



Biological and Water Quality Assessment of Upper Des Plaines River: Year 2 Rotation 2018



Upper Des Plaines River @former Hollister Dam Site (16-7)

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Biological and Water Quality Assessment of Upper Des Plaines River: Year 2 Rotation 2018

Mainstem and Selected Tributaries

Lake County, IL

Technical Report MBI/2020-2-2

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FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or “bioassessment”, is an interdisciplinary monitoring effort coordinated on a waterbody specific or watershed scale. This may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire watersheds, multiple and overlapping stressors, and tens of sites. The 2018 Year 2 monitoring rotation included 17 sites on the Upper Des Plaines River mainstem and single sites on three unnamed tributaries to the mainstem all within Lake County. All of these sites were previously sampled in 2016 biological assemblages and habitat and a portion of the mainstem annually since 2015 for water chemistry. The principal focus of the 2018 bioassessment is on the status of the Illinois General Use for aquatic life and recreation.

Scope of the 2018 Biological and Water Quality Assessment

The Midwest Biodiversity Institute (MBI) was contracted by the Des Plaines Watershed Workgroup (DRWW) to develop a biological and water quality monitoring and assessment plan for Upper Des Plaines River watershed within Lake County, IL. The plan was incorporated into a Quality Assurance Project Plan (QAPP; DRWW 2016) that was submitted to and approved by Illinois EPA. The spatial sampling design consisted of an intensive pollution survey and geometric allocation of sites. This design was employed to fulfill multiple purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. Targeted sites were positioned upstream and downstream from major discharges, other sources of potential pollution releases and contamination, and major tributaries to provide a “pollution profile” of the major mainstem streams and rivers. Sampling locations in the smaller tributaries were allocated by a geometric progression of drainage area to a “resolution” of 0.5-1.0 square miles. The major program objectives include:

1. Determine the aquatic life status of each sampling location in quantitative terms, i.e., not only if a waterbody is impaired, but the spatial extent and severity of the impairment and the respective departures from established criteria;
2. Determine the proximate stressors that correspond to observed impairments for the purpose of targeting appropriate management actions to those stressors; and,
3. Screen for any potential issues with use attainability.

To meet these objectives data was collected with methods that provide high quality results and in conformance with the practices of Illinois EPA (IEPA 2010a,b; 2011a-g; 2014a,b) and Illinois DNR (2010a,b) and under a project QAPP approved by IEPA (DRWW 2016).

Previous biological assessments of the Upper Des Plaines River basin streams and rivers include major surveys by Illinois EPA (IEPA 1988,), Illinois DNR (IDNR; Pescitelli and Widloe 2018; Pescitelli 2016; Pescitelli and Rung 2010a,b; Day 1991; Heidinger 1989; Bertrand 1984; Langbein and Wright 1976; Muench 1968), Illinois Natural History Survey (Bilger et al. 2016; Sherwood et al. 2016), U.S. Geological Survey (Steffeck and Streigl 1989), Shedd Aquarium (Bland and Willink 2015), and others (Slawski et al. 2008). Some of these surveys included the entirety of the Des Plaines River and others focused on the Upper Des Plaines defined as the mainstem and tributaries upstream from the confluence with Salt Creek. Smaller surveys of specific tributaries in Lake Co. have also been conducted, but none were of sufficient scope or coverage to meaningfully compare to the initial watershed assessment in 2016 (MBI 2017) or the Year 1 watershed bioassessments of the Indian, Buffalo, or Aptakistic Creek subwatersheds (MBI 2018). The recent basin-wide fish surveys by IDNR included only a single site located on Indian Creek. Other fish surveys include two sites on Seavey Drainage Ditch (pre- and post-dam removal 2008, 2010), a qualitative fish survey in Seavey Ditch and Indian Creek in June 2016 (Bland et al. 2016) and a more recent and comprehensive survey of fish, macroinvertebrates, and mussels in streams potentially impacted by the State Route 53 extension northward through Lake Co. in 2014 and 2015 (Sherwood et al. 2016; Bilger et al. 2016; Douglas et al. 2016). This included 3 sites in the Buffalo Creek subwatershed and 7 sites in Indian Creek subwatershed sampled for fish and 4 of these 10 sites sampled for macroinvertebrates.

The 2018 assessment is the first to utilize the analyses and outputs of the Northeastern Illinois Integrated Prioritization System (NE IL IPS; MBI 2020). Specifically biological effect thresholds for five biological condition categories (i.e., excellent, good, fair, poor, and very poor) were developed for 87 chemical water quality, sediment chemistry, and habitat attributes that are more regionally relevant than what has been used previously. For nutrients, this includes not only more refined thresholds for nutrient parameters, but a nutrient index that synthesizes IPS variables into a more tractable scale of overall nutrient effects. The IPS also yields a Restorability factor for impaired sites, reaches, and watersheds and a Threat/Susceptibility factor for attaining sites. In combination with better stressor thresholds and across five condition categories this has provided more certainty of the assignment of causes and sources of impairment and threats.

EXECUTIVE SUMMARY

Summary of Findings

Aquatic Life Condition Assessment

The primary indicators of the status of the Illinois General Use for aquatic life are the Illinois fish and macroinvertebrate Indices of Biotic Integrity and generally following the guidance in the 2018 Integrated Report (IEPA 2018) with certain exceptions. The status of aquatic life is reported here in an attainment table (Table 1) and expressed as full, partial, or non-support and based on the most limiting of either the fish or macroinvertebrate results. Non-support is further subdivided into non-support fair and non-support poor; the partial support category was added to clarify instances where only one of the two assemblages attains the General Use support fish or macroinvertebrate threshold. Of the 17 sites assessed for the General Use in the Upper Des Plaines River mainstem for aquatic life five (5) were in full support, five (5) in partial support, six (6) non-support-fair, and only one (1) non-support poor. The fish assemblage has been the most limiting factor in the non-support and partial support determinations throughout northeastern Illinois failing to meet the IEPA General Use threshold for the FBI at any mainstem site in 2016. These first time findings of full support (and even the partial support) are significant improvements for the Upper Des Plaines River mainstem.

Causes and Sources of Non-attainment¹

Causes and sources were determined for each impaired site and included categorical or parameter level associations and their sources (if known). These were compared to the IEPA derived causes listed in the 2018 Integrated Report (IEPA 2018) for coinciding sites. With the recent availability of more comprehensive and regionally relevant analyses of stressors in the Northeast Illinois via the Integrated Prioritization System (NE IL IPS; MBI 2020) assigning causes can be done at a better level of detail and reliability. This approach still involves using a lines of evidence approach where chemical and physical threshold exceedances generated by the NE IL IPS within a causal category (or for a parameter) is better related to a biological impairment. This goes well beyond the association of a coincidental exceedance of a criterion or other threshold with a biological impairment. Knowing about relationships that are supported by prior empirical observations in other studies and our own experiences continues to boost the confidence in causal assignments. This process varies from that used by IEPA in that additional and regionally developed effect thresholds were used to derive causes beyond those used by IEPA.

Thirteen (13) causes across seven (7) major categories and five (5) source categories were identified for the upper Des Plaines River mainstem in 2018 (Figure 1). Of the 13 causes, three (3) were habitat related (siltation, embeddedness, and channel modification) and nine (9) were

¹ A **Cause** is an agent (or agents) associated with an aquatic life or recreational use impairment; a **Source** is the origin of the causal agent. Nomenclature generally follows U.S. EPA and state 303[d] listing guidelines.

Table 1. Aquatic life use attainment status in the 2018 Upper Des Plaines River study area with associated causes and sources of impairment listed for partial and non-supporting sites determined by this study and by IEPA (2018) for matching sites (see footnotes for fIBI and mIBI use support thresholds). fIBI, Mlwb, and mIBI values are color coded in accordance with meeting five narrative classes (key at bottom of table). The most limiting assemblage for partial support is fish. IPS restorability score are provided for non and partially supporting sites and susceptibility and threat scores are provided for fully supporting sites.

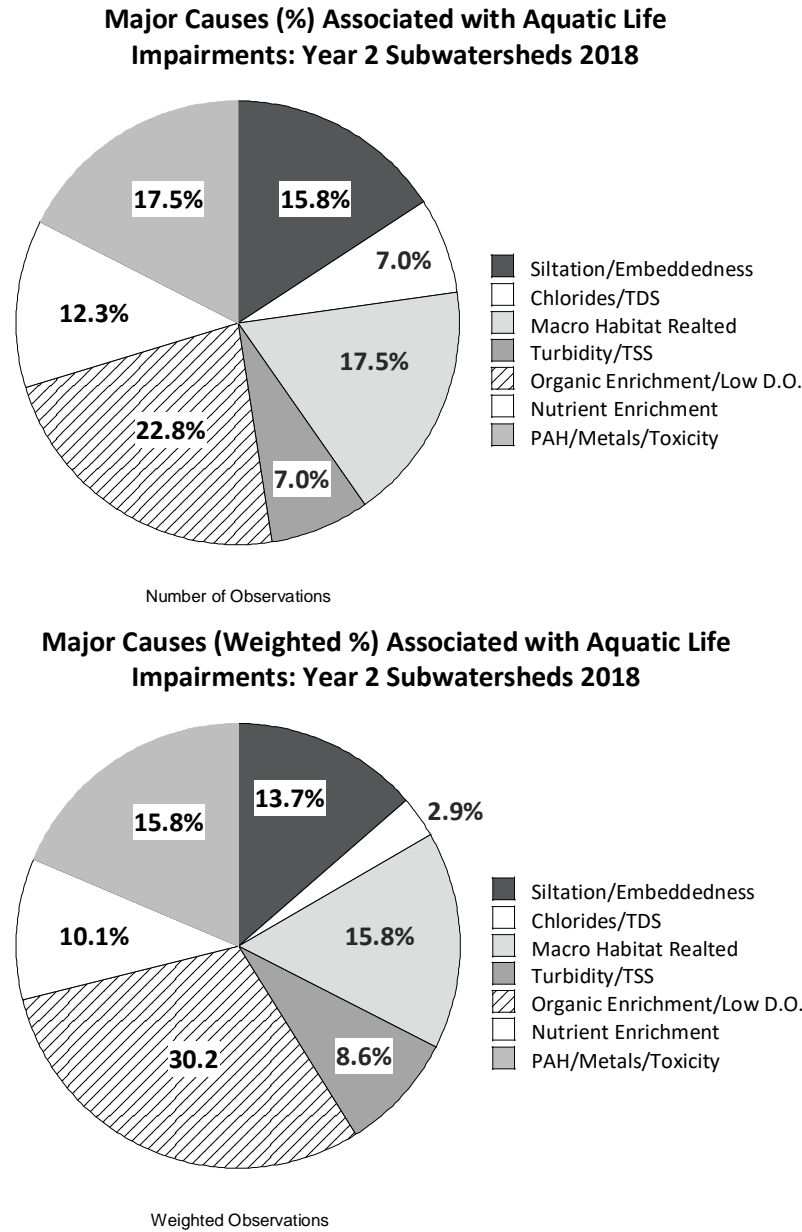
Site ID	River Mile	Drainage Area (sq. mi.)	AQLU Status	fIBI ¹	mIBI ²	QHEI ³	2018 MBI Causes by Stressor Threshold Narrative Category			MBI Sources	2018 IEPA Causes	IPS Restorability Score (0-100)	IPS Susceptibility Score (0-100)	IPS Threat Score (0-100)
							Very Poor ⁴	Poor ⁴	Fair ⁴					
Des Plaines River Mainstem														
13-6	109.3	123.7	NON - Fair	33.5	33	58.5	Low D.O.,Org. Enrich.	Embedded,Turbidity	QHEI Ratio,Siltation,No Sinuosity,Recov. Channel.	Altered Flow; Habitat Modification, NPS	D.O., TSS (Site G-08)	41.2		
13-5	106.6	137.3	NON - Poor	29.5	20.7	50.0	Diel D.O.,Org. Enrich.	QHEI Ratio,No Cover,Substr.,Turbidity	Siltation,Embeddness,Recov. Channel	Altered Flow; Habitat Modification, NPS		48.7		
13-4	102.9	145.6	NON - Fair	26.5	29.9	59.0	Low D.O.	Org. Enrich.,Substr.,Chan; Turbidity;	Low DO,QHEI,TSS,Sed. Metals;	Altered Flow; Habitat Modification, NPS	As,D.O.,Siltation,TSS (Site G-25)	48.1		
13-18	99.72	212.9	NON - Fair	22.5		47.0	Impounded,Siltation	QHEI Ratio,Channel Mod.,Metals		Altered Flow; Habitat Modification, NPS		39.8		
13-19	99.3	213.2	NON - Fair	30.0	35.9	79.0	None	QHEI Ratio,Metals	Siltation,Embeddness	Habitat Modification, NPS		76.1		
13-3	98.7	220.3	Partial	33.5	53.7	74.0	None	None	Low D.O.,Org. Enrich.,QHEI Score,Turbidity,Metals	Upstream Flow & Habitat Modifications, NPS		90.5		
13-2	96.82	225.4	Partial	35.0	48.3	84.5	None	Org. Enrich.; PAH	None	Upstream Flow & Habitat Modifications, NPS		93.6		
13-1	94.2	232.0	FULL	42.5	60.7	78.5	FULL Attainment - No Causes Assigned			FULL Attainment - No Sources Assigned	As,Chloride,TP (Site G-07)		56.9	15.38
13-16	90.6	253.8	FULL	41.0	55.2	72.5	FULL Attainment - No Causes Assigned			FULL Attainment - No Sources Assigned			65.2	7.69
16-6	87.1	261.4	FULL	42.0	54.7	74.0	FULL Attainment - No Causes Assigned			FULL Attainment - No Sources Assigned			56.9	11.54
16-7	84.6	266.5	FULL	41.5	47.5	80.5	FULL Attainment - No Causes Assigned			FULL Attainment - No Sources Assigned			62.0	7.69
16-5	83.6	268.1	Partial	32.5	56	67.0	None	Org. Enrich.,Metals,PAH	QHEI,Chloride,PAH	Urban NPS, WWTP		85.4		
16-8	82.9	268.9	Partial	33.5	41.7	72.5	None	Metals	TP,QHEI,Chloride	Urban NPS, WWTP	Unknown,TP (Site G-35)	88.1		
16-4	80	273.2	Partial	37.0	52	70.0	None	Org. Enrich.,Metals	TP,Nitrate,QHEI,Chloride	Urban NPS, WWTP		59.1		
16-3	76.7	314.7	Partial	38.0	54.3	73.0	None	Metals	TP,Nitrate,QHEI Score,Chloride	Urban NPS, WWTP		93.8		
16-2	75.4	324.0	FULL	42.0	55.2	59.8	FULL Attainment - No Causes Assigned			FULL Attainment - No Sources Assigned			38.7	19.2
16-1	71.7	358.7	NON - Fair	40.5	35.8	74.5	None	Diel D.O.,Org. Enrich.,Metals	Chloride	Urban NPS, WWTP		95.7		
Unnamed Tributary to Werhane Lake Drain														
16-10	0.10	0.22	ND	Site was dry and not sampled in 2019										
Unnamed Tributary to Des Plaines River														
16-9	0.40	1.19	Non-Fair	34.0	38.9	60.5	None	Turbidity	Low D.O.,QHEI Score	Urban NPS		57.2		
Werhane Lake Drain														
16-10B	0.80	0.22	Non-Fair	38.0	34.0	61.3	None	None	QHEI Ratio; Siltation,Embedded,Recov. Channel	Urban NPS		35.0		
Narrative Category														
Excellent			FULL	≥50	>73	>84.5						Very High	Very Low	Very Low
Good			FULL	>41-49	41.8-72.9	>75.9						High	Low	Low
Fair			Non-Fair	30-<41	30-41.7	<75.9						Moderate	Moderate	Moderate
Poor			Non-Poor	>15-29	>15-29	<50.1						Low	High	High
Very Poor			Non-Poor	≤15	≤15	<25.0						Very Low	Very High	Very High

¹ fIBI: full support ≥41; nonsupport-fair ≥20<41; nonsupport-poor <20.

² mIBI: full support ≥41.8; nonsupport-fair ≥20.9<41.8; nonsupport-poor <20.9.

³ From Table 6 - IPS thresholds for habitat attributes.

⁴ IPS derived primary, secondary, and tertiary causes assigned by weighting the stressor rank * FIT factor - see Appendix E; primary causes rank >8-10, secondary causes rank >6-8, tertiary causes rank >4-6.



chemical (low dissolved oxygen, turbidity, total suspended solids, organic enrichment, nutrient enrichment, chlorides, metals, and polycyclic aromatic hydrocarbons [PAHs]). The proportion of causes was assessed based on the number of observations and weighted observations (Figure 1), the latter being based on the severity of the expression of the cause in chemical water column, sediment chemistry, or habitat measures. A higher weighting was assigned based on the narrative rating of an exceedance with 5 for very poor, 3 for poor, and 1 for fair.

Organic enrichment/low D.O. was the leading cause with a weighted frequency of 30.2%. Some of the SNAP indicators were a part of this determination including elevated total Kjeldahl nitrogen (TKN) which indicates excessive enrichment from nitrogenous organic materials. With the exception of Macro Habitat Related and Siltation causes at site 13-18, this was also the only causal category where the indicators were in the very poor narrative range. It also occurred primarily in the upper mainstem which is affected by legacy channel modifications

Figure 1. Categorical causes associated with aquatic life impairments in the upper Des Plaines River mainstem, 2018 based on the number of observations (upper) and the weighted observations (lower), the latter based on the narrative rating of threshold exceedances (very poor = 5, poor = 3, and fair = 1).

and hydrological alterations that have made flow fluctuations more extreme and an overall greater susceptibility to the effects of organic enrichment. TKN values that were elevated into the very poor range at the upper sites persisted downstream through the remainder of the mainstem and it is possible that at least a portion is being exported from the modified upper mainstem. Closely allied causes such as turbidity/TSS (2.8%) were especially elevated into the

very poor range at the upper three (3) modified locations. This was followed in rank by macro habitat related alterations (17.5%) which with only a few exceptions also occurred in the upper mainstem. Closely allied causes siltation and embeddedness of the bottom substrate ranked fourth (13.7%) and were more widespread throughout the study area. The PAH/Metals/ Toxicity category ranked third (15.8%) and occurred primarily in the mid and lower reaches of the mainstem where urbanization increases. These emanated almost entirely from the exceedances of sediment chemistry with some sites having as many as seven (7) or eight (8) parameters above IPS thresholds or IEPA guidelines. Nutrient enrichment was listed as a cause in only 10.1% of the weighted observations and was due primarily to fairly minor exceedances of total P and a few very high nitrate-N concentrations in the lower mainstem. Chlorides/TDS (8.6%) rounded out the causes categories occurring in the mid to lower mainstem where urbanization increased. The weighting resulted in the leading cause organic enrichment/low D.O. increasing over the number of observations by 7.4% the largest difference among all of the causal categories. Macro habitat related and the chloride/TDS causes increased by 1.2% and 1.6%, respectively while all of the other causes declined from 1.7-4.2%, the latter being the turbidity/TSS cause category.

Habitat alteration, general nonpoint source (NPS) runoff, and urban NPS runoff were listed as sources in 67.7% or just more than two-thirds of the causes. Altered flow and wastewater effluent were the two remaining sources affiliated with the assigned causes. The causes and sources were derived from the analyses described in the **SYNTHESIS** section (pp. 54-55) where the rationale for assigning causes and sources is detailed. These constitute the principal causes and sources that would need to be addressed to resolve the aquatic life impairments listed in Table 1. Illinois EPA (2018) listed causes at four (4) of the 17 mainstem sites which corresponded to some of the MBI causes including D.O., TSS, and siltation. The listing of a wider variety causes by MBI is due to the use of a wider array of effect thresholds, differences in the interpretation of impairments, and most of all to differences in the spatial survey design. IEPA sampled 13 fewer sites than MBI in the upper Des Plaines River (Table 1) leaving some reaches in the longitudinal continuum unassessed for impairment and cause/source determination purposes.

IPS Restorability, Susceptibility, and Threat Results

The recent availability of the Northeast Illinois Integrated Prioritization System (IPS) in 2020 (MBI 2020a,b) permitted the calculation of Restorability scores for non-supporting and partially supporting sites and Susceptibility and Threat scores for fully supporting sites. Such was the case in the Upper Des Plaines mainstem in 2018 with 12 non-supporting and partially supporting sites and five (5) fully supporting sites. In terms of Restorability seven (7) of the 12 non and partially supporting mainstem sites had Restorability scores ranked as high (1) or very high (6). The remaining five (5) impaired mainstem sites ranked as moderate. The high and very high rankings mean that the likelihood of reaching full attainment is plausible and likely accomplished without major physical restoration interventions. None of these sites had any very poor causes assigned and three were impacted by hydromodifications located immediately upstream. The high and very high ranked sites were located downstream from the entry of large volumes of treated municipal wastewater and one moderate site (16-4) missed a high

Restorability ranking by only 0.9 units. The other four (4) moderate ranked sites occurred in the upper mainstem that has been subject to more severe hydromodifications including legacy channelization with little or no recovery and flow alteration. These sites also exhibited multiple poor and very poor causes of impairment including low D.O., excessive diel D.O. swings, elevated turbidity, siltation, and a predominance of modified QHEI attributes. Addressing these impairments would require structurally oriented restoration actions to address the modified habitat (i.e., reduce or eliminate the modified habitat attributes) and altered flow conditions which would be a significant undertaking for river channel of that size.

For the five (5) fully supporting sites, Susceptibility and Threat scores were applied. The expectations for these IPS factors is based on assessing the risk of future non-support for sites that have higher Susceptibility and/or Threat rankings and are therefore at imminent risk of declining to partial or non-support. In terms of the narrative assignments being used at present (see Table 1, bottom), four (4) of the fully supporting sites have a low to moderate Susceptibility rankings and very low Threat rankings. The other fully supporting site (16-2) in the lower part of the mainstem had a high Susceptibility ranking, but a very low Threat ranking. For both the Susceptibility and the Threat rankings for the five attaining sites, the main factor influencing the rankings were habitat and low D.O. related causes that were accompanied by elevated TKN and elevated sediment metals. The biggest difference between the four consecutive fully supporting sites (13-1, 13-16, 16-6, and 16-7) and the lower fully supporting site (16-2) was due to habitat related factors reflected in the QHEI, QHEI channel scores, and QHEI substrate scores related to past channel modification at the lower site. A working hypothesis is that the consecutive four attaining sites are reflecting impacts being exported from the upstream modified reach and which are mitigated by the dilution provided by advanced treatment quality wastewater discharges. Thus assuring continued full support and further restoring impaired sites located upstream and downstream rests on mitigating the degraded habitat and flow conditions more than doing additional treatment at the WWTPs. Validating this hypothesis should be a focus of future planning efforts aimed at not only addressing the remaining impairments, but assuring that the recently observed full support is maintained and enhanced.

Synthesis of Results

Perhaps one of the more important observations of the 2018 bioassessment is that the entry of the large volumes of treated municipal wastewater were beneficial and likely offset some the otherwise detrimental impacts that are exported downstream from the upper modified reaches of the mainstem. Four consecutive sites beginning at site 13-1 downstream from the NSWRD Gurnee WRF were in full attainment of the General Use for aquatic life while exhibiting moderate and low Susceptibility rankings and very low Threat rankings. The sites downstream from Mill Creek (13-3) and the NSWRD Waukegan WRF (13-2) were in partial attainment with the FBI values missing attainment by 8.5 and 6 units respectively. These two sites also had very high Restorability rankings. Partial attainment followed at the next four consecutive sites again with the FBI being the limiting factor, but also incrementally improved over 2016 with two sites missing attainment by only 2 and 3 units. With only one exception, these sites also had very high Restorability rankings. Site 16-2 was in full attainment followed by non-fair at the most

downstream site (16-1), but with the fIBI missing by only 0.5 units. Here, too, Susceptibility rankings were moderate to low, but Threat scores were very low. The biological results downstream from the entry of treated wastewater at site 13-3 were better both in terms of AQLU status and the fIBI and mIBI scores than at the five upstream most sites that were in non-fair and non-poor attainment status and with three (3) of five (5) fIBI scores in the very poor range. These upstream sites also had the lowest Restorability rankings in the mainstem being in the moderate range. We expect that conditions could continue to improve downstream from Mill Creek provided that wastewater effluent quality is maintained, but addressing the upstream channel and flow alterations is needed to reduce the risk of continued or future impairment to downstream sites.

Recreational Use Assessment

Levels of fecal bacteria in the form of *Escherichia coli* (*E. coli*) cfu²/100 mL were used to assess the status of recreation in and on the water. The IEPA General Use criteria are expressed as counts of fecal coliform bacteria, which were not measured here, hence the U.S. EPA national criteria for *E. coli* were used instead. The U.S. EPA *E. coli* criteria are expressed in terms of a 90-day geometric mean and a statistical threshold value (STV) which is the 90th percentile of the data distribution that is not be exceeded by more than 10 percent of the samples. Given the small sample size limitations of this survey, mean values of 2-3 samples were used as an *approximation* of the 90-day geometric mean and maximum values as the STV. The U.S. EPA recommended 90-day geometric mean criteria value is 126 cfu/100 ml and the STV criteria value is 410 cfu/100 ml (U.S. EPA 2012).

E. coli results for the Des Plaines River mainstem at 16 locations was available from 2018 and at 12 locations in 2015, 2016, and 2017 each (Table 3). The frequency of exceedances of the U.S. EPA recommended geometric mean and STV criteria has varied between years, but have been fewer and spatially scattered each year since 2015 (Table 3). Among the 16 sites sampled for *E. coli* in 2018, four (4) had maximum values that exceeded the STV and three (3) sites had exceedances of the geometric mean with two sites having exceedances of both criteria (Table 2). Two of the instances of exceedances were at the upstream most two sites (13-6 and 13-5) and are presumably related to nonpoint source runoff. The dual exceedances of the mean and STV (the highest single value in 2018) at site 16-7 (RM 84.6) is 0.2 miles downstream from the Libertyville WWTP discharge (RM 84.8). The second highest value at site 16-7 was an exceedance of the STV and is downstream from the confluence of Aptakisic Creek which had numerous mean and STV exceedances in 2017 (MBI 2018). The five total exceedances in 2017 (one mean, four STV) were the fewest observed among the four years of data collection and coincided with record high flows that occurred over much of the year. There were eight total exceedances in 2016 with no clear longitudinal pattern under comparatively lower flows than in 2017 and 2018. The highest number of exceedances (12) occurred in 2015 with a clear pattern beginning at site 13-3 and including exceedances of the mean at every downstream site. This was also a comparatively low flow year on par with 2016. The overall results suggests a greater influence of point sources during low flow years and adding nonpoint sources in higher flow

² cfu = colony forming units

Table 2.E. coli values (cfu/100 ml) for samples collected in the Year 2 Upper Des Plaines River study area during May-October 2015 thru 2018. Yellow shaded values exceed the recommended U.S. EPA (2012) 90-day geometric mean (126 cfu/100 mL) and red shaded values exceeded the maximum STV (410 cfu/100 mL) recreation use criteria.

Site ID	River Mile	Samples	Minimum	Mean	Maximum
Upper Des Plaines River 2018					
13-6	109.3	3	70.3	159.8	325.5
13-5	106.6	3	40.4	140.3	410.6
13-4	102.9	3	26.5	73.7	228.2
13-18	99.3	3	34.1	71.1	107.1
13-3	98.7	3	99.0	109.4	126.7
13-2	96.82	3	101.7	173.1	238.2
13-1	94.2	3	65.0	120.0	344.8
13-16	90.6	3	29.8	46.5	65.7
16-6	87.1	3	35.9	116.6	770.1
16-7	84.6	3	52.0	223.2	1553.1
16-5	83.6	3	14.6	22.6	34.1
16-8	82.9	3	5.2	41.5	121.0
16-4	80	3	50.4	77.0	165.8
16-3	76.7	3	32.8	77.8	325.5
16-2	75.4	3	10.7	63.9	1119.9
16-1	71.7	2	32.7	34.9	37.3
Upper Des Plaines River 2017					
13-6	109.3	4	6.3	65.2	214.0
13-5	106.6	4	49.6	102.2	276.0
13-4	102.9	4	39.9	80.8	123.0
13-3	98.7	4	27.9	57.8	105.0
13-2	96.82	4	20.4	57.3	99.0
13-1	94.2	5	7.5	115.0	579.0
16-6	87.1	4	30.9	86.8	921.0
16-5	83.6	4	1.0	8.0	39.0
16-4	80	4	1.0	53.0	1410.0
16-3	76.7	4	52.1	160.2	1550.0
16-2	75.4	4	1.0	17.2	75.9
16-1	71.7	4	1.0	16.2	56.5
Upper Des Plaines River 2016					
13-6	109.3	4	27.2	90.5	387
13-5	106.6	4	1.0	14.1	121
13-4	102.9	4	42.2	129.4	548
13-3	98.7	4	1.0	41.6	488
13-2	96.82	4	158.0	307.2	1200
13-1	94.2	4	111.0	151.2	179
16-6	87.1	4	81.6	118.3	326
16-5	83.6	4	55.4	108.0	248
16-4	80	4	64.4	117.8	225
16-3	76.7	4	65.1	125.6	411
16-2	75.4	4	54.6	108.8	308
16-1	71.7	4	52.9	174.6	2420

Table 2. (continued)

Site ID	River Mile	Samples	Minimum	Geometric Mean	Maximum
Upper Des Plaines River 2015					
13-6	109.3	2	70.6	96.9	133
13-5	106.6	2	59.4	88.2	131
13-4	102.9	2	42.8	83.0	161
13-3	98.7	2	144.0	388.8	1050
13-2	96.82	2	236.0	438.8	816
13-1	94.2	2	88.4	139.1	219
16-6	87.1	2	108.0	144.0	192
16-5	83.6	2	125.0	233.2	435
16-4	80	2	219.0	223.5	228
16-3	76.7	2	140.0	167.7	201
16-2	75.4	2	86.0	149.8	261
16-1	71.7	2	52.0	141.9	387

years that presumably have more runoff events. However, the low frequency of samples in a given year limits the diagnostic value of the data hence a more intensive study would need to be undertaken to firm up the recreational use status and to better pinpoint sources of *E. coli*.

