Monitoring Strategy for the Des Plaines River Watershed

Revised March 2017

Purpose

This Monitoring Strategy for the Des Plaines River Watershed in Lake County Illinois was developed by the Monitoring Committee of the Des Plaines River Watershed Workgroup (DRWW). The Monitoring Strategy was written and submitted to comply with the terms of Illinois Environmental Protection Agency's (Illinois EPA) Financial Assistance Agreement (FAA) 3191506. This Monitoring Strategy exceeds the minimum requirements of the Agreement and includes items that are in excess of what is required or eligible under the Section 319 program.

The Monitoring Strategy is considered a living document. The DRWW Monitoring Committee will use adaptive management to review the results of the monitoring program and will revise and update the Monitoring Strategy if changes are needed. A memo from Midwest Biodiversity Institute (MBI) recommending an enhancement of the monitoring station locations based on a Geometric Site Analysis resulted in this revision of the strategy to expand the number of sampling sites from 44 to 70 locations in 2016. In 2016, 44 locations were sampled for water chemistry (6 location that should have been sampled were not due to a miscommunication), 49 locations for sediment (1 location that should have been sampled was not due to a miscommunication), and 69 locations were sampled for biology (1 location that should have been sampled was not due to a miscommunication). As of the date of this document, the DRWW monitoring committee is budgeting to continue sampling 70 locations; 50 locations for water chemistry, and 1/3 of the 70 sites for biological/sediment each year for the next three years. Two Quality Assurance Project Plans (QAPPs) were developed for the monitoring program. The Bioassessment QAPP and the Flow Monitoring QAPP are appended to and inform this Monitoring Strategy.

Introduction and Background

The Des Plaines River Watershed covers over 130,000 acres or just over 200 square miles. The river starts just west of Kenosha, Wisconsin and flows south through Racine and Kenosha Counties in Wisconsin, and then through Lake, Cook, and Will Counties in Illinois. The river then joins the Sanitary and Ship Canal in Lockport, flows west through Joliet, before converging with the Kankakee River to form the Illinois River. The Illinois River then flows into the Mississippi River which flows south to the Gulf of Mexico.

Portions of the Des Plaines River, tributaries and lakes within the watershed in Lake County are listed as impaired by the Illinois EPA and do not meet their designated uses under the Clean Water Act. Segments are listed as impaired for pollutants including arsenic, chloride, dissolved oxygen, fecal coliform, iron, manganese, methoxychlor, mercury, phosphorous, polychlorinated biphenyls, and total suspended solids. Phosphorous is currently limited by regulatory action through Publicly Owned Treatment Works (POTWs) National Pollutant Discharge Elimination System (NPDES) permits. In addition, Total Maximum Daily Loads (TMDLs) have been completed for some stream segments and lakes within the watershed and more will continue to be developed. However, it is unclear as to

whether any of these regulatory mechanisms will ultimately allow for the impaired waterbodies to meet Clean Water Act standards.

The Des Plaines River Watershed Workgroup (DRWW) brings together local stakeholders to 1) better determine stressors to the aquatic system through a long term water quality monitoring program; and 2) to work together to preserve and enhance water quality in the Des Plaines River and its tributaries. The monitoring strategy was developed by the DRWW Monitoring Committee and revised with consulting assistance from Geosyntec Consultants and the Midwest Biodiversity Institute. Illinois EPA Section 319(h) grant funds awarded under Agreement Number 3191506 will reimburse DRWW costs to refine and revise the monitoring strategy and the QAPPs for implementation.

Data collected under this monitoring program will be used in the development of the Des Plaines River watershed-based plan. Data will be uploaded on at least an annual basis following the Illinois EPA requirements for reporting surface-water -monitoring data format (EDDMasterStructureAndFormat_VersionAsOf2015_06_30_ToChrisDavis_2016_02_1...) as described in the Data and Reporting Section of this strategy. The 2015-2016 water chemistry data is being delivered to Illinois EPA in concert with this revised monitoring strategy by March 31, 2017.

Program Goals

The DRWW will undertake a comprehensive monitoring program to fulfill the following goals:

- Develop and implement a comprehensive monitoring program that will include chemical, physical, and biological components that will accurately identify the quality of stream and river ecosystems as well as stressors associated with non-attainment of water quality standards and designated uses. The DRWW monitoring program will establish baseline conditions, and then measure progress towards meeting water quality standards.

