are the sensitivity 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 their supervising Pollution Control Officer I (PCOI), or qualified laboratory personnel responsible for sample analysis.

2. Microbiological analysis shall be performed by analysts who have been certified as competent by the Illinois Department of Public Health (IDPH).

3. The laboratory contracted to perform radiochemical analyses shall possess National Environmental Laboratory Accreditation Program accreditation and maintain certification for the examination of radiochemical parameters from any state within the United States.

A9: Documents and Records

1. The Project Managers and QA Officers for the District and the IEPA shall retain copies of all annual updates and revisions of this QAPP.

2. The Project Managers and QA Officers for the District and the IEPA shall retain copies of all sampling procedures and analytical procedures used for collection and 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 management reports.

5. The Project Manager shall retain copies of all communications to and from outside agencies and other interested parties.

6. All the records and reports listed above will be retained for 10 years at the Cecil 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 59 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. At a point near where major tributaries exit the District's service area.
3. Near the intake control structures where water is diverted into the waterways from Lake Michigan.
4. Upstream and downstream of District facilities, including WRPs, aeration stations, and pumping stations.
5. At the confluence of significant waterway branches.
6. At the Lockport control facility where most flow from the District service area leaves the waterways system.
7. Near the downstream end of a reach designated by the IEPA as a waterbody segment or assessment unit.

The IEPA utilizes water quality data to prepare its annual 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. In 2000, the District began reviewing the IEPA's definition of segments for waters in the District's jurisdiction. As a result of this review and discussions with the IEPA, some of the segments were redefined by the IEPA in a meeting held in July 2001. Several new locations were added or changed in 2001 to provide adequate coverage of all segments.

Sampling locations must be readily accessible and judged safe for all sampling activities. Bridges over the waterways have provided ideal sampling locations.

Sampling locations may be added or removed from the monitoring network based upon periodic assessments of monitoring needs and resources available. Recent changes to sampling locations are footnoted in Table 1.

Sampling Frequency. All 59 sampling locations are monitored at least monthly. The sampling frequency for each parameter is shown in Table 5. 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 Waterway Systems. Most of the treated wastewater originating in the District's service area flows through the Lockport Powerhouse and Lock.

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

Selection of Sampling Methods. Sampling of the waterways could be accomplished by either collection of a single sample at each sampling location or by the use of cross-sectional sampling methods whereby multiple samples would be collected at each sampling location.

Cross-sectional sampling typically involves taking samples at specified collinear locations across a body of water. Each transect may include a single sample, multiple samples taken at various depths, or a single depth-integrated sample. Cross-sectional samples may be analyzed individually or composited into one or more samples depending upon the objectives of the project.

The use of cross-sectional sampling methods in a flowing channel does not always ensure that a more representative composite sample will be obtained. In a uniformly mixed channel, no number of samples taken within a cross-section can be more representative than a single sample taken at any point within the channel. Also, the interpretation of composite samples derived from cross-sectional sampling may be confounded by several factors, including the variations of flow velocity occurring within the channel and the length of time required to obtain all samples in the cross-sectional sampling grid.

Cross-sectional sampling methods are not utilized for this project because of their complexity, because of the additional time and personnel required to obtain cross-sectional samples, and because cross-sectional sampling is not required to obtain representative samples. The District waterways are in fact cross-sectionally well mixed because they are generally long and narrow channels having “plug-flow” characteristics. This means that analytes introduced at any point in a waterway are quickly dispersed and moved forward with the channel flow. Sampling for this project is performed by taking a single surface water grab sample at the center of the waterway.

Uniformity of mixing in the Chicago Waterway System (CWS) has in fact been evaluated at numerous locations in six separate studies since September 1998 using cross-sectional dissolved oxygen (DO) measurements performed at numerous locations throughout the waterways system. These studies have consistently verified cross-sectional uniformity.

If additional evidence of uniform mixing should ever be required, the District will devise and carry out additional testing as appropriate. If warranted, sampling methods will be changed as necessary to ensure that representative samples are being collected.

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 in-stream water quality. Periodically, the parameters monitored are reviewed. A parameter may be dropped from monitoring if the parameter is found to be non-essential for the goals of the project or if the parameter is judged too resource intensive to analyze. If parameters are needed for a monitoring purpose, they will be added to the project. Recent changes in parameters analyzed are footnoted in Table 4.

B2: Sampling Methods

Manual sampling from bridges 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 personnel, perform the sampling under the direction of the supervising PCOI.

The 20 locations on the Des Plaines Waterway System, the DuPage River, and the Fox River are sampled on the first Monday of each month. The 15 most northern sampling locations on the CWS are sampled on the second Monday of each month. The remaining 11 locations on the CWS are sampled on the third Monday of each month. The 13 sampling locations on the Calumet Waterway 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. The bucket is lowered into the waterway from the upstream side of the bridge at the most central location of the waterway. 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 with a calibrated pH/temperature probe. The contents of the bucket are then discarded and the bucket is lowered and refilled as necessary to provide sample for the individual sample aliquots. A separate water sample is taken for measurement of DO using a special sampling device that prevents aeration of the sample during collection. The sterile sample container for bacterial analysis is filled separately in the waterway to prevent contact of the sample with non-sterile surfaces.

There are, however, two exceptions to sampling at the upstream side of the bridge: Sampling location 42, the Route 83 Bridge over the Chicago Sanitary and Ship Canal (CSSC); and sampling location 48, the Stephen Street Bridge. Each of these locations is sampled from the District Pollution Control Boat from the center of the waterway. The bridges are not sampled due to the following reasons: Sampling location 42, Route 83 Bridge over the CSSC, is inaccessible and unsafe; and sampling location 48, the Stephen Street Bridge, no longer exists.

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 6.

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.

All water samples are transported to the SAL after collection accompanied by sample collection sheets. The laboratory physically receives the samples from the Industrial Waste Division transporter. A sanitary chemist, or a laboratory technician under the direct supervision of a sanitary 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 C (°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 analysis and radiochemical analysis are then routed to the appropriate laboratories at the Cecil 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 log-in at the SAL, the aliquot for sulfate analysis is transported to the CAL within 24 hours by the Maintenance and Operation courier.

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), dissolved oxygen (eight hours), hexavalent chromium (24 hours), biochemical oxygen demand (48 hours), and turbidity (48 hours).

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

The original sample collection sheets are returned to the supervising PCOI for review. The PCOI enters the collection date for each sample into the LIMS. The PCOI 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 7 have been selected that meet the minimum measurement objectives presented in Table 4. Column 1 of Table 7 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 chloride, chlorophyll, and nonylphenol, 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 and nonylphenol.

Table 8 shows laboratory preservation and maximum holding time from the time of sampling for each analyzed parameter. Column 2 of Table 8 gives the laboratory preservation. Field pH adjustments (Table 6) are indicated in column 2 in parentheses. The maximum holding time for each parameter is given in column 3 of Table 8. 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 9. Column 3 of Table 9 identifies the laboratory method SOP. The analytical method SOPs are incorporated into this QAPP by reference in column 3 of Table 9. SOPs for analytical methods are available from the Project Manager or the responsible Laboratory Manager identified in Section A4.

Table 10 compares the minimum measurement objective against the reporting limit (RL) achieved by the designated District laboratory. The laboratory RL is shown in column 2 of Table 10, and column 3 contains the minimum measurement objective. All analytes meet the minimum measurement objective.

All data collected for this project will be reported to the analyte RL, as this is the reportable level established in the District's National Pollutant Discharge Elimination System (NPDES) permits. Test results less than the RL will be reported as either zero or as less than the numerical value of the RL.

B5: Quality Control

Equipment blanks will be used to verify that field samples are free of contamination. Each sampling team will prepare equipment blanks for the appropriate parameters at a sampling location on each day of sampling. The SAL will review the test results. Whenever significant contamination is found, the laboratory 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 supervising PCOI and his/her supervisor. For any quality control or other nonconformance issue, the supervising PCOI and his/her supervisor 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 QAP and laboratory SOPs should be referred to for specific information relating to quality control.

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 who are required to respond within 48 hours of notification. 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 63 handheld pH/temperature meters used for field measurements (or similar model) are maintained by the SAL. These instruments are calibrated for pH in the laboratory before each use. Calibration records are kept by the 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 stocking spare parts for these meters, performing routine maintenance, and 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 QAPs. 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 QAPs 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) 2003 R1 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, 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 chemical analytical data have resided in the District LIMS since 1996. Historical data back to 1970 are stored in Excel® spreadsheet files and SAS® files. Whenever data are manually entered into a software file from hardcopy reports, each number is verified to ensure accuracy of manual entry.