Biological and Water Quality Assessment of Upper Des Plaines River: Year 2 Rotation 2018

STUDY AREA DESCRIPTION

Lake County is comprised of 53 individual communities and 18 townships with a total area of 1368 square miles of which a significant fraction are waterbodies comprised of lakes, wetlands, rivers, and streams in the Upper Des Plaines River basin. According to the 2010 U.S. Census the population of Lake Co. is 703,462 (272,957 in the Upper Des Plaines watershed) with a density of 1,572 people per square mile and 260,310 housing units making it the third most populated county in Illinois ranking behind adjacent Cook and nearby DuPage Counties. The Des Plaines River originates in Wisconsin near Racine in Kenosha Co. north of where it enters Illinois in Lake County. The Des Plaines River flows due south for 110 miles joining the Kankakee River to form the Illinois River. The total watershed area is approximately 2110 square miles of which 1231 are in Illinois (Healy 1979). The watershed in Lake Co. is “trellised” meaning it is narrow in width relative to the length of the mainstem thus the tributaries are of comparatively shorter lengths with comparatively small drainage areas.

General Landscape Setting

The 2018 study area lies mostly within the Kettle Moraine subregion of the Southeastern Wisconsin Till Plains Level III ecoregion with lesser portions in the Valparaiso-Wheaton Morainal Complex subregion of the Central Corn Belt Plains Level III ecoregion (Table 4; Woods et al. 1995). The Kettle Moraine subregion occupies the majority of the study area to the west and northwest of the mainstem. It is characterized by poorly drained, hilly to hummocky morainal areas that include conspicuous glacial landforms, numerous lakes, and wetlands including bogs, fens, and marshes. Drainage networks are less integrated and more poorly developed than on the older till and outwash plains of adjacent Rock River Drift Plain subregion. Lakes are typically larger and more concentrated than to the south in the Valparaiso Morainal Complex subregion and much more common than in other neighboring subecoregions. Soils are largely derived from thick late-Wisconsinan glacial drift and thin loess deposits where they occur. Alfisols are common, but Mollisols and Histosols also occur. Overall, organic soils are more extensive than elsewhere in Illinois, and Mollisols are less common than in subregions to the west. In the early 1800s moraines were covered by savanna, prairie, and forest (oak-hickory) with depressions containing wetlands. Landscape alterations in the 1900s reduced the tracts of forest and nonforested wetlands replacing them with urban and suburban development. However, wooded areas, lakes, and wetlands are still common especially in the extensive forest preserves.

The Valparaiso-Wheaton Morainal Complex subregion is a hilly, hummocky to rolling area containing moraines, kames, eskers, and outwash plains with numerous small lakes and marshes. Soils are largely derived from thick, late-Wisconsinan glacial drift and thin loess deposits where they occur. Alfisols are common and Mollisols also occur, but are less common

Table 3. Level IV subregions of the 2016 Upper Des Plaines River watershed study area and their key attributes (from Woods et al. 1995).

Level IV Subregion	Physiography	Geology	Soils	Potential Natural Vegetation	Land Use/Land Cover
Kettle Moraine (53b)	Glaciated, hummocky to hilly area with steeply sloping moraines, outwash plains, closed depressions, mounds, level areas, and many wetlands and natural lakes.	Wisconsinan-age glacial till, outwash gravels, and thin loess (<20"). Silurian & Ordovician dolomite, lime-stone, and shale bedrock.	Mostly Alfisols (Hapludalfs, Epiaqualfs); also, Mollisols (Argiudolls, Endoaquolls), Histosols.	Oak-hickory forest, oak savanna, & blue-stem prairie occur on moraines. Wetlands (bogs, fens, seeps, sedge meadows, marshes) were common.	Forest, pasture-land, & wetland. Home sites common on moraines and lakes.
Valparaiso-Wheaton Morainal Complex (54f)	Glaciated, hilly, hummocky, rolling area containing moraines, kames, eskers, rolling till plains, outwash plains, kettle holes, and ravines. Small lakes and marshes are common.	Wisconsinan-age glacial till, Quarternary lake deposits, thin loess (<20") & alluvium. Ordovician & Silurian dolomite, limestone, & shale bedrock buried by glacial drift with outcrops along some streams.	Alfisols (Epiaqualfs, Hapludalfs), Mollisols (Endoaquolls, Argiudolls), Inceptisols (Eutrudepts).	A mosaic of oak-hickory forest & bluestem prairie. Dry prairies and dry upland forests on dry soils; mesic forests on poorly drained uplands. Floodplain forests in river bottoms.	Mostly growing urban/suburban development, but wooded areas, wetlands, and pastureland are common in preserves.

than in neighboring subregions. In the early 1800s prairie and forest (oak-hickory) dominated the moraines with swamp white oak forests and marshes occurring in poorly drained areas. Prairie covered slightly more than half of this subregion. Subsequent fire suppression has reduced the number of prairie openings, thereby increasing forest density. Today, urban and suburban development is increasingly replacing rural land uses. However, wooded areas, lakes, and wetlands are still common especially in the County owned forest preserves. Land uses are varied and include residential (26.3%), public/private open space (19.4%), agricultural (12.2%), transportation (10.6%), forest/grassland (9.3%), water (7.0%), wetlands (5.4%), and the remainder comprised of six other land use types (Lake Co. Local Planning Committee 2012).

Major Point Sources

Point sources of pollution were originally inventoried as part of the 2016 Upper Des Plaines Bioassessment (MBI 2017) to understand the extent of their potential impact and for the intensive pollution survey monitoring design. There are a total of 18 wastewater treatment plants (WWTP) in the Upper Des Plaines watershed within Lake Co. of which eight (8) are major discharges comprising a total of more than 80 million gallons per day (MGD; average annual flows) of treated wastewater. Of this total the majority is discharged by the North Shore Water Reclamation District Gurnee (NSWRD; 23.6 MGD), NSWRD Waukegan (22.0 MGD), and Lake Co. Dept. of Public Works (LCDPW) Des Plaines River WWTPs (16.0 MGD). The 2018 (Year 2) study

area includes seven (7) of the eight (8) major discharges listed in Table 5. All except one of these facilities have advanced treatment for oxygen demanding wastes (BOD), ammonia-N ($\text{NH}_3\text{-N}$), and suspended solids (TSS). The Mundelein WWTP is the only secondary treatment facility remaining. Six (6) facilities have phosphorus removal technology and all eight (8) facilities now monitor for N and P (MBI 2017).

NPDES Permit Special Conditions

All of the major permitted WWTPs are subject to Special Conditions related to the discharge of nutrients, but not all have final language. The first special condition states:

“The Permittee shall, within twelve (12) months of the permit effective date, prepare and submit to the Agency a feasibility study that identifies the method, timeframe, and costs of reducing phosphorus levels in its discharge to a level meeting a potential future effluent standard of 0.5 and 0.1 mg/L. The study shall evaluate the costs of the application of these limits on a monthly, seasonal, and annual average basis.”

The second special condition states:

“The Permittee shall submit a Nutrient Implementation Plan (NIP) for Agency approval with the NPDES renewal application. The NIP must identify phosphorus input reductions by point source discharges, non-point source discharges and other measures necessary to remove dissolved oxygen and offensive condition impairments in the Des Plaines River watershed. The Permittee shall implement the recommendations of the plan that are applicable to said Permittee per the schedule approved by the Agency. The Permittee may work cooperatively with the Des Plaines River Watershed Workgroup (DRWW) to prepare a single NIP that is common among DRWW permittees.”

In addition all of the WWTPs that are members of the DRWW are subject to additional special conditions in their respective NPDES permits as follows:

“The Permittee shall conduct monthly water quality sampling in the receiving stream both upstream and downstream of the NPDES outfall for the following parameters: dissolved phosphorus, total phosphorus, total organic carbon, chlorophyll a, dissolved oxygen, total ammonia nitrogen, nitrate/nitrite, total Kjeldahl nitrogen, pH, total suspended solids, volatile suspended solids and temperature. The results shall be submitted to the Agency by March 31 of each year. The Permittee may work cooperatively with the DRWW to conduct monitoring and prepare a single annual monitoring report that is common among DRWW permittees.”

Nutrient Assessment Reduction Plan (NARP)

The State of Illinois developed the Illinois Nutrient Loss Reduction Strategy (NLRS; State of Illinois 2018) to deal with the enrichment of Illinois surface waters by primary nutrients (N and P). As part of the NLRS Illinois EPA developed a process termed the Nutrient Assessment

Reduction Plan (NARP) which is to be developed for major wastewater treatment facilities by December 31, 2023. All of the major WWTPs that are members of the DRWW have initiated planning for meeting the NARP requirements. Depending on the findings of the DRWW NARP process additional controls on discharges of N and P could be forthcoming.

Nonpoint Sources

Nonpoint sources in the 2018 study area included a mix of agricultural and urban sources, the latter of varying intensities ranging from light suburban to heavy urban and industrial land uses. These have been extensively classified and delineated by the Lake Co. SMC. Hydromodification of stream and river flows and habitat also occurs with the former being influenced by land uses and the latter mostly in the form of legacy channelization and riparian encroachment by agriculture and urban and suburban development. The influence of legacy hydromodification is especially evident in the upper mainstem.

Sampling Sites Selection and Locations

A Monitoring Strategy for the Des Plaines River Watershed was developed by the Monitoring Committee of the Des Plaines River Watershed Workgroup in 2015 (DRWW 2016). The spatial allocation of sites was established by the DRWW for water sampling in 2015 and this was used as the core for the initial allocation of additional biological and habitat sites. While the initial baseline survey of the entire Upper Des Plaines River watershed in 2016 included 70 sites, a rotation through three subsets of the Upper Des Plaines River basin in Lake Co. was initiated in 2017. The 2018 survey of the mainstem is Year 2 of that rotation.

Spatial Survey Design

MBI developed a combined intensive pollution survey and geometric allocation of sites for the sampling of fish, macroinvertebrates, and habitat in 2016 (MBI 2017). This consisted of deriving progressive geometric panels of drainage area and assigning sampling sites where these occurred throughout the Upper Des Plaines watershed. Adding targeted sites to fill gaps in the longitudinal continuum left by the DRWW tiered design to fulfill a pollution survey design for the mainstem and major tributaries resulted in a total of 70 sites. Each sampling site was assigned a unique DRWW numeric site code, a river mile, and UTM coordinates by individual river or stream.

The 2018 (Year 2) study area included 17 sites in the Des Plaines River mainstem between Russel Rd. near the Illinois-Wisconsin state line and Palatine Frontage Rd. near the Lake Co.-Cook Co. boundary (Figure 2; Table 6; Appendix Table A-1). Three small orphan tributaries that enter the mainstem from the east, Werhane Lake Drain, an unnamed tributary to Werhane Lake Drain, and an unnamed tributary to the Des Plaines mainstem were also included in the 2018 survey. All sites were sampled for fish, macroinvertebrates, habitat, and meter-read water quality at a minimum. Fourteen (14) sites were sampled continuously with YSI Datasonde recorders with one-half deployed for consecutive one-week periods during August

Table 4. Major wastewater treatment facilities that discharge either directly or via tributaries (river miles are indicated) to the 2018 Upper Des Plaines River mainstem (DPW – Dept. of Public Works; NSWRD – North Shore Water Reclamation District; WRF – Water Reclamation Facility; WWTP – Wastewater Treatment Plant). Treatment levels and nutrient information from U.S. EPA Discharge Monitoring Report (DMR) Pollutant Loading Tool (https://cfpub.epa.gov/dmr/facility_detail.cfm).

Facility	Receiving Water Body	River Mile	Latitude	Longitude	Avg. Flow 2018 (MGD) ¹	Design Avg. Flow (MGD) ²	Treatment Type ³	Nutrient Removal ⁴
Lake Co. DPW Mill Creek WWTP	Mill Creek/Des Plaines R.	1.0/102.0	42°25'00"N	87°55'40"W	0.9	2.1	AWT	P
NSWRD Waukegan WRF	Des Plaines R.	98.1	42°22'15"N	87°54'53"W	19.1	22.0	AWT	P
NSWRD Gurnee WRF	Des Plaines R.	95.5	42°21'25"N	87°55'36"W	15.4	23.6	AWT	P
Libertyville WWTP	Des Plaines R.	84.8	42°15'15"N	88°56'10"W	4.0	4.0	AWT	M
Mundelein WWTP	Des Plaines R.	84.6	42°15'11"N	87°50'34"W	4.0	5.0	Secondary	M
Lake Co. DPW New Town Century WWTP	Des Plaines R.	82.3	42°13'30"N	87°56'15"W	2.9	6.0	AWT	P
Lake Co. DPW Des Plaines WWTP	Aptakisic Cr./ Des Plaines R.	0.8/76.4	42°09'47"N	87°55'40"W	9.5	16.0	AWT	P

¹ Effluent quality reported to MBI by DRWW and individual POTWs.

² Design average flow from NPDES fact sheet.

³ AWT – Advanced Wastewater Treatment – generally 10-20 mg/L CBOD₅, 1.5-3.0 NH₃-N; 12-24 mg/L TSS; Secondary – generally 30 mg/L CBOD₅/TSS, and no NH₃-N removal.

⁴ M – nutrient (N and P) monitoring only; P – 1.0 mg/L limitation.

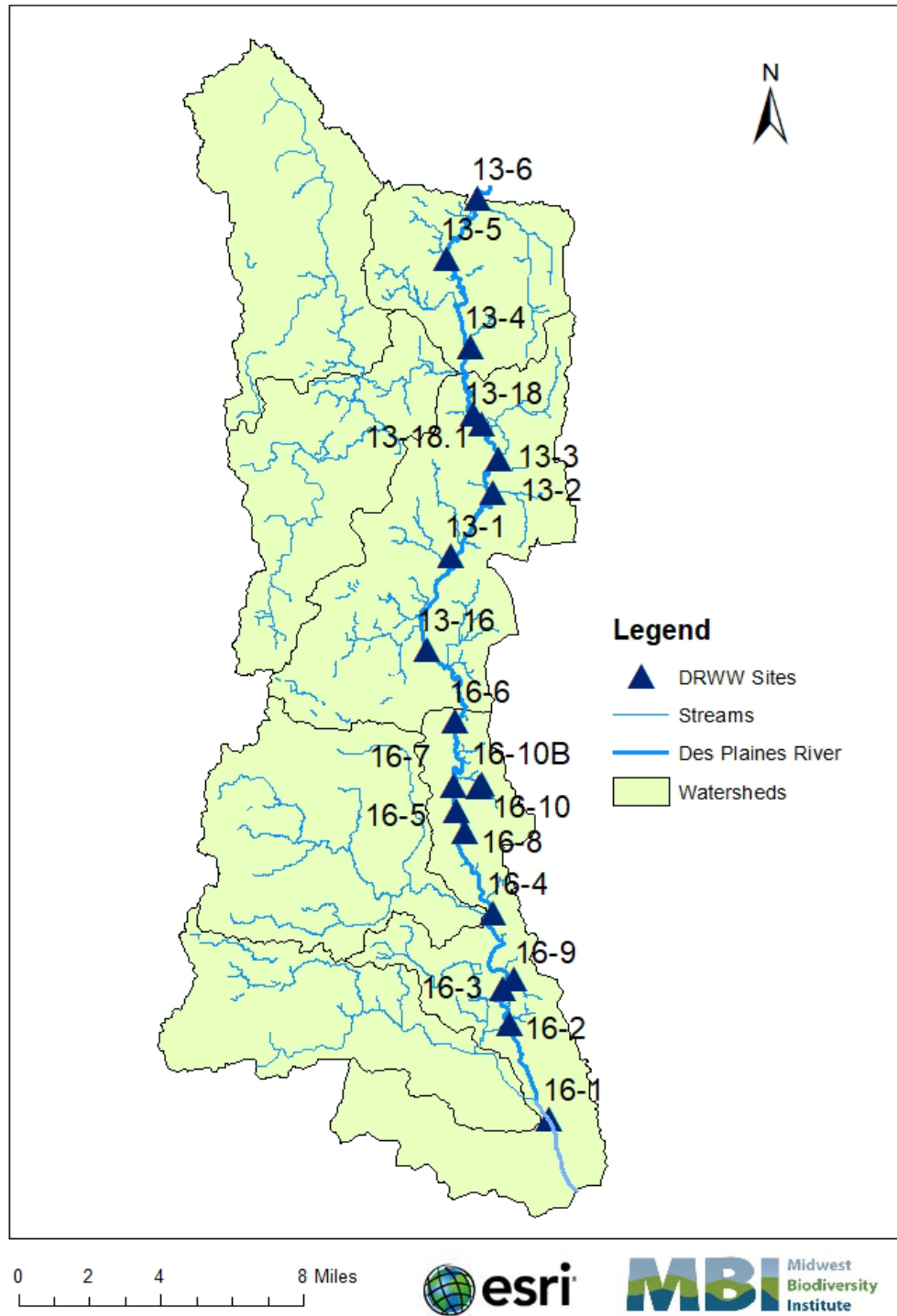


Figure 2. Location of biological, chemical, and habitat sampling sites in the DRWW Year 2 study area, 2018. Site codes correspond to the sites listed in Table 3.

Table 5. Locations of sampling sites in the Year 2 Des Plaines River study area in 2018 showing the site ID, river or stream, location, river mile, and what sampling was performed at each (F – fish; MH – multihabitat macroinvertebrate; QHEI – Qualitative Habitat Evaluation Index; Datasonde; Benthic Chlorophyll a, and water chemistry in accordance with Tier 1-4 designation.

Site ID	River	Location	River Mile	Gradient	Drainage Area (mi. ²)	Biota	Habitat	Datasonde	Benthic Chlorophyll a	Water Chemistry			
										Tier 1	Tier 2	Tier 3	Tier 4
13-6	Des Plaines River	Russel Rd.	109.3	5.64	123.67	F, MH	QHEI	X	X	1			
13-5	Des Plaines River	IL 173	106.6	5.15	137.29	F, MH	QHEI	X	X		2		
13-4	Des Plaines River	Wadsworth Road	102.9	4.67	145.55	F, MH	QHEI	X	X		2		
13-18	Des Plaines River	Above Riffle Structure	99.72	2.63	213.17	F, MH	QHEI						4
13-19	Des Plaines River	Below Riffle Structure	99.3	2.63	212.87	F, MH	QHEI	X	X				4
13-3	Des Plaines River	US Rt. 41	98.7	4.26	220.29	F, MH	QHEI	X	X	1			
13-2	Des Plaines River	McClure Ave.	96.82	4.04	225.36	F, MH	QHEI	X	X	1			
13-1	Des Plaines River	IL 120	94.2	3.61	232.03	F, MH	QHEI	X	X	1			
13-16	Des Plaines River	Buckley Rd.	90.6	3.32	253.75	F, MH	QHEI						4
16-6	Des Plaines River	Rockland Rd.	87.1	2.70	261.41	F, MH	QHEI	X	X	1			
16-7	Des Plaines River	Hollister Dam site	84.6	2.77	266.48	F, MH	QHEI						4
16-5	Des Plaines River	IL 60 (Town Line Rd.)	83.6	2.72	268.07	F, MH	QHEI	X	X	1			
16-8	Des Plaines River	Wright Woods Dam site	82.9	2.64	268.9	F, MH	QHEI						4
16-4	Des Plaines River	Half Day Rd.	80	2.39	273.21	F, MH	QHEI	X	X	1			
16-3	Des Plaines River	Deerfield Rd.	76.7	2.24	314.68	F, MH	QHEI	X	X			3	
16-2	Des Plaines River	E. Lake Cook Rd.	75.4	2.19	323.96	F, MH	QHEI	X	X	1			
16-1	Des Plaines River	Palantine Frontage Rd.	71.7	2.13	358.68	F, MH	QHEI	X	X	1			
16-9	UT to Des Plaines River	Timberleaf Lane	0.4	13.85	1.19	F, MH	QHEI						4
16-10	UT to Werhane Lake Drain	St. Marys Rd.	0.1	40.0	0.21	Dry	Dry						4
16-10B	Werhane Lake Drain	Dst. St Marys Rd.	0.8	11.24	0.22	F, MH	QHEI						4

2018 and with benthic chlorophyll a samples collected in the same week of deployment at the same sites. DRWW collected grab water samples in 2018 accordance with a site being designated as Tier 1-3 for which the specific analytes varied. No water samples were collected at Tier 4 sites, only the four (4) parameters that were measured with a water quality meter.

METHODS

All methods followed Illinois EPA and DNR procedures, except as modified to meet the needs of the DRWW, but with the goal of providing comparable data to evaluate aquatic life and recreational use attainment. This includes fish, macroinvertebrates, habitat, bacteria, chemical parameters (water and sediment), continuous data for selected parameters, and benthic chlorophyll a. Recreational use attainment was evaluated with *Escherichia coli* and using the U.S. EPA national criteria since none were available from Illinois EPA.

Chemical/Physical Water Quality - Methods

Water Column Sampling

The specific methods of data collection followed IEPA (2012a) and chemical laboratory analyses were provided by Suburban Labs. The chemical/physical parameter categories (demand, nutrients, metals, organics) and the frequency of sample collection are summarized in DRWW (2016, 2018). DRWW assigned tiers to the sampling sites as follows:

- **Tier 1:** Nine (9) sites located on the mainstem Des Plaines River that were sampled monthly for water May through September and November and March (seven times per year) for all demand³, nutrient, and bacteria parameters. Sampling was previously done annually under low flow conditions for water column metals and water organics, but this was discontinued in 2018. Sediment samples analyzed for metals and organics are collected concurrent with a bioassessment.
- **Tier 2:** Two (2) sites located on the Des Plaines mainstem were sampled monthly from May through September and in November and March (seven times per year) for the majority of the demand, nutrient, and bacteria parameters. Sampling was previously done annually under low flow conditions for water column metals and water organics, but this was discontinued in 2018. Sediment samples analyzed for metals and organics are collected concurrent with a bioassessment.
- **Tier 3:** One (1) site located on the Des Plaines was sampled monthly from May through September and in November and March (seven times per year) for the majority of demand, nutrient, and bacteria parameters. Sediment samples analyzed for metals and organics are collected concurrent with a bioassessment.
- **Tier 4:** Eight (8) sites, five in the mainstem and three (3) in the tributaries that were not sampled for water chemistry. These sites were sampled with a water quality meter during each fish sampling event.

³ Demand parameters include: chlorides, conductivity, pH, TOC, sulfate, total suspended solids, volatile suspended solids, dissolved oxygen, temperature, and turbidity.

Sediment Sampling

Surficial sediments were sampled for bulk chemical analysis at all 17 mainstem locations (Tier 1-4) following IEPA methods (IEPA 2011b). Samples were collected in October 2018 and were analyzed by Suburban Labs.

Nutrient Effect Assessment Procedure

A new methodology to assess the effect of nutrient enrichment was introduced in the 2017 Year 1 assessment (MBI 2019). Modeled after the Stream Nutrient Assessment Procedure (SNAP) developed by Ohio EPA (2015b), it includes consideration of the width of the diel variation in continuously measured D.O. and the biomass of chlorophyll a in benthic algae in addition to the concentration of total phosphorus and dissolved inorganic nitrogen (nitrates + nitrites). Other nutrient related parameters such as volatile suspend solids (VSS), turbidity, and total Kjeldahl nitrogen (TKN) were included when they were collected at one of the 14 Datasonde and benthic chlorophyll a locations (Table 6). Datasondes were deployed for consecutive 3-4 day periods during times of low stream flow and elevated summer ambient temperatures (YSI 2012, 2017). New to this analysis in 2018 are the number of phosphorus sensitive species derived from the NE IL IPS stressor analyses and a Nutrient Ranking Index that was also developed with IPS outputs (Appendix E). Together these results were used to determine five degrees of nutrient enrichment (none, low, moderate, high, and severe). This represents the first attempt to use this methodology in the Upper Des Plaines mainstem.

A summary of the number of water and sediment parameters and samples collected in 2018 are found in Table 7. The parameters analyzed and frequencies of collection varied by DRWW tier assignment as was previously described.

Biological Assemblage Sampling

Biological assemblages in the 2018 Year 2 study area included fish and macroinvertebrates at 20 instream locations. Biological and habitat sampling adhered to a summer-early fall index period of June 16-October 15 for fish and July 1-September 30 for macroinvertebrates. For fish all mainstem river sites were sampled twice and macroinvertebrates once, the latter with a 10% resample. A habitat evaluation was performed at all fish sites using the QHEI (Ohio EPA 2006) and a site description accompanied the Illinois EPA multihabitat macroinvertebrate samples. All sampling occurred during periods of summer-fall base flows – periods of higher flows and elevated runoff were avoided.

Fish Assemblage Methods

Fish were collected two times at each of the 17 mainstem sites using a raft-mounted electrofishing apparatus. Pulsed D.C. current was produced by a Smith-Root 5.0 GPP pulsator powered by a 5.0 kW alternator and 12.5 h.p. gasoline engine mounted on a 15.5' Wing raft. The electrode array used followed Ohio EPA (1989a) electrofishing design specifications. Sampling effort for this method was 0.5 km of lineal shoreline with all available habitats sampled intensively in a general downstream direction. Fish were collected once at each

Table 6. Summary of the number of water chemistry parameters and samples collected by parameter category for water column (left) and surficial sediment (right) samples in the Year 2 study area in 2018.

Parameters/ Category	Water		Sediment	
	Parameters	Samples	Parameters	Samples
All	15	1,217	71	1,208
<i>E. coli</i>	1	90	0	0
Field pH & temperature	2	228	0	0
Demand ¹	2	123	0	0
Nutrients ²	6	373	2	34
Ionic Strength ³	2	285	0	0
Suspended Materials ⁴	2	118	0	0
Metals	0	0	20	341
Organic Compounds	0	0	48	816
Other (Cyanide)	0	0	1	17
¹ Includes dissolved oxygen and turbidity ² Includes total ammonia, total phosphorus, total nitrate, TKN, benthic chlorophyll a, sestonic chlorophyll a ³ Includes total chloride, and conductivity ⁴ Includes total suspended solids and volatile suspended solids				

tributary site with pulsed D.C. electrofishing units including a Wisconsin AbP-3 battery-powered back pack or T&J 1736 DCV units. Deference was given to the most effective method given the prevailing site and water characteristics. The upper boundary for using the battery-powered back pack electrofishing unit was two times the depth and five times the width of the net ring (anode). Wider and deeper sites were sampled with the T&J 1736 DCV generator powered unit as a bank set longline arrangement. All wadeable sites were sampled in an upstream direction. The primary net ring served as the anode and a woven steel cable cathode trailed from the back pack unit or from the longline cord. A dip net was used to assist in the capture of stunned fish. A two or three-person crew consisting of a fish crew leader and one or two field technicians conducted the sampling under summer-fall base flow conditions. Sampling effort was standardized by distance and included a 150 meter long reach for all wadeable sites.

Captured fish were placed in a live well or live net for processing at the end of each site. Water was regularly replaced and/or aerated to maintain adequate oxygen levels in the water and to minimize mortality. Samples from each site were processed by enumerating and recording weights by species and by life stage (young-of-the-year, juvenile, and adult) on a standard water resistant field sheet. The incidence of external anomalies was recorded following procedures outlined by Ohio EPA (1996, 2015a) and refinements made by Sanders et al. (1999).

Fish were released back into the water after they were identified to species, examined for external anomalies, and weighed either individually or in batches. Larval fish, if collected, were not included in a sample and fish measuring less than 15–20 mm in length were generally excluded as a matter of practice (excepting adults of small species). All sites were marked with GPS coordinates (beginning, middle, and end of a sampling reach) and site data was recorded on a standard field form.

While the majority of captured fish were identified to species in the field, any uncertainty about field identification required vouchering for laboratory identification. Voucher specimens were preserved in borax buffered 10% formalin solution and labeled by date, stream, and geographic identifier (e.g., river mile and site number). Regional ichthyology keys were used including the Fishes of Illinois (Smith 1979) and updates available through the Illinois Natural History Survey (INHS). Scientific nomenclature followed Page et al. (2012). Vouchers were deposited at The Ohio State University Museum of Biodiversity (OSUMB) in Columbus, OH. The data were used to calculate the Illinois Fish Index of Biotic Integrity (fIBI; Smogor 2000, 2005) as the primary assessment of fish assemblage quality and the Modified Index of Well-Being (MIwb; Ohio EPA 1987) in addition to expressions of species richness and relative abundance.

Macroinvertebrate Methods

Macroinvertebrate methods followed the Illinois EPA multi-habitat method (IEPA 2011c,d) at all sites (Table 3). The IEPA multi-habitat method involves the selection of a sampling reach that has instream and riparian habitat conditions typical of the assessment reach. Sampling reach requirements included flow conditions that approximate typical summer base flows, the absence of highly influential tributary streams, the presence of one riffle/pool sequence or analog (i.e., run/bend meander or alternate point-bar sequence), if present, and a length of at least 300 feet and up to 800 feet. The collection of macroinvertebrates was accomplished with a dip net in all bottom-zone and bank-zone habitat types that occurred within a sampling site. Water conditions must allow a sampler to apply the 11-transect habitat-sampling method or to estimate with reasonable accuracy via visual or tactile cues the amount of each of several bottom-zone and bank-zone habitat types. All sites were marked with GPS coordinates (beginning and end of a sampling reach) and site data was recorded on a standard field form.

Multi-habitat macroinvertebrate samples were field preserved in 10% formalin. Upon delivery to the MBI lab in Hilliard, OH the preserved samples were transferred to 70% ethyl alcohol. Laboratory procedures followed the IEPA (2011e) methodology which requires the production of a 300-organism subsample from a gridded tray following a scan and pre-pick of large and/or rare taxa. Taxonomic resolution was at the lowest practicable resolution for the common macroinvertebrate assemblage groups such as mayflies, stoneflies, caddisflies, midges, and crustaceans, which goes beyond the genus level requirement of IEPA (2011g). However, calculation of the Macroinvertebrate IBI (mIBI) adhered to the IEPA methods by using genera as the benchmark level of taxonomic resolution for mIBI scoring, but analyses using the lowest resolution data were accomplished.