- Assist NPDES permittees in meeting monitoring permit requirements, including monitoring requirements for upstream and downstream of POTWs and Municipal Separate Storm Sewer Systems (MS4s). (Note: Costs for permit required monitoring are not included in Illinois EPA grant funded activities.)

The proposed monitoring program will document the existing water quality status of the rivers and streams of the Des Plaines River watershed within Lake County, Illinois. The monitoring program will emphasize the direct assessment of biological assemblages by sampling fish and macroinvertebrates using standardized sampling and assessment methodologies. In addition to determining aquatic life status, the monitoring program will also ascertain the associated causes and sources associated with biological impairments by using paired chemical, physical, and other stressor data and information within a systematic analytical process detailed in a comprehensive plan of study, specifically monitoring habitat and water and sediment chemistry.

Budget and Timeline

The DRWW uses annual membership dues to support the comprehensive monitoring program. Qualified contractors are secured through a competitive bid process to provide the bioassessment and flow monitoring services. The estimated monitoring program cost is $501,443 for years 2015-2017 as presented below. 319 Grant match is provided by the sediment analysis, biological monitoring and assessment and flow monitoring, which are all voluntary and not required by permit.

Estimated Monitoring Program Cost

Program Component	2015-2017 Est. Cost	Monitoring Strategy & QAPP	319 Grant	2015-2017 Est. Match
Development of Monitoring Strategy and QAPP	$47,500	-	$47,500	0
Water Chemistry Sampling	$136,508	-	-	0
Sediment Analysis	$48,000	-	-	$48,000
Biological Monitoring and Assessment	$195,335	$12,319	-	$183,016
Flow Monitoring	$74,100	$9,582	-	$64,518
Geosyntec	$31,678	$31,678	-	0
ESTIMATED TOTAL COST	$533,121	$53,579	$47,500	$295,534

Data collection for the monitoring program covered under FAA 3191506 runs from July 1, 2015 - October 31, 2017. A final monitoring program report will be submitted to Illinois EPA by January 31, 2018.

Monitoring Plan

The monitoring program consists of two components: a bioassessment consisting of fish, macroinvertebrate, habitat and water and sediment chemistry monitoring; and flow monitoring. Water column chemistry monitoring will be completed annually with a tiered site design, as shown in Table 3. The collecting of fish and macroinvertebrates samples and habitat assessment was completed for 69 sites in 2016 (one site was not sampled due to a miscommunication). Thereafter, biological sampling will be completed on a rotating basis with one third of the 70 monitoring sites being completed each year (dependent on cost and available funds). Sediment chemistry will be conducted concurrent with biological monitoring. Flow monitoring data may be used for modeling purposes and to calculate pollutant concentrations in the future. The monitoring design and protocol is modeled after the DuPage River Salt Creek Workgroup and the Lower DuPage River Watershed Coalition (Yoder 2012).

Monitoring Sites and Equipment

In 2016, a total of 70 sites were sampled; biological monitoring was conducted at 69 sites, water chemistry was collected at 44 sites and sediment was collected at 49 sites. Flow monitoring equipment was installed and downloaded at 21 sites once in 2016. The flow monitoring contract has been extended to include 6 more downloads/manual measurements in 2017. Monitoring sites are located throughout the Des Plaines River watershed within Illinois as shown in Figures 1 and 2 and listed in Table 1. Monitoring sites are located on the main stem, tributaries, and within the headwaters, and were selected to investigate the contribution of point sources and non-point sources. Publicly Owned Treatment Works (POTWs) are bracketed with monitoring sites located both upstream and downstream to determine POTW effluent impacts on the receiving waters. Sites are also located to determine the influences of tributary streams and other features, for example, the impact of online lakes.

Necessary equipment for the monitoring program is presented in Table 2 and is described in the monitoring sections that follow. All of the monitoring equipment is being provided by the contractors. Fifteen (15) stream dataloggers and two (2) barometric pressure dataloggers were purchased, installed and will be maintained by the flow monitoring contractor on behalf of the DRWW. The equipment cost is included in the flow monitoring contract and budgeted as DRWW grant match. DRWW will maintain ownership of the dataloggers after the flow monitoring contract is completed.