As the waterways are sampled routinely, the samples are prelogged into the District's LIMS. The supervising PCOI 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 Analytical Microbiology Laboratory and the OCAL follow documented procedures for sample login, sample acceptance, analysis, and data verification. Test data from the Analytical Microbiology Laboratory are manually entered into LIMS, while OCAL data is automatically uploaded from instrument to LIMS.

Water samples for radiochemical analysis are received and logged in by the SAL. Samples are preserved by the Radiochemist and picked up by the contracted laboratory, who completes a chain of custody form. The analytical results are reviewed and manually entered into LIMS by the Radiochemist.

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. Water quality limits are checked for each sampling station for the applicable General Use or Secondary Contact water quality limit. An exceedance of these limits prompts retesting for confirmation. The highest confirmed value is reported.

Retesting for analytes with regulatory limits is only done for a confirmed QC problem in the execution of analysis or if the regulatory limit has been exceeded. No retesting will be performed on the basis of historical limits or multi-day 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 or to confirm a regulatory limit exceedance, then the highest confirmed value is reported unless otherwise specified above.

As sample analysis in the Analytical Laboratories Division (ALD) Laboratories is completed each month, the approved test data are collected from the LIMS Oracle® database and transferred into an Excel® spreadsheet. To simplify data handling, this spreadsheet is also used to collect field test data (pH and temperature) and test data from the Analytical Microbiology Laboratory (fecal coliform) and the radiochemistry analyses (gross alpha and gross beta radioactivity). The ALD Excel® spreadsheet includes all parameters, except for organics data. 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 monthly spreadsheet from the ALD laboratories is checked for completeness and atypical test data. This review is performed by the SAL Senior Environmental Chemist and the Supervising Environmental Chemist (Laboratory Manager). When atypical test data are found, they are reported to the appropriate analytical section supervisor for further investigation. If the investigation does not reveal a reason for the atypical data, the section supervisor is requested to reanalyze the sample provided that sufficient sample is available and the maximum holding time has not been exceeded. The retest result is reported as the valid result except when the original test result exceeds a water quality standard. If a water quality standard is exceeded by the original test result, and no error is found that invalidates the original test result, then the highest test result (original or retest) is reported.

Following final approval of ALD laboratory data, the ALD Excel® spreadsheet file is sent to the Biostatistician who creates a file in SAS® (Statistical Analysis Software) from the Excel® data file. A second Excel® file from the Organic Compounds Analytical Laboratory containing the organics test data for BETX is sent to the Biostatistician, and it is also uploaded into SAS®. SAS® is the statistical analysis software used to review and analyze the data.

All project data are checked by the Biostatistician for compliance with applicable IPCB water quality limits. Currently, limit exceedance reports are produced quarterly, and a comprehensive water quality report is produced annually. The quarterly limit exceedance reports summarize IPCB water quality limit exceedances by parameter for each major waterway system and IPCB designated use classification. These reports also assess compliance with target limits for certain parameters that do not currently have IPCB water quality limits. In addition, each exceedance is listed with location, date, and applicable water quality limit or target limit.

The annual water quality report presents the following:

1. Annual average parameter concentrations for the sampling stations immediately upstream and downstream of the District's seven WRPs.

2. Rates of compliance for parameters with water quality standards in each waterway system.

3. Annual parameter averages at each sampling location for each of the previous 11 years.

4. Annual exceedance counts for each limited parameter at each sampling location for each of the previous eight years.

GROUP C: ASSESSMENT AND OVERSIGHT

C1: Assessment and Response Actions

Weekly surveillance of a sampling team is conducted by the project PCOI to verify that water samples are being collected properly and sampling procedures are followed. The results of each surveillance are documented by the PCOI. As stated in Section B5, the supervising PCOI 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 Coordinator 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 quality assurance plans. 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 Coordinator with copies to the persons listed on the approval page of this QAPP.

Also, the project Data Review and Reporting 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 Data Review and Reporting 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 and IWAL participate in two proficiency-testing studies each year. Two proficiency-testing studies are the semi-annual Water Pollution Study and the third is the National Pollutant Discharge Elimination System (NPDES) Discharge Monitoring Report Quality Assurance (DMR-QA) Study. The NPDES DMR-QA Study may be a combined study with one of the Water Pollution Studies. 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 ALD 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 Analytical Microbiology Laboratory is certified by the IDPH and must successfully pass a biannual on-site audit conducted by the IDPH.

All District laboratories have implemented annual internal audits.

C2: Reports to Management

The Project Manager and all those on the approval list 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 not undertaken.

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 Biostatistician also reviews the data after it is transferred into the SAS® software. If errors are discovered, the Biostatistician reports them to the Supervising Environmental Chemist of the SAL or Supervising Instrumentation Chemist of the OCAL for investigation and resolution.

D2: Verification and Validation Methods

Sample collection records can be verified by the Field Operations Manager identified in Section A4. Laboratory data shall be verified as necessary by the SAL 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 Data Review and Reporting Manager (Section A4) has all calculations used for checking applicable IPCB water quality standards. He should be consulted regarding any questions pertaining to compliance with water quality standards and the reporting of data in the annual waterways water quality report. All data handling and calculations for the water quality report are performed using SAS® software and SAS® user programs.

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 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 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. The storage of project data in STORET.
9. The quarterly violations reports and the annual project report.
10. Corrective actions taken during the previous year for field and laboratory operations.
11. Coordination of the project with the IEPA.
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. Changes or deviations in the operation of the project shall not be made without authorization by the Project Director. The need of a change in project operation should be conveyed by the appropriate responsible person to the Project Coordinator. Data users and other interested persons may also suggest changes to the project to the Project Coordinator.

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

Following approval, a memorandum documenting each authorized change shall be prepared by the Project Coordinator and distributed to those on the approval list, as well as the other Assistant Directors of the M&R Department. All approved changes shall be given a sequential number, which includes the year issued, shown as follows: "AWQM Deviation 2001-xx." Approved changes shall be considered an amendment to the QAPP and shall be incorporated into the QAPP when it is updated annually.

Following the annual QAPP review, the Project Coordinator will prepare the annual QAPP update. The Project Manager, with the assistance of the Project Coordinator and the QA Officer, will prepare a separate report annually detailing all changes made to the project over the last year.

REFERENCES

"1999 Annual Summary Report, Water Quality Within the Waterways System of the Metropolitan Water Reclamation District of Greater Chicago," Report No. 01-12, Metropolitan Water Reclamation District of Greater Chicago, October 2001.

Environmental Protection Agency, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," Code of Federal Regulations, Volume 40, Part 136, March 26, 2007.

Standard Methods for the Examination of Water and Wastewater, Prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation, Washington, DC, 18th ed., 1992.

Standard Methods for the Examination of Water and Wastewater, Prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation, Washington, DC, 20th ed., 1998.

State of Illinois Rules and Regulations, Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter I: Pollution Control Board, January 14, 1999.

FIGURE 1: AMBIENT WATER QUALITY MONITORING PROJECT ORGANIZATION CHART

```
|-- Project Director ---------------------------------- O
|       (Planning, decision making, and ultimate execution   |
|       of project)                                          |
|                                            IEPA Project Manager
|                                              (IEPA coordination)
O--- Project Manager                                         |
|    |  (Project planning, execution, and                    |
|    |  reporting)                              IEPA QA Officer
|    |                                         (IEPA oversight, QA/QC)
|    |                                                       |
O----O-- QA Officer ---------------------------------------O
|     |   | (Project QA/QC)
|     |   |
O----O---O- Project Coordinator
  |  |     |   (Project coordination and reporting)
  |  |     |
  |  |   O-O--- Field Operations Manager
  |  |   |          (Execution of field activities)
  |  |   |                        |
  |  |   |              Sampling Teams
  |  |   |                |  (Sample collection and preservation, field measurements
  |  |   |                |  and transport of samples)
  |  |   |                |
  | O---O------ Laboratories
  |      |          Stickney Analytical Laboratory
  |      |          Industrial Waste Analytical Laboratory
  |      |          Calumet Analytical Laboratory
  |      |          Analytical Microbiology Laboratory
  |      |          Organic Compounds Analytical Laboratory
  |      |          Aquatic Ecology and Water Quality Section
  |      |             (Analysis, data verification, and data storage of LIMS)
  |      |                |
```

(*continued on next page*)

FIGURE 1 (Continued): AMBIENT WATER QUALITY MONITORING PROJECT ORGANIZATION CHART

```
          |  |              |                 |
(to Project Manager)

   |    (to Project Coordinator)
   |       |
   |       |      (to Laboratories)
   |       |                  |
   |       |                  |
   |       O---- Stickney Analytical Laboratory Manager
   |       |        (Excel® spreadsheet, data review and exceedance reporting)
   |       |                          |
   |       |                          |
   O----- O---------- Data Review and Reporting Manager
                          (SAS® database, data review, violation checking, and annual reports)
```