Area of Degradation and Attainment Values

New in 2018 is the use of the Area of Degradation Value (ADV) and Area of Attainment Value (AAV) to demonstrate the trajectory of the biological assemblages and aquatic life use attainment through time and within pollution impact reaches of the Upper Des Plaines River mainstem. The ADV (Yoder and Rankin 1995; Yoder et al. 2005) was originally developed to quantify the extent and severity of departures from a biocriterion within a pollution impact reach that is defined by the impact from one or more sources downstream through an initial zone of impact and through zones of partial to complete recovery. For results that surpass a biocriterion this is expressed as an Area of Attainment Value (AAV) that quantifies the extent to which the minimum attainment criterion is surpassed. The ADV/AAV correspond to the area of the polygon formed by the longitudinal profile of FBI and mBI scores and the straight line boundary formed by their respective biocriterion, the ADV below and the AAV above. The computational formula (after Yoder et al. 2005) is:

$$ADV/AAV = \sum [(aIBI_a + aIBI_b) - (pIBI_a + pIBI_b)] * (RMA - RMB), \text{ for } a = 1 \text{ to } n, \text{ where;}$$

aIBI_a = actual IBI at river mile a,
 aIBI_b = actual IBI at river mile b,
 pIBI_a = IBI biocriterion at river mile a,
 pIBI_b = IBI biocriterion at river mile b,
 RMA = upstream most river mile,
 RMB = downstream most river mile, and
 n = number of samples.

The average of two contiguous sampling sites is assumed to integrate biological assemblage status for the distance between the points. The intensive pollution survey design typically positions sites in close enough proximity to sources of stress and along probable zones of impact and recovery so that meaningful changes are adequately captured. We have observed biological assemblages as portrayed by their respective indices to change predictably in proximity to major sources and types of pollution in numerous instances (Ohio EPA1987a; Yoder and Rankin 1995; Yoder and Smith 1999; Yoder et al. 2005). Thus, the longitudinal connection of contiguous sampling points produces a reasonably accurate portrayal of the extent and severity of impairment in a specified river reach as reflected by the indices (Yoder and Rankin 1995). The total ADV/AAV for a specified river segment is normalized to ADV/AAV units/mile for making comparisons between years and rivers. The ADV is calculated as a negative (below the biocriterion) expression; the AAV is calculated as a positive (above the biocriterion) expression. Each depicts the extent and degree of impairment (ADV) and attainment (AAV) of a biological criterion, which provides a more quantitative depiction of quality than do pass/fail descriptions. It also allows the visualization of incremental changes in condition that may not alter the pass/fail status, but are nonetheless meaningful in terms of incremental change over space and time. In these analyses, the Warmwater Habitat (WWH) biocriterion for the fish and macroinvertebrate indices, which vary by use designation and ecoregion, were used as the threshold for calculating the ADV and AAV for the Mill Creek mainstem. The WWH use designation represents the minimum goal required by the Clean

Water Act (CWA) for the protection and propagation of aquatic life, thus it was used as a standard benchmark for the ADV/AAV analyses.

Habitat Assessment

The QHEI (Rankin 1989, 1995; Ohio EPA 2006) was employed as the principal aquatic habitat assessment methodology at each site. The protocol was accomplished as part of the fish assemblage method by the fish crew leader who is trained and experienced in using the QHEI. The QHEI measures six categories of habitat that are important to the aquatic biota with a scoring range of 0-100. QHEI scores of 60 have generally been regarded as sufficient to support the General Use for aquatic life, while scores below 45 indicate substantial deficiencies in habitat that can preclude attainment of the General Use. These rules-of-thumb have been altered by the NE IL IPS analyses and the newer thresholds were used to assess habitat quality. A QHEI matrix (Rankin 1995) showing the occurrence of good and modified attributes was also developed to evaluate the overall capacity of the stream habitat to support the General Use at each site and to diagnose potential deficiencies that might be limiting to the aquatic assemblages.

Data Management

All data was managed by MBI in internal databases that permit ready access and analysis. Biological and habitat data is stored in a routine based on the Ohio ECOS format that MBI uses for all biological data management tasks. Biological data analysis included the calculation of the Illinois fish and macroinvertebrate IBIs for determining General Use aquatic life status and the accompanying data attributes to enhance the diagnosis of impairments. Habitat data was analyzed using the QHEI and also via a QHEI attributes matrix to aid in assessing habitat related impairments. Summaries of species/taxa relative abundance and QHEI metrics at each site and by sampling date are provided in Appendices A-C.

Determining Use Attainability

Illinois EPA offers a single aquatic life use designation that applies to all rivers and streams through the General Use provision of the Illinois WQS. This is the presumed use applicable to all rivers and streams in Illinois which includes the 2017 study area. An assessment of aquatic life use attainability is therefore not a routine outcome of a biological and water quality assessment and was not performed herein. However, the data collected is adequate to determine if habitat is a limiting factor for any instances of non-support. New in 2018 is the availability of stressor thresholds, Restorability and Susceptibility/Threat factors, and other analyses based on five narrative categories consisting of excellent, good (meets General Use), fair, poor, and very poor quality the boundaries of which simulate the application of a tiered aquatic life use (TALU) framework.

Determining Use Attainment

The determination of the attainment status of the Illinois General Use for aquatic life generally followed the guidance in the 2018 IEPA Integrated Report (IEPA 2018) relying primarily on the biological results and attainment of the fIBI and mIBI thresholds expressed as fully supporting, partially supporting, non-supporting fair, and non-supporting poor, with the most limiting result of either the fish or macroinvertebrates determining the assignment of fair or poor. The addition of a partial support category and the five narrative condition categories goes beyond the current IEPA structure, the former done to highlight where one assemblage attained their respective fIBI or mIBI biocriterion and the latter to support incremental analyses of condition both above and below the General Use benchmark.

Determining Causal Associations

Using the results, conclusions, and recommendations of this assessment requires an understanding of the methodology used to determine biological status and assigning associated causes and sources of impairment utilizing the accompanying chemical/physical data and source information (e.g., point source loadings, land use). New in 2018 was the availability of outputs from the Northeastern Illinois Integrated Prioritization System (NE IL IPS; MBI 2020). These outputs included regionally derived stressor threshold for more than 70 chemical and habitat variables and Restorability rankings for impaired sites and Susceptibility and Threat rankings for sites that attained the Illinois General Use biological criteria.

Causal Diagnosis

Describing the causes and sources associated with observed biological impairments relies on an interpretation of multiple lines of evidence including water chemistry data, sediment chemistry data, habitat data, effluent data, land use data, and biological response signatures (Yoder and Rankin 1995; Yoder and DeShon 2003). Thus the assignment of associated causes and sources of biological impairment in this report represents the association of impairments (based on response indicators) with stressor and exposure indicators using linkages to the bioassessment data based on previous experiences with analogous situations and impact types. This was done by relating exceedances of chemical thresholds such as chronic and acute water quality criteria and relevant biological effects thresholds for water and sediment chemistry from the NE IL IPS tool and dashboard to further refine the relative importance of categorical and/or parameter specific causes. The reliability of the identification of associated causes and sources is increased where other such prior associations have been observed. This process relies on multiple lines of evidence concerning the biological response which is the ultimate measure of success in water quality management. The NE IL IPS derived exceedance thresholds for chemical and habitat parameters used in the causal analyses were also used in the tabular and graphical presentation of the chemical water and sediment results. When combined with the Restorability and Susceptibility/Threat rankings this improved the certainty of the assignment of causes and sources to an observed biological impairment.

Hierarchy of Water Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators comprised of ecological, chemical, and toxicological measures, can ensure that all relevant pollution sources are judged objectively on the basis of environmental results. A tiered approach that links the results of administrative actions with true environmental measures was employed in our analyses. This integrated approach is outlined in Figure 3 and includes a hierarchical continuum from administrative to true environmental indicators. The six “levels” of indicators include:

- Level 1 - actions taken by regulatory agencies (permitting, enforcement, grants);
- Level 2 - responses by the regulated entity (treatment works, pollution prevention);
- Level 3 - changes in discharged quantities (pollutant loadings);
- Level 4 - changes in ambient conditions (chemical/physical water quality, habitat);
- Level 5 - changes in uptake and/or assimilation (tissue contamination, biomarkers, assimilative capacity); and,
- Level 6 - changes in health, ecology, or other effects (ecological condition, human and wildlife health).

In this process the results of administrative activities (levels 1 and 2) are linked to water quality (levels 3, 4, and 5) which translates to a response (level 6). An example is the aggregate effect of billions of dollars spent on water pollution control in the U.S. since the early 1970s that have been determined with quantifiable measures of environmental condition. In this case the hierarchy was applied to a specific stream reach that is impacted by multiple point and nonpoint sources. The administrative steps taken by Illinois EPA to issue NPDES permits (Level 1) and the steps taken by the permit holders (Level 2) are easily described and quantified. Quantifying changes in the loadings of pollutants (Level 3) can be affected by the quality and completeness of the effluent monitoring which includes the capture of stressors that actually affect the receiving streams. Likewise, documenting changes in ambient conditions (Level 4) can also be affected by the quality and completeness of the chemical/physical monitoring that not only includes the parameters but also the spatial design in relation to sources of pollution. This in turn informs about how pollution sources tax the assimilative capacity (Level 5) of a receiving stream. The end result of all the above is portrayed by the response in the biological indicators which is expressed as attainment or non-attainment of the Illinois General Use aquatic life thresholds for the fish and macroinvertebrate IBIs (IEPA 2016). Symptoms expressed by the biota beyond the index scores can be useful in aiding the causal diagnosis as a feedback loop in the hierarchy of indicators process.

Superimposed on this hierarchy is the concept of stressor, exposure, and response indicators.

- *Stressor* indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications.

- *Exposure* indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent.
- *Response* indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise the Illinois EPA biological endpoints.

Completing the Cycle of WQ Management: Assessing and Guiding Management Actions with Integrated Environmental Assessment

Indicator Levels

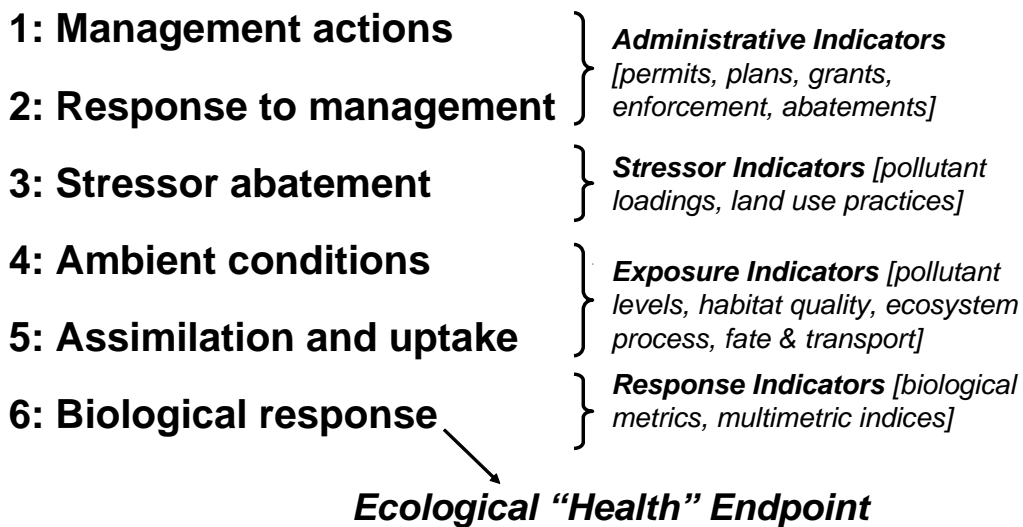


Figure 3. The hierarchy of administrative and environmental indicators which can be used to support monitoring and assessment, reporting, and an evaluation of the effectiveness of pollution controls on a receiving stream. This is patterned after a model developed by U.S. EPA (1995a,b) and enhanced by Karr and Yoder (2004).

This classification of indicators represents the essential technical elements for the pollution survey design that was employed in the Upper Des Plaines bioassessments by using each indicator *within* its most appropriate role which are most appropriate for each (Yoder and Rankin 1998).

Causal Associations

Describing the causes and sources associated with biological impairments in the study area involved the interpretation of multiple lines of evidence that included water chemistry,

sediment chemistry, habitat, and effluent data, a general knowledge about upstream land uses, and biological response signatures within the biological data itself. The assignment of causes and sources of biological impairment result from the association of the impairment with exceedances of water quality criteria or other response-based thresholds and the proximity to sources of pollution. This process was strengthened by the availability of regionally derived stressor effect thresholds from the NE IL IPS (MBI 2020) that classified stressor levels into excellent, good, fair, poor, and very poor categories.

RESULTS – CHEMICAL/PHYSICAL WATER QUALITY

Chemical/physical water quality in the 2018 Year 2 study area was characterized by grab sample data collected from the water column six times at each Tier 1-3 sites during summer-fall base flows and by hand held meter only at Tier 4 sites. Sediment chemistry was determined from samples collected at all 17 Tier 1-4 sites in October 2018. Commonly detected chemical parameters were compared either to the criteria in the Illinois WQS, IEPA non-standard benchmarks, reference benchmarks, and/or biologically derived thresholds from the NE IL IPS tool and dashboard (MBI 2020; Table 6). As such, the chemical/physical data herein serves as an indicator of the degree of exposure and stress in support of using the biological data to assess the attainment of designated aquatic life uses and to assist in assigning associated causes and sources. Parameter groupings included field, demand, ionic strength, nutrients, heavy metals, and organic compounds. Bacteria data were collected by grab samples and were used primarily to determine the status of recreational uses in accordance with U.S. EPA National Water Quality Criteria (U.S. EPA 2012).

Flow Regime

The flow regime in the Year 2 study area during the period January 1 – December 31 for all years of DRWW monitoring during 2015, 2016, 2017, and 2018 is depicted in Figure 4 based on the gauge operated by the U.S. Geological Survey on Des Plaines River near Gurnee, IL (USGS 05528000). The flow regime was comparatively low in 2016 occurring at or below the $Q_{7,10}$ flow for an extended period during August, September, and the first half of October with no interruptions by higher flow episodes. Flows were also comparatively lower in 2015, but with an extended period in August and September with flows below the median (50th %ile) and being preceded by higher flow episodes in June and July. Flows were much higher in 2017 when the flood stage flow was greatly exceeded over a period of consecutive weeks in mid-July. These record high flow events forced the postponement of the second biological survey of the mainstem until 2018. Flows in that year were also comparatively elevated exceeding the flood stage flow in May and June and then again in October. However, flows were sufficiently “normal” to conduct the biological survey in late July-early August and September.

Point Source Effluent Quality

Point source discharges of treated wastewater are a significant contribution of pollutant loadings to the upper Des Plaines River mainstem with design average flows of 78.7 MGD (MGD; or 146.2 cubic feet/second [cfs]) among seven (7) major wastewater treatment plants (WWTPs; Table 3). This total comprises 79.8% of the $Q_{7,10}$ flow of 37 cfs⁴ at the USGS Gurnee Gage and 57.1% of the median flow (110 cfs at the USGS Gurnee Gage). In 2018, the annual average discharge flow totaled 55.8 MGD (103.7 cfs) of treated wastewater (71% of the average design flows) which comprised 74% of the $Q_{7,10}$ flow (37 cfs at the USGS Gurnee Gage) and 48%

⁴ Design critical low flows for determining water based effluent limits for each individual facility vary and can be found in the NPDES permit fact sheet for each.

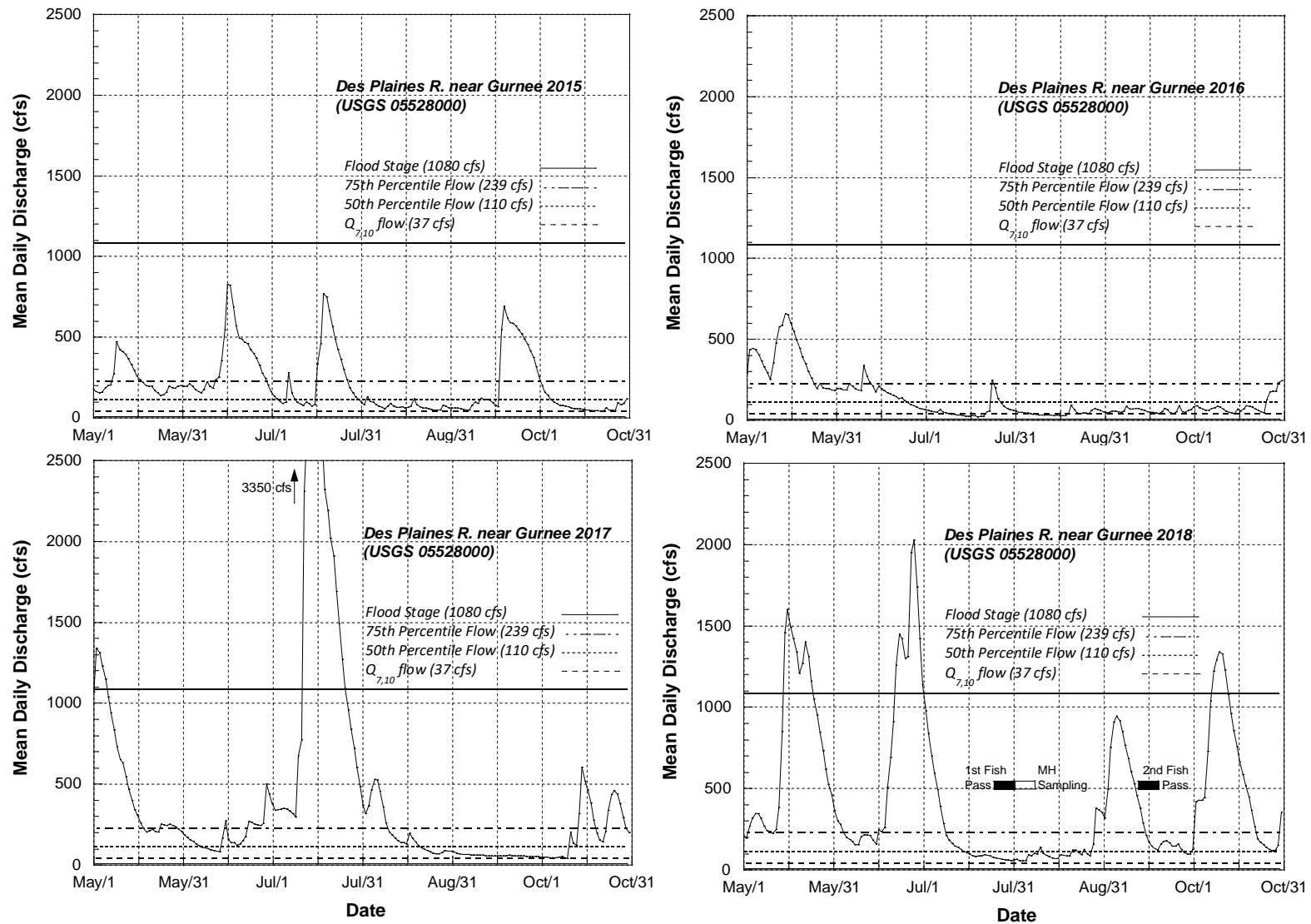


Figure 4. Daily flow measured at the USGS gage on the Des Plaines River (USGS 05528500) near Gurnee, IL during calendar years 2015 (upper left), 2016 (upper right), 2017 (lower left), and 2018 (lower right). The horizontal lines are the flood stage, 75th percentile, 50th percentile, and the seven-day, ten year ($Q_{7,10}$) critical low flows. The span of biological data collection in 2018 is indicated by shaded bars in the 2018 lower right panel.

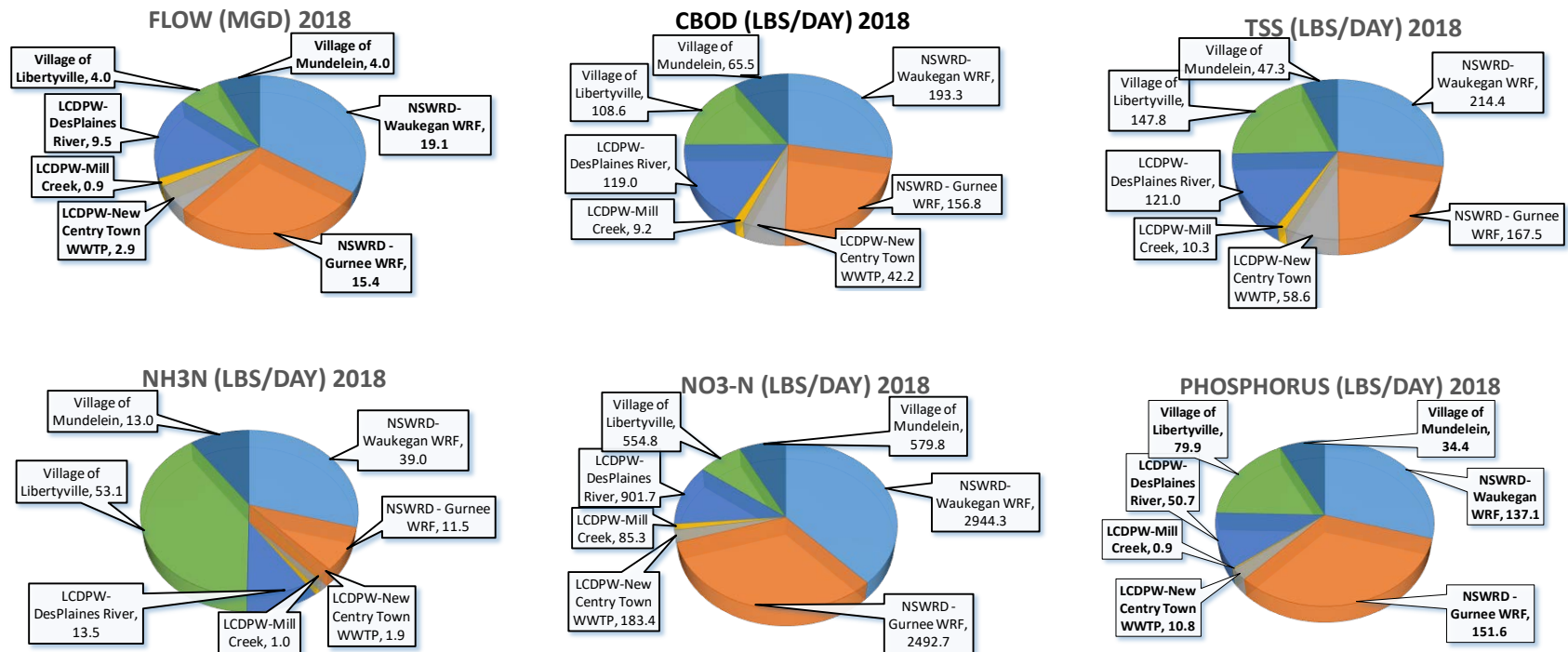


Figure 5. Proportions of effluent flow (MGD) and pollutant loadings (lbs./day) discharged by seven (7) major WWTPs to the mainstem Des Plaines River in 2018. Proportions and loadings are based on the annual averages of each parameter. Discharges are listed in order from upstream to downstream in the inset table (bottom right).

Facility	RM	Flow (MGD)	CBOD ₅ (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)	NO ₃ -N (lbs/day)	Total P (lbs/day)
1 - LCDPW-Mill Creek	102.0	0.9	9.2	10.3	1.0	85.3	0.9
2 - NSWRD-Waukegan WRF	98.1	19.1	193.3	214.4	39.0	2944.3	137.1
3 - NSWRD - Gurnee WRF	95.5	15.4	156.8	167.5	11.5	2492.7	151.6
4 - Village of Libertyville	84.8	4.0	108.6	147.8	53.1	554.8	79.9
5 - Village of Mundelein	84.6	4.0	65.5	47.3	13.0	579.8	34.4
6 - LCDPW-New Centry Town WWTP	82.3	2.9	42.2	58.6	1.9	183.4	10.8
7 - LCDPW-DesPlaines River	76.4	9.5	119.0	121.0	13.5	901.7	50.7
Total Flow/Loading		55.8	694.7	766.9	133.0	7742.0	465.4
Proportion of Total Flow/Loading		78.8%	67.5%	65.6%	48.1%	81.9%	72.9%

of the median flow (110 cfs at the USGS Gurnee Gage). As a result the upper Des Plaines is considered to be “effluent dominated” which consists primarily of discharged treated wastewater and runoff from urban and agricultural areas (Onnis-Hayden et al. 2006). The NSWRD Waukegan, NSWRD Gurnee, and Lake Co. DPW Des Plaines facilities comprised 65-82% of the flow and loadings discharged to the Des Plaines River. A major exception was for NH₃-N where Libertyville comprised 40% of the total loadings with the other three facilities contributing 48% of the total NH₃-N load. Summaries of 2018 flow and loads from each facility follow in the order of occurrence along the Des Plaines River mainstem from upstream to downstream (Table 5).

Lake Co. DPW Mill Creek WWTP

The Lake Co. Department of Public Works (DPW) Mill Creek WWTP discharged an annual average flow of 0.9 MGD (NPDES Permit No. IL0071366) which was 1.6% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The Mill Creek WWTP discharges to Mill Creek one mile upstream of the confluence with the Des Plaines River and it is the uppermost major facility on the mainstem. The design average flow (DAF) for the facility is 0.9 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 2.1 MGD. Treatment consists of screening, grit removal, activated sludge, sedimentation, filtration, ultraviolet disinfection, sludge handling facilities, and biological phosphorus removal with chemical addition as a backup system. In terms of 2018 effluent quality the Mill Creek WWTP discharged the lowest proportion of loadings of CBOD₅ (1.6%) TSS (1.3%), NH₃-N (0.8%), NO₃-N (1.1%), and total P (0.2%; Figure 4).

NSWRD Waukegan WRF

The North Shore Water Reclamation District (NSWRD) Waukegan Water Reclamation Facility (WRF) discharged an annual average flow of 19.1 MGD (NPDES Permit No. IL0030244) which was 34.3% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The design average flow (DAF) for the facility is 19.1 million gallons per day (MGD) and the design maximum flow (DMF) is 22.0 MGD. Treatment consists of screening, grit removal, excess flow treatment, Imhoff tanks, primary settling, two-stage activated sludge, phosphorus removal (discharge to Waukegan North Ditch), rapid sand filters, and ultra violet (UV) disinfection. Sludge treatment includes gravity belt thickening, belt press dewatering, drying and landfill disposal/land application. The NSWRD is a member of the Des Plaines Watershed Workgroup (DRWW). In 2018 the Waukegan WRF discharged the highest proportion of loadings of CBOD₅ (27.8%) TSS (28.0%), and NO₃-N (38.0%) and second highest loadings of NH₃-N (29.3%) and total P (29.5%; Figure 5).

NSWRD Gurnee WRF

The NSWRD Gurnee Water Reclamation Facility (WRF) discharged an annual average flow of 15.4 MGD (NPDES Permit No. IL0035092) which was 27.6% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The design average flow (DAF) for the facility is 15.4 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 23.6 MGD. Treatment consists of screening, excess flow diversion, influent flow measurement, flow splitting, primary clarifiers,

first stage aeration, intermediate clarifiers, nitrification aeration, final clarifiers, tertiary filtration, effluent measurement, UV disinfection, sludge processing and excess flow basin/overflow contact tank (outfall 002). In terms of 2018 effluent quality the Waukegan WRF discharged the second highest proportion of loadings of CBOD₅ (22.6%), TSS (21.8%), and NO₃-N (32.2%) and the highest proportion of total P (32.6%; Figure 5). The NH₃-N loading (8.6%) was the third lowest among the seven treatment plants.

Libertyville WWTP

The Libertyville WWTP discharged an annual average flow of 4.0 MGD (NPDES Permit No. IL0029530) which was 7.2% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The design average flow (DAF) for the facility is 4.0 million gallons per day (MGD) which is also the design maximum flow (DMF). Treatment consists of screening, grit removal, primary sedimentation, activated sludge, final clarifiers, filtration, disinfection (chlorination and dechlorination), sludge handling facilities and excess flow treatment and disinfection. Libertyville is a member of the Des Plaines Watershed Workgroup (DRWW). In terms of 2018 effluent quality the Libertyville WWTP discharged the highest proportion of loadings of NH₃-N (39.9%), third highest proportion of loadings of TSS (19.3%) and total P (17.2%), and fourth highest loadings of CBOD₅ (15.6%) and third lowest NO₃-N (7.2%; Figure 5).

Mundelein WWTP

The Mundelein WWTP discharged an annual average flow of 4.0 MGD (NPDES Permit No. IL0029530) which was 7.2% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The design average flow (DAF) for the facility is 4.0 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 5.0 MGD. Treatment consists of screening, grit removal, primary sedimentation, activated sludge, final clarifiers, filtration, disinfection (chlorination and dechlorination), sludge handling facilities, and excess flow treatment and disinfection. Mundelein *is not* a member of the Des Plaines Watershed Workgroup (DRWW). In terms of 2018 effluent quality the Mundelein WWTP discharged the third highest proportion of loadings of NH₃-N (9.8%) and total P (17.2%), the fourth highest loadings of 7.5 NO₃-N, the third lowest proportion of loadings of CBOD₅ (9.4%) and second lowest TSS (6.2%; Figure 5).

Lake Co. DPW New Century Town WWTP

The Lake Co. Department of Public Works (DPW) New Century Town WWTP discharged an annual average flow of 2.9 MGD (NPDES Permit No. IL0022071) which was 5.2% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The design average flow (DAF) for the facility is 2.9 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 6.0 MGD. Treatment consists of screening, grit removal, activated sludge, settling, filtration, disinfection, and sludge handling facilities. Lake Co. is a member of the Des Plaines Watershed Workgroup (DRWW). In terms of 2018 effluent quality the New Century Town WWTP discharged the second lowest proportion of loadings of CBOD₅ (6.1%), NH₃-N (1.4%), and NO₃-N (2.4%), the third lowest TSS (7.6%) and total P (2.3%; Figure 5).

Lake Co. DPW Des Plaines WWTP

The Lake Co. Department of Public Works (DPW) Des Plaines WWTP discharged an annual average flow of 9.5 MGD (NPDES Permit No. IL0022055) which was 17.0% of the total among the seven (7) major treatment plants that directly impact the mainstem of the Des Plaines River (Table 5; Figure 5). The Des Plaines WWTP discharges to Aptakisic Creek 0.8 miles upstream of the confluence with the Des Plaines River and it is the lowermost major facility on the mainstem. The design average flow (DAF) for the facility is 9.5 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 16.0 MGD. Treatment consists of screening, grit removal, activated sludge, settling, filtration, disinfection, and sludge handling facilities. Lake Co. is a member of the Des Plaines Watershed Workgroup (DRWW). In terms of 2018 effluent quality the Lake Co. Des Plaines WWTP discharged the second lowest proportion of loadings of CBOD₅ (6.1%), NH₃-N (1.4%), and NO₃-N (2.4%), the third lowest TSS (7.6%) and total P (2.3%; Figure 5).