Water Column and Sediment Chemistry Monitoring

Water column and sediment chemistry is being sampled using a tiered site design to allow for more frequent monitoring of sites with greater flow and tributary area while still allowing for comprehensive coverage of the watershed. Water samples will be collected using grab samples upstream of the monitoring station unless otherwise noted in site description maps. If high pollutant loads are detected, follow up sampling at a refined scale may be undertaken to further determine the cause. Table 3 shows the parameters and summarizes the frequency of sampling described below for water column and sediment chemistry monitoring. Monitoring sites in Figures 1 and 2 are also color coded to represent the four (4) tiers described below: Tier 1 is red, Tier 2 is green, Tier 3 is blue and Tier 4 is brown.

- Tier 1: 10 sites located on the mainstem Des Plaines River and Mill Creek, monitored monthly May through September and in November and March (seven times per year) for all demand, nutrient, and bacteria parameters; will also be monitored annually under low flow conditions for water column metals, water organics, and in 2017-2019 once every three years concurrent with the bioassessment for sediment metals and sediment organics.
- Tier 2: 11 sites located on the Des Plaines and tributary streams for water and sediment chemistry will occur monthly from May through September and in November and March (seven times per year) for the majority of demand, nutrient, and bacteria parameters; annually under low flow conditions for water column metals, water organics, and once every three years concurrent with the bioassessment for sediment metals and sediment organics.
- Tier 3: 29 stream stations located on the Des Plaines and tributary streams within the watershed for water and sediment chemistry will occur monthly from May through September and in November and March (seven times per year) for the majority of demand, nutrient, and bacteria parameters and once every three years concurrent with the bioassessment for sediment metals and sediment organics.
- Tier 4: 20 stream stations located on tributary streams within the watershed monitored once every three years for bioassessment.

Equipment necessary to complete the water column and sediment chemistry monitoring will be provided by the contractor and may include buckets, collection bottles, and gloves. A detailed equipment list is included in Table 2.

Biological Monitoring

The biological monitoring was completed at 69 sites in 2016, and will be conducted on a rotating basis in the future. Beginning in 2017, fish and macroinvertebrate assemblages and habitat will be monitored with approximately one third of the locations sampled each year. Biological sampling for fish and macroinvertebrate assemblage data and habitat follow established protocols of the Illinois Department of Natural Resources (Illinois DNR; 2001) and Illinois EPA (1997, 2005), and will be capable of producing comparable data and assessments. Sampling methods are determined by the contractor based on whether the stream is non-wadeable or wadeable and are documented in the Quality Assurance Project Plan (QAPP). Equipment necessary to complete the bioassessment is provided by the contractor and may include electrofishing equipment, nets, and an analytical field meter (see Table 2 for a complete list).

Flow Monitoring

Through a combination of the installation of new data loggers and obtaining data from existing equipment, flow will be monitored at 21 locations within the Des Plaines River watershed project area. Flow monitoring locations include six existing United States Geological Survey (USGS) gage stations and 15 additional locations. Flow data was downloaded and manually measured once in 2016 and is contracted to be completed 6 more times in 2017. The collected flow monitoring data will be used to calculate pollutant loading. Equipment necessary to measure stream cross sections and for flow monitoring was provided by the contractor. DRWW will maintain ownership of the newly purchased dataloggers allowing for their use in succeeding years for the DRWW monitoring program (see Table 2 for a complete equipment list).

Quality Assurance Project Plan

All monitoring is being conducted under two Illinois EPA approved QAPPs. The DRWW used the DuPage River Salt Creek Workgroup's (DRSCW) approved QAPP and adapted it to be watershed specific for the Des Plaines Watershed bioassessment monitoring. A separate QAPP was developed and submitted to Illinois EPA for flow monitoring. Both QAPPs are appended to this Monitoring Strategy.

Illinois EPA requires the development of a QAPP for any activity involving the collection and analysis of environmental data. A QAPP presents the policies and procedures, organization, objectives, quality assurance requirements, and quality control activities designed to achieve the type and quality of environmental data necessary to support project or program objectives. It is the policy of Illinois EPA that no data collection or analyses will occur without an approved QAPP. All in-house and external environmental data collection activities are subject to this requirement. All contracts must address quality assurance requirements (e.g., data quality and reporting requirements) when those contracts pertain to, or have an impact on, data collection or analysis activities. Additionally, all grants and contracts need to address quality assurance requirements specified in applicable state acquisition or procurement regulations. The DRWW QAPP follows U.S. and Illinois EPA guidance for the development of a project specific QAPP.