FIGURE 2: AMBIENT WATER QUALITY MONITORING PROGRAM WATERWAY SAMPLE STATIONS

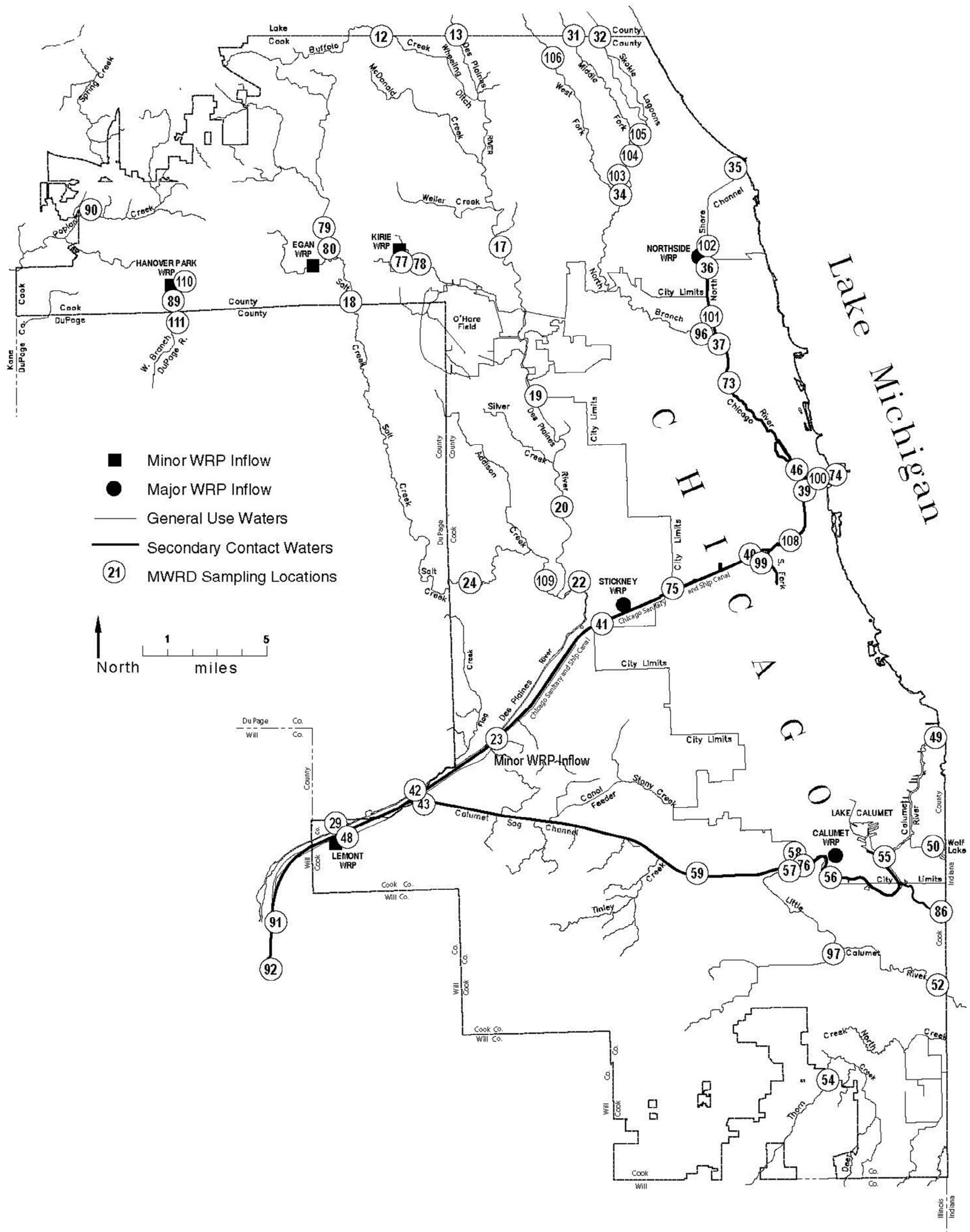

TABLE 1: SAMPLING LOCATIONS

Station[1]	Location	IEPA Classification
Chicago Waterway System		
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	General Use
102	Oakton Street, North Shore Channel	General Use
36	Touhy Avenue, North Shore Channel	Secondary Contact
101	Foster Avenue, North Shore Channel	Secondary Contact
37	Wilson Avenue, North Branch of Chicago River	Secondary Contact
73	Diversey Parkway, North Branch of Chicago River	Secondary Contact
46	Grand Avenue, North Branch of Chicago River	Secondary Contact
74	Lake Shore Drive, Chicago River	General Use
100	Wells Street, Chicago River	General Use
39	Madison Street, South Branch of Chicago River	Secondary Contact
108	Loomis Street, South Branch of Chicago River	Secondary Contact
99	Archer Avenue, South Fork South Branch of Chicago River	Secondary Contact
40	Damen Avenue, Chicago Sanitary and Ship Canal	Secondary Contact
75	Cicero Avenue, Chicago Sanitary and Ship Canal	Secondary Contact
41	Harlem Avenue, Chicago Sanitary and Ship Canal	Secondary Contact
42	Route 83, Chicago Sanitary and Ship Canal	Secondary Contact
48	Stephen Street, Chicago Sanitary and Ship Canal	Secondary Contact
92	Lockport Powerhouse Forebay	Secondary Contact
Calumet Waterway System		
49	Ewing Avenue, Calumet River	General Use
50	Wolf Lake, Burnham Avenue	General Use
55	130th Street, Calumet River	General Use
86	Burnham Avenue, Grand Calumet River	Secondary Contact

TABLE 1 (Continued): SAMPLING LOCATIONS

Station[1]	Location	IEPA Classification
Calumet Waterway System (Continued)		
56	Indiana Avenue, Little Calumet River	Secondary Contact
76	Halsted Street, Little Calumet River	Secondary Contact
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	Secondary Contact
59	Cicero Avenue, Calumet-Sag Channel	Secondary Contact
43	Route 83, Calumet-Sag Channel	Secondary Contact
Des Plaines River		
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
Fox River		
90	Route 19, Poplar Creek	General Use
DuPage River		
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[2]	General Use

TABLE 1 (Continued): SAMPLING LOCATIONS

Station[1]	Location	IEPA Classification
Salt Creek		
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
Higgins Creek		
77	Elmhurst Road, Higgins Creek	General Use
78	Wille Road, Higgins Creek	General Use

[1]Refer to Figure 2 map for locations of all sampling stations.
[2]Arlington Drive (111) replaced Lake Street (64) in 2011.

TABLE 2: LATITUDE AND LONGITUDE OF SAMPLING LOCATIONS

Station	Description	North Latitude	West Longitude
12	Buffalo Creek @ Lake-Cook Rd.	42° 09.110'	87° 58.150'
13	Des Plaines River @ Lake-Cook Rd.	42° 09.126'	87° 54.612'
17	Des Plaines River @ Oakton St.	42° 01.512'	87° 52.494'
18	Salt Creek @ Devon Ave.	41° 59.546'	87° 59.924'
19	Des Plaines @ Belmont Ave.	41° 56.236'	87° 50.975'
20	Des Plaines River @ Roosevelt Rd.	41° 51.878'	87° 49.639'
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'
24	Salt Creek @ Wolf Rd.	41° 49.548'	87° 54.025'
29	Des Plaines River @ Stephen St.	41° 40.899'	88° 00.147'
31	Middle Fork, North Branch Chicago River @ Lake-Cook Rd.	42° 09.144'	87° 49.101'
32	Skokie River @ Lake-Cook Rd.	42° 09.143'	87° 47.605'
34	North Branch Chicago River @ Dempster St.	42° 02.461'	87° 47.267'
35	North Shore Channel @ Central St.	42° 03.830'	87° 41.210'
36	North Shore Channel @ Touhy Ave.	42° 00.690'	87° 42.600'
37	North Branch Chicago River @ Wilson Ave.	41° 57.860'	87° 41.800'
39	South Branch Chicago River @ Madison St.	41° 52.911'	87° 38.135'
40	Chicago Sanitary & Ship Canal @ Damen Ave.	41° 50.498'	87° 40.520'
41	Chicago Sanitary & Ship Canal @ Harlem Ave.	41° 48.263'	87° 48.104'
42	Chicago Sanitary & Ship Canal @ Route 83	41° 42.130'	87° 56.360'
43	Calumet-Sag Channel @ Route 83	41° 41.790'	87° 56.480'
46	North Branch Chicago River @ Grand Ave.	41° 53.480'	87° 38.440'
48	Chicago Sanitary & Ship Canal @ Stephen St.	41° 40.750'	88° 00.683'
49	Calumet River @ Ewing St.	41° 43.683'	87° 32.536'
50	Wolf Lake @ 127th St.	41° 39.878'	87° 32.330'
52	Little Calumet River @ Wentworth Ave.	41° 35.131'	87° 31.792'
54	Thorn Creek @ Joe Orr Rd.	41° 31.250'	87° 37.522'