Water Column Chemistry

The water column chemistry results were analyzed for spatial (longitudinal) patterns resulting from the pollution survey design in the Des Plaines River mainstem. The results were screened for exceedances of Illinois WQS, Illinois non-standard benchmarks, regional reference benchmarks, and biological effect thresholds derived from the NE IL IPS (Appendix A; Table 7) were assessed. Exceedances of these benchmarks and thresholds are indicated on the plots and tables of the 2018 chemical results.

Exceedances of Biological Effect and Reference Thresholds

The principal purpose of chemical sampling in a bioassessment is to provide data that supports the interpretation and the assignment of associated causes of biological impairments. Chemical exceedances of biological effect thresholds is essential to that process and has previously included the Illinois water quality criteria, regional reference benchmarks, and national and regional biological effects compendia. Some of these consist of correlations between concentrations of substances that correspond to biological quality gradients across significant geographical areas while others are toxicological endpoints derived from laboratory studies. Two regional studies that have been used include correlative effects levels of different chemicals by the DuPage River Salt Creek Working Group (DRSCWG; Miltner et al. 2010) in northeastern Illinois and the Metropolitan Sewer District of Greater Cincinnati (MSDGC; MBI 2015) in southwest Ohio. NOAA Screening Quick Reference Tables (SQRT; Buchman 2008) were also used especially for chemicals that are not included in the Illinois WQS.

The NE IL IPS (MBI 2020) thresholds for water column chemical parameters that are applicable in the Des Plaines Year 2 study area appear in Table 8 (all 87 variables are listed in Appendix A). Sediment chemical thresholds are provided in Table 9 and were also evaluated against threshold and probable effect levels (TEL and PEL) established by MacDonald et al. (2000) and IEPA (Short 1998). The severity of exceedances of these values offered by the multiple narrative classes (i.e., excellent, good, fair, poor, and very poor) were used to support the

Table 7. Biological effect thresholds derived from Northeast Illinois streams and rivers for selected water column parameters as part of the NE IL IS development and used to assess results from the Year 2 Des Plaines River study area. The most limiting of the fish or macroinvertebrate assemblages for each parameter are indicated along with thresholds for excellent, good, fair, poor, and very poor biological condition.

Parameter Code	Variable Name	Units	Limiting Assemblage	Site Size	Sample N	Excellent	Good	Fair	Poor	Very Poor
Water Column Parameters										
P1002	Arsenic	µg/L	Macros	Head-Wade	985	--	≤3.616	>3.455	>5.029	>6.603
P1027	Cadmium, Total	µg/L	Fish	Head-Wade	1464	≤0.937	>0.937	>0.974	>0.983	>0.991
P1034	Chromium, Total	µg/L	Fish	Head-Wade	1464	≤1.398	>1.398	>1.540	>2.682	>3.824
P1042	Copper, Total	µg/L	Fish	Head-Wade	1464	--	≤4.480	>4.480	>4.969	>5.458
P1051	Lead, Total	µg/L	Macros	Head-Wade	985	≤2.851	>2.851	>3.335	>3.884	>4.434
P1055	Manganese, Total	µg/L	Macros	Head-Wade	985	≤53.71	>53.71	>77.03	>107.1	>137.2
P1092	Zinc, Total	µg/L	Fish	Head-Wade	1464	≤7.47	>7.47	>9.78	>11.00	>12.22
P530	Total Suspended Solids	mg/L	Fish	Head-Wade	1464	≤17.50	>17.50	>31.60	>35.15	>38.69
P549	Volatile Suspended Solids	mg/L	Fish	Head-Wade	1464	≤5.000	>5.000	>7.769	>9.825	>11.88
P82078	Turbidity	NTU	Macros	Head-Wade	985	--	≤19.3	>19.3	>25.9	>32.5
P630	Nitrate-N	mg/L	Fish	Head-Wade	1464	≤3.767	>3.767	>5.045	>7.344	>9.643
P615	Nitrite	mg/L	Macros	Head-Wade	985	≤0.014	>0.014	>0.040	>0.068	>0.096
P665	Total Phosphorus	mg/L	Fish	Head-Wade	1464	≤0.106	>0.106	>0.277	>1.002	>1.726
P70300	Total Dissolved Solids	mg/L	Fish	Head-Wade	1464	≤453.8	>453.8	>558.0	>651.2	>744.5
P940	Chloride, Total	mg/L	Fish	Head-Wade	1464	≤40.00	>40.00	>120.0	>184.9	>249.8
P945	Sulfate, Total	mg/L	Macros	Head-Wade	985	≤58.27	>58.27	>73.10	>83.45	>93.81
P94	Conductivity	µS/cm	Fish	Head-Wade	1464	≤739	≥739	>1038	>1208	>1378
P299	Mean Dissolved Oxygen	mg/L	Macros	Head-Wade	985	≥9.42	<9.42	<9.25	<6.11	<3.05
DO_MAX	Maximum DO	mg/L	Macros	Head-Wade	985	≤10.36	≥10.36	>12.21	>14.24	>16.28
DO_MIN	Minimum DO	mg/L	Macros	Head-Wade	985	--	≤8.47	>7.55	>8.19	>8.84
P310	BOD (5-Day)	mg/L	Macros	Head-Wade	985	≤1.30	>1.30	>2.35	>3.45	>4.54
P610	Total Ammonia	mg/L	Macros	Head-Wade	985	≤0.084	>0.084	>0.100	>0.190	>0.280
P625	Total Kjeldhal Nitrogen	mg/L	Macros	Head-Wade	985	≤1.07	>1.07	>1.12	>1.63	>2.14

Table 8. Biological effect thresholds derived from Northeast Illinois streams and rivers for selected sediment chemical parameters as part of the NE IL IS development and used to assess results from the Year 2 Des Plaines River study area. The most limiting of the fish or macroinvertebrate assemblages for each parameter are indicated along with thresholds for excellent, good, fair, poor, and very poor biological condition.

Parameter Code	Variable Name	Units	Limiting Assemblage	Site Size	Sample N	Excellent	Good	Fair	Poor	Very Poor
Sediment Chemistry Parameters										
P1003	Arsenic	mg/kg	Macros	Head-Wade	985	--	<8.65	>8.65	>15.82	>23.67
P1028	Cadmium	mg/kg	Macros	Head-Wade	985	--	<0.933	>0.745	>1.354	>1.963
P1029	Chromium	mg/kg	Macros	Head-Wade	985	<20.53	>20.53	>23.30	>26.22	>29.15
P1043	Copper	mg/kg	Macros	Head-Wade	985	<19.00	>19.00	>29.78	>40.45	>51.12
P1052	Lead	mg/kg	Macros	Head-Wade	985	<15.50	>15.50	>24.80	>33.04	>41.27
P1053	Manganese	mg/kg	Macros	Head-Wade	985	<841.0	>841.0	>845.5	>996.8	>1148
P1068	Nickel	mg/kg	Macros	Head-Wade	985	--	<19.50	>19.50	>22.52	>25.53
P1093	Zinc	mg/kg	Macros	Head-Wade	985	<75.00	>75.00	>100.0	>133.9	>167.8
P34203	Acenaphthylene	µg/kg	Macros	Head-Wade	985	--	<86.38	>86.38	>103.6	>120.9
P34208	Acenaphthene	µg/kg	Macros	Head-Wade	985	--	<84.25	>84.25	>104.8	>125.3
P34223	Anthracene	µg/kg	Macros	Head-Wade	985	--	<78.00	>78.00	>119.9	>161.8
P34233	Benzo(b)fluoranthene	µg/kg	Macros	Head-Wade	985	--	<520.8	>520.8	>1437	>2354
P34245	Benzo(k)fluoranthene	µg/kg	Macros	Head-Wade	985	--	<207.0	>207.0	>434.7	>662.4
P34250	Benzo(a)pyrene	µg/kg	Macros	Head-Wade	985	--	<230.0	>230.0	>798.3	>1367
P34262	Delta-BHC	µg/kg	Macros	Head-Wade	985	--	<2.098	>2.098	>6.19	>10.28
P34323	Chrysene	µg/kg	Macros	Head-Wade	985	--	<266.0	>266.0	>958.3	>1651
P34379	Fluoranthene	µg/kg	Macros	Head-Wade	985	--	<774.0	>774.0	>2432	>4091
P34384	Fluorene	µg/kg	Macros	Head-Wade	985	--	<84.25	>84.25	>104.8	>125.3
P34406	Indeno(1,2,3-cd)pyrene	µg/kg	Macros	Head-Wade	985	--	< 260.5	>260.5	>623.3	>986.2
P34445	Naphthalene	µg/kg	Macros	Head-Wade	985	--	< 86.38	>86.38	>103.6	>120.9
P34464	Phenanthrene	µg/kg	Macros	Head-Wade	985	--	< 243.5	>243.5	>803.3	>1363
P34472	Pyrene	µg/kg	Macros	Head-Wade	985	--	< 393.0	>393.0	>1570	>2747
P34524	Benzo(g,h,i)perylene	µg/kg	Macros	Head-Wade	985	--	< 335.0	>335.0	>792.1	>1249
P34529	Benzo[a]anthracene	µg/kg	Macros	Head-Wade	985	--	< 239.0	>239.0	>699.4	>1160
P34559	Dibenz(a,h)anthracene	µg/kg	Macros	Head-Wade	985	--	< 101.0	>101.0	>167.3	>233.7

assignment of causes of biological impairment provided that there was a logical linkage of the chemical exceedance with the biological impairment. The chemical results are also displayed graphically for selected parameters and in tables of exceedances of effect thresholds for select parameter groups for both water column and sediment chemistry results. With the exception of D.O. there were no exceedances of parameters that have IEPA water quality criteria.

Demand and Nutrient Related Parameters

Demand and nutrient related parameters consist of those related to the discharges of treated and untreated sewage, organic enrichment from point and nonpoint sources, nutrient parameters and their effects, and physical parameters such as total suspended solids, turbidity, and temperature.

Dissolved Oxygen (D.O.)

Exceedances of dissolved oxygen (D.O.) were assessed with continuous data obtained from Datasonde deployments during August. Short-term deployments of Datasonde continuous recorders in mid-August 2018 recorded exceedances of parts of the IEPA D.O. criteria (Figure 6). All of the deployments were made after August 1 hence the minimum was evaluated against the 3.5 mg/L criterion and the 6 mg/L 7-day average criterion. There was insufficient data to evaluate the weekly and rolling average aspects of the IEPA D.O. criteria, so the median was compared to the weekly average of 6.0 mg/L for screening purposes. Exceedances of the 3.5 mg/L minimum criterion occurred at three (3) sites and were the most pronounced at site 13-4 (RM 102.9) just upstream from the confluence with Mill Creek where nearly one-half of the values were below 3.5 mg/L. Exceedances of the minimum also occurred at the upstream most site (13-6; RM 109.3) and at site 13-3 (RM 98.7) at U.S. Rt. 41 the latter approaching 25% of the readings. Median values were used to assess exceedances of the 6.0 mg/L average criterion which occurred at four (4) sites, 13-6 (RM 109.3), 13-4 (RM 102.9), 13-3 (RM 98.7), and 13-1 (RM94.2). Of these the median of just below 4.0 mg/L at 13-4 and just above 4.0 at 13-3 were the largest exceedances of the average criterion. The remaining two exceedances were minor by comparison. All other sites met both the minimum and average D.O. criteria. Only two sites 13-5 and 16-1 had diel fluctuations at or more than 6.5 mg/L. This further evaluated as symptom of excessive nutrient enrichment in the modified SNAP assessment. All of the significant exceedances with the exception of site 13-3 occurred upstream of the entry of large volumes of municipal wastewater into the Des Plaines River mainstem.

Ammonia-Nitrogen (N)

Levels of ammonia-N were either below or just above or at the mean detection level (MDL) in 2015, 2016, and 2017 with no values that would suggest significant chronic or acutely toxic effects to aquatic life (Figure 7). Median values in 2018 were more frequently detected and higher than in the three preceding years. All values were either at the boundary of the good range or within the lower fair range. The two highest values in the fair range included site 13-3 and site 16-7 with the highest median value in 2018 at the latter. The longitudinal pattern suggests inputs between the Wetland Research riffle and the NSWRD Gurnee WRF and with the

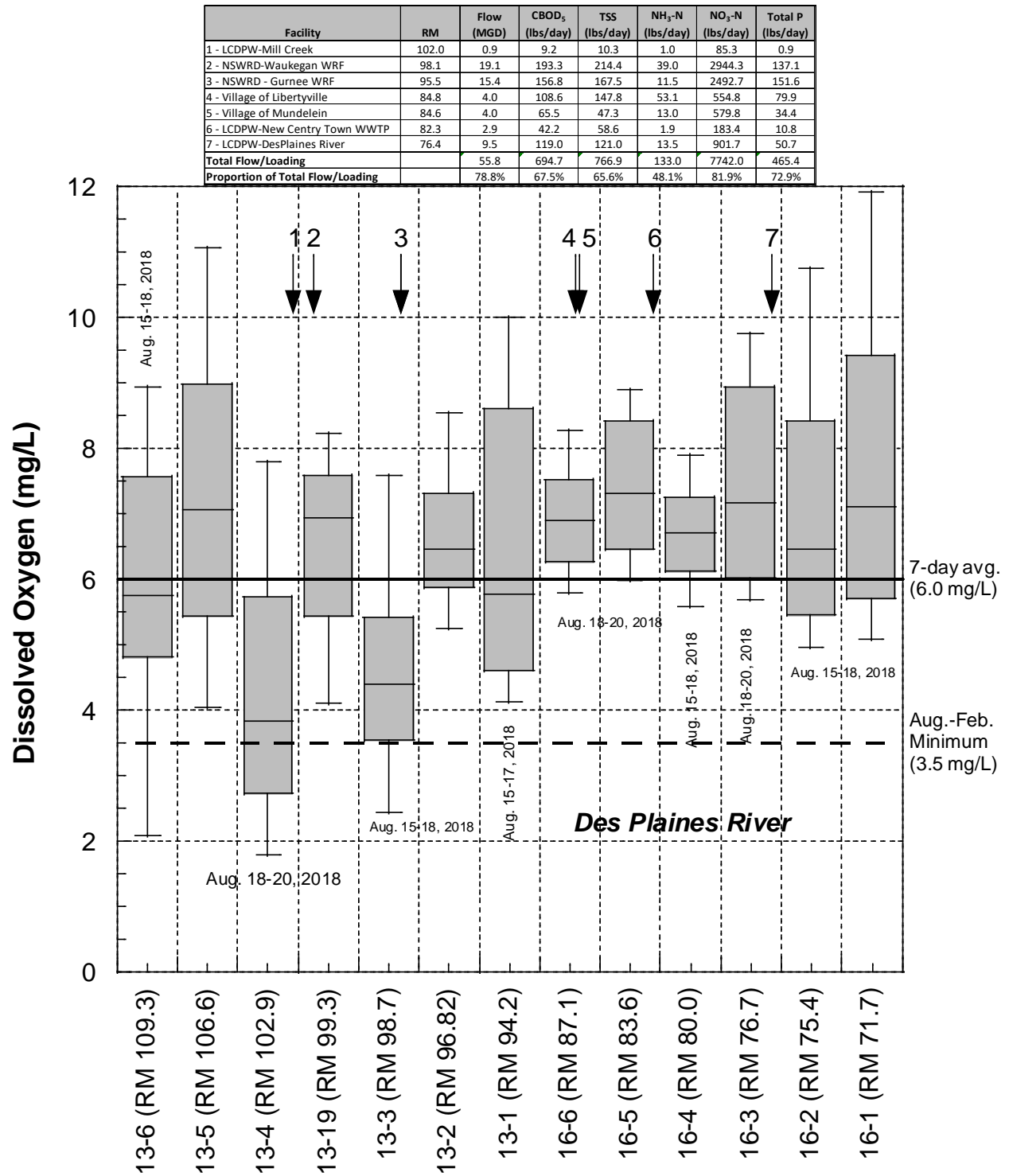


Figure 6. Dissolved oxygen (D.O.) concentrations (mg/L) measured continuously by Datasondes deployed for 3-4 day periods during August 15-18 and 18-20, 2018 at 13 locations in the 2018 Year 2 study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The IEPA August-February minimum (3.5 mg/L) and the 7-day average D.O. criteria are shown by solid and dashed lines. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

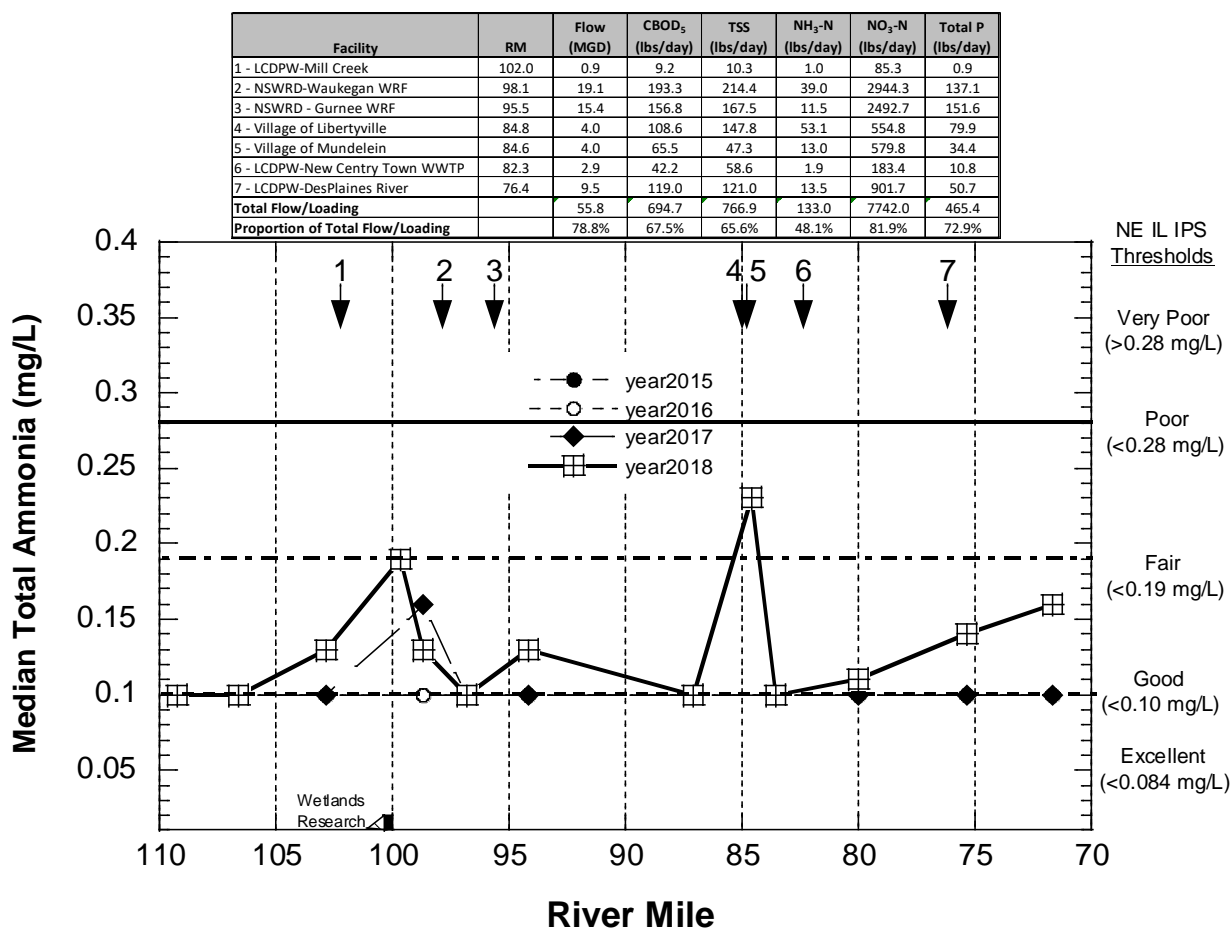


Figure 7. Concentrations of median ammonia-N in the upper Des Plaines River mainstem during June-October 2018. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

highest median value occurring immediately downstream from the Libertyville and Mundelein WWTPs the former discharging the highest loading of ammonia-N in 2018. A sharp decline occurred at 16-5 with values increasing through the low to mid fair range downstream. There were no measured ammonia-N values that exceeded the Illinois WQS criteria.

Total Phosphorus

Median total phosphorus levels were consistently low and within the good range of the IPS derived threshold at all sites upstream from the entry of the largest point sources (NSWRD Waukegan WRF; number 2 in Figure 8) in all years 2015-18. In 2018 median total P values remained within the good range until site 16-8 where values only slightly exceeded the good

Facility	RM	Flow (MGD)	CBOD ₅ (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)	NO ₃ -N (lbs/day)	Total P (lbs/day)
1 - LCDPW-Mill Creek	102.0	0.9	9.2	10.3	1.0	85.3	0.9
2 - NSWRD-Waukegan WRF	98.1	19.1	193.3	214.4	39.0	2944.3	137.1
3 - NSWRD - Gurnee WRF	95.5	15.4	156.8	167.5	11.5	2492.7	151.6
4 - Village of Libertyville	84.8	4.0	108.6	147.8	53.1	554.8	79.9
5 - Village of Mundelein	84.6	4.0	65.5	47.3	13.0	579.8	34.4
6 - LCDPW-New Centry Town WWTP	82.3	2.9	42.2	58.6	1.9	183.4	10.8
7 - LCDPW-DesPlaines River	76.4	9.5	119.0	121.0	13.5	901.7	50.7
Total Flow/Loading		55.8	694.7	766.9	133.0	7742.0	465.4
Proportion of Total Flow/Loading		78.8%	67.5%	65.6%	48.1%	81.9%	72.9%

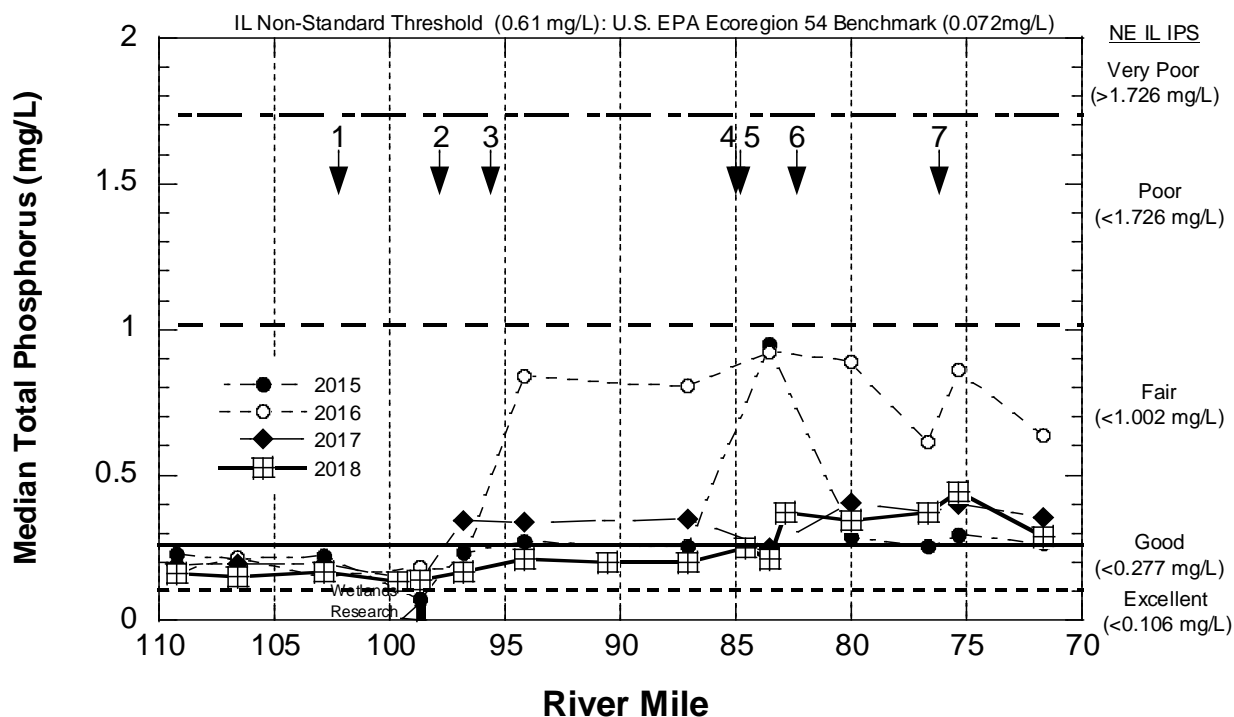


Figure 8. Concentrations of median total phosphorus in the upper Des Plaines River mainstem during June-October 2018. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

threshold in the remainder of the mainstem. Levels in prior years were higher particularly in 2016 under persistent low river flows (see Figure 4) when all values downstream from the NSWRD Gurnee WRF were in the upper fair range. With the exception of a single high value in 2015 at site 16-8. The role of total P (and other indicators) as a contributor to overall nutrient enrichment effects was evaluated as part of the modified SNAP procedure (Ohio EPA 2015b) discussed later.

Total Nitrate-N (NO₃-N)

Median total nitrate-N was well within the IPS exceptional threshold (<3.767 mg/L) downstream to site 16-6 and with little variation between years excepting higher values of >1.0-3.5 mg/L in 2018 within the physically modified upper mainstem (Figure 9). Downstream from 16-6 median values were barely within the good range in 2018. Values increased markedly into the poor range (>9.643 mg/L) downstream from the Lake Co. New Century Town WWTP extending to just upstream from Aptakisic Creek which receives effluent from the Lake Co. Des Plaines River WWTP. Concentrations rapidly declined downstream of this point to the

Facility	RM	Flow (MGD)	CBOD ₅ (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)	NO ₃ -N (lbs/day)	Total P (lbs/day)
1 - LCDPW-Mill Creek	102.0	0.9	9.2	10.3	1.0	85.3	0.9
2 - NSWRD-Waukegan WRF	98.1	19.1	193.3	214.4	39.0	2944.3	137.1
3 - NSWRD - Gurnee WRF	95.5	15.4	156.8	167.5	11.5	2492.7	151.6
4 - Village of Libertyville	84.8	4.0	108.6	147.8	53.1	554.8	79.9
5 - Village of Mundelein	84.6	4.0	65.5	47.3	13.0	579.8	34.4
6 - LCDPW-New Centry Town WWTP	82.3	2.9	42.2	58.6	1.9	183.4	10.8
7 - LCDPW-DesPlaines River	76.4	9.5	119.0	121.0	13.5	901.7	50.7
Total Flow/Loading		55.8	694.7	766.9	133.0	7742.0	465.4
Proportion of Total Flow/Loading		78.8%	67.5%	65.6%	48.1%	81.9%	72.9%

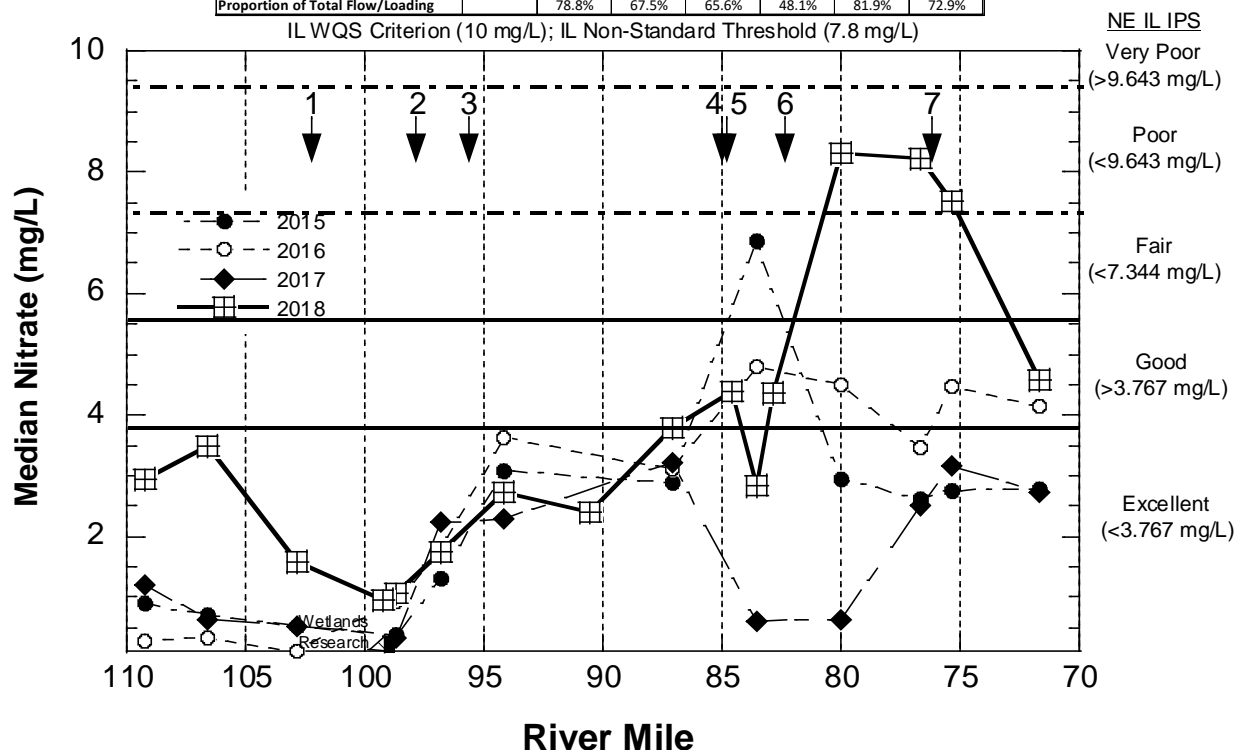


Figure 9. Concentrations of median total nitrate-N in the upper Des Plaines River mainstem during June-October 2018. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

good range through the remainder of the mainstem in 2018. The results in other years were quite variable in the lower reach of the mainstem, but were in the good or exceptional range and with only one fair range value recorded in 2015. There was no apparent pattern related to effluent loadings in 2018 as nitrate-N values downstream from the two largest loading sources (NSWRD Waukegan and Gurnee WRFs; see table above Figure 9). The role of total nitrate-N and other indicators as a contributor to overall nutrient enrichment effects was considered as part of the modified SNAP procedure (Ohio EPA 2015b).