Data and Reporting

Suburban Labs, the water and sediment chemistry contractor, sends water column and sediment chemistry data to the DRWW following analysis via email in the format of one final report of laboratory analysis in pdf form per site. After data is collected at each site for that sampling event (occurring seven times annually), the laboratory sends an Excel spreadsheet summarizing all sites and parameters. DRWW staff take this data and format it to fit the Illinois EPA requirements for reporting surface-water - monitoring data format (EDDMasterStructureAndFormat_VersionAsOf2015_06_30_ToChrisDavis_2016_02_1...) .

Midwest Biodiversity Institute (MBI), the bioassessment contractor, will send biological data to the DRWW within ten weeks of sample collection and it will ultimately be appended to the project database. An annual data submittal will be provided to the DRWW within two months of the final field event. This report will be provided electronically and as a hard copy, with chain-of-custody forms and laboratory reports attached.

MBI will also be responsible for completing a final monitoring report, analyzing the results of the water column and sediment chemistry as well as the fish, macroinvertebrate, and habitat data. Interpretative

statistics, such as long-term central tendencies, will be based on all available data within the database, developed over time, including past data collection efforts.

Burns & McDonnell, the flow monitoring contractor, will report the flow data monthly in an editable Microsoft Excel file, and will provide a final report in PDF format with all analytical results, analytical method, chain(s) of custody and a field log.

Data will be submitted annually to Illinois EPA. Illinois EPA approved an extension to the December 31st annual delivery date for 2016 data to March 31, 2017. All monitoring data will be submitted to Illinois EPA by December 31, 2017.

References

Illinois DNR. 2001. IDNR stream fisheries sampling guidelines. Watershed Protection Section, Springfield, IL. 9 pp.

Illinois EPA. 2005. Methods of collecting macroinvertebrates in streams (July 11, 2005 draft). Bureau of Water, Springfield IL. BOW No. xxxx. 6 pp.

Illinois EPA. 1997. Quality assurance methods manual. Section G: Procedures for fish sampling, electrofishing safety, and fish contaminant methods. Bureau of Water, Springfield, IL. 39 pp.

Yoder, C.O. 2012. Quality Assurance Project Plan: Biological and Habitat Assessment of the DuPage River and Salt Watersheds.

Figure 1: 2016 Sampling locations within watershed planning area.