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

Station	Description	North Latitude	West Longitude
55	Calumet River @ 130th St.	41° 39.550'	87° 34.349'
56	Little Calumet River @ Indiana Ave.	41° 39.136'	87° 35.828'
57	Little Calumet River @ Ashland Ave.	41° 39.099'	87° 39.633'
58	Calumet-Sag Channel @ Ashland Ave.	41° 39.312'	87° 39.640'
59	Calumet-Sag Channel @ Cicero Ave.	41° 39.282'	87° 44.284'
73	North Branch Chicago River @ Diversey Ave.	41° 55.920'	87° 40.940'
74	Chicago River @ Lake Shore Drive	41° 53.305'	87° 36.864'
75	Chicago Sanitary & Ship Canal @ Cicero Ave.	41° 49.169'	87° 44.616'
76	Little Calumet River @ Halsted St.	41° 39.440'	87° 38.476'
77	Higgins Creek @ Elmhurst Rd.	42° 01.287'	87° 56.436'
78	Higgins Creek @ Wille Rd.	42° 01.120'	87° 56.201'
79	Salt Creek @ Higgins Rd.	42° 01.880'	88° 00.679'
80	Salt Creek @ Arlington Heights Rd.	42° 00.736'	88° 00.075'
86	Grand Calumet River @ Burnham Ave.	41° 37.870'	87° 32.352'
89	West Branch DuPage River @ Walnut Lane	41° 59.745'	88° 08.179'
90	Poplar Creek @ Route 19	42° 01.841'	88° 14.516'
91	Des Plaines River @ Material Service Rd.	41° 35.794'	88° 04.112'
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse Forebay	41° 34.256'	88° 04.704'
96	North Branch Chicago River @ Albany Ave.	41° 58.475'	87° 42.375'
97	Thorn Creek @ 170th St.	41° 35.357'	87° 34.862'
99	South Fork, South Branch Chicago River @ Archer Ave.	41° 50.331'	87° 39.849'
100	Chicago River Main Stem @ Wells St.	41° 53.259'	87° 38.045'
101	North Shore Channel @ Foster Ave.	41° 58.560'	87° 42.286'
102	North Shore Channel @ Oakton St.	42° 01.592'	87° 42.600'
103	North Branch Chicago River @ Golf Rd.	42° 03.318'	87° 46.925'

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

Station	Description	North Latitude	West Longitude
104	North Branch Chicago River @ Glenview Rd.	42° 04.129’	87° 46.466’
105	Skokie River @ West Frontage Rd.	42° 05.332’	87° 45.594’
106	West Fork, North Branch Chicago River @ Dundee Rd.	42° 08.300’	87° 50.095’
108	South Branch Chicago River @ Loomis St.	41° 50.752’	87° 39.642’
109	Salt Creek @ Brookfield Ave.	41° 49.370’	87° 50.494’
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’

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

Station	Description	Quadrant	TWP	Range	Sec.	¼ Sec
12	Buffalo Creek @ Lake-Cook Rd.	Wheeling	43N	11E	32	SE
13	Des Plaines River @ Lake-Cook Rd.	Wheeling	43N	11E	35	SE
17	Des Plaines River @ Oakton St.	Park Ridge	41N	12E	21	SE
18	Salt Creek @ Devon Ave.	Elmhurst	41N	11E	33	SW
19	Des Plaines @ Belmont Ave.	River Forest	40N	12E	22	SE
20	Des Plaines River @ Roosevelt Rd.	Berwyn	39N	12E	23	NE
22	Des Plaines River @ Ogden Ave.	Berwyn	38N	12E	1	NE
23	Des Plaines River @ Willow Springs Rd.	Calumet-Sag Bridge	38N	12E	33	SW
24	Salt Creek @ Wolf Rd.	Hinsdale	39N	12E	31	SE
29	Des Plaines River @ Stephen St.	Romeoville	37N	11E	20	NW
31	Middle Fork, North Branch Chicago River @ Lake-Cook Rd.	Highland Park	43N	12E	34	SE
32	Skokie River @ Lake-Cook Rd.	Highland Park	43N	12E	34	SE
34	North Branch Chicago River @ Dempster St.	Highland Park	43N	13E	18	SE
35	North Shore Channel @ Central St.	Evanston	42N	14E	31	SW
36	North Shore Channel @ Touhy Ave.	Evanston	42N	13E	26	SE
37	North Branch Chicago River @ Wilson Ave.	Chicago Loop	40E	13E	13	NE
39	South Branch Chicago River @ Madison St.	Chicago Loop	39N	14E	16	NW
40	Chicago Sanitary & Ship Canal @ Damen Ave.	Englewood	39N	14E	30	SW
41	Chicago Sanitary & Ship Canal @ Harlem Ave.	Berwyn	38N	12E	7	NW
42	Chicago Sanitary & Ship Canal @ Route 83	Calumet-Sag Bridge	37N	11E	11	SE
43	Calumet-Sag Channel @ Route 83	Calumet-Sag Bridge	37N	11E	14	SE
46	North Branch Chicago River @ Grand Ave.	Chicago Loop	39N	14E	9	NW
48	Chicago Sanitary & Ship Canal @ Stephen St.	Romeoville	37N	11E	20	NW
50	Wolf Lake @ 127th St.	Lake Calumet	37N	15E	29	SW
52	Little Calumet River @ Wentworth Ave.	Calumet City	36N	10W	29	NE
54	Thorn Creek @ Joe Orr Rd.	Harvey	35N	14E	16	NE
55	Calumet River @ 130th St.	Lake Calumet	37N	14E	36	NE
56	Little Calumet River @ Indiana Ave.	Lake Calumet	37N	14E	34	SW
57	Little Calumet River @ Ashland Ave.	Blue Island	37N	14E	32	SW
58	Calumet-Sag Channel @ Ashland Ave.	Blue Island	37N	14E	32	SW
59	Calumet-Sag Channel @ Cicero Ave.	Blue Island	37N	13E	34	NW

TABLE 3 (Continued): QUADRANT, TOWNSHIP, AND RANGE OF SAMPLING LOCATIONS

Station	Description	Quadrant	TWP	Range	Sec.	¼ Sec
73	North Branch Chicago River @ Diversey Ave.	Chicago Loop	40N	14E	30	SW
74	Chicago River @ Lake Shore Drive	Chicago Loop	39N	14E	10	NE
75	Chicago Sanitary & Ship Canal @ Cicero Ave.	Englewood	38N	13E	3	NW
76	Little Calumet River @ Halsted St.	Blue Island	37N	14E	33	NW
77	Higgins Creek @ Elmhurst Rd.	Arlington Hts.	41N	11E	25	NW
78	Higgins Creek @ Wille Rd.	Arlington Hts.	41N	11E	25	NW
79	Salt Creek @ Higgins Rd.	Palatine	41N	11E	20	NW
80	Salt Creek @ Arlington Heights Rd.	Palatine	41N	11E	29	SE
86	Grand Calumet River @ Burnham Ave.	Lake Calumet	36N	15E	5	SW
89	West Branch DuPage River @ Walnut Lane	West Chicago	41N	10E	31	SW
90	Popular Creek @ Route 19	Streamwood	41N	9E	17	SW
91	Des Plaines River @ Material Service Rd.	Joliet	36N	10E	22	SW
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse	Joliet	36N	10E	27	SW
96	North Branch Chicago River @ Albany Ave.	Chicago Loop	40N	13E	12	SW
97	Thorn Creek @ 170th St.	Calumet City	36N	14E	24	SW
99	South Fork, South Branch Chicago River @ Archer Ave.	Englewood	39N	14E	29	SW
100	Chicago River Main Stem @ Wells St.	Chicago Loop	39N	14E	9	SW
101	North Shore Channel @ Foster Ave.	Chicago Loop	41N	13E	12	SE
102	North Shore Channel @ Oakton St.	Evanston	41N	13E	23	SE
103	North Branch Chicago River @ Golf Rd.	Park Ridge	41N	12E	8	SE
104	North Branch Chicago River @ Glenview Rd.	Park Ridge	41N	12E	36	SE
105	Skokie River @ West Frontage Rd.	Park Ridge	41N	13E	30	NE
106	West Fork, North Branch Chicago River @ Dundee Rd.	Highland Park	42N	12E	4	SE
108	South Branch Chicago River @ Loomis St.	Englewood	39N	14E	28	NW
109	Salt Creek @ Brookfield Ave.	Berwyn	39N	12E	35	SW
110	West Branch DuPage River @ Springinsguth Rd.	Streamwood	41N	10E	26	SW
111	West Branch DuPage River Arlington Drive	West Chicago	40N	10E	6	SE