Total Kjeldahl Nitrogen (TKN)

Median total organic nitrogen as measured by Total Kjeldahl Nitrogen (TKN), an indicator of the living or recently dead fraction of sestonic algae, is an informative indicator of nutrient enrichment. While TKN is not a direct effect parameter, it is indicative of the effects of organic enrichment by nitrogenous biomass. Median TKN values exceeded the poor and very poor IPS thresholds at all except two sites (13-5 and 16-1) which were in the fair range (Figure 10). The 2018 values were also well above values in 2015-17 which with the exception of the upstream

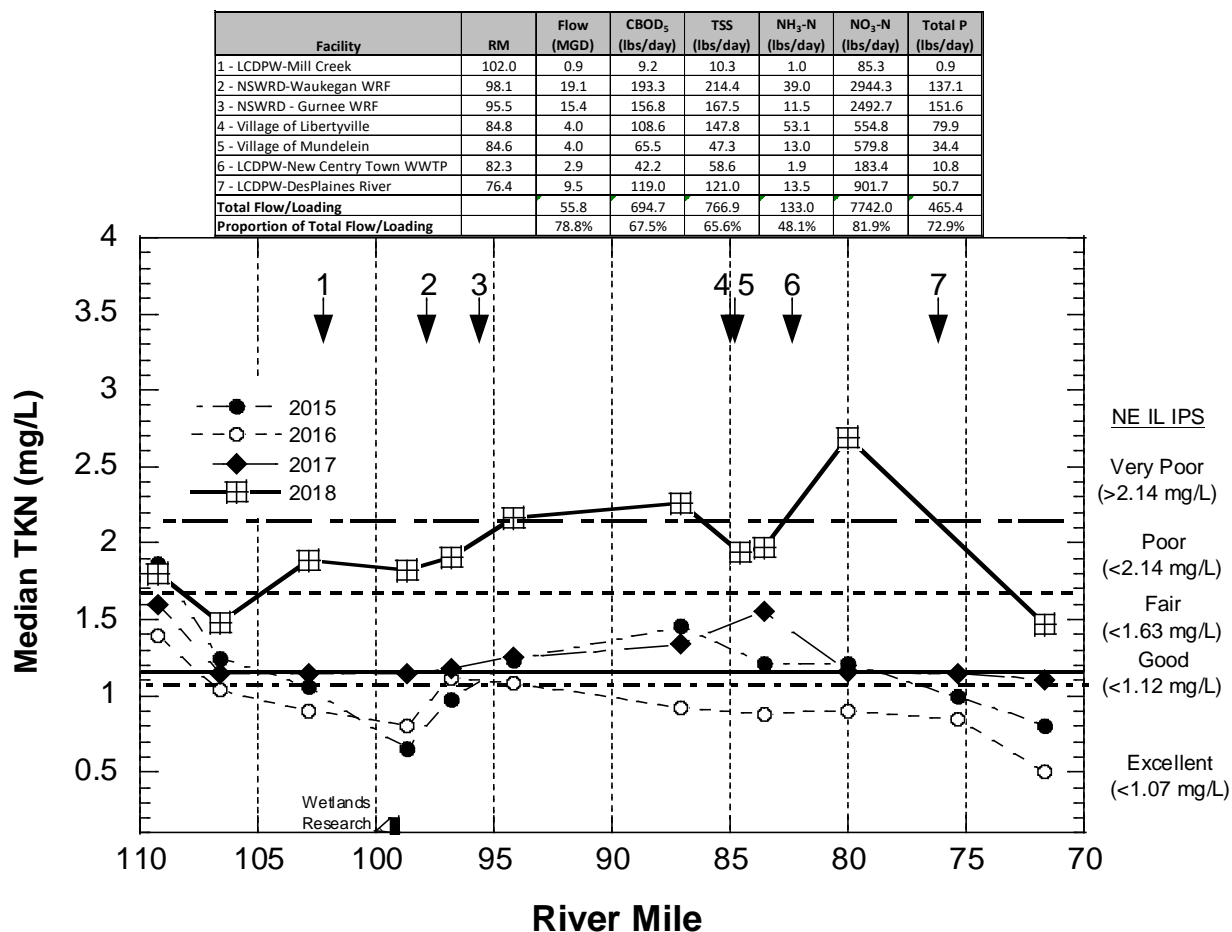


Figure 10. Concentrations (mg/L) of median total Kjeldahl nitrogen (TKN) in the upper Des Plaines River mainstem during June-October 2015-18. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

most site (13-6) and three mid-river (16-6, 16-7, and 16-5) sites were mostly in the good and even exceptional ranges. The 2018 TKN results roughly track with the ammonia-N results, but are the most similar in that the results for each were clearly higher than in prior years. Unlike the tributary results in 2017 (MBI 2018) there is not a distinct relationship with the flow regime of any particular year. The role of TKN and other indicators as a contributor to overall nutrient enrichment effects was considered as part of the modified SNAP procedure.

Total Suspended Solids

Total suspended solids (TSS) can reflect either inorganic suspended sediment and/or organic matter in the form of sestonic algae. While all median TSS values (mg/L) were in the good or exceptional range in all years, the longitudinal pattern shows the influence of nonpoint source inputs and their effect combined with the altered hydrology and habitat at the three upstream most sites (Figure 11, upper). TSS values were the highest at these sites especially in 2018 and declining by about 50% downstream of the full effect of the two largest volume wastewater

discharges (NSWRD Waukegan and Gurnee WRFs). Turbidity (NTUs) followed a similar longitudinal pattern, but median values were in the fair and poor range downstream to site 13-1 (Figure 11, lower). Because TSS and Turbidity can reflect the effects of nutrient enrichment they are included in the modified SNAP procedure.

Nutrient Effects Assessment

The impact of nutrients on aquatic life has been well documented (e.g., Allan 2004), but the derivation of criteria and their form and application are only just now emerging. Because of the widely varying efforts to develop nutrient criteria by the States, conflicting U.S. EPA oversight, and the potential cost of additional nutrient controls it has been a controversial issue (Evans-White et al. 2014). Unlike toxicants, the influence of nutrients on aquatic life is indirect and primarily via their influence on algal photosynthesis and respiration and the resulting increased magnitude of diel D.O. swings and by the biochemical oxygen demand exerted by algal decomposition. Nutrients can also affect food sources for macroinvertebrates and fish and the response of aquatic life to elevated nutrients is co-influenced by habitat (e.g., substrate composition), stream flow (e.g., scouring and dilution), temperature, and exposure of the water column to sunlight. Illinois is the leading state in terms of nitrogen (16.8%) and phosphorus (12.9%) loadings exported towards the Gulf of Mexico via the Illinois and Upper Mississippi Rivers where an anoxic zone has developed (U.S. EPA 2008). In Illinois, as in neighboring Midwestern states that drain to the Mississippi River, efforts are underway to modernize nutrient water quality criteria. However, nutrient export is not the only concern – local impacts are also important and the focus of this evaluation is on local effects in the upper Des Plaines River mainstem.

The combined effects of nutrient enrichment were assessed to supplement the preceding descriptions of concentrations of each of the key nutrient related parameters. A multi-parameter approach modified from the Ohio SNAP method (Ohio EPA 2015a) and the newer large rivers methodology (Miltner 2018), and as described in the Methods section, was employed in a manner similar to its first use in the Year 1 study area in 2017 (MBI 2018). A new addition to the assessment of nutrient impacts is a Nutrient Ranking Index (NRI) that is part of the NE IL IPS outputs (MBI 2020; Appendix E). The NRI consists of a summed ranking of each of the individual nutrient or nutrient-related stressor parameters with each weighted based on a tightness of fit coefficient (FIT). At this point it is a standalone indicator that is compared to the modified SNAP outcome.

The results are detailed in a matrix that shows the fish and macroinvertebrate IBIs, the QHEI score, total P, nitrate-N, TKN, the maximum and minimum D.O. (based on Datasondes), the width of the diel D.O. swing, benthic chlorophyll a (as biomass), an overall rating of the degree of nutrient enrichment based on the frequency and magnitude of exceedances of thresholds for the aforementioned indicators and parameters, and the NRI for 13 sites in the 2018 study area (Table 10). The overall degree of nutrient enrichment effects are represented by five narrative ratings of the Enrichment Status that results from the degree to which each of the nutrient

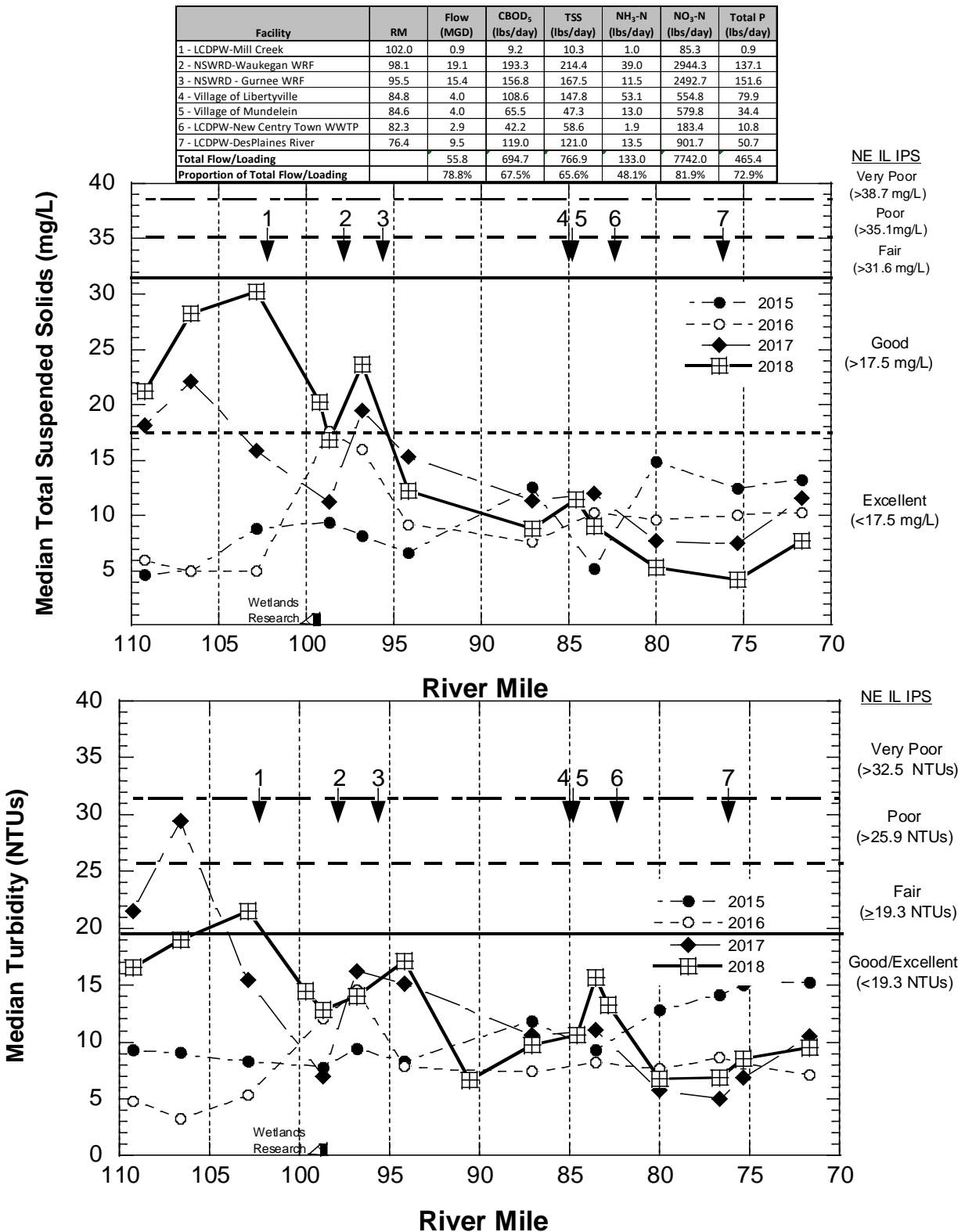


Figure 11. Concentrations (mg/L) of median total suspended solids (TSS, upper) and turbidity (NTUs, lower) in the upper Des Plaines River mainstem during June-October 2015-18. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

Table 9. Results of applying an interim modified Stream Nutrient Assessment Procedure to 13 sites in the 2018 Year 2 study area. Descriptions of how each result reflects the degree of nutrient enrichment effects and results in an assignment of enrichment status are at the bottom of the matrix along with the source of the narrative thresholds for each parameter. Biological sampling sites that lacked sufficient D.O., chemical, and chlorophyll a data are included for comparison of the biological and habitat results.

Site ID	River Mile	Drainage Area (mi. ²)	fIBI	mIBI	QHEI	AOL Attainment Status	TP (mg/L)	Nitrate (mg/L)	Max. D.O. (mg/L)	Min. D.O. (mg/L)	D.O. Swing (mg/L)	D.O. Swing Narrative	Benthic Chloro-phyll a (mg/m ²)	Benthic Chloro-phyll a Narrative	VSS (mg/L)	TKN (mg/L)	Turbidity (NTUs)	Sestonic Chloro-phyll a (mg/L)	Enrichment Status	Biological Nutrient Index	Rationale for Enrichment Status	
13-6	109.3	123.67	33.5	33.0	58.5	NON - Fair	0.179	2.868	8.93	2.08	6.46	High	21.90	Very Low	4.53	2.93	39.8	15.5	Enriched	12.2	High DO Swing, Very High TKN, Very High TSS	
13-5	106.6	137.29	29.5	20.7	50.0	NON - Poor	0.141	3.050	11.06	4.04	6.51	Wide	16.60	Very Low	4.35	1.69	36.3	8.6	Highly Enriched	9.0	Very High DO Swing, High TKN, Very High Turbidity	
13-4	102.9	145.55	26.5	29.9	59.0	NON - Fair	0.185	2.071	7.79	1.78	5.61	High	28.00	Very Low	6.00	2.56	38.1	11.3	Highly Enriched	11.1	High DO Swing, Very High TKN, Very High Turbidity	
13-18	99.72	213.17	30.0	35.9	47.0	NON-Fair																
13-19	99.3	212.87	30.0	35.9	79.0	NON - Fair			8.22	4.09	3.14	Low	18.40	Very Low								
13-3	98.7	220.29	33.5	53.7	74.0	Partial	0.140	1.525	7.57	2.43	4.04	Moderate	30.50	Very Low	3.08	1.93	21.7	14.0	Not Nutrients	8.8	Moderate DO Swing, High TKN, Moderate Turbidity	
13-2	96.82	225.36	35.0	48.3	84.5	Partial	0.168	2.923	8.53	5.25	2.85	Low	34.30	Very Low	3.87	2.03	28.1	13.1	Likely Nutrients	10.1	High TKN, High Turbidity	
13-1	94.2	232.03	42.5	60.7	78.5	FULL	0.235	3.932	9.99	4.12	5.87	High	33.50	Very Low	3.28	2.69	27.1	4.2	Not Nutrients	12.9	Full AQLU Attainment	
13-16	90.6	253.8	41.0	55.2	72.5	FULL																
16-6	87.1	261.41	42.0	54.7	74.0	FULL	0.252	6.920	8.27	5.79	2.18	Low	20.70	Very Low	2.04	2.18	13.0		Not Nutrients	16.7	Full AQLU Attainment	
16-7	84.6	266.5	41.5	47.5	80.5	FULL																
16-5	83.6	268.07	32.5	56.0	67.0	Partial	0.261	2.830	8.90	5.98	2.87	Low			4.44	2.18	12.4	62.0	Likely Nutrients	11.4	Very High TKN	
16-8	82.9	268.9	33.5	41.7	72.5	Partial																
16-4	80.0	273.21	37.0	52.0	70.0	Partial	0.378	7.998	7.88	5.57	1.94	Normal	32.80	Very Low	1.68	2.52	10.7		Likely Nutrients	15.8	Very High TKN, High Nitrate, Moderate TP	
16-3	76.7	314.68	38.0	54.3	73.0	Partial	0.345	6.950	9.75	5.68	4.07	Moderate	14.70	Very Low			11.3		Not Nutrients	8.2	Moderate DO Swing, Moderate TP, Moderate Nitrate	
16-2	75.4	323.96	42.0	55.2	59.8	FULL	0.379	6.770	10.75	4.96	5.68	High	31.40	Very Low	1.78		15.1		Likely Nutrients	8.1	Hi DO Swing, Moderate TP, Moderate Nitrate	
16-1	71.7	358.68	40.5	35.8	74.5	NON - Fair	0.271	4.690	11.92	5.07	6.79	Wide	26.00	Very Low	1.97	2.05	12.4	6.3	Likely Nutrients	12.7	Very High DO Swing, High TKN	
Condition Category Thresholds	Excellent	≥50	>73	>84.5	FULL	≤0.106	≤3.77	<10.36	>6.9	< 2.0 mg/L	Normal	< 60 mg/m ²	Very Low	<5.0	<1.07				Not Nutrients	<10		
	Good	>41-49	41.8-72.9	>75.9	FULL	>0.106-0.277	>3.77-5.05	>10.36-12.2	6-6.9	2.0-4.0 mg/L	Low	60-150 mg/m ²	Low	5.0-7.77	1.07-1.12	<19.8	<5.0		Not Nutrients	10-15		
	Fair	30-41	30-41.7	<75.9	PARTIAL	>0.277-1.02	>5.05-7.34	>12.2-14.2	4.0-5.9	4.0-5.0 mg/L	Moderate	150-320 mg/m ²	Moderate	7.77-9.83	1.12-1.63	18.8-25.9	>5.0		Likely Nutrients	15-25		
	Poor	>15-29	>15-29	<50.1	NON-Fair	>1.02-1.726	>7.34-9.64	>14.2-16.3	2.0-3.9	5.0-6.5 mg/L	High	150-320 mg/m ²	High	9.83-11.88	1.63-2.14	25.9-32.5			Enriched	25-35		
	Very Poor	≤15	≤15	<25.0	NON-Poor	≥1.726	≥9.64	≥16.3	<2.0	>6.50 mg/L	Wide	>320 mg/m ²	Very High	>11.88	>2.14	>32.5			Highly Enriched	>35		
Source	IPS	IEPA	IEPA	IPS	IPS	IPS	IPS	IPS	IPS	IPS	MBI/SNAP	MBI/SNAP	MBI/SNAP	MBI/SNAP	IPS	IPS	IPS	MBI	MBI/SNAP	IPS		

parameters and SNAP indicators exceeded their respective thresholds, the minimum and maximum D.O., the width of the diel D.O. swing, benthic chlorophyll a, and sestonic chlorophyll a biomass. The Highly Enriched and Enriched narratives are assigned where the indicators are exceeded in terms of the number and magnitude of exceedances and are associated with a biological impairment. The Likely Nutrients narrative is where there are either an insufficient number and/or magnitude of exceedances to warrant an Enriched status, thus it serves as an indication where a threat for nutrient enrichment exists. The Not Nutrients narratives rule out nutrient effects as a cause of impairment and it is assigned to sites with full attainment of the General use biocriteria. Two sites (13-5 and 13-4) had a severe nutrient enrichment effect assigned and the upstream most site (13-6) was considered to be enriched. All three sites are in a hydrologically and physically modified reach of the upper mainstem, the latter reflected in fair and poor QHEI scores. All were impaired with 13-5 being in the non-poor aquatic life use attainment category. The nutrient indicators at these three sites point to nitrogenous enrichment due to excessive growths of algae and aquatic macrophytes such as that observed in 2016 under critical low flows at the Illinois-Wisconsin state line (Figure 12). This extended downstream to at least site 13-4 and possibly further except that data was lacking to conduct the modified SNAP assessment until the entry of the first wastewater treatment discharge (Lake Co. DPW Mill Creek WWTP) via Mill Creek (RM 102.0). This site is also downstream from the Wetland Research “riffle” which forms a small impoundment in the mainstem at RM 99.4 and



Figure 12. Photograph of the mainstem of the Upper Des Plaines river at the Illinois-Wisconsin state line just upstream from site 13-6 (RM 109.3) illustrating the modified channel and sluggish flow and resulting effects of nutrient enrichment.

which may be acting as a settling basin for suspended algae. The entry of permanent flows via the various WWTPs is probably the most important factor that hydrologically mitigates the almost total lack of flow upstream during extended dry weather periods and thus reducing the retention time for nutrients to exert any negative effects. This is also the reach of river where QHEI scores improved to the good and high fair ranges with the highest score in 2018 observed immediately downstream from the Wetland Research riffle.

As stated in the Methods section this remains a preliminary assessment method pending the development of a larger database of nutrient effect indicators for Northeast Illinois rivers and streams. As was observed in the 2017 Year 1 assessment (MBI 2018) the assignment of the nutrient enrichment effect ratings for the 2018 results does not appear to track closely with the two primary nutrient parameters, total P and nitrate-N. Only a few sites in the lower part of the mainstem study area had total P or nitrate-N values in the fair or poor ranges. TKN is a sometimes overlooked indicator of nutrient enrichment effects and it is recommended along with TSS as part of the Ohio EPA large river nutrient method (Miltner 2018). TKN was available at enough sites to reveal it was consistently in the poor and very poor ranges at all sites where it was measured. Turbidity serves as a potential indicator of suspended algae and it was in the very poor range at the three modified upstream sites and then declining downstream where it was consistently in the good range by site 16-6. Based on these results the predominant source of nutrient enrichment is presumably from nonpoint sources in the upper watershed and the effects are exacerbated by the combination of hydrological and physical modifications that are more prevalent in the upper mainstem and tributaries. The entry of larger volumes of permanent flow via the major wastewater treatment facilities seems to mitigate most of the negative effects that emanate from the upper watershed.

Temperature

Temperature is a controlling factor for aquatic life, hence it is important to document the thermal regime and note any apparent alterations. This was done continuously via the short-term deployment of Datasondes. Based on continuous data collected during the Datasonde deployments in mid-August 2018, there were no temperature values that exceeded the Illinois temperature standards or otherwise were of concern in terms of potential harm to aquatic life. Typically the potential for adverse thermal effects are evaluated based on the warmest period of the year and against temperature criteria that are intended to protect aquatic life. The IEPA summer maximum criterion of 32.2°C (90°F) is at the extreme upper maximum for the most sensitive riverine fish species and which is shown to be met at all times by the continuous data (Figure 13). We also used the more modernized Ohio temperature criteria that are river specific with a maximum and average criteria of 31.7°C (89.0°F) and 29.4°C (85.0°F) and these are met as well, but the maximum of 31.5°C at the uppermost and highly modified site 13-6 was the highest value measured in 2018 and was just below the Ohio maximum criterion. Otherwise, there is no reason to believe that temperatures are a widely limiting factor to the biota. The median temperature declined by 4°C downstream from the NSWRD Gurnee WRF discharge and remaining at or just above 25°C for the remainder of the upper mainstem.

Facility	RM	Flow (MGD)	CBOD ₅ (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)	NO ₂ -N (lbs/day)	Total P (lbs/day)
1 - LCDPW-Mill Creek	102.0	0.9	9.2	10.3	1.0	85.3	0.9
2 - NSWRD-Waukegan WRF	98.1	19.1	193.3	214.4	39.0	2944.3	137.1
3 - NSWRD - Gurnee WRF	95.5	15.4	156.8	167.5	11.5	2492.7	151.6
4 - Village of Libertyville	84.8	4.0	108.6	147.8	53.1	554.8	79.9
5 - Village of Mundelein	84.6	4.0	65.5	47.3	13.0	579.8	34.4
6 - LCDPW-New Centry Town WWTP	82.3	2.9	42.2	58.6	1.9	183.4	10.8
7 - LCDPW-DesPlaines River	76.4	9.5	119.0	121.0	13.5	901.7	50.7
Total Flow/Loading		55.8	694.7	766.9	133.0	7742.0	465.4
Proportion of Total Flow/Loading		78.8%	67.5%	65.6%	48.1%	81.9%	72.9%

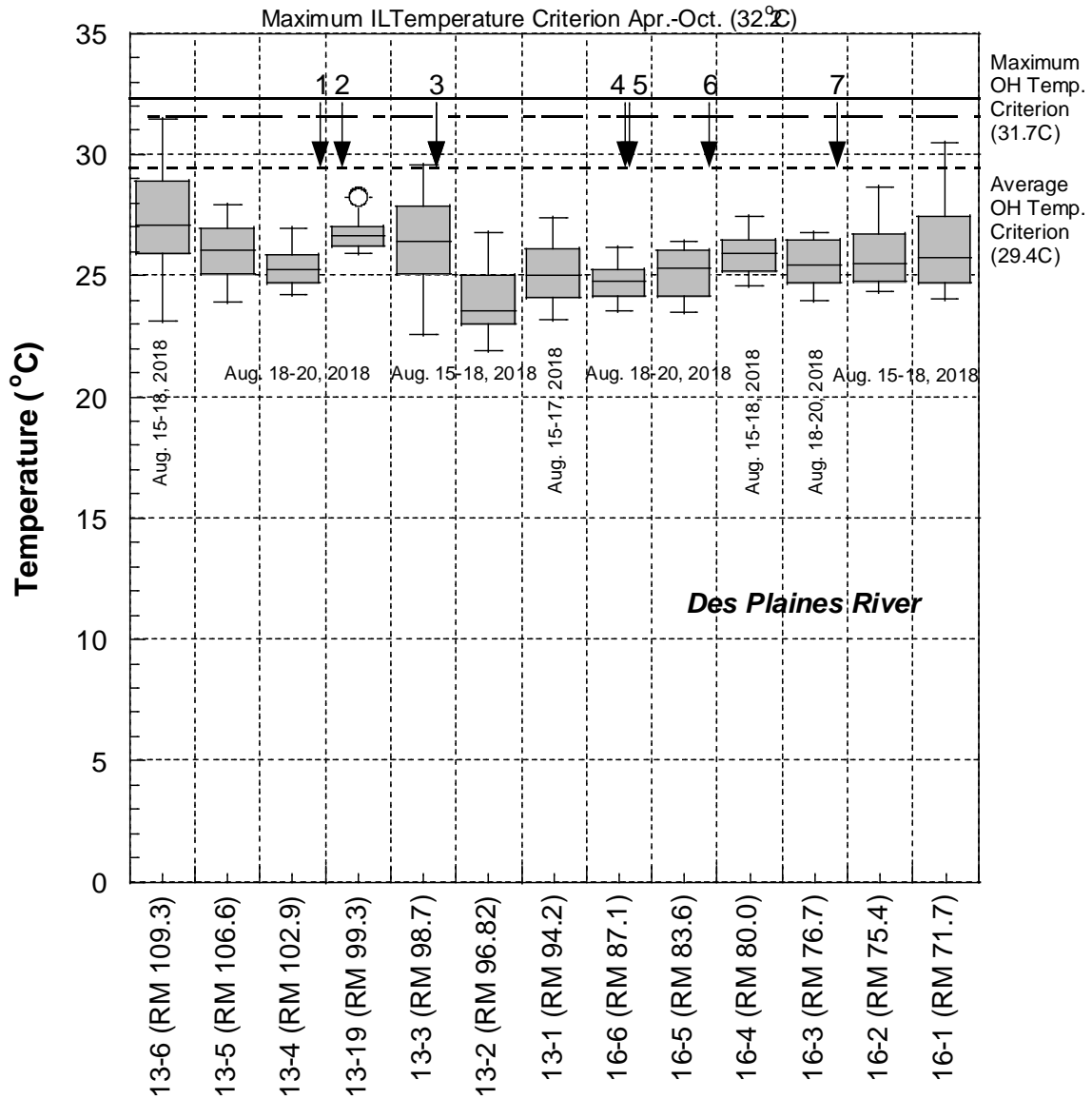


Figure 13. Temperature (°C) measured continuously by Datasondes deployed for 3-4 day periods during mid-August at 13 locations in the 2018 study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The IEPA maximum (32.2°C) and the Ohio EPA River mainstem maximum (31.7°C) and average (29.4°C) criteria are shown by solid and dashed lines. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

Ionic Strength Parameters

Ionic strength parameters are generally in the form of dissolved solutes that can be delivered to rivers and streams in runoff events and point source effluents and some are associated with urban runoff specifically. These include parameters measured in the water column and commonly include conductivity, total dissolved solids, and ions such as chlorides and sulfate. Typically our analysis has been geared to urban parameters which includes common heavy metals, but these were not analyzed in the water samples in 2018. Instead metals and organic compounds common to urban areas were analyzed in sediment samples.

Chlorides

In temperate climates such as exist in northern Illinois, dissolved materials in the form of chlorides are an emerging problem because they accumulate in soils and shallow groundwater and have been documented to reach concentrations that can threaten and impair aquatic life. Of particular concern in urban areas with high road density is the concentration of chlorides from winter road salt applications and point source loadings from water treatment blowdown. Kelly et al. (2012) identified a steadily increasing trend in chloride levels in the Illinois River at Peoria where the median increased from 20 mg/L in 1947 to nearly 100 mg/L in 2004 with high values in the 1940s of <40 mg/L rising to >300 mg/L by 2003. Chlorides do not exhibit a simple runoff and export mode of effect, but rather accumulate in near surface groundwater (Kelly 2008), soils, and land surfaces adjacent to streams. Seasonal studies have shown that elevated summer concentrations are correlated with higher and acute concentrations during late winter and spring periods (Kaushal et al. 2005). Research in New England (Kaushal et al. 2005) and Minnesota (Novotny et al. 2008) show that chlorides can accumulate in watersheds and that there is a strong association between high winter and elevated summer concentrations. Novotny et al. (2008) identified that 78% of the road salt applied in a Minnesota watershed accumulated in a given year and contributed to an increase in summer chloride concentrations.

Median total chloride concentrations (mg/L) in the upper Des Plaines River mainstem are depicted in Figure 14. Median values between all years 2015-18 were in the good or fair range of the IPS thresholds. The general pattern was a moderate increase in a downstream direction as the mainstem emerged from the agricultural and suburban setting in the upper watershed to the increasingly urbanized downstream watersheds. Median chloride values were consistently the highest in 2016 under extended low flow periods in the summer and early fall, but lowest in 2015 also under more extended periods of low flow and in contrast to the high flow events in 2017 and 2018 (see Figure 4). The downstream increase is gradual and appears to not be related to specific point source.