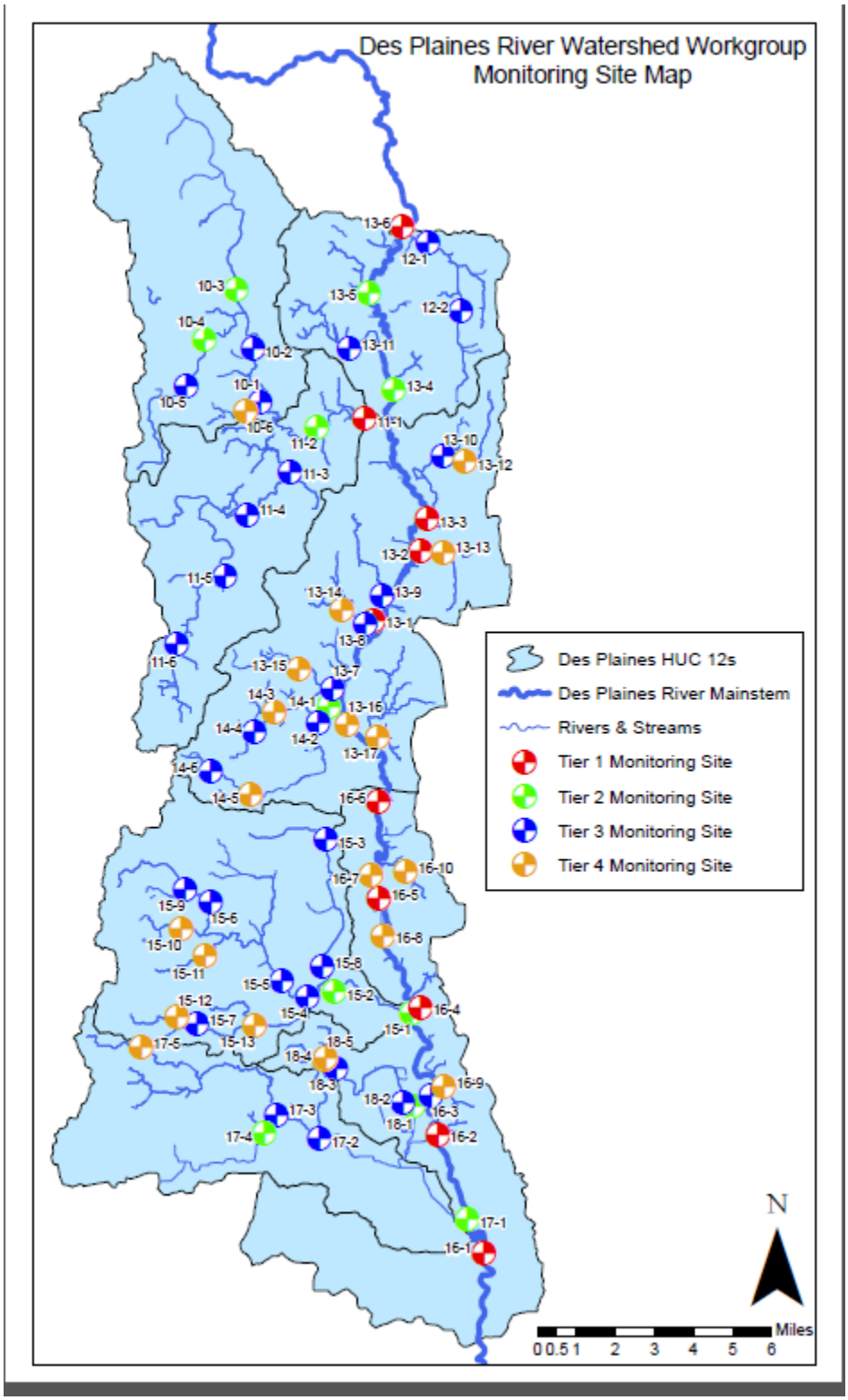

Figure 2: 2016 Sampling locations by Tier with municipal boundaries background.