TABLE 4: ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA AND OBJECTIVES

Parameter	Minimum Measurement Criteria	Minimum Measurement Objectives
Dissolved oxygen	NA	0.1 mg/L[1]
Temperature	NA	0.1 degree C[1]
pH	NA	0.1 pH unit[1]
Ammonia nitrogen	15.0 mg/L	3.0 mg/L
Ammonia nitrogen, un-ionized[2]	0.1 mg/L[3]	0.025 mg/L
Nitrate and nitrite nitrogen	No standard	
Kjeldahl nitrogen	No standard	
Phosphorus, total	No standard	
Sulfate	500 mg/L	100 mg/L
Total dissolved solids	1000 mg/L	200 mg/L
Suspended solids	No standard	
Volatile suspended solids	No standard	
Turbidity	No standard	
Alkalinity	No standard	
Chloride	500 mg/L	100 mg/L
Fluoride	1.4 mg/L	0.3 mg/L
Organic carbon, total	No standard	
Phenol	0.1 mg/L	0.02 mg/L
Cyanide, total	0.1 mg/L	0.02 mg/L
Cyanide, weak acid dissociable	0.022 mg/L	0.004 mg/L
Arsenic, total	0.36 mg/L	0.07 mg/L
Barium, total	5.0 mg/L	1.0 mg/L
Boron, total	1.0 mg/L	0.2 mg/L
Cadmium, total	0.009 mg/L[4]	0.002 mg/L
Calcium, total	No standard	
Chromium, trivalent[5]	1.0 mg/L[4]	0.2 mg/L
Chromium, hexavalent	0.016 mg/L	0.003 mg/L
Copper, total	0.017 mg/L[4]	0.003 mg/L
Iron, total	2.0 mg/L	0.4 mg/L
Lead, total	0.1 mg/L[3]	0.02 mg/L

TABLE 4 (Continued): ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA AND OBJECTIVES

Parameter	Minimum Measurement Criteria	Minimum Measurement Objectives
Magnesium, total	No standard	
Manganese, total	1.0 mg/L	0.2 mg/L
Mercury, total	0.0006 mg/L[3]	0.0001 mg/L
Nickel, total	1.0 mg/L	0.2 mg/L
Selenium, total	1.0 mg/L	0.2 mg/L
Silver, total	0.005 mg/L	0.001 mg/L
Zinc, total	1.0 mg/L	0.2 mg/L
Arsenic, dissolved	No standard	
Barium, dissolved	No standard	
Boron, dissolved	No standard	
Cadmium, dissolved	No standard	
Calcium, dissolved	No standard	
Chromium, dissolved	No standard	
Copper, dissolved	No standard	
Iron, dissolved	0.5 mg/L[3]	0.1 mg/L
Lead, dissolved	No standard	
Magnesium, dissolved	No standard	
Manganese, dissolved	No standard	
Mercury, dissolved	No standard	
Nickel, dissolved	No standard	
Selenium, dissolved	No standard	
Silver, dissolved	No standard	
Zinc, dissolved	No standard	
Fecal coliform	200 cfu/100 mL	40 cfu/100 mL
n-Hexane extractable materials	15 mg/L[3]	3 mg/L
Total residual chlorine[6]	0.019 mg/L	0.004 mg/L
Gross alpha radioactivity	No standard	
Gross beta radioactivity	100 pCi/L	20 pCi/L
Chlorophyll	No standard	

TABLE 4 (Continued): ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA AND OBJECTIVES

Parameter	Minimum Measurement Criteria	Minimum Measurement Objectives
BETX (Benzene, ethyl benzene toluene and xylene)	No standard	
Organic priority pollutants[7]	No standards	
Nonylphenols	No standard	

NA = Not applicable.
[1]Required sensitivity.
[2]Calculated from pH, temperature, and ammonia nitrogen.
[3]Secondary contact water quality standard.
[4]Calculated standard based on a minimum water hardness of 100 mg/L as $CaCO_3$.
[5]Trivalent chromium measured as total chromium.
[6]Total residual chlorine not analyzed.
[7]Organic priority pollutants are identified in 40 CFR Part 122, Appendix D, Table II as amended.

TABLE 5: SAMPLING FREQUENCY

Station	Description	General Sampling[1]	Oil and Grease	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
106	Dundee Road, West Fork North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
103	Golf Road, West Fork North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
31	Lake-Cook Road, Middle Fork North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
104	Glenview Road, Middle Fork North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
32	Lake-Cook Road, Skokie River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
105	Frontage Road, Skokie River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
34	Dempster Street, North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
96	Albany Avenue, North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
35	Central Street, North Shore Channel	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
102	Oakton Street, North Shore Channel	Monthly 2nd Mon.	Monthly 2nd Mon.	Monthly 2nd Mon.	Bi-monthly	Semi-annually	Quarterly
36	Touhy Avenue, North Shore Channel	Monthly 2nd Mon.	Monthly 2nd Mon.	Monthly 2nd Mon.	Bi-monthly	Semi-annually	Quarterly

TABLE 5 (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	Oil and Grease	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
101	Foster Avenue, North Shore Channel	Monthly 2nd Mon.	Monthly 2nd Mon.		Bi-monthly	Semi-annually	
37	Wilson Avenue, North Branch Chicago River	Monthly 2nd Mon.	Monthly 2nd Mon.		Bi-monthly	Semi-annually	
73	Diversey Parkway, North Branch Chicago River	Monthly 2nd Mon.	Monthly 2nd Mon.		Bi-monthly	Semi-annually	
46	Grand Avenue, North Branch Chicago River	Monthly 2nd Mon.	Monthly 2nd Mon.		Bi-monthly	Semi-annually	Quarterly
74	Lake Shore Drive, Chicago River	Monthly 3rd Mon.		Monthly 3rd Mon.	Bi-monthly	Semi-annually	
100	Wells Street, Chicago River	Monthly 3rd Mon.		Monthly 3rd Mon.	Bi-monthly	Semi-annually	
39	Madison Street, South Branch Chicago River	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
108	Loomis Street, South Branch Chicago River	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
99	Archer Avenue, South Fork South Branch Chicago River	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
40	Damen Avenue, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	

TABLE 5 (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	Oil and Grease	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
75	Cicero Avenue, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly
41	Harlem Avenue, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly
42	Route 83, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
48	Stephen Street, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	Quarterly
92	Lockport Powerhouse Chicago Sanitary & Ship Canal	Weekly Every Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly
49	Ewing Avenue, Calumet River	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
50	Burnham Avenue, Wolf Lake	Monthly 4th Mon.			Bi-monthly	Semi-annually	
55	130th Street, Calumet River	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
86	Burnham Avenue, Grand Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	
56	Indiana Avenue, Little Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	Quarterly
76	Halsted Street, Little Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	Quarterly

TABLE 5 (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	Oil and Grease	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
52	Wentworth Avenue, Little Calumet River	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
54	Joe Orr Road, Thorn Creek	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
97	170th Street, Thorn Creek	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
57	Ashland Avenue, Little Calumet River	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
58	Ashland Avenue, Calumet-Sag Channel	Monthly 4th Mon.	Monthly 4th Mon.		Bi-monthly	Semi-annually	
59	Cicero Avenue, Calumet-Sag Channel	Monthly 4th Mon.	Monthly 4th Mon.		Bi-monthly	Semi-annually	Quarterly
43	Route 83, Calumet-Sag Channel	Monthly 4th Mon.	Monthly 4th Mon.		Bimonthly	Semi-annually	
12	Lake-Cook Road, Buffalo Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
13	Lake-Cook Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
17	Oakton Street, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon..	Bi-monthly	Semi-annually	
19	Belmont Avenue, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	

TABLE 5 (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	Oil and Grease	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
20	Roosevelt Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
22	Ogden Avenue, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
23	Willow Springs Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
29	Stephen Street, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
91	Material Service Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
90	Route 19, Poplar Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
110	Springinsguth Road, West Branch DuPage River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
89	Walnut Lane, West Branch DuPage River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
111	Arlington Drive, West Branch DuPage River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
79	Higgins Road, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
80	Arlington Heights Road, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly

TABLE 5 (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling1	Oil and Grease	Radio-Activity	BETX2	OPPs	Nonyl-phenols
18	Devon Avenue, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
24	Wolf Road, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
109	Brookfield Avenue, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
77	Elmhurst Road, Higgins Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Bimonthly
78	Wille Road, Higgins Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Bimonthly

[1]The 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, weak acid dissociable (WAD) cyanide, phenol, alkalinity, chloride, fluoride, turbidity, total dissolved solids, total suspended solids, total organic carbon, and chlorophyll. General sampling excluded oil and grease, radioactivity, E.Coli, BETX, priority organics, and nonylphenol.