Conductivity

Dissolved materials are also measured by specific conductance or conductivity which is depicted in Figure 15 for continuous data and Figure 16 for grab sample data. The continuous conductivity data showed most sites with values in the good and fair ranges, except for comparatively high values at the upstream most site (13-6), a large number of low and high

Facility	RM	Flow (MGD)	CBOD ₅ (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)	NO ₃ -N (lbs/day)	Total P (lbs/day)
1 - LCDPW-Mill Creek	102.0	0.9	9.2	10.3	1.0	85.3	0.9
2 - NSWRD-Waukegan WRF	98.1	19.1	193.3	214.4	39.0	2944.3	137.1
3 - NSWRD - Gurnee WRF	95.5	15.4	156.8	167.5	11.5	2492.7	151.6
4 - Village of Libertyville	84.8	4.0	108.6	147.8	53.1	554.8	79.9
5 - Village of Mundelein	84.6	4.0	65.5	47.3	13.0	579.8	34.4
6 - LCDPW-New Centry Town WWTP	82.3	2.9	42.2	58.6	1.9	183.4	10.8
7 - LCDPW-DesPlaines River	76.4	9.5	119.0	121.0	13.5	901.7	50.7
Total Flow/Loading		55.8	694.7	766.9	133.0	7742.0	465.4
Proportion of Total Flow/Loading		78.8%	67.5%	65.6%	48.1%	81.9%	72.9%

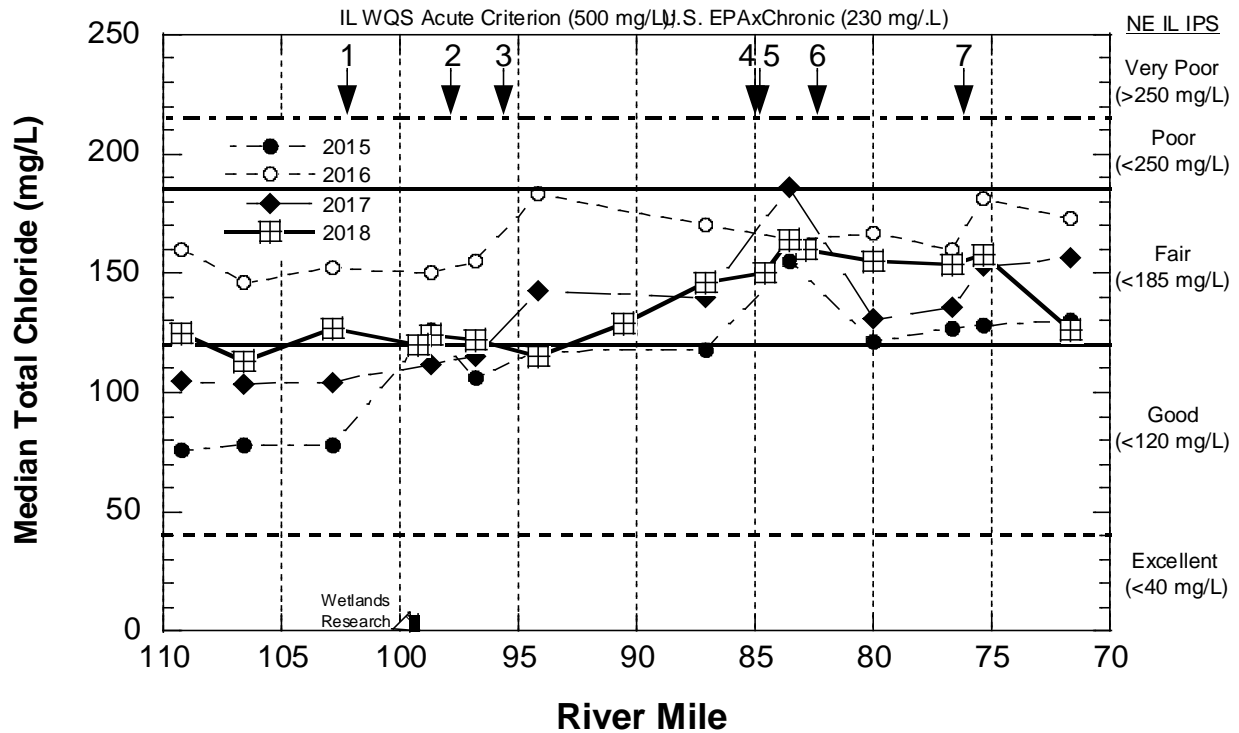


Figure 14. Concentrations (mg/L) of median total chloride in the upper Des Plaines River mainstem during June-October 2015-18. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

readings at the upstream most site are likely the result of the same hydrological and physical habitat conditions that exacerbate nutrient effects, low flows and extended retention times that allow both nutrients and dissolved materials to concentrate.

Median conductance values ($\mu\text{S}/\text{cm}$) based on grab samples from the mainstem (Figure 16) showed a response similar to that exhibited by chloride in Figure 14. Median conductance values between all years 2015-18 were in the good or fair range of the IPS thresholds. The general pattern was a moderate increase in a downstream direction as the mainstem emerged from the agricultural and suburban setting in the upper watershed to the increasingly urbanized downstream watersheds. Median conductance values were consistently the highest in 2016 under extended low flow periods in the summer and early fall, but lowest in 2015 also under more extended periods of low flow and in contrast to the high flow events in 2017 and 2018

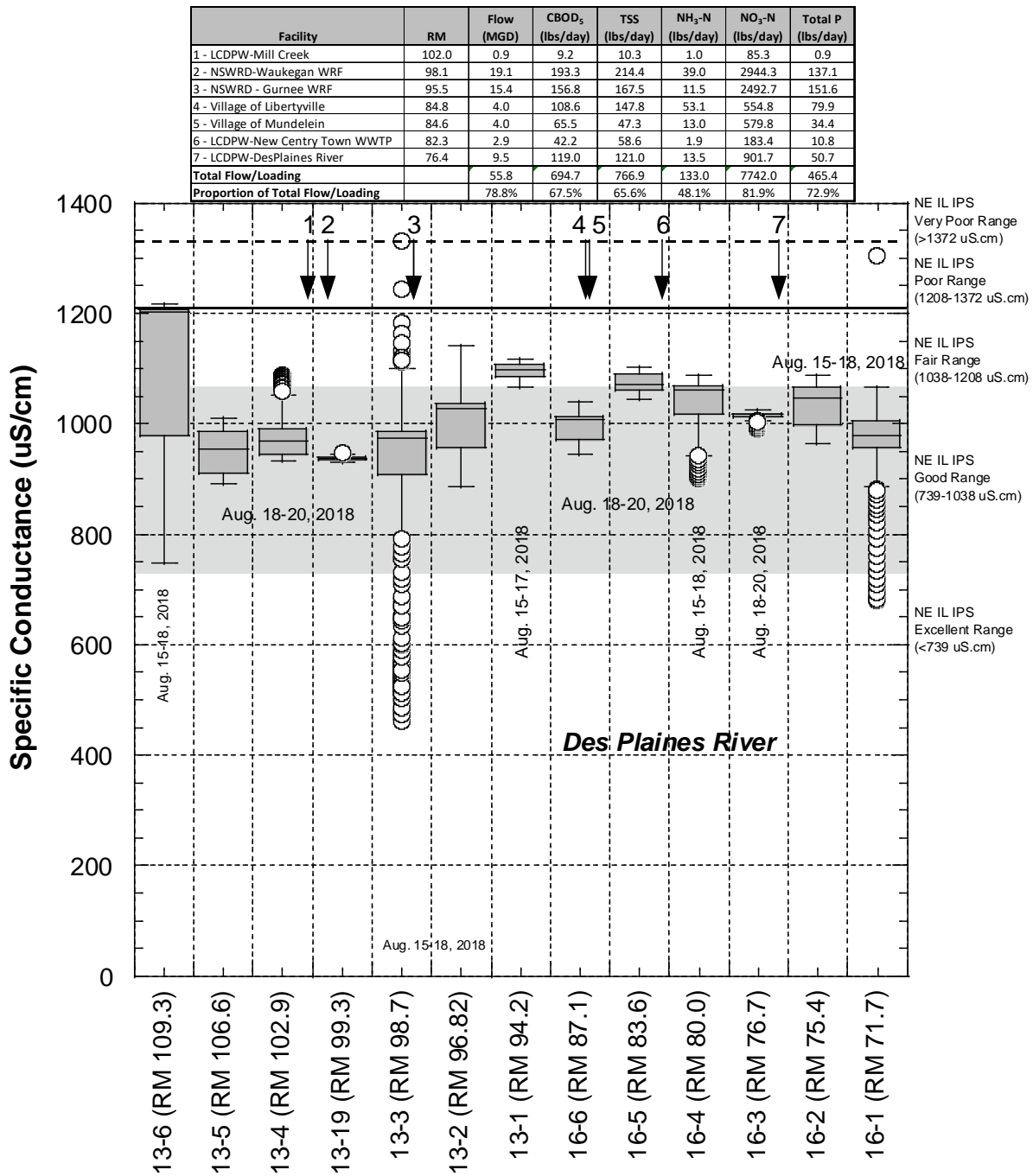


Figure 15. Specific conductance ($\mu\text{S}/\text{cm}$) measured continuously by Datasondes deployed for 3-4 day periods during mid-August at 13 locations in the 2018 study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The IPS thresholds for five narrative ratings are shown by solid and dashed lines. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

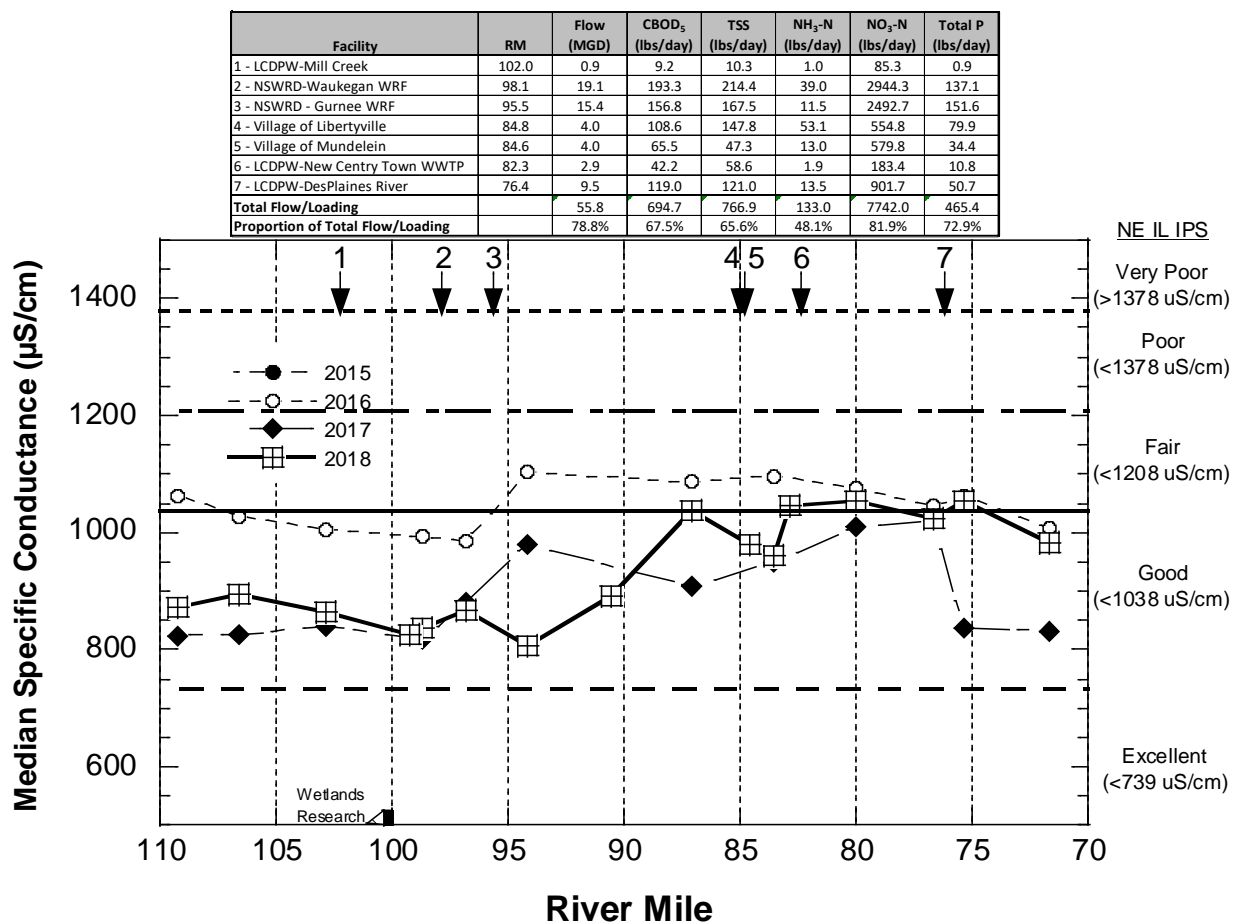


Figure 16. Median specific conductance in the upper Des Plaines River mainstem during June-October 2015-18. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 6. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

(see Figure 4). The downstream increase is gradual and appears to not be related to a specific point source.

Sediment Chemistry

Sediment samples were evaluated against guidelines compiled by McDonald et al. (2000), Illinois sediment metals guidelines (Short 1998), and the new IPS derived narrative ranges (see Table 9). The MacDonald et al. (2000) threshold effect levels (TEL) are where toxic effects are initially apparent and likely to affect the most sensitive organisms. Probable effect levels (PEL) are where toxic effects are more likely to be observed over a wider range of organism sensitivities. Short (1998) identified elevated and extremely elevated sediment metal concentrations for Illinois streams and rivers. The new IPS thresholds are based on analyses against the most sensitive species to each sediment metal and PAH parameter (MBI 2020).

Sediment metal sampling results from 2018 are summarized by concentration rating and parameter class in Table 11 and polycyclic aromatic hydrocarbon (PAHs) compounds in Table 12. PAHs result from the incomplete combustion of hydrocarbons and are a common component of stormwater runoff in urban areas – they are not a direct part of any manufacturing process.

Metals in Sediment

Elevated levels of heavy metals in sediment are commonly associated with runoff from roads and highways and industrial and municipal sources. Exceedances of the new IPS thresholds were extensive for aluminum and beryllium with numerous exceedances of poor and very poor threshold values (Table 11). These occurred as the mainstem entered and passed through the most urbanized part of the watershed and they are presumably related to nonpoint source runoff. Cadmium levels were also elevated, but mostly in the fair and poor range with the latter increasing in the lower mainstem reaches. The pattern for poor cadmium values appeared related to the entry of wastewater discharges. Manganese has been detected in prior surveys of the mainstem and tributaries. In 2018 it abruptly increased to very poor levels in the Wetland Research impoundment (13-18) and immediately downstream (13-19), declining at the next 3 sites, but increasing again to poor and very poor values through the remainder of the mainstem. This has been attributed to urban runoff with no clear pattern related to point sources. Zinc levels increased from good to fair and poor beginning at site 13-16 and remaining so through the remainder of the mainstem. This pattern appears related to the entry of the larger volumes of wastewater. Mercury exceeded MacDonald et al. (2000) TEC level at sites 16-6, 16-7, and 16-1 with the highest value of 1.04 µg/kg at 16-8 nearly reaching the IL highly elevated threshold. The remaining metals parameters were either in the good range or lacked any criteria for an evaluation.

PAH Compounds in Sediment

The levels of PAH compounds found in sediment were evaluated in a manner similar to metals, but with only the MacDonald et al. (2000) TEC and PEC and the IPS derived thresholds for five narrative categories. Most of the results were below the method detection limit, but some exceedances of the IPS thresholds appear in Table 12. Only six values were in the poor and very poor ranges. This included Benzo(b)fluoranthene with very poor values at 13-2 and 16-5, Benzo(g,h,i)perylene with very poor values at the same two sites, Indeno(1,2,3-cd)pyrene and Phenanthrene with poor values at 16-8. Sites 13-2 and 16-5 had eight (8) and seven (7), respectively, fair, poor, and very poor values the most of any site in the 2018 study area. The IPS thresholds coincide with the MacDonald et al. (2000) TEC and PEC values with the former generally less than the IPS good level and the latter only roughly consistent with the IPS very poor values. The sporadic levels of PAH contamination in the study area is largely related to urban runoff and being restricted to the mainstem as it enters more urbanized areas of the watershed. No PAHs were detected at the three upstream most sites where agricultural and suburban land uses predominate.

Table 10. Heavy metal concentrations (mg/kg) in sediment at 17 sites in the 2018 Year 2 Des Plaines River mainstem. Highlighted cells correspond to one or more of the narrative thresholds listed at the bottom.

Site ID	River Mile	Drainage Area (sq. mi.)	Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (µg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Strontium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
13-6	103.9	123.7	6,320	6.09	61.6	0.412	1.47	0.58	10.5	6.06	15.6	16,200	7.08	522	ND	12.4	ND	306	45.9	13.5	60.2
13-5	106.6	137.3	10,700	8.15	98.3	0.658	4.91	1.11	18.0	8.60	27.0	22,300	10.1	733	ND	19.0	ND	410	63.0	20.0	98.4
13-4	102.9	145.6	8,770	7.33	74.7	0.531	3.69	0.96	15.3	7.76	25.7	21,300	18.1	487	ND	16.9	ND	340	50.5	19.5	102
13-18	99.7	212.8	12,000	9.88	99.1	0.671	1.24	1.20	17.8	9.44	20.0	26,400	9.03	1,280	ND	20.8	0.172	445	41.6	21.3	88.2
13-19	99.3	213.1	12,100	10.1	105	0.675	1.04	1.24	18.0	9.59	20.1	26,500	8.78	1,340	ND	20.8	0.152	449	49.3	21.2	90.8
13-3	98.7	220.3	10,800	8.11	84.2	0.621	2.48	1.09	16.1	9.07	19.8	25,200	9.16	738	ND	18.0	ND	266	41.1	20.7	79.5
13-2	96.82	225.4	9,350	12.7	75.5	0.516	1.98	0.84	15.4	7.24	19.4	22,200	10.9	929	ND	15.3	0.088	326	34.7	17.2	89.9
13-1	94.2	232	8,180	11.7	70.8	0.477	2.78	0.73	13.6	6.50	18.8	20,300	14.1	821	ND	14.7	0.126	332	32.5	15.5	91.6
13-16	90.6	253.8	10,900	17.3	107	0.627	2.53	1.39	17.9	8.63	26.3	27,700	15.3	1,170	ND	19.2	0.231	460	41.3	19.7	124
16-6	87.1	261.3	11,200	15.7	107	0.638	2.59	1.49	18.6	8.74	26.7	27,600	14.9	1,160	0.202	19.3	0.204	432	39.8	18.9	133
16-7	84.6	266.5	9,230	12.5	97.6	0.549	2.72	1.21	17.1	7.41	26.2	23,600	14.0	1,020	0.086	16.3	0.197	470	39.0	15.7	123
16-5	83.6	268.1	10,100	13.3	110	0.586	3.57	1.43	21.2	7.88	34.5	25,000	16.6	1,020	ND	17.7	0.276	442	43.0	17.4	151
16-8	82.9	268.9	9,320	10.9	92.7	0.559	3.01	1.24	17.6	7.64	31.3	22,600	16.4	866	1.04	17.2	0.171	463	38.7	16.2	135
16-4	80	273.2	9,640	11.9	99.7	0.562	3.42	1.43	18.4	7.60	34.9	23,500	16.5	1,000	0.135	17.2	0.274	435	40.1	16.5	133
16-3	76.7	314.7	10,800	12.8	109	0.629	3.43	1.51	19.8	8.57	32.3	26,200	16.4	1,180	ND	19.6	0.328	427	41.3	17.6	147
16-2	75.4	324	9,590	11.1	109	0.567	3.42	1.45	17.9	7.79	31.9	24,400	15.4	924	ND	17.8	0.312	417	46.1	16.5	142
16-1	71.7	358.7	9,740	13.8	127	0.580	3.06	1.56	22.0	8.59	40.7	26,700	23.3	1,230	0.176	19.4	0.327	532	53.1	17.6	183
MacDonald et al. 2000	TEC	None	9.79	None	None	None	0.99	43.4	None	31.6	2000	35.8	460	0.18	22.7	1.6	None	None	None	121	
	PEC	None	33	None	None	None	4.98	111	None	149	40000	128	1100	1.06	48.6	2.2	None	None	None	459	
Short 1998	IL Elevated	None	7.2	145	None	None	2	37	None	37	26100	60	1100	0.28	26	None	None	None	None	170	
	IL Highly Elev.	None	18	230	None	None	9.3	110	None	170	53000	245	2300	1.4	45	5	None	None	None	760	
NE IL IPS	Excellent	None	None	None	None	None	None	<20.53	None	<19.00	None	<15.50	<841.0	None	None	None	None	None	None	<75.00	
	Good	<6480	<8.65	<141.0	<0.411	None	<0.933	<23.30	None	<29.78	None	<24.80	<845.5	None	<19.50	<0.483	None	<81.80	None	<100.0	
	Fair	>6480	>8.65	>141.0	>0.411	None	>0.933	>23.30	None	>29.78	None	>24.80	>845.5	None	>19.50	>0.483	None	>81.80	None	>100.0	
	Poor	>8272	>15.82	>150.3	>0.496	None	>1.354	>26.22	None	>40.45	None	>33.04	>996.8	None	>22.52	>1.261	None	>106.8	None	>133.9	
Very Poor	<10064	>23.67	>168.7	>0.581	None	>1.963	>29.15	None	>51.12	None	>41.27	>1148	None	>25.53	>2.039	None	>131.9	None	>167.8		

Table 11. Sediment PAH levels (mg/kg) in sediments at 17 sites in the 2018 Year 2 Des Plaines River mainstem. Highlighted cells correspond to one or more of the narrative thresholds listed at the bottom (TEL – threshold effect level; PEL – probable effect level; ND – not detected; gray cells have no values).

Site ID	RM	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
13-6	109.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-5	106.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-4	102.9	ND	ND	ND	ND	ND	157	ND	ND	161	ND	309	ND	ND	ND	ND	228
13-18	99.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-19	99.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-3	98.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-2	96.82	ND	ND	ND	266	444	729	414	403	663	ND	ND	350	ND	483	981	ND
13-1	94.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13-16	90.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
16-6	87.1	ND	ND	ND	ND	ND	292	ND	ND	ND	ND	367	ND	ND	ND	ND	330
16-7	84.6	ND	ND	ND	ND	ND	313	193	ND	316	ND	493	ND	155	ND	171	439
16-5	83.6	ND	ND	ND	271	456	724	438	410	732	ND	ND	358	ND	699	ND	ND
16-8	82.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	875	ND	937	ND	ND
16-4	80	ND	ND	ND	ND	150	ND	ND	152	234	ND	392	ND	ND	ND	153	317
16-3	76.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	406	ND	ND	ND	ND	349
16-2	75.4	ND	ND	ND	ND	ND	317	ND	ND	ND	ND	343	ND	ND	ND	ND	308
16-1	71.7	ND	ND	ND	ND	ND	ND	ND	863	ND	ND	ND	ND	ND	ND	ND	ND
MacDonald et al. 2000	TEC	None	None	57.2	108	150	240	170	240	166	33	423	77.4	200	176	204	195
	PEC	None	None	845	1050	1450	13,400	320	13,400	1,290	135	2,230	536	3,200	561	1,170	1,520
NE IL IPS	Exc./Good	<84.25	<86.38	<78.00	<239.0	<230	<207.0	<335.0	<520.8	<266.0	<101.0	<774.0	<84.25	<260.5	<86.38	<243.5	<393.0
	Fair	>84.25	>86.38	>78.00	>239.0	>230	>207.0	>335.0	>520.8	>266.0	>101.0	>774.0	>84.25	>260.5	>86.38	>243.5	>393.0
	Poor	>104.8	>103.6	>119.9	>699.4	>798.3	>434.7	>792.1	>1437	>958.3	>167.3	>2432	>104.8	>623.3	>103.6	>803.3	>1570
	V. Poor	>125.3	>120.9	>161.8	>1160	>1367	>662.4	>1249.0	>2354	>1651	>233.7	>4091	>125.3	>986.2	>120.9	>1363	>2747

Physical Habitat Quality for Aquatic Life - QHEI

The physical habitat of a stream or river is a primary determinant of biological quality and potential. Streams in the glaciated Midwest, left in their natural state, typically offer pool-run-riffle sequences, moderate to high sinuosity, and well-developed channels with deep pools, heterogeneous substrates, and cover in the form of woody debris, hard substrates, and aquatic macrophytes. Lower gradient streams may not offer as distinct riffle habitats and are oftentimes run and glide dominated, but can still offer a diversity of substrates, well developed pool habitats, and well developed instream cover features associated with woody debris and aquatic macrophytes. The Qualitative Habitat Evaluation Index (QHEI) categorically scores basic components of stream and riverine habitat into ranks according to the degree to which those components are found compared to a natural state, or conversely, in an altered or modified state. In the Upper Des Plaines River study area, QHEI scores and physical habitat attributes were recorded in conjunction with the fish sampling conducted at each site.

2018 Year 2 Study Area

Based on QHEI scores and the number of good and modified attributes (after Rankin 1989, 1995; Table 13 and Figure 17) overall habitat quality ranged from poor (13-18) to good (four sites) in 2018 with most of the mainstem sites in the upper fair range. The IPS derived QHEI scores for the five narrative categories were used and these are more stringent than the prior usage of narrative ratings from Ohio. The upper most four sites had fair and one poor QHEI with the values in the lower portion of the fair range (50.1-75.9). This was the result of the extensive hydrological and physical modifications in the upper mainstem and watershed. The small impoundment formed by the Wetland Research riffle had the lowest QHEI score of 47.0 which is poor. QHEI scores increased to the high fair and good range beginning at the site (13-19) immediately downstream from the Wetland Research riffle. Only two sites (16-5 and 16-2) had QHEI scores less than 70.

The fair and poor QHEI scores at the upper most four sites were the result of a predominance by high and moderate influence modified attributes (Table 13). High influence modified attributes included sparse or no cover (13-5 and 16-2), channelized or no recovery (13-18), and silt-muck substrates (13-18). Moderate influence modified attributes were numerous with the highest number (7) occurring at the four upstream most sites and also at site 16-5. The ratio of modified:good attributes were fair (>2.00) at two of these sites and poor (>4.00) at two sites. Ratios ≥ 2.0 generally indicate a greater number of habitat modifications that would require direct mitigation to reverse. It also means that meeting the General Use biocriteria would likely be precluded by habitat regardless of water quality conditions raising concerns about use attainability (Rankin 1995). The sites with ratios <2.0 is the result of having fewer modified attributes coupled with enough good attributes to offset the negative influence of the modified attributes. Fast current types were absent at all except five (5) sites which reflected the generally low gradient character of the mainstem. Sand substrates were observed at all except the three (3) upstream most sites. Other commonly occurring modified attributes included moderate-extensive site and riffle embeddedness which is consistent with previous findings

Table 12. QHEI matrix of good and modified habitat attributes for sites in the Upper Des Plaines River Year 2 study area during 2018. QHEI scores are shaded in accordance with IPS derived ranges; green – Good; yellow – Fair; orange – poor. Ratios of poor to good attributes are shaded as yellow (fair; >2.00), orange (poor; >4.00), and red (very poor; >10.00)

Site ID	River Mile	QHEI	Good Habitat Attributes										High Influence Modified Attributes					Moderate Influence Modified Attributes										Ratios			
			No.Channelization Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	“Good” Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	<= 2 Cover Types	Intermittent Flow/Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle	No Riffle	Poor Habitat Attributes
Des Plaines River Mainstem (2018)																															
13-6	109.3	58.5		■				■			3				0	●	●			●	●			●	●	●		7	0.00	2.33	
13-5	106.6	50.0		■				■			2			●	1	●	●			●	●			●	●		●	7	0.50	4.00	
13-4	102.9	59.0		■				■			3				0	●	●			●	●			●	●		●	7	0.00	2.33	
13-18	99.72	47.0						■			2	●	●		2		●	●			●	●			●	●		●	7	1.00	4.50
13-19	99.30	79.0	■	■	■	■	■	■	■	■	7				0		●	●						●	●			4	0.00	0.57	
13-3	98.7	74.0	■	■	■	■	■	■	■	■	6				0			●			●			●	●	●		5	0.00	0.83	
13-2	96.82	84.5	■	■	■	■	■	■	■	■	9				0			●									1	0.00	0.11		
13-1	94.2	78.5	■	■	■	■	■	■	■	■	8				0			●							●		2	0.00	0.25		
13-16	90.6	72.5	■	■	■	■	■	■	■	■	7				0		●	●				●			●	●	5	0.00	0.71		
16-6	87.1	74.0	■	■	■	■	■	■	■	■	8				0			●						●		●	3	0.00	0.38		
16-7	84.6	80.5	■	■	■	■	■	■	■	■	8				0			●							●	●	2	0.00	0.25		
16-5	83.6	67.0	■	■		■		■		■	4				0		●	●			●	●			●	●	7	0.00	1.75		
16-8	82.9	72.5	■	■	■	■	■	■	■	■	8				0			●			●			●	●	●	4	0.00	0.50		
16-4	80.0	70.0	■	■	■	■	■	■	■	■	5				0	●		●			●	●			●	●	5	0.00	1.00		
16-3	76.7	73.0	■	■	■	■	■	■	■	■	6				0			●			●	●			●	●	5	0.00	0.83		
16-2	75.4	59.8	■	■	■	■	■	■	■	■	6			●	1		●	●			●	●			●	●	6	0.17	1.17		
16-1	71.7	74.5	■	■	■	■	■	■	■	■	8				0		●	●			●	●			●	●	5	0.00	0.63		
Unnamed Tributary to Des Plaines River @RM (2018)																															
16-9	0.4	60.5	■	■		■	■				4			●	1		●				●			●	●		●	5	0.25	1.50	
Werhane Lake Drain (2018)																															
16-10B	0.8	61.3		■				■			3				0	●	●			●	●			●	●	●	7	0.00	2.33		

throughout the Upper Des Plains watershed (MBI 2017, 2018). An increased number of good habitat attributes offset the modified attributes at most of the sites downstream from and including site 13-19 resulting in modified:good ratios of less than 1.00 at all except site 16-5.