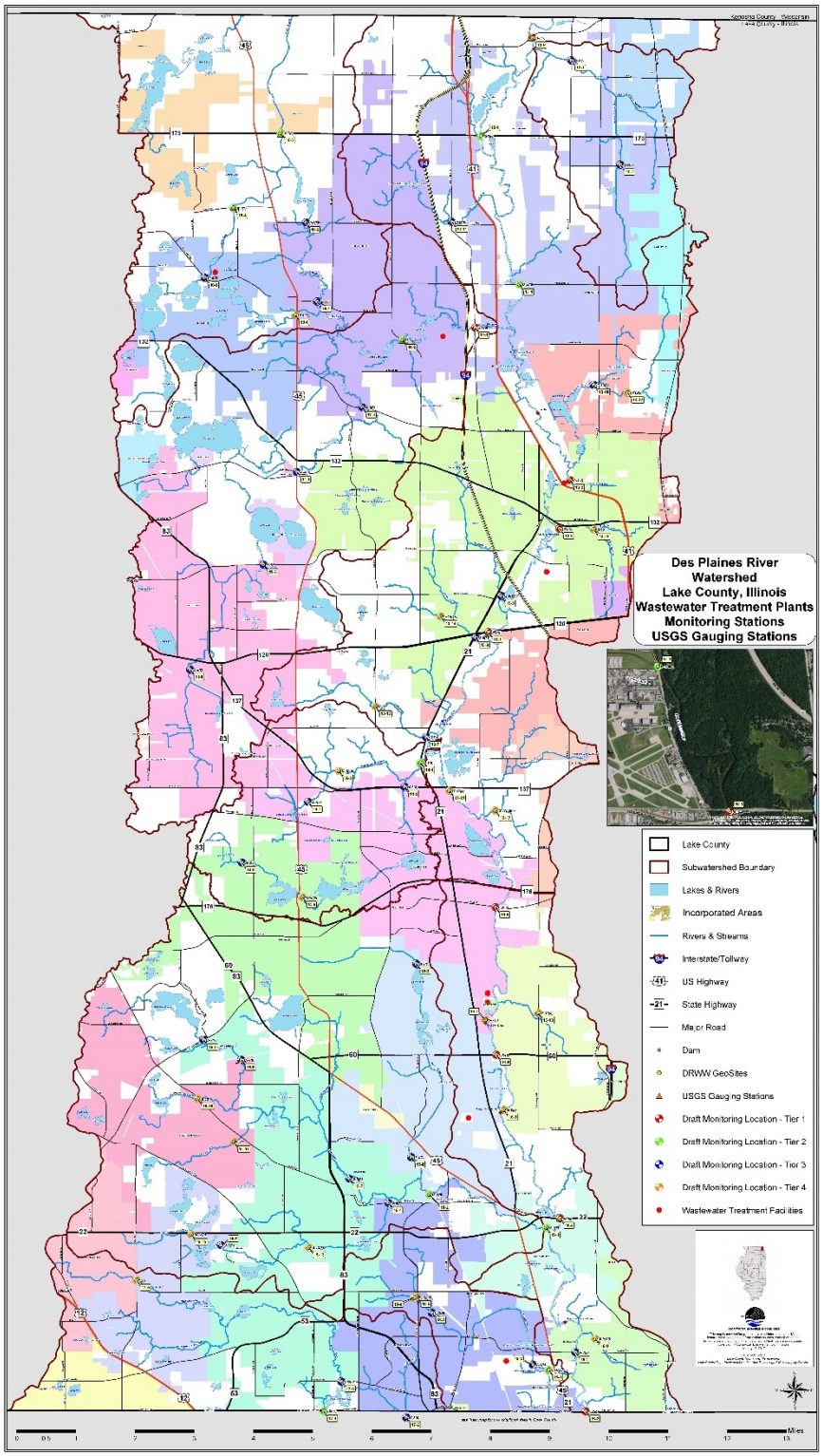

Table 1 2016 Sampling Locations

DRWW ID	RM	River/Stream Name	Subwatershed	Tier 1	Tier 2	Tier 3	Tier 4
10-1	1.1	North Mill	North Mill Creek			3	
10-2	8.1	North Mill	North Mill Creek			3	
10-3	10	North Mill Creek	North Mill Creek		2		
10-4	1.7	North Mill	North Mill Creek		2		
10-5	3.1	North Mill	North Mill Creek			3	
10-6	0	Unnamed Trib to North Mill Creek	North Mill Creek				4
11-1	0.7	Mill Creek	Mill Creek	1			
11-2	1.7	Mill Creek	Mill Creek		2		
11-3	7.2	Mill Creek	Mill Creek			3	
11-4	10	Mill Creek	Mill Creek			3	
11-5	14	Mill Creek	Mill Creek			3	
11-6	17	Mill Creek	Mill Creek			3	
12-1	0.7	Newport Drainage Ditch	Newport Drainage Ditch			3	
12-2	3	Newport Drainage Ditch	Newport Drainage Ditch			3	
13-1	94	Des Plaines River	Upper Des Plaines Riv	1			
13-2	97	Des Plaines River	Upper Des Plaines Riv	1			
13-3	99	Des Plaines River	Upper Des Plaines Riv	1			
13-4	103	Des Plaines River	Upper Des Plaines River		2		
13-5	107	Des Plaines River	Upper Des Plaines River		2		
13-6	109	Des Plaines River	Upper Des Plaines Riv	1			
13-7	0.3	Bull's Brook @ Rt 21	Upper Des Plaines River			3	
13-8	0.2	Belvidere Rd Tributary	Upper Des Plaines River			3	
13-9	0.4	Stone Roller @ Lake Carina	Upper Des Plaines River			3	
13-10	2	Suburban Country Club Trib	Upper Des Plaines River			3	
13-11	1.4	Slocum Corners Creek	Upper Des Plaines River			3	
13-12	5.2	Suburban County Club Trib	Upper Des Plaines River				4
13-13	0.4	Unnamed trib. - Greenleaf Creek	Upper Des Plaines River				4
13-14	0.2	Unnamed Trib to Belvidere Rd Trib.	Upper Des Plaines River				4
13-15	2	Bull's Brook	Upper Des Plaines River				4
13-16	91	Des Plaines River	Upper Des Plaines River				4
13-17	0.3	Unnamed Trib to Des Plaines River	Upper Des Plaines River				4
14-1	0.5	Bull Creek	Bull Creek		2		
14-2	1	Bull Creek	Bull Creek			3	
14-3	1.6	Bull Creek	Bull Creek				4
14-4	2.5	W. Branch Bull Creek	Bull Creek			3	
14-5	4.7	Bull Creek	Bull Creek				4
14-6	6	Bull Creek	Bull Creek			3	