[2]BETX is the sum of benzene, ethyl benzene, toluene, and xylene.

TABLE 6: SAMPLE CONTAINERS AND FIELD PRESERVATION

Parameter	Container and Field Preservation
1. Dissolved oxygen	300 mL glass stoppered bottle, sample is fixed immediately after collection with manganous sulfate solution, alkali-iodide solution and sulfuric acid. Chill sample with ice and protect from light. See Appendix AI page AI-5 for the correct procedure.
2. 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 AI page AI-4 and AI-5 for the correct procedure.
3. General chemistry[1] (see footnote for parameters)	1 gallon polyethylene bottle. Chill sample with ice.
4. Metals, total	250 mL polyethylene bottle with 2.5 mL conc. HNO_3 to adjust pH<2. Chill sample with ice.
5. Metals, dissolved	900 mL certified clean 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 1 mL of conc. HNO_3.)
6. Cyanide, total and WAD cyanide	½ gallon plastic bottle with 5 mL 10% NAOH to adjust pH>12. Chill sample with ice.
7. Phenol	1 quart glass bottle with 2 mL of conc. H_2SO_4 to adjust pH<2. Chill sample with ice.
8. n-Hexane extractable materials	2-1 quart glass bottles. Chill sample with ice.
9. Alkalinity, chloride, turbidity, total dissolved solids, total suspended solids	1 gallon wide-mouth plastic bottle. Chill sample with ice.
10. Sulfate with ice.	250 mL polyethylene bottle. Chill sample

TABLE 6 (Continued): SAMPLE CONTAINERS AND FIELD PRESERVATION

	Parameter	Container and Field Preservation
11.	Carbon, total organic	500 mL wide-mouth glass bottle with 1 mL H_2SO_4 to adjust pH<2. Chill sample with ice.
12.	Radiochemistry	1 liter polyethylene bottle.
13.	Chlorophyll	1 liter HDPE Nalgene amber, wide-mouth bottle with 1 mg powdered $MgCO_3$. Chill sample with ice.
14	Volatile organics, BETX (benzene, ethyl benzene, toluene, and xylene)	Three 40-mL vials with screw caps, each with 25 mg ascorbic acid, filled to overflowing with no air bubbles. Chill sample with ice.
15.	Base/neutral and acid extractable compounds, pesticides, PCBs, OPPs and nonylphenols[2]	1 gallon glass with 0.7 mL of 50% sodium thiosulfate solution. Chill sample with ice.

[1]General chemistry parameters include ammonia nitrogen, nitrate and nitrite nitrogen, Kjeldahl nitrogen, total phosphorus, and fluoride.
[2]Nonylphenol analyzed from same container as OPPs.

TABLE 7: ANALYTICAL METHODS

Parameter	Method	Method Reference
Dissolved oxygen	Titration	SM 4500-O C
Temperature	Electrode	SM 2550 B
pH	Electrode	SM 4500-H^+ B
Ammonia nitrogen	Colorimetric	EPA 350.1
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	Turbidimetric	EPA 375.4
Total dissolved solids	Gravimetric	SM 2540 C
Suspended solids	Gravimetric	SM 2540 D
Volatile suspended solids	Gravimetric	SM 2540 E
Turbidity	Nephelometric	SM 2130 B
Alkalinity	Titration	SM 2320 B
Chloride	Potentiometric	SM 4500-Cl D
Fluoride	Potentiometric	SM 4500 F-C
Organic carbon, total	UV-Oxidation	SM 5310 C
Phenol	Colorimetric	EPA 420.2
Cyanide, total	Colorimetric	EPA 335.3
Cyanide, weak acid dissociable	Colorimetric	SM 4500-CN I
Arsenic, total	ICP	EPA 200.7, SM 3120 B
Barium, total	ICP	EPA 200.7, SM 3120 B
Boron, total	ICP	EPA 200.7, SM 3120 B
Cadmium, total	ICP	EPA 200.7, SM 3120 B
Calcium, total	ICP	EPA 200.7, SM 3120 B
Chromium, trivalent[2]	ICP	EPA 200.7, SM 3120 B
Chromium, hexavalent	Colorimetric	SM 3500-Cr B
Copper, total	ICP	EPA 200.7, SM 3120 B
Iron, total	ICP	EPA 200.7, SM 3120 B
Lead, total	ICP	EPA 200.7, SM 3120 B
Magnesium, total	ICP	EPA 200.7, SM 3120 B
Manganese, total	ICP	EPA 200.7, SM 3120 B
Mercury, total; General Use	Cold vapor AFS	EPA 1631 E
Mercury, total; Secondary Contact	Cold vapor AA	SM 3112 B
Nickel, total	ICP	EPA 200.7, SM 3120 B
Selenium, total	ICP	EPA 200.7, SM 3120 B
Silver, total	ICP	EPA 200.7, SM 3120 B
Zinc, total	ICP	EPA 200.7, SM 3120 B
Arsenic, dissolved	ICP	SM 3030 B, SM 3120 B
Barium, dissolved	ICP	SM 3030 B, SM 3120 B

TABLE 7 (Continued): ANALYTICAL METHODS

Parameter	Method	Method Reference
Boron, dissolved	ICP	SM 3030 B, SM 3120 B
Cadmium, dissolved	ICP	SM 3030 B, SM 3120 B
Calcium, dissolved	ICP	SM 3030 B, SM 3120 B
Chromium, dissolved	ICP	SM 3030 B, SM 3120 B
Copper, dissolved	ICP	SM 3030 B, SM 3120 B
Iron, dissolved	ICP	SM 3030 B, SM 3120 B
Lead, dissolved	ICP	SM 3030 B, SM 3120 B
Magnesium, dissolved	ICP	SM 3030 B, SM 3120 B
Manganese, dissolved	ICP	SM 3030 B, SM 3120 B
Mercury, dissolved	Cold vapor AA	SM 3030 B, SM 3112 B
Nickel, dissolved	ICP	SM 3030 B, SM 3120 B
Selenium, dissolved	ICP	SM 3030 B, SM 3120 B
Silver, dissolved	ICP	SM 3030 B, SM 3120 B
Zinc, dissolved	ICP	SM 3030 B, SM 3120 B
Fecal coliform	Membrane	SM 9222 D
n-Hexane extractable materials	Gravimetric	EPA 1664, Rev. A
Gross alpha radioactivity	Gas proportional	SM 7110
Gross beta radioactivity	Gas proportional	SM 7110
Chlorophyll	Colorimetric	SM 10200 H
BETX (Benzene, ethyl Benzene, toluene, xylene)	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
Nonylphenols	GC/MS	GCMS004[3]

[1]Calculated from pH, temperature, and ammonia nitrogen.
[2]Trivalent chromium measured as total chromium.
[3]USEPA Region V Method, Revision 1 dated June 6, 2003.

TABLE 8: LABORATORY PRESERVATION AND MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation[1,2]	Maximum Holding Time
Dissolved oxygen (Fixed)	Refrigerate	8 hours
Temperature	NA	0.25 hours
pH	NA	0.25 hours
Ammonia nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Ammonia nitrogen, Un-ionized[3]	NA	NA
Nitrate and nitrite nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Nitrite	Refrigerate	48 hours
Kjeldahl nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Phosphorus, total	(a) Refrigerate, (b) with H_2SO_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
Turbidity	Refrigerate, store in dark	48 hours
Alkalinity	Refrigerate	14 days
Chloride	None required	28 days
Fluoride	None required	28 days
Organic carbon, total	Refrigerate, H_2SO_4 to pH<2	28 days
Phenol	Refrigerate, H_2SO_4 to pH<2	28 days
Cyanide, total	Refrigerate, NaOH to pH>12	14 days
Cyanide, weak acid dissociable	Refrigerate, NaOH to pH>12	14 days
Chromium, hexavalent	Refrigerate	24 hours
Metals, total (excluding mercury)	HNO_3 to pH<2	6 months
Mercury, total	HNO_3 to pH<2	28 days
Metals, dissolved (excluding mercury)	Filter, HNO_3 to pH<2	6 months
Mercury, dissolved	Filter, Refrigerate, HNO_3 to pH<2	28 days
Fecal coliform	Refrigerate	6 hours

TABLE 8 (Continued): LABORATORY PRESERVATION AND MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation[1,2]	Maximum Holding Time
n-Hexane extractable materials	Refrigerate, H_2SO_4 to pH<2	28 days
Gross alpha radioactivity	HNO_3 to pH<2	None
Gross beta radioactivity	HNO_3 to pH<2	None
Chlorophyll	Refrigerate	30 days
BETX (Benzene, ethyl benzene, toluene, xylene)	Refrigerate	7 days
Organic priority pollutants	Refrigerate	7 days
Nonylphenols	Refrigerate	7 days

NA = Not applicable.
[1]All samples stored in ice after collection and in transport to laboratory. Thermal preservation and chemical field preservation checked at arrival. Field preservation shown in parentheses.
[2]Refrigeration at 4°C.
[3]Calculated from pH, temperature, and ammonia nitrogen.