The three small tributaries that were part of the 2018 Year 2 study area were likewise assessed for habitat quality. Only two sites had sufficient water at the time of fish sampling hence the Unnamed Tributary to Werhane Lake Drain (16-10) was not assigned a QHEI score. Both the Unnamed Tributary to the Des Plaines River (16-9) and Werhane Lake Drain (16-10B) had fair QHEI scores of 60.5 and 61.43 respectively (Table 11). These sites also had a relatively high number of modified attributes with Werhane Lake Drain having a modified:good attributes ratio of 2.33 (fair).

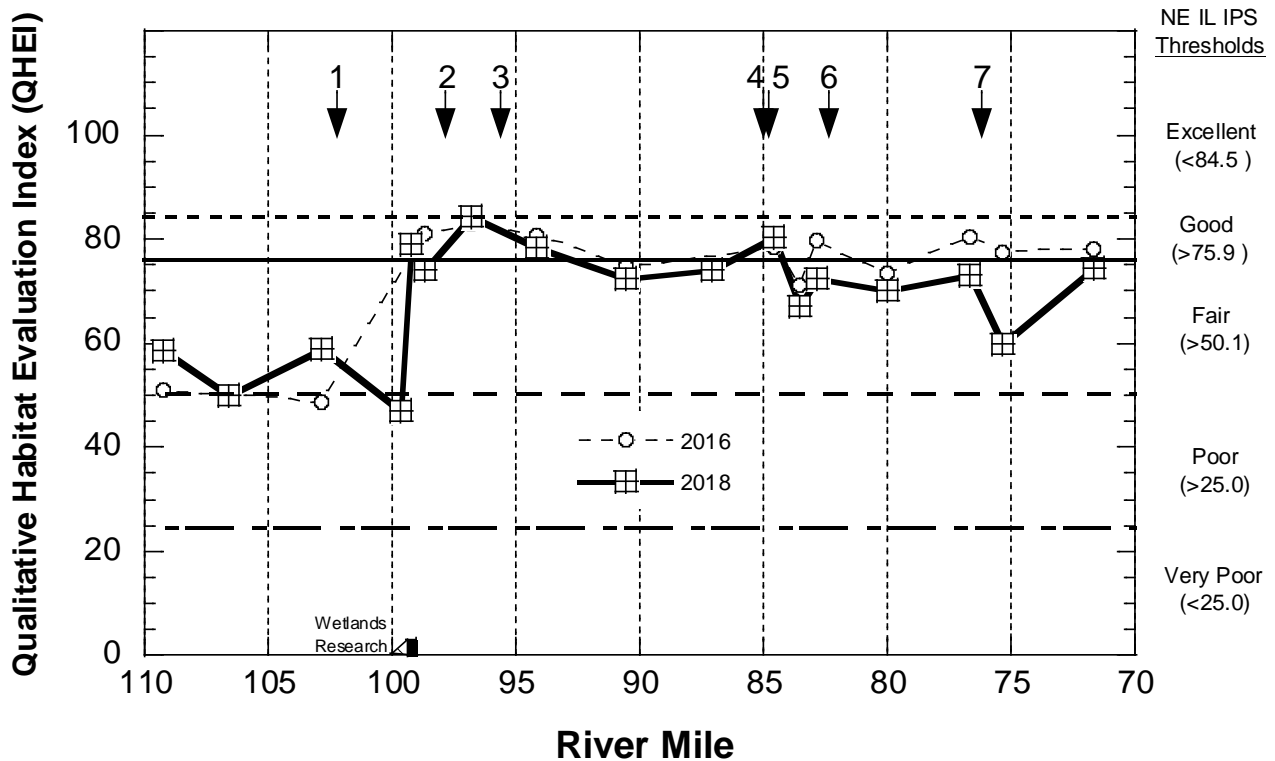


Figure 17. Qualitative Habitat Evaluation Index (QHEI) scores in the UPPER Des Plaines River mainstem in 2018. The IPS narrative ranges of QHEI scores from excellent to very poor are indicated by solid and dashed lines.

Biological Assemblages – Macroinvertebrates

There were 104 unique macroinvertebrate taxa collected in the upper Des Plaines River mainstem in 2018 (Appendix B). This is comparable to the 103 taxa that were collected in 2016. The predominant taxa collected were mostly indicative of good water quality. The most numerous was the genus *Tricorythodes*, a Mayfly taxon, followed by *Cheumatopsyche sp.*, a Caddisfly taxon, *Gammarus sp.*, a crustacean, and *Baetis intercalaris*, a Mayfly taxon (Table 14). The Chironomid *Polypedilum (P.) illinoense* ranked fifth and it can be a highly tolerant taxon to both toxics and siltation. However, the greater abundance and occurrence of the more sensitive Caddisfly and Mayfly taxa more than offset its presence.

Table 13. The fifteen (15) most abundant macroinvertebrate taxa collected in the upper Des Plaines River mainstem including sites collected, numbers collected, taxa group, functional group, and taxa tolerance assignments.

Taxa Code	Taxa Name	Sites Collected	Number Collected	Taxa Group	IL Functional Group	IL Tolerance Score
16700	<i>Tricorythodes sp</i>	11	671	MA	CG	5
52200	<i>Cheumatopsyche sp</i>	15	550	CA	CF	6
06800	<i>Gammarus sp</i>	16	475	N	CG*	3
11130	<i>Baetis intercalaris</i>	12	311	MA	CG	7
84470	<i>Polypedilum (P.) illinoense</i>	14	263	D	SH	5
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	14	252	D	SH	6
83158	<i>Endochironomus nigricans</i>	6	221	D	SH	6
03600	<i>Oligochaeta</i>	12	191	N	CG	10
78655	<i>Procladius (Holotanypus) sp</i>	12	179	D	PR	8
85265	<i>Cladotanytarsus vanderwulpi group sp 5</i>	10	163	T	CG	7
84450	<i>Polypedilum (Uresipedilum) flavum</i>	15	156	D	SH	6
06201	<i>Hyaella azteca</i>	9	124	N	CG	5
85625	<i>Rheotanytarsus sp</i>	11	121	T	CF	6
77750	<i>Hayesomyia senata or Thienemannimyia n</i>	13	114	D	PR	6
97601	<i>Corbicula fluminea</i>	13	103	N	CF	4

Taxa Group: N - Non-Insect; MA - Mayfly; O - Odonata; CA - Caddisfly; D - Dipteran; T - Tribe Tanytarsini; CO - Coleoptera
 IL Functional Group: CG - Collector/Gatherer; PR - Predator; CF - Collectors/Filterers; SH - Shredder; SC - Scraper
 IL Tolerance Score Ranges from 0 (Least Tolerant) to 10 (Most Tolerant); CG* the genus Gammarus does not have a group listed, but the common Gammarus species found are listed as CG

Macroinvertebrate Assemblage 2018

Macroinvertebrate assemblage quality in the upper Des Plaines River mainstem ranged mostly from good to fair condition (Figure 18). Ten (10) of the 16 sites met the mBI General Use biocriterion of 41.8. The upstream most four sites were all impaired for macroinvertebrates and ranged from poor at site 13-6 to fair at the next three sites including the site (13-19) immediately downstream from the Wetland Research riffle. The 2018 results reflect an improvement over 2016 especially in the reach downstream from the NSWRD Gurnee WRF

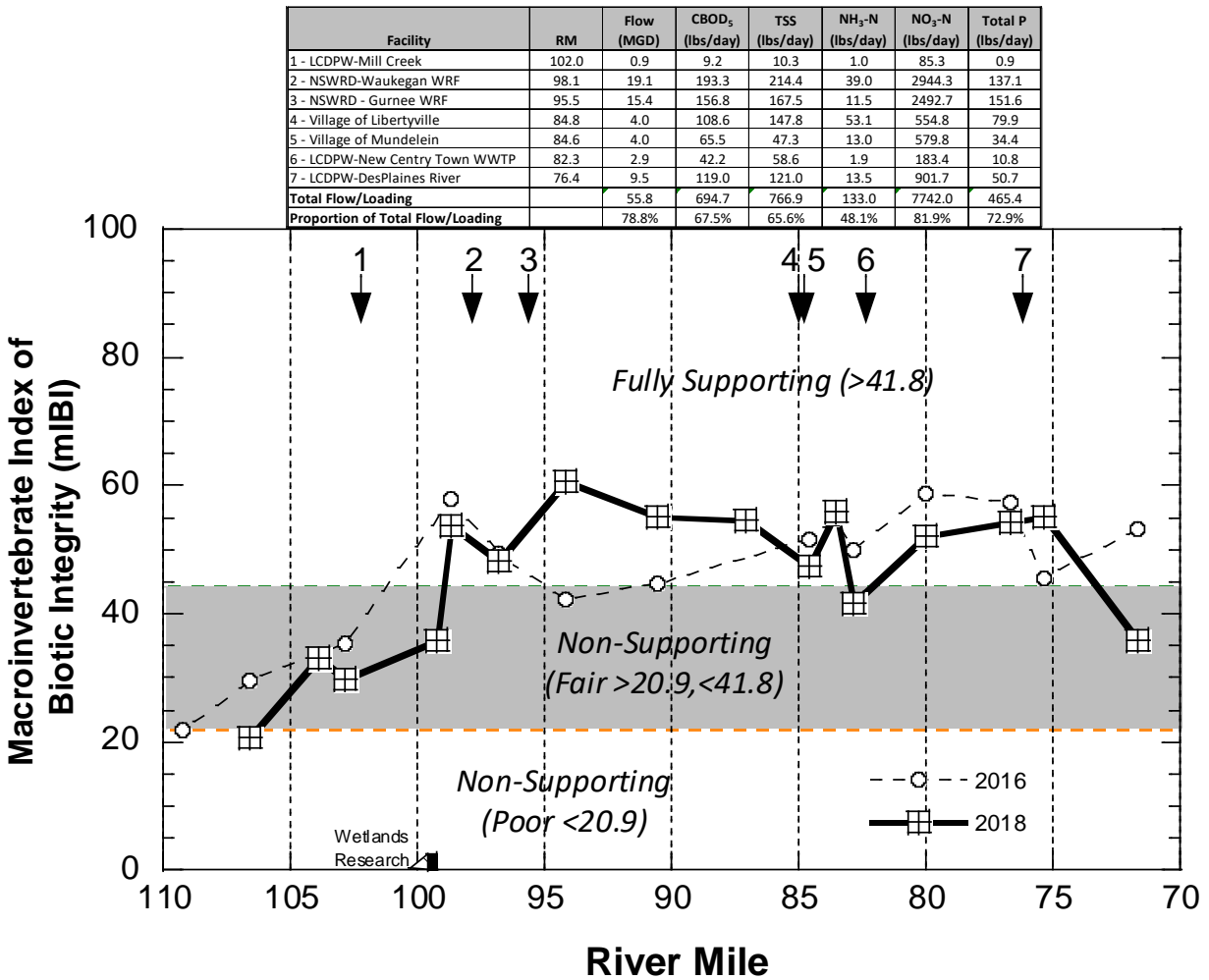


Figure 18. Illinois macroinvertebrate IBI scores for the upper Des Plaines River in 2016 and 2018. IEPA thresholds for determining full support, non-support-fair, and non-support-poor of the General Use for aquatic life are indicated by dashed lines and grey shading. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

discharge. The only reversal of this trend was at the most downstream site (16-1) which was in the non-fair range in 2018 and a 17.4 point decline in the mIBI.

Table 15 lists selected mIBI metrics and other macroinvertebrate assemblage attributes two of which are key biological response signatures associated with toxic impacts (%toxic tolerant taxa) and organic enrichment (%organic enrichment tolerant taxa; Yoder and DeShon 2003). Total taxa collected at each site ranged from 21-35 taxa. No sites exceeded either the toxic or organic enrichment signature thresholds for poor or very poor. The number of EPT taxa ranged from 3-9 with all except one site (13-5) reflecting good conditions. The proportion of EPT taxa ranged from 2.4-71.5% with most sites in the good quality range. Values ranged from 2.4-10.6% at the four upstream most sites which coincides with the enriched and modified habitat and altered hydrology that exists in the upper mainstem and watershed in general. Most all of the taxa and attributes in Table 15 were in the good or fair range with the exception of only four poor values that occurred in the upper reaches of the mainstem.

Table 14. Selected fish and macroinvertebrate assemblage attributes for sites sampled in the Upper Des Plaines watershed mainstem in 2016 and 2018. Biological index scores are shaded by level of use support: Exceptional – blue; Good (fully supporting) - green; Fair (non-support) - yellow; Poor (non-support) – orange; Very Poor - red; key metrics as signatures of toxic or organic enrichment impacts are based on Yoder and DeShon (2003).

Site ID	River Mile	Drainage Area (mi. ²)	Fish Data							Macroinvertebrate Data								
			fIBI	MIwb	Native Sp.	%DELT	Intolerant sp.	%Mineral Spawners	Percent Tolerant	mIBI	Total Taxa	Intolerant Taxa	%Tolerant Taxa	EPT Taxa	%EPT	MBI	%Toxic Tolerant Taxa	%Organic Enrich. Taxa
Des Plaines River Mainstem																		
13-6	109.30	123.67	33.5	8.75	24	0.38	2	3.1	25.0	33.0	21	2	6.5	4	10.6	5.1	0.3	6.2
13-5	106.60	137.29	29.5	7.74	20	0.57	1	2.1	30.8	20.7	21	2	39.1	3	2.4	7.9	0	32.5
13-4	102.90	145.55	26.5	8.65	18	0.0	1	2.5	24.4	29.9	22	1	11.1	4	5.9	6.1	3.1	15.0
13-18	99.30	212.87	22.5	8.36	14	0.29	1	2.8	28.2	<i>Not sampled – impoundment</i>								
13-19	93.0	213.17	30.0	8.94	20	0.0	2	7.3	35.0	35.9	29	1	9.2	5	10.1	5.7	0.0	25.2
13-3	98.70	220.29	33.5	9.39	22	0.44	3	6.8	27.5	53.7	35	5	7.4	8	25.2	5.7	2.2	21.2
13-2	96.82	225.36	35.0	8.66	20	0.13	2	18.3	32.6	48.3	31	3	4.1	5	40.3	5.6	0.3	8.6
13-1	94.20	232.03	42.5	9.38	24	0.74	4	26.5	23.5	60.7	32	5	4.5	9	34.3	5.1	6.8	7.1
13-16	90.60	253.75	41.0	8.94	24	0.37	4	24.1	25.6	55.2	24	6	3.6	6	48.8	4.8	3.7	7.1
16-6	87.10	261.41	42.0	8.67	25	1.52	5	25.0	30.6	54.7	32	5	8.4	8	24.9	5.6	24.9	14.0
16-7	84.60	266.48	41.5	8.41	25	0.19	5	12.5	26.8	47.5	26	3	5.2	5	55.2	5.5	0.6	19.0
16-5	83.60	268.07	32.5	8.52	21	0.19	3	7.2	26.2	56.0	25	5	3.2	5	54.3	5.4	7.7	11.0
16-8	82.90	268.9	33.5	8.13	22	0.15	3	8.5	27.3	41.7	25	4	16.4	7	16.7	6.2	18.0	21.7
16-4	80.00	273.21	37.0	7.72	17	0.42	2	24.3	30.3	52.0	30	4	8.4	6	44.0	5.5	4.9	11.6
16-3	76.70	314.68	38.0	8.55	21	0.0	3	14.4	26.2	54.3	29	4	4.7	6	59.9	5.2	1.0	11.1
16-2	75.40	323.96	42.0	7.97	22	0.27	5	21.2	23.4	55.2	24	4	1.9	5	71.5	5.2	7.8	4.9
16-1	71.70	358.68	40.5	8.19	22	0.64	3	21.6	28.1	35.8	21	2	14.0	4	33.1	5.7	2.8	9.5
Unnamed Tributary to Werhane Lake Drain																		
16-10	0.10	0.22	<i>Not sampled – site was dry</i>															
Unnamed Tributary to Des Plaines River																		
16-9	0.40	1.19	34		7	0	0	0	42.9	38.9	27	3.5	20.5	5	4.9	6.7	3.6	23.8
Werhane Lake Drain																		
16-10B	0.80	0.22	38		12	0	0	0	50	34.0	25	1	13.9	3	1.4	5.7	1.1	26.3
Exceptional			>50	>9.6	>29	0	≥ 5		≤16.1	>65.0							0	<5
Good			≥41	>8.5	>14	<1.3	≥4	>40.7	<30.3	≥41.8	≥23	≥3	<7.5	≥3	>24.5	<4.9	<5	<15
Fair			<41.8	>5.8	>12	<3.0	<3	<40.7	<40	<41.8	≤23	≥2	<28	2	≥7.7	>4.9	<20	≥15
Poor			<20	<5.8	>7	>10	≤1	<10	>50	≤20.9	<16	<2	>28.1	1	<7.7		≥35	≥35
Very Poor				<4.0	<7	>20		<0.8	≥70			0		0			<60	>60

Biological Assemblages – Fish

Forty-seven (47) native and two (2) non-native fish species were collected along with four (4) hybrids in the Year 2 study area in 2018. The fish assemblage was predominated by tolerant and moderately tolerant fish species (Table 16). Bluegill, Bluntnose Minnow, Green Sunfish, Largemouth Bass, Pumpkinseed Sunfish, and Blackstripe Topminnow were the most numerous species collected in 2018. Common Carp, White Sucker, Channel Catfish, Spotted Sucker, Pumpkinseed Sunfish, Northern Pike, Bluegill, Largemouth Bass, Bowfin, Rock Bass, and Yellow Bullhead predominated in terms of biomass. Out of the top 15 species, five (5) are highly

Table 15. *The fifteen most abundant species by number and ten most abundant by weight collected in the upper Des Plaines mainstem in 2018. IL and OH tolerance assignments, numbers/weight (kg) collected, and percent collected by each (species with blank tolerance are intermediate).*

Species	Tolerance		No./Wt. Collected	% By Number
	IL	OH		
Species Ranks by Numbers				
Bluegill		P	1677	17.0
Buntnose Minnow	T	T	1361	13.8
Green Sunfish	T	T	910	9.2
Largemouth Bass			784	8.0
Pumpkinseed		P	550	5.6
Blackstripe Topminnow			543	5.5
Spotfin Shiner			424	4.3
Rock Bass			420	4.3
Hornyhead Chub	I	I	385	3.9
Common Carp	T	T	379	3.8
White Sucker	T	T	375	3.8
Johnny Darter			304	3.1
Blackside Darter			230	2.3
Golden Shiner	T	T	216	2.2
Spotted Sucker			173	1.8
Species Ranks by Weight (Kg)				
Common Carp	T	T	11.79	28.1
White Sucker	T	T	6.94	16.5
Channel Catfish			4.82	11.5
Spotted Sucker			4.06	9.7
Northern Pike			2.54	6.1
Bluegill		P	2.21	5.3
Largemouth Bass			1.95	4.7
Bowfin			1.70	4.0
Rock Bass			0.92	2.2
Yellow Bullhead	T	T	0.84	2.0

I – intolerant; P – moderately tolerant; T – highly tolerant.

tolerant, two (2) moderately tolerant, and only one (Hornyhead Chub) is intolerant. Many of these species are also common in lower gradient and wetland influenced rivers while others are ubiquitous to rivers and streams throughout the region. Of note was the collection of 48 Blackchin Shiner, an Illinois threatened species, in the upper mainstem. There have been recent efforts to reestablish this species in the region (Bland 2013).

Fish Assemblage 2018

Fish IBI (fIBI) scores are the mean of two sampling passes within the summer-early fall index period. The General Use criterion of 41 was met or surpassed at five (5) sites (Table 15; Figure 19) which is a first for not only the upper Des Plaines River watershed, but all other sites sampled by MBI in northeastern Illinois since 2006 with the exception of the DuPage River immediately downstream from the Channahon Dam in Will County. The fIBI scores that did not meet the General Use biocriterion were in the fair range with the lowermost site coming within

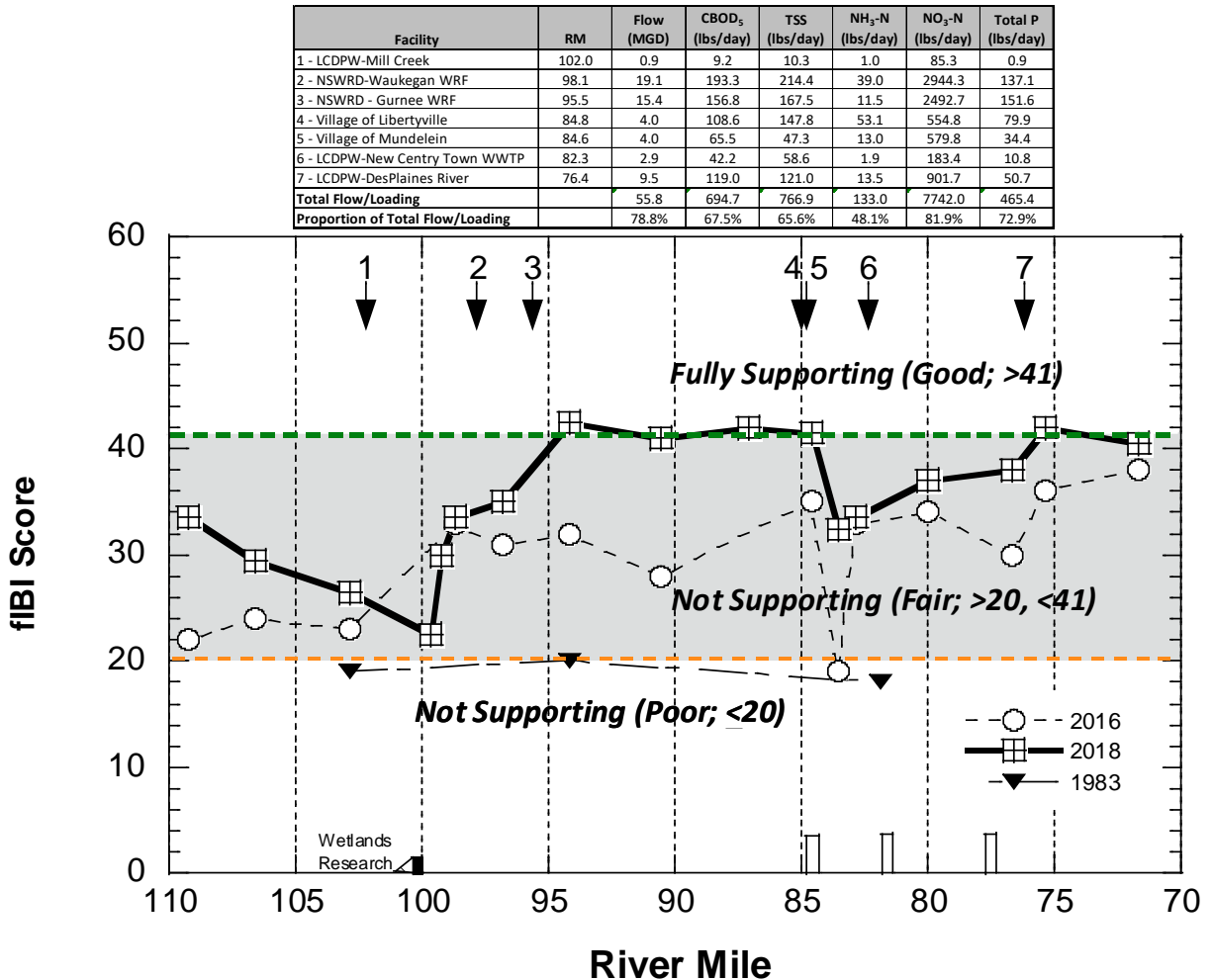


Figure 19. Illinois fish IBI (fIBI) scores for the upper Des Plaines River in 2016 and 2018 (with 3 sites from 1983). IEPA thresholds for determining full support, non-support-fair, and non-support-poor of the General Use for aquatic life are indicated by dashed lines and grey shading. A key to sources (numbers) are in the table above the figure along with flow and loads from each.

0.5 units of meeting. Longitudinally the results show the comparatively low scores in the modified upper reach of the mainstem, a recovery to full attainment at the site downstream from the NSWRD Gurnee WRF, and an interruption of the recovery at site 16-5 just downstream from the Libertyville and Mundelein WWTPs. Libertyville WWTP was the largest contributor of ammonia-N loadings in 2018 and the pollution response profile is suggestive of a potential localized effect. The fIBI scores improved to full attainment by site 16-2.

The Modified Index of Well-Being (MIwb) has no formal biocriteria in Illinois, but using the Ohio biocriteria it attained the Ohio equivalent of the General Use at 10 sites and was fair at the other seven (7). Among selected fIBI metrics, native species ranged from 14 in the impoundment formed by the Wetland Research riffle (16-18) to 25 at sites 16-6 and 16-7. All values except 16-18 were good (Table 15). Key metrics and attributes that had values predominantly in the good range were %DELT anomalies with only one slightly elevated value (1.52%) at site 16-6. The %tolerant species ranged from 23.4-35.0%, 12 sites were in the good range and remainder fair. Intolerant species ranged from 1-5 with good values (≥ 4) at five (5) sites mid-river, fair values (2-3) at seven (7) sites bracketing the good values, and poor values (≤ 1) at the five upstream most sites. The poorest performing metric was mineral substrate spawners ranging from 2.1% at site 13-5 to 26.3% at site 13-1. No values were considered good with nine (9) sites fair and the remainder poor including all but two sites in the upper mainstem downstream to site 13-3. The low gradient characteristics of the upper Des Plaines River fish assemblage lack sufficient mineral substrate spawners to score good. Nevertheless, fIBI scores have increased with other metrics scoring high enough meet or come close to meeting the fIBI biocriterion for the General Use.

Our assessment of the status of the fish assemblage in the upper Des Plaines mainstem, with the exception of observed attainment of the fIBI criterion at five (5) sites in 2018, seems to track with the recently completed long term assessment of the greater Des Plaines subbasin by Illinois DNR (Pescitelli and Widloe 2018). They concluded:

“Conditions in the Des Plaines River Basin have improved markedly since the first IDNR basin survey in 1974. Fish species richness and IBI’s have increased and sportfish populations have recovered to provide opportunities for urban anglers. Despite improvements, stream ratings based on the fish IBI remain primarily in the “Fair/Non-supportive” range for aquatic life use. Although species richness is increasing, there are still low numbers of sucker species, intolerant species and specialist fishes. The decreased abundance of tolerant fish species in recent years and the appearance of intolerant species, such as the Rosyface Shiner, suggest that current water quality conditions could support additional sensitive and specialist fishes.”

Pescitelli and Widloe (2018) provided several analyses of the long term dataset that extends back to the early 1980s all of which reveal significant improvements in several indicators and attributes of the Des Plaines subbasin fish assemblages. While their sampling intensity was almost 10 times less than our 2016 and 2018 efforts, it did reveal the hydrologically and physically modified upper mainstem to be distinct in at least one analysis.

SYNTHESIS

The baseline biological condition of the upper Des Plaines River mainstem has been shaped by the naturally low gradient and wetland-origins of the region. The current condition of the biological assemblages reflects changes that have altered these natural features mostly via hydrological and physical alterations in the upper watershed related to agricultural and suburban development to more intensive urban development in the lower portions of the study area. Both the direct and indirect influences of the altered hydrology and habitat alterations in the upper 10 miles were quite evident in the chemical, habitat, and bioassessment results. The legacy of hydrological and habitat alterations in the upper mainstem and the greater watershed (including the Wisconsin portion), have resulted in sluggish flows, excessive siltation and substrate embeddedness, nuisance growths of algae and macrophytes, and indicators of excessive nutrient enrichment due primarily to nonpoint source inputs that are further exacerbated by the altered flows and habitat. These adverse conditions seem to exert their greatest influence under seasonal low flows during the summer months. The addition of large volumes of treated wastewater downstream from Mill Creek and especially below the NSWRD Waukegan and Gurnee WRFs seemed to be the point where many of the chemical, habitat, and biological indicators showed improvement from upstream. While not all were at levels considered to be in line with full attainment of the General Use, the first ever observations of full biological attainment is both noteworthy and encouraging. These indications were observed despite the mainstem being effluent dominated during low flow periods.

Two new tools were applied in the 2018 Year 2 assessment and included the Area of Degradation and Area of attainment Values (ADV/AAV; Yoder et al. 2005, 2019) to better visualize and quantify the extent and severity of biological impairment *and* the extent and sustainment of full attainment. This approach was used to determine the extent of changes that have taken place between the 2016 and 2018 upper Des Plaines mainstem bioassessments. Sufficient historical data was simply not available at enough locations along the longitudinal pollution continuum to include data prior to 2016, but there is little doubt that conditions were much worse in the 1980s and before which would have yielded even more negative ADV values. The ADV/AAV is calculated individually for each index and was done here for the fIBI and mIBI (Figure 20) and separating the upper 10 miles of modified flow and habitat from the remainder of the mainstem downstream to the Lake-Cook Co. line with the boundary at the confluence with Mill Creek.