Table 1 (con't)

15-1	0.2	Indian Creek	Indian Creek		2		
15-2	2.4	Indian Creek	Indian Creek		2		
15-3	3.7	Indian Creek	Indian Creek			3	
15-4	0	Indian Creek	Indian Creek			3	
15-5	5.4	Indian Creek	Indian Creek			3	
15-6	9.8	Indian Creek	Indian Creek			3	
15-7	4.6	Indian Creek	Indian Creek			3	
15-8	0.5	Seavey Drainage Ditch	Indian Creek			3	
15-9	11	Indian Creek	Indian Creek			3	
15-10	0.8	West Branch Indian Creek	Indian Creek				4
15-11	0.8	Forest Lake Drain	Indian Creek				4
15-12	5.2	Kildeer Creek	Indian Creek				4
15-13	2.2	Kildeer Creek	Indian Creek				4
16-1	72	Des Plaines River	Lower Des Plaines Riv	1			
16-2	75	Des Plaines River	Lower Des Plaines Riv	1			
16-3	77	Des Plaines River	Lower Des Plaines River			3	
16-4	80	Des Plaines River	Lower Des Plaines Riv	1			
16-5	84	Des Plaines River	Lower Des Plaines Riv	1			
16-6	87	Des Plaines River	Lower Des Plaines Riv	1			
16-7	85	Des Plaines River	Lower Des Plaines River				4
16-8	83	Des Plaines River	Lower Des Plaines River				4
16-9	0.4	Unnamed Trib to Des Plaines River	Lower Des Plaines River				4
16-10	1	Werhane Lake Drain	Lower Des Plaines River				4
17-1	0.8	Buffalo Creek	Buffalo Creek		2		
17-2	6.1	Lake Cook Rd @ Farington Ditch	Buffalo Creek			3	
17-3	7.7	Buffalo Creek	Buffalo Creek			3	
17-4	0.7	Buffalo Creek	Buffalo Creek		2		
17-5	14	Unnamed trib.	Buffalo Creek				4
18-1	0.5	Aptakisic	Aptakisic Creek		2		
18-2	0.8	Aptakisic	Aptakisic Creek			3	
18-3	4.3	Aptakisic Creek	Aptakisic Creek			3	
18-4	4.7	Aptakisic Creek	Aptakisic Creek				4
18-5	0.1	Unnamed Trib to Aptakisic Creek	Aptakisic Creek				4
				10	11	29	20

Note: 70 Sites total were sampled in 2016, 69 for biological, 44 for water chemistry and 49 for sediment.

Table 2: Equipment Needed:

Water Chemistry Sampling Equipment	**Sediment Sampling Equipment**	**Biological Sampling Equipment**
1-gallon HDPE bucket	Stainless steel bowl	Bucket
Sample bottles	ASTM-EE11 No. 230 sieve	Personal protective equipment
Disposable gloves	Stainless steel spoon	Geographical Positioning System
Cooler	Sample bottles	Measuring tape/stick
Ice	Ice	Formaldehyde
Portable analytical field meter	Disposable gloves	Scale
Vehicle	Cooler	Boat
Nylon rope	Aluminum foil	Generator Powered Pulsator
Field books/log sheets/chain of custody	Field books/log sheets/chain of custody	Field books/log sheets/chain of custody
Antibacterial soap	Antibacterial soap	Electrofishing equipment
Markers	Markers	Nets
Labels	Labels	Stakes
Sampling pole	Vehicle	Anchors
Map book	Map book	Map book
Distilled or reagent-grade deionized water	Distilled or reagent-grade deionized water	
	Isopropyl alcohol	
	Non-phosphate detergent	
	Cleaning brush with non-metallic bristles	
Flow Monitoring Equipment		
Stream dataloggers (15)		
Barometric pressure dataloggers (2)		
Survey rod		
Laser level		
Real time kinematic (RTK) or global positioning system (GPS)		