TABLE 9: RESPONSIBLE LABORATORIES AND METHOD STANDARD OPERATING PROCEDURE IDENTIFICATION

Parameter	Laboratory	Method SOP ID
Dissolved oxygen (Fixed)	Industrial Waste	IW-DO-WINKLER
Temperature	Field measurement	M90 Oper. Instr.
pH	Field measurement	M90 Oper. Instr.
Ammonia nitrogen	Stickney	ST-NH3
Ammonia nitrogen, un-ionized[1]	Calculation	NA
Nitrate and nitrite nitrogen	Stickney	ST-NO3/NO2
Kjeldahl nitrogen	Stickney	ST-TKN
Phosphorus, total	Stickney	ST-TP
Sulfate	Calumet	CaSO4
Total dissolved solids	Stickney	ST-TDS
Suspended solids	Stickney	ST-TSS/VSS
Volatile suspended solids	Stickney	ST-TSS/VSS
Turbidity	Stickney	ST-TURB
Alkalinity	Stickney	ST-Alk
Chloride	Stickney	ST-Cl
Fluoride	Stickney	ST-F
Organic carbon, total	Industrial Waste	IW-TOC
Phenol	Industrial Waste	IW-PHENOL-A
Cyanide, total	Industrial Waste	IW-CN-AUTO
Cyanide, weak acid dissociable	Industrial Waste	IW-CN-WAD
Chromium, hexavalent	Stickney	ST-Cr+6
Metals, total and dissolved (except mercury)	Stickney	ST-ICPPE
Mercury, total and dissolved	Stickney	ST-CVAAS
Fecal coliform	Microbiology	
n-Hexane extractable materials	Industrial Waste	IW-FOG-SPE
Gross alpha radioactivity	Radiochemistry	A/B.TSD
Gross beta radioactivity	Radiochemistry	A/B.TSD
Chlorophyll	Aquatic Ecology	
Benzene, ethyl benzene,	Organic Compounds Analytical	SOPEPA624
		toluene, xylene
Organic priority pollutants	Organic Compounds Analytical	SOPEPA624[2] SOPEPA625[3] SOPEPA608[4]
Nonylphenols	Organic Compounds Analytical	GCMS004[5]

[1]Calculated from pH, temperature and ammonia nitrogen.
[2]Volatile organic compounds.
[3]Base/neutral and acid extractable compounds.
[4]Pesticides and PCBs.
[5]USEPA Region V Method, Revision 1 dated June 6, 2003.

TABLE 10: COMPARISON OF LABORATORY REPORTING LIMIT AND MINIMUM MEASUREMENT OBJECTIVES

Parameter	Reporting Limit (RL)	Minimum Measurement Objectives
Temperature	NA	0.1 degree C[1]
Dissolved oxygen	NA	0.1 mg/L[1]
pH	NA	0.1 pH unit[1]
Ammonia nitrogen	0.1 mg/L	3.0 mg/L
Ammonia nitrogen, un-ionized[2]	NA	0.025 mg/L
Nitrate and nitrite nitrogen	0.04 mg/L	
Nitrite nitrogen	0.02 mg/L	
Kjeldahl nitrogen	0.2 mg/L	
Phosphorus, total	0.125 mg/L	
Sulfate	0.53 mg/L	100 mg/L
Total dissolved solids	40 mg/L	200 mg/L
Suspended solids	4 mg/L	
Volatile suspended solids	NA	
Turbidity	1.0 NTU	
Alkalinity	5.0 mg/L	
Chloride	0.5 mg/L	100 mg/L
Fluoride	0.1 mg/L	0.3 mg/L
Organic carbon, total	0.2 mg/L	
Phenol	0.005 mg/L	0.02 mg/L
Cyanide, total	0.005 mg/L	0.02 mg/L
Cyanide, weak acid dissociable	0.0008 mg/L	0.004 mg/L
Arsenic, total	0.05 mg/L	0.07 mg/L
Barium, total	0.003 mg/L	1.0 mg/L
Boron, total	0.045 mg/L	0.2 mg/L
Cadmium, total	0.010 mg/L	0.002 mg/L
Calcium, total	0.30 mg/L	
Chromium, trivalent[3]	0.0025 mg/L	0.2 mg/L
Chromium, hexavalent	10 µg/L	11 µg/L
Copper, total	0.010 mg/L	0.2 mg/L
Iron, total	0.10 mg/L	0.4 mg/L

TABLE 10 (Continued): COMPARISON OF LABORATORY REPORTING LIMIT AND MINIMUM MEASUREMENT OBJECTIVES

Parameter	Reporting Limit (RL)	Minimum Measurement Objectives
Iron, soluble	0.020 mg/L	0.1 mg/L
Lead, total	0.015 mg/L	0.02 mg/L
Magnesium, total	0.35 mg/L	
Manganese, total	0.0030 mg/L	0.2 mg/L
Mercury, total	0.00025 mg/L	0.0001 mg/L
Nickel, total	0.010 mg/L	0.2 mg/L
Selenium, total	0.10 mg/L	0.2 mg/L
Silver, total	0.0030 mg/L	0.005 mg/L
Zinc, total	0.015 mg/L	0.2 mg/L
Fecal coliform	10 cfu/100 mL	40 cfu/100 mL
n-Hexane extractable materials	3 mg/L3 mg/L	
Gross alpha radioactivity	3 pCi/L[4]	
Gross beta radioactivity	4 pCi/L[4]20 pCi/L	
Chlorophyll	1 µg/L	
BETX, total	2 µg/L	
Benzene	2 µg/L	
Ethyl benzene	2 µg/L	
	Toluene	2 µg/L
Xylenes (total)	3 µg/L	
Organic priority pollutants	Variable[5]	
Nonylphenols	5 µg/L	

NA = Not applicable.
[1]Required sensitivity.
[2]Calculated from pH, temperature and ammonia nitrogen. Significant figures for pH, temperature, and ammonia nitrogen allow calculation to 0.01 mg/L.
[3]Trivalent chromium measured as total chromium.
[4]RL varies with total solids concentration of the sample.
[5]Contact the Organic Compounds Analytical Laboratory for specific compound RLs.

AMBIENT WATER QUALITY MONITORING PROJECT
QUALITY ASSURANCE PROJECT PLAN

APPENDIX I

SAMPLING PROCEDURES

WATERWAY SAMPLING
Revision: September 19, 2011

Bridge Sampling Procedures

1. Before sample collection day, scrub the stainless steel sampling bucket, stirrers, and DO sampling device with a solution of non-interfering residue-free critical cleaning liquid detergent and water. Rinse with de-ionized water.

2. Only take samples from the upstream side of the bridge with the exception of sampling #s WW_42 and WW_48, which will be sampled by the District's Pollution Control Boat.

3. Take the samples from a representative location - the center of the river at the deepest point. <u>DO NOT SAMPLE FROM THE BANK OF THE WATERWAY</u>.

4. 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.

5. 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 equipment blanks from pail. See Section C.

   d. When required, collect organics samples from pail. See Section D.

6. 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 pH as obtained with the handheld meter.

g. Sample temperature as obtained with the handheld meter.

h. Sample storage temperature.

i. 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.

j. At the bottom of the collection sheet, a space is available for additional remarks.

7. Upon completion of the sampling assignment, immediately transport the samples to the laboratory for analysis.

8. 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. Properly identify (label) each sample container and arrange in order specified on sample trays.

2. 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.

3. Empty the bucket, lower and retrieve it two more times rinsing thoroughly to acclimate it to the waterway.

4. 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.

5. Whenever the sampling bucket is being raised or lowered from the bridge, give special attention to insure 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.

6. 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.

7. Samples to be collected and order in trays:

   a. General chemistry sample; 1-gallon (wide-mouth plastic) container.

   b. Alkalinity, turbidity, chloride, solids sample; plastic one-gallon container, fill to shoulder.

   c. Cyanide sample; fill the plastic half-gallon container (containing 5 mL of 10% NaOH preservative) to shoulder.

   d. Phenol sample; fill the glass sample bottle to the shoulder; exercise <u>CAUTION</u> as bottle contains 2 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative.

   e. Radiochemistry sample; fill 1 liter plastic bottle to shoulder. <u>Do not</u> overfill.

   f. Dissolved metals sample; fill a 900 mL certified clean, plastic bottle.

   g. Total organic carbon; fill a 500-mL glass bottle.

   h. 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.)

   i. Sulfate fill a 250 mL square plastic bottle.

j. Chlorophyll; fill an opaque, brown 1-liter bottle (obtained from Room LE213). Leave approximately 1/2-inch air space at top of bottle. NOTE: The bottle contains a 1-mL magnesium carbonate suspension. (Overfilling may cause a loss of preservative.)

k. Oil and grease sample; fill two glass quart jars.