Table 3: Water Quality Sampling Parameters

Parameter	DRWW Frequency	Tier 1	Tier 2	Tier 3	Tier 4*
Demand		Number of Sample Events per Year			
Chloride	monthly May-Sept, Nov, Mar	7	7	7	0
Conductivity	monthly May-Sept, Nov, Mar	7	7	7	0
pH	monthly May-Sept, Nov, Mar	7	7	7	0
TOC	monthly May-Sept, Nov, Mar	7	0	0	0
Sulfate	monthly May-Sept, Nov, Mar	7	0	0	0
TSS	monthly May-Sept, Nov, Mar	7	7	0	0
Volatile Suspended Solids	monthly May-Sept, Nov, Mar	7	7	0	0
DO	monthly May-Sept, Nov, Mar	7	7	7	0
Temperature	monthly May-Sept, Nov, Mar	7	7	7	0
Turbidity	monthly May-Sept, Nov, Mar	7	7	7	0
Metals					
Total Hardness	annually under low flow conditions	1	1	0	0
Iron	annually under low flow conditions	1	0	0	0
Sodium	annually under low flow conditions	1	0	0	0
Arsenic	annually under low flow conditions	1	0	0	0
Manganese	annually under low flow conditions	1	1	0	0
Mercury	annually under low flow conditions	1	0	0	0
Copper	annually under low flow conditions	1	0	0	0
Nickel	annually under low flow conditions	1	0	0	0
Zinc	annually under low flow conditions	1	0	0	0
Nutrients					
Ammonia	monthly May-Sept, Nov, Mar	7	7	0	0
Total Nitrates (NO2 + NO3)	monthly May-Sept, Nov, Mar	7	7	7	0
TKN	monthly May-Sept, Nov, Mar	7	7	0	0
Total phosphorus	monthly May-Sept, Nov, Mar	7	7	7	0
Dissolved reactive phosphorus	monthly May-Sept, Nov, Mar	7	7	0	0
Bacteria					
E. coli	monthly May-Sept, Nov, Mar	7	7	7	0
Water Organics					
PCBs	annually under low flow conditions	1	0	0	0
Pesticides	annually under low flow conditions	1	0	0	0
Methoxychlor	annually under low flow conditions	1	0	0	0
PNAs	annually under low flow conditions	1	0	0	0
VOCs	annually under low flow conditions	1	0	0	0
Sediment Metals					
Aluminum	concurrent w/ bioassessment	1	1	1	0
Arsenic	concurrent w/ bioassessment	1	1	1	0
Barium	concurrent w/ bioassessment	1	1	1	0
Beryllium	concurrent w/ bioassessment	1	1	1	0
Boron	concurrent w/ bioassessment	1	1	1	0
Cadmium	concurrent w/ bioassessment	1	1	1	0
Chromium	concurrent w/ bioassessment	1	1	1	0
Cobalt	concurrent w/ bioassessment	1	1	1	0

Table 3 (cont.): Water Quality Sampling Parameters

Parameter	DRWW Frequency	Tier 1	Tier 2	Tier 3	Tier 4*
Sediment Metals		Number of Sample Events per Year			
Copper	concurrent w/ bioassessment	1	1	1	0
Fluoride	concurrent w/ bioassessment	1	1	1	0
Iron	concurrent w/ bioassessment	1	1	1	0
Lead	concurrent w/ bioassessment	1	1	1	0
Manganese	concurrent w/ bioassessment	1	1	1	0
Mercury	concurrent w/ bioassessment	1	1	1	0
Nickel	concurrent w/ bioassessment	1	1	1	0
Potassium	concurrent w/ bioassessment	1	1	1	0
Silver	concurrent w/ bioassessment	1	1	1	0
Sodium	concurrent w/ bioassessment	1	1	1	0
Strontium	concurrent w/ bioassessment	1	1	1	0
Vanadium	concurrent w/ bioassessment	1	1	1	0
Zinc	concurrent w/ bioassessment	1	1	1	0
Sediment Organics					
PCBs	concurrent w/ bioassessment	1	1	1	0
Pesticides	concurrent w/ bioassessment	1	1	1	0
Methoxychlor	concurrent w/ bioassessment	1	1	1	0
PNAs	concurrent w/ bioassessment	1	1	1	0
VOCs	concurrent w/ bioassessment	1	1	1	0
TKN	concurrent w/ bioassessment	1	1	1	0
Phosphorus	concurrent w/ bioassessment	1	1	1	0
Cyanide	concurrent w/ bioassessment	1	1	1	0
Herbicides (2, 4, D, 2,4,5 TP)	concurrent w/ bioassessment	1	1	1	0
Phenols	concurrent w/ bioassessment	1	1	1	0

* Tier 4: 20 stream stations located on tributary streams within the watershed monitored approximately once every three years for bioassessment only in years 2017-2019.