8. After all the sample aliquots have been poured-off, rinse the sample bucket and stirring rod with de-ionized water.

9. Place each sample aliquot into the 72-quart thermal ice chest filled from 1/3 to 1/2 full of ice cubes. Insure the sample bottles are surrounded in ice.

Section B: Dissolved Oxygen and Bacterial Samples

The DO sample and bacterial sample are collected at the same time using a DO sampler that has been modified to hold the bacterial sample container. The DO and bacterial samples are collected as follows:

a. The bacterial container is a sterilized 4 oz. plastic bottle with foil covered plastic screw cap. The DO container is a 300-mL glass bottle.

b. Do not open bacterial bottle until sampling, and replace foil covered plastic cap as soon as possible.

c. 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.

d. Do not remove foil from plastic cap.

e. Insert bacterial bottle into the compartment attached to the outside of the DO sampling can making sure not to allow the top of the bottle to touch any part of the sample can.

f. Place a 300-mL DO glass bottle into the special DO sampling device.

g. Slowly lower the DO sampling device with the bacterial bottle and DO bottle into the waterway to the depth of approximately 3 feet from the surface taking care to prevent turbulence and the formation of air bubbles while filling.

h. Raise the sampling device when all the air bubbles have stopped rising.

i. Remove the bacterial bottle from the DO sampling device.

j. Obtain a second bacterial bottle, label, and then remove the foil-covered lid.

k. 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.

l. Do not remove foil from plastic cap.

m. Pour the aliquot obtained with the DO sampling device into the second bacterial bottle. Fill the bottle approximately 80 percent full. DO NOT OVERFILL.

n. Place the sample into the cooler on ice.

o. Return the bacterial bottle used to collect the sample to the Microbiology Laboratory.

p. Place the sample into the cooler on ice.

q. Remove the DO bottle. Replace the glass stopper and pour off excess water at the top of the bottle.

r. Remove the glass stopper and add 1 mL of manganous sulfate (use Reagent Dispenser #1). Then, add 1-mL potassium hydroxide – potassium iodide solution (alkali-iodide-azide reagent) (use Reagent Dispenser #2). NOTE: The tips of the Reagent Dispensers, #1 and #2, should be at the surface of the liquid in the DO bottle when the reagents are added. Add reagents slowly, allowing them to run down the inside of the bottle neck, to avoid introducing air into the sample. This prevents the introduction of extraneous oxygen into the sample.

s. Replace the glass stopper on the DO bottle carefully to exclude air bubbles.

t. Rinse the bottle with river water or fresh water, if available.

u. Mix the sample by inverting the bottle several times until dissolution is complete. NOTE: The initial precipitate, manganous hydroxide, combines with the DO in the sample to form manganic hydroxide, a brown precipitate. Place the bottle in an area protected from direct sunlight while precipitate is settling.

v. When the precipitate settles approximately half way in the sample, add 1-ml sulfuric acid (Reagent #3), by removing the glass stopper on the sample bottle and placing the tip of the Reagent Dispenser #3 in the inside neck of the bottle above the level of the sample. This allows the acid to run down the inside of bottleneck, and mix with the sample. Once again, this eliminates the introduction of extraneous oxygen into the sample.

w. Replace the glass stopper on the DO bottle.

x. Rinse the bottle with river water or fresh water if it is available.

y. Mix the sample by inverting bottle several times.

z. Place sample into cooler on ice. (Protect from sunlight.)

aa. Complete appropriate entries on sample collection sheet.

Section C: Equipment Blanks. If sampling is occurring at one of the following stations, then equipment blanks must be obtained: WW_78, WW_23, WW_90, WW_32, WW_37, WW_36, WW_108, WW_41, WW_50, WW_57, and WW_52. Equipment blanks are collected as follows:

a. Properly identify (label) each sample container and arrange in order specified on sample trays.

b. Fill the stainless steel bucket two-thirds full with reagent water obtained from the laboratory.

c. Proceed with the filling of the sample containers as is done in Section A, steps g through i, refilling the bucket as necessary to fill all sample containers.

d. Complete sample collection sheet as appropriate.

Section D: Organics Samples. Organic priority pollutants (OPP), nonylphenol, 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/nonylphenols samples. These containers contain a preservative and should not be rinsed prior to filling.

2. OPP/nonylphenol 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 insure 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 by the night transporter.

Equipment Required for Sampling

1. Labels - Electronically generated adhesive backed labels with identifying LIMS barcode.

2. Bottles (per station, note: an equipment blank will require an additional set of sample containers a through k).

   a. Gallon (polyethylene) – General chemistry.

   b. Gallon (polyethylene) – Alkalinity, turbidity, chloride, solids.

   c. 1/2 Gallon (polyethylene) – Cyanide.

   d. Quart (glass) – Phenol.

   e. Quart (polyethylene) – Radiochemistry.

   f. 900 mL (polyethylene – certified clean) – Dissolved metals.

   g. 500-mL (glass) – Total organic carbon.

   h. 8 oz. (polyethylene) – Trace metals (total).

   i. 250-ml rectangular (polyethylene) – Sulfate.

   j. 1 liter brown, opaque (plastic) – Chlorophyll.

   k. Two quarts (glass) – Oil & grease (2).

   l. Two 4 oz. (polypropylene w/foil covered stopper) – Fecal coliform.

m. 300 mL (narrow-mouth glass w/ ground glass stopper) – Dissolved oxygen.

n. Three 40-mL vials (amber colored glass) – BETX.

o. Three 40-mL vials (amber colored glass); and 1 gallon (glass) – Organic priority pollutants and nonylphenols.

3. Sampling Devices.

   a. Stainless steel bucket and lid.

   b. Stainless steel DO sampling device equipped with a lid and a fill tube that extends into the glass 300 mL DO sample bottle stopping just below the bottom. This device is designed to bleed sample into the bottle through the tube and the bottle is filled to overflowing inside the device to prevent turbulence and the formation of air bubbles while filling. Attached to this device is a stainless steel holder for a bacti-bottle.

   c. Portable handheld electronic pH and temperature meter.

   d. Sufficient length of 3/8-inch nylon rope (approximately 100 feet).

4. Miscellaneous.

   a. River Run Collection Sheet, for locations to be sampled.

   b. 72-quart ice chests as needed.

   c. Ice.

   d. DO reagents.

   e. Gray plastic container for storage of sampling rope during sampling events.

   f. 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.

Stainless steel stirring rod.

g. Two carboys of reagent water provided by the SAL.

Safety

1. <u>DO NOT</u> park District vehicle on a bridge. Attempt off-road parking, if possible.

2. Use rotating lights on the vehicle when stopped.

3. When parking on the road, use safety cone markers.

4. Wear red warning vests <u>and life vests</u>.

5. Wear gloves and eye protection when handling DO reagents. Do not allow reagents to come into contact with each other outside of the DO bottle since they are extremely reactive.

6. 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.

AMBIENT WATER QUALITY MONITORING PROJECT
QUALITY ASSURANCE PROJECT PLAN

APPENDIX II

SAMPLE COLLECTION SHEET

#3 **Calumet, Little Calumet, Cal-Sag Watershed**

DATE COLLECTED:____________ COLLECTED BY: ____________ WEATHER: ____________

DATA CODE	LOCATION	TIME	TEMP	GEN. CHEM.	F.O.G.	ALK / FL. TURB.	CYN.	PHEN.	T.M.	SOL. T.M.	BACT	D.O.	RAD.	TOC	PRIORTIY POLL.	SO4	CHLORO. a	pH	REMARKS
54	Thorn Creek at Joe Orr Road N. Lat. W. Long.				■										■			6.5-9.0	LIMS#
97	Thorn Creek at 170th Street N. Lat. W. Long.				■										■			6.5-9.0	LIMS#
52	Little Calumet River at Wentworth avenue (167th Street)				■										■			6.5-9.0	LIMS#
	EQUIPMENT BLANK				■						■	■	■		■		■		LIMS#
59	Cal - Sag Channel at Cicero Avenue (near 131st St) N. Lat. W. Long.												■		■			6.0-9.0	LIMS#
43	Cal - Sag Channel at Route # 83 Bridge N. Lat. W. Long.												■		■			6.0-9.0	LIMS#

STORED AT 4 deg. C YES ______ NO ______, IN CUSTODY OF ____________ METER # ____________

TRANSPORTED BY: ____________ ____________

RELINQUISHED BY: ____________ DATE:________ TIME: ________ VEHICLE ____________

RECEIVED BY LABORATORY: ____________ DATE:________ TIME: ________

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