The ADVs for both the fIBI and mIBI reveal the severity and extent of impairment of the General use for aquatic life in 2016 in both the upper and lower reaches as indicated by the ADVs (shown as negative values). This tracks with the analyses done on that data and reported in an earlier report (MBI 2017) that showed all sites in the upper watershed to be impaired. In 2018, the upstream reach remained impaired as evidenced by the extent of the ADV values which increased for macroinvertebrates indicating a worsening of the impairment for that assemblage. This tracks with the prior description of chemical, hydrological, and habitat alterations in this reach. In the lower reach downstream from Mill Creek the observance of AAVs tracked with the finding of full attainment at five (5) of 12 sites in this reach. The

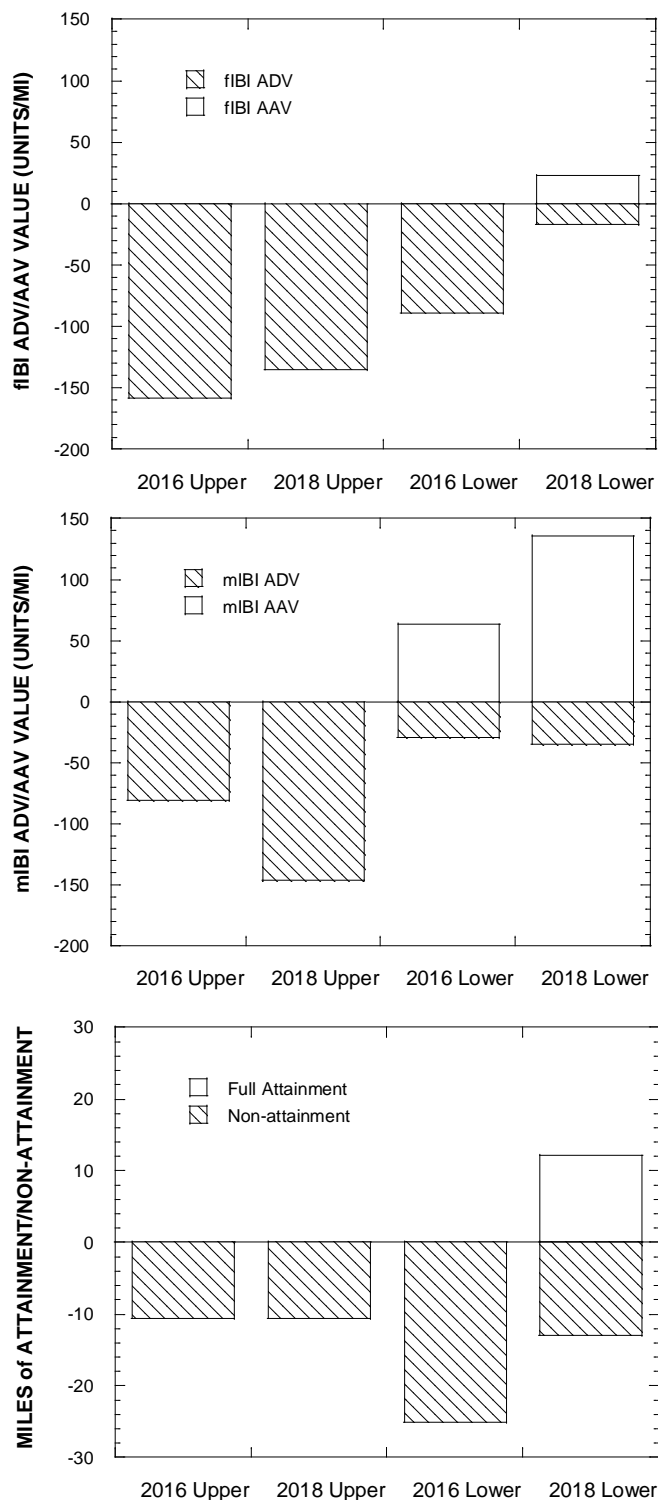


Figure 20. Area of Degradation (ADV; cross hatched) and Area of Attainment (AAV; open shading) values in the upper reach and remaining lower reach of the upper Des Plaines River in 2016 and 2018 (upper and middle panels). The miles of full and non-attainment appear in the lower panel.

macroinvertebrate AAVs were higher as the mIBI met the General Use biocriterion in both years and at all except the downstream most site in 2018. By attaining the fIBI General Use biocriterion AAVs first occurred in 2018, but also with a significant reduction in the ADV between 2016 and 2018. The resulting influence on General Use attainment is revealed for both the upper and lower reaches between 2016 and 2018 with no change in the upper reach and the first appearance of full attainment in the lower reach in 2018 accompanied by a lessening of non-attainment (Figure 20). The overall trajectory is unchanged in the modified upper reach and one of incremental improvement in the lower reach of the mainstem.

Newly derived IPS thresholds for water and sediment chemistry and physical habitat attributes were also available to assess causes of impairment. The more refined approach for deriving these thresholds included a more refined stratification of these values for parameters that showed valid relationships with biological responses based on species and taxa level analyses and then correlated with the corresponding fish and macroinvertebrate IBIs (MBI 2020). This produced thresholds across four or five narrative categories of quality (excellent, good, fair, poor, and very poor). This now replaces the formerly used binary (i.e., “pass/fail”) approach to evaluating exceedances of chemical and physical effect thresholds and criteria. Thus a more graded approach to the assignment of causes and sources of Illinois General Use biological impairments is now made possible. These new tools were integrated with the previously used tools and indicators to assign associated

causes to the biological impairments observed in 2018. The new IPS framework also offers the semblance of a tiered aquatic life use (TALU) stratification of goals that has been incorporated into all IPS outputs to support local restoration and protection efforts by the respective watershed groups and stakeholders.

The biological criteria for fish and macroinvertebrates used by Illinois EPA (2018) establish the thresholds by which impaired sites and reaches are determined. The assignment of causes in this analysis generally attempts to follow the overall intent of the Illinois Integrated Report assessment guidelines, but is supplemented by the more extensive biological effect thresholds provided by the newly updated IPS tools and indicators (MBI 2020). The delineation of causes and sources was based on integrating and synthesizing the preceding analyses of categorical and parameter-specific stressor threshold exceedances. The most influential of these in 2018 are included in Table 17 along with the fish and macroinvertebrate IBI scores. Habitat alteration is represented by the QHEI and the QHEI modified:good attributes ratio, D.O. includes the minimum measured by Datasondes, the effect of nutrient enrichment by the diel D.O. swing narrative, the nutrient enrichment effect status, the new IPS nutrient index, new IPS chemical threshold exceedances for water and sediment, and biological response signatures for organic enrichment and toxic tolerant indicators. The rationale for listing the predominant causal categories in 2018 follows:

- **Organic Enrichment/Low D.O.** (13 observations; weighted frequency of 32.7%) – any low D.O. value, any TKN value of poor or very poor (TKN used as a proxy for BOD per Miltner 2018);
- **Macro Habitat Related** (10 observations; weighted frequency of 18.7%) – any high influence *Channelized/No Recovery* or moderate influence *Recovering from Channelization* in the QHEI attributes matrix (Table 11) or a poor or very poor QHEI score.
- **PAH/Metals/Toxicity** (10 observations; weighted frequency of 15.8%) – any sediment metal or PAH threshold exceedance in Table 8, *PEC or PEL* exceedance, or IEPA elevated thresholds and any toxic *Biological Response* in Table 14.
- **Siltation/Embeddedness** (9 observations; weighted frequency of 13.7%) – any high influence *Silt/Muck Substrate* and/or moderate-extensive embeddedness in the QHEI attributes matrix (Table 11).
- **Nutrient Enrichment** (7 observations; weighted frequency of 10.1%) - diel D.O. Swing narrative ratings of *High* or *Wide* and/or nutrient enrichment status of *Highly Enriched, Enriched, or Likely Nutrients* as described in Table 9. SNAP narrative ratings that were accompanied by high TKN and low total P and nitrate-N were also correlated the Organic Enrichment/Low D.O. cause category in the modified upper mainstem.
- **Chloride/TDS** (4 observations; weighted frequency of 8.6%) – any chloride value >biological effect fair, poor, or very poor threshold in Table 8.

Organic Enrichment/Low D.O. was the most pervasive cause and was the most severe as indicated by very poor narratives in the hydrologically and habitat modified reach of the

Table 16. Key chemical, physical, and biological response indicators of impairment observed at each site in the Upper Des Plaines River study area in 2018. The causes associated with biological impairments are drawn from analyses of habitat, nutrient effects, chemical IPS and other threshold exceedances, sediment chemical IPS exceedances, and biological response signatures. Causes of impairment are classified as fair, poor, or very poor in accordance with the exceedance of corresponding thresholds. See footnotes for table references and biological, physical, and chemical threshold intervals. IPS restorability score are provided for non and partially supporting sites and susceptibility and threat scores are provided for fully supporting sites.

Site ID	River Mile	Drainage Area (sq. mi.)	AQU Status	fIBI ¹	mIBI ²	QHEI ³	QHEI Modified: Good Ratio ⁴	Min. D.O. (Sonde) <WQC ⁵	Diel D.O. Swing ⁶	Diel D.O. Swing Narrative ⁶	IPS Nutrient Index ⁷	Chemical WQC Exceedances ⁸	>Fair Chemical Thresholds ⁹	>Sediment Metals Thresholds ⁹	>Sediment PAH Thresholds ⁹	%Organic Enrichment Signatures ¹⁰	%Toxic Tolerant Signatures ¹⁰	2018 Causes by Stressor Threshold Narrative Category			2018 Sources	Restorability Score (0-100)	IPS Susceptibility Score (0-100)	IPS Threat Score (0-100)
																		Very Poor ¹¹	Poor ¹¹	Fair ¹¹				
Des Plaines River Mainstem																								
13-6	109.3	123.7	NON - Fair	33.5	33	58.5	2.00	2.1	6.5	High	18.9	None	TKN, Turb.	Be	None	None	None	Low D.O.,Org. Enrich.	Embedded,Turbidity	QHEI Ratio,Siltation,No Sinuosity,Recov. Channel.	Altered Flow; Habitat Modification, NPS	41.2		
13-5	106.6	137.3	NON - poor	29.5	30.7	50.0	2.67	4.0	6.5	Wide	16.18	None	TKN, Turb.	Al,Be, Cd	None	M (32.5%)	None	Diel D.O.,Org. Enrich.	QHEI Ratio,No Cover,Substr.,Turbidity	Siltation,Embeddness,Recov. Channel	Altered Flow; Habitat Modification, NPS	48.68		
13-4	102.9	145.6	NON - Fair	26.5	29.9	59.0	2.00	1.8	5.6	High	19.08	None	TKN, Turb.	Al,Be, Cd	None	M (15.0%)	None	Low D.O.	Org. Enrich.,Substr.,Chan; Turbidity;	Low DO,QHEI,TSS,Sed. Metals;	Altered Flow; Habitat Modification, NPS	48.07		
13-18	99.72	212.9	NON - Fair	22.5		47.0	2.33				10.54	None		Al,As,Be,Cd,Fe,Mn,Ni	None	M (25.2%)	None	Impounded,Siltation	Channel Mod.,Metals		Altered Flow; Habitat Modification, NPS	39.8		
13-19	99.3	213.2	NON - Fair	30.0	35.9	79.0	0.50	4.1	3.1	Low	5.2	None		Al,As,Be,Cd,Fe,Mn,Ni	None	M (21.2%)	None	None	QHEI Ratio,Metals	Siltation,Embeddness	Habitat Modification, NPS	76.07		
13-3	98.7	220.3	Partial	33.5	53.7	74.0	0.71	2.4	4.0	Moderate	15.14	None	TKN	Al,Be,Cd	None	None	None	None	Low D.O.,Org. Enrich.,QHEI Score,Turbidity,Metals		Upstream Flow & Habitat Modifications, NPS	90.51		
13-2	96.82	225.4	Partial	35.0	48.3	84.5	0.10	5.3	2.9	Low	15.58	None	TKN, Turb.	Al,As,Be,Mn	PAH (8)	None	None	None	Org. Enrich.; PAH	None	Altered Flow; Habitat Modification, NPS	93.58		
13-1	94.2	232.0	FULL	42.5	60.7	78.5	0.22		5.9	High	18.64	None	TKN, Turb.	Al,As,Be,Mn	None	None	M (6.8%)		FULL Attainment - No Causes Assigned		FULL Attainment - No Sources Assigned	56.9	15.38	
13-16	90.6	253.8	FULL	41.0	55.2	72.5	0.63				10.38	None	None	Al,As,Be,Cd,Fe,Mn,Zn	None	None	None		FULL Attainment - No Causes Assigned		FULL Attainment - No Sources Assigned	65.2	7.69	
16-6	87.1	261.4	FULL	42.0	54.7	74.0	0.33	5.8	2.2	Low	19.32	None	TKN	Al,As,Be,Cd,Fe,Mn,Hg,Zn	PAH (1)	None	M (24.9%)DBT (0.52%)		FULL Attainment - No Causes Assigned		FULL Attainment - No Sources Assigned	56.9	11.54	
16-7	84.6	266.5	FULL	41.5	47.5	80.5	0.22				20.2	None	None	Al,As,Be,Cd,Mn,Hg,Zn	PAH (3)	M (19.0%)	None		FULL Attainment - No Causes Assigned		FULL Attainment - No Sources Assigned	62.0	7.69	
16-5	83.6	268.1	Partial	32.5	56	67.0	1.40	6.0	2.9	Low	15.9	pH (2)	TKN	Al,As,Be,Cd,Cu,Mn,Zn	PAH (7)	None	M (7.7%)	None	Org. Enrich.,Metals,PAH	QHEI,Chloride,PAH	Urban NPS, WWTP	85.42		
16-8	82.9	268.9	Partial	33.5	41.7	72.5	0.44				11.84	None	None	Al,As,Be,Cd,Cu,Hg,Mn,Zn	PAH (2)	M (21.7%)	M (18.0%)	None	Metals	TP,QHEI,Chloride	Urban NPS, WWTP	88.11		
16-4	80	273.2	Partial	37.0	52	70.0	0.83	5.6	1.9	Normal	20.3	None	TKN,NO ₃ -N	Al,As,Be,Cd,Cu,Mn,Zn	None	None	None	None	Org. Enrich.,Metals	TP,Nitrate,QHEI,Chloride	Urban NPS, WWTP	59.06		
16-3	76.7	314.7	Partial	38.0	54.3	73.0	0.71	5.7	4.1	Moderate	11.8	None	None	Al,As,Be,Cd,Cu,Fe,Mn,Ni,Zn	None	None	None	None	Metals	TP,Nitrate,QHEI Score,Chloride	Urban NPS, WWTP	93.83		
16-2	75.4	324.0	FULL	42.0	55.2	59.8	0.86	5.0	5.7	High	11.62	None	None	Al,As,Be,Cd,Cu,Mn,Zn	PAH (1)	None	M (7.8%)		FULL Attainment - No Causes Assigned		FULL Attainment - No Sources Assigned	38.7	19.2	
16-1	71.7	358.7	NON - Fair	40.5	35.8	74.5	0.56	5.1	6.8	Wide	16.92	None	TKN	Al,As,Be,Cd,Cu,Fe,Hg,Mn,Zn	PAH (1)	None	None	None	Diel D.O.,Org. Enrich.,Metals	Chloride	Urban NPS, WWTP	95.72		
Unnamed Tributary to Werhane Lake Drain																								
Site was dry and not sampled in 2019																								
Unnamed Tributary to Des Plaines River																								
16-9	0.40	1.19	Non-Fair	34.0	38.9	60.5	1.75				9.8	None				M (23.8%)	None	None	Turbidity	Low D.O.,QHEI Score	Urban NPS	57.2		
Werhane Lake Drain																								
16-10B	0.80	0.22	Non-Fair	38.0	34.0	61.3	1.50					None				M (26.3%)	None	None	None	QHEI Ratio; Siltation,Embedded,Recov. Channel	Urban NPS	35		
Narrative Category																								
Excellent																								
FULL >=50 >73 >84.5 <0.50 >=6.0 <2.0 Normal <10 None None None None 0 <5																								
Good																								
FULL >41-49 41.8-72.9 >75.9 <2.00 >=5.0 >=2.0-4.0 Low 10-15 1 1 <5 <15																								
Fair																								
Non-Fair 30-41 30-41.7 <75.9 <2.00 >=3.5 >=4.0-5.0 Moderate 15-25 2-3 2-4 2-3 <20 >=15																								
Poor																								
Non-Poor >15-29 >15-29 <50.1 >4.00 <3.5 >=5.0-6.5 High 25-35 4-6 5-6 4-6 >35 >35																								
Very Poor																								
Non-Poor <15 <15 <25.0 <2.00 <2.0 >=6.50 Wide >35 >6 >6 >6 >60 >60																								
¹ fIBI: full support >41; nonsupport fair >20<41; nonsupport poor <20 ² mIBI: full support >41.8; nonsupport fair >20.9<41.8; nonsupport poor <20.9 ³ From Table 6 - IPS thresholds for habitat attributes. ⁴ From Table 11 - QHEI matrix of good and modified attributes. ⁵ From Table 8 - modified SNAP variables matrix. ⁶ IPS derived nutrient index - see Appendix F. ⁷ Exceedances of Illinois water quality criteria. ⁸ Number and magnitude of water column chemical threshold exceedances (Appendix E). ⁹ Sediment metal and organic exceedances of NE IL IPS thresholds in Table 7 or MacDonald et al. (2000) PEC/TEC or IEPA elevated levels - see Tables 9 (metals) and 10 (PAH compounds). ¹⁰ Biological response signatures for organic enrichment - see Table 13 (M - macroinvertebrates; F - fish). ¹¹ Biological response signatures for general toxicity - see Table 12 (M - macroinvertebrates; F - fish). ¹² IPS derived very poor (primary), poor (secondary), and fair (tertiary) causes assigned by weighting the stressor rank * FIT factor - see Appendix E; primary causes rank >8-10, secondary causes rank <6-8, tertiary causes rank <4-6.																								

uppermost mainstem. Only the Macro Habitat Related and Siltation causes in the Wetland Research riffle impoundment were also indicated by a very poor narrative. Macro Habitat Related causes were the next most frequent with 10 observations and a weighted frequency of 18.7%. This cause also was more frequent in the upper mainstem, but localized occurrences extended downstream through the lower mainstem. The PAH/Metals/Toxicity causal category also had 10 observations and a weighted frequency of 15.8% and were due almost entirely to an increased number of sediment metals threshold exceedances at all sites in the lower 20 miles of the mainstem. PAH exceedances in sediment were high at only two sites in the lower one-half of the mainstem and the only toxic biological response signatures were fair narratives and at two sites in the lower mainstem. Nutrient Enrichment with 7 observations and a weighted frequency of 10.1% was the most serious in the modified upper mainstem and more tepid with fair narratives in the wastewater discharge impacted portions of the middle and lower mainstem. Chloride/TDS with 4 observations and a weighted frequency of 8.6% were likewise tepid with fair narratives at four consecutive sites immediately downstream from the four sites in full attainment of the General Use biocriteria.

Perhaps one of the more important observations of the 2018 bioassessment is that the entry of the large volumes of treated municipal wastewater were beneficial and likely offset some the otherwise detrimental impacts that are exported downstream from the upper modified reaches of the mainstem. Four consecutive sites beginning at site 13-1 downstream from the NSWRD Gurnee WRF were in full attainment of the General Use for aquatic life. The sites downstream from Mill Creek (13-3) and the NSWRD Waukegan WRF (13-2) were in partial attainment with the fIBI values missing attainment by 8.5 and 6.0 units respectively. Partial attainment then occurred at the next four consecutive sites between sites 16-5 and 16-3 again with the fIBI being the limiting factor, but also incrementally improved with two sites missing attainment by only 2 and 3 units. Site 16-2 was in full attainment followed by non-fair at the most downstream site (16-1), but with the fIBI missing by only 0.5 units. The biological results downstream from the entry of treated wastewater at site 13-3 were better both in terms of AQLU status and the fIBI and mIBI scores than at the five upstream most sites that were in non-fair and non-poor attainment status and with three (3) of five (5) fIBI scores in the very poor range. We expect that conditions could continue to improve downstream from Mill Creek provided that wastewater effluent quality is maintained.

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APPENDIX A

IPS Derived Biological Effect Thresholds

- A-1: Northeast IL IPS Derived Biological Effect Thresholds for Water Column Parameters**
- A-2: Northeast IL IPS Derived Biological Effect Thresholds for Sediment Chemistry Parameters**
- A-3: Northeast IL IPS Derived Biological Effect Thresholds for Habitat and Land Use Parameters**

Appendix Table A-1. NE IL IPS derived biological effect thresholds for water column chemical parameters.

Parameter Code	Variable Name	Units	Limiting Assemblage	Site Size	Sample N	Excellent	Good	Fair	Poor	Very Poor
P1007	Barium, Total	µg/L	Fish	Head-Wade	1464	<74.1	>74.09	>84.88	>101.8	>118.6
P1027	Cadmium, Total	µg/L	Fish	Head-Wade	1464	≤0.937	>0.937	>0.974	>0.983	>0.991
P1034	Chromium, Total	µg/L	Fish	Head-Wade	1464	≤1.398	>1.398	>1.540	>2.682	>3.824
P1042	Copper, Total	µg/L	Fish	Head-Wade	1464	--	≤4.480	>4.480	>4.969	>5.458
P1082	Strontium	µg/L	Fish	Head-Wade	1464	≤169.1	>169.1	>190.8	>280.4	>370.1
P1092	Zinc, Total	µg/L	Fish	Head-Wade	1464	≤7.47	>7.47	>9.78	>11.00	>12.22
P1105	Aluminum, Total	µg/L	Fish	Head-Wade	1464	≤310.0	>310.0	>393.3	>560.2	>727.0
P530	Total Suspended Solids	mg/L	Fish	Head-Wade	1464	≤17.50	>17.50	>31.60	>35.15	>38.69
P549	Volatile Suspended Solids	mg/L	Fish	Head-Wade	1464	≤5.000	>5.000	>7.769	>9.825	>11.88
P630	Nitrate-N+Nitrite-N	mg/L	Fish	Head-Wade	1464	≤3.767	>3.767	>5.045	>7.344	>9.643
P665	Total Phosphorus	mg/L	Fish	Head-Wade	1464	≤0.106	>0.106	>0.277	>1.002	>1.726
P70300	Total Dissolved Solids	mg/L	Fish	Head-Wade	1464	≤453.8	>453.8	>558.0	>651.2	>744.5
P916	Calcium, Total	mg/L	Fish	Head-Wade	1464	≤84425	>84425	>86067	>86313	>86559
P929	Sodium, Total	mg/L	Fish	Head-Wade	1464	≤16275	>16275	>45000	>79056	>113112
P940	Chloride, Total	mg/L	Fish	Head-Wade	1464	≤40.00	>40.00	>120.0	>184.9	>249.8
P1002	Arsenic	µg/L	Macros	Head-Wade	985	--	≤3.616	>3.455	>5.029	>6.603
P1051	Lead, Total	µg/L	Macros	Head-Wade	985	≤2.851	>2.851	>3.335	>3.884	>4.434
P1055	Manganese, Total	µg/L	Macros	Head-Wade	985	≤53.71	>53.71	>77.03	>107.1	>137.2
P1067	Nickel, Total	µg/L	Macros	Head-Wade	985	--	≤3.470	>3.470	>9.585	>15.70
P299	Mean Dissolved Oxygen	mg/L	Macros	Head-Wade	985	≥9.42	<9.42	<9.25	<6.11	<3.05
P310	BOD (5-Day)	mg/L	Macros	Head-Wade	985	≤1.30	>1.30	>2.35	>3.45	>4.54
P610	Total Ammonia	mg/L	Macros	Head-Wade	985	≤0.084	>0.084	>0.100	>0.190	>0.280
P615	Nitrite	mg/L	Macros	Head-Wade	985	≤0.014	>0.014	>0.040	>0.068	>0.096
P625	Total Kjeldhal Nitrogen	mg/L	Macros	Head-Wade	985	≤1.07	>1.07	>1.12	>1.63	>2.14
P720	Cyanide, Total	µg/L	Macros	Head-Wade	985	≤8	>8	>10	>10	>10
P937	Potassium, Total	mg/L	Macros	Head-Wade	985	≤3158	>3158	>6300	>7718	>9129
P945	Sulfate, Total	mg/L	Macros	Head-Wade	985	≤58.27	>58.27	>73.10	>83.45	>93.81
P82078	Turbidity	NTU	Macros	Head-Wade	985	--	≤19.3	>19.3	>25.9	>32.5
DO_MAX	Maximum DO	mg/L	Macros	Head-Wade	985	≤10.36	≥10.36	>12.21	>14.24	>16.28
DO_MIN	Minimum DO	mg/L	Macros	Head-Wade	985	--	≤8.47	>7.55	>8.19	>8.84
P94	Conductivity	µS/cm	Fish	Head-Wade	1464	≤739	≥739	>1038	>1208	>1378

31 variables

Appendix Table A-2. NE IL IPS derived biological effect thresholds for sediment chemical parameters.

Parameter Code	Variable Name	Units	Limiting Assemblage	Site Size	Sample N	Excellent	Good	Fair	Poor	Very Poor
P1003	Arsenic	mg/kg	Macros	Head-Wade	985	--	≤8.65	>8.65	>15.82	>23.67
P1008	Barium	mg/kg	Macros	Head-Wade	985	--	≤141.0	>132.0	>150.3	>168.7
P1013	Beryllium	mg/kg	Macros	Head-Wade	985	--	≤0.411	>0.411	>0.496	>0.581
P1028	Cadmium	mg/kg	Macros	Head-Wade	985	--	≤0.933	>0.745	>1.354	>1.963
P1029	Chromium	mg/kg	Macros	Head-Wade	985	≤20.53	>20.53	>23.30	>26.22	>29.15
P1043	Copper	mg/kg	Macros	Head-Wade	985	≤19.00	>19.00	>29.78	>40.45	>51.12
P1052	Lead	mg/kg	Macros	Head-Wade	985	≤15.50	>15.50	>24.80	>33.04	>41.27
P1053	Manganese	mg/kg	Macros	Head-Wade	985	≤841.0	>841.0	>845.5	>996.8	>1148
P1068	Nickel	mg/kg	Macros	Head-Wade	985	--	<19.50	>19.50	>22.52	>25.53
P1078	Silver	mg/kg	Macros	Head-Wade	985	--	<0.483	>0.483	>1.261	>2.039
P1083	Strontium	mg/kg	Macros	Head-Wade	985	--	<81.80	>81.80	>106.8	>131.9
P1093	Zinc	mg/kg	Macros	Head-Wade	985	≤75.00	>75.00	>100.0	>133.9	>167.8
P1103	Tin	mg/kg	Macros	Head-Wade	985	--	< 11.00	>8.86	>16.73	>24.60
P1108	Aluminum	mg/kg	Macros	Head-Wade	985	--	<6480	>6480	>8272	>10064
P34203	Acenaphthylene	µg/kg	Macros	Head-Wade	985	--	<86.38	>86.38	>103.6	>120.9
P34208	Acenaphthene	µg/kg	Macros	Head-Wade	985	--	<84.25	>84.25	>104.8	>125.3
P34223	Anthracene	µg/kg	Macros	Head-Wade	985	--	<78.00	>78.00	>119.9	>161.8
P34233	Benzo(b)fluoranthene	µg/kg	Macros	Head-Wade	985	--	<520.8	>520.8	>1437	>2354
P34245	Benzo(k)fluoranthene	µg/kg	Macros	Head-Wade	985	--	<207.0	>207.0	>434.7	>662.4
P34250	Benzo(a)pyrene	µg/kg	Macros	Head-Wade	985	--	<230.0	>230.0	>798.3	>1367
P34262	Delta-BHC	µg/kg	Macros	Head-Wade	985	--	<2.098	>2.098	>6.19	>10.28
P34323	Chrysene	µg/kg	Macros	Head-Wade	985	--	<266.0	>266.0	>958.3	>1651
P34379	Fluoranthene	µg/kg	Macros	Head-Wade	985	--	<774.0	>774.0	>2432	>4091
P34384	Fluorene	µg/kg	Macros	Head-Wade	985	--	<84.25	>84.25	>104.8	>125.3
P34406	Indeno(1,2,3-cd)pyrene	µg/kg	Macros	Head-Wade	985	--	< 260.5	>260.5	>623.3	>986.2
P34445	Naphthalene	µg/kg	Macros	Head-Wade	985	--	< 86.38	>86.38	>103.6	>120.9
P34464	Phenanthrene	µg/kg	Macros	Head-Wade	985	--	< 243.5	>243.5	>803.3	>1363
P34472	Pyrene	µg/kg	Macros	Head-Wade	985	--	< 393.0	>393.0	>1570	>2747
P34524	Benzo(g,h,i)perylene	µg/kg	Macros	Head-Wade	985	--	< 335.0	>335.0	>792.1	>1249
P34529	Benzo[a]anthracene	µg/kg	Macros	Head-Wade	985	--	< 239.0	>239.0	>699.4	>1160
P34559	Dibenz(a,h)anthracene	µg/kg	Macros	Head-Wade	985	--	< 101.0	>101.0	>167.3	>233.7

31 variables

Appendix Table A-3. NE IL IPS derived biological effect thresholds for habitat attributes and land use variables.

Parameter Code	Variable Name	Units	Limiting Assemblage	Site Size	Sample N	Excellent	Good	Fair	Poor	Very Poor
CHANNEL	Channel Score	QHEI Units	Fish	Head-Wade	1393	≥16.8	<16.8	<14.00	<9.2	<4.6
COVER	Cover Score	QHEI Units	Fish	Head-Wade	1393	≥16.0	<16.0	<14.0	<9.2	<4.6
CURRENT	Current Score	QHEI Units	Fish	Head-Wade	1393	≥7.0	>7.0	<7.0	<4.6	<2.3
DEPTH	Depth Score	QHEI Units	Fish	Head-Wade	1393	≥10.0	>10.0	<10.0	<6.6	<3.3
EMBEDDED	Embeddedness Score	QHEI Units	Fish	Head-Wade	1393	≤1.3	>1.3	>1.6	>2.4	>3.2
GRAD_S	Gradient Score	QHEI Units	Fish	Head-Wade	1393	≥10.0	>10.0	<10.0	<6.6	<3.3
GRADIENT	Gradient (ft/mi)	feet/mile	Fish	Head-Wade	1393	≥8.8	<8.8	<4.3	<2.8	<1.4
HYD_QHEI	Hydro-QHEI	QHEI Units	Fish	Head-Wade	1393	≥17.0	>17.0	<19.5	<12.9	<6.4
MWH_ATTR	Poor Habitat Attributes	Number	Fish	Head-Wade	1393	≤1	<1	>1	>3	>6
POOL	Pool Score	QHEI Units	Fish	Head-Wade	1393	≥11.3	<11.3	<10.0	<6.6	<3.3
QHEI	QHEI Score	QHEI Units	Fish	Head-Wade	1393	≥84.5	>75.9	<75.9	<50.1	<25.0
RIFFLE	Riff< Score	QHEI Units	Fish	Head-Wade	1393	≥5.8	≥5.8	<5.8	<3.9	<1.9
RIPARIAN	Riparian Score	QHEI Units	Fish	Head-Wade	1393	≥6.0	>6.0	<6.0	<4.0	<2.0
SILTCOVE	Silt Cover Scotre	QHEI Units	Fish	Head-Wade	1393	≤2.0	<2.0	>2.0	>2.7	>3.33
SUBSTRAT	Substrate Score	QHEI Units	Fish	Head-Wade	1393	≥16.0	<16.0	<15.0	<9.9	<5.0
WWH_ATTR	Good Habitat Attributes	Number	Fish	Head-Wade	1393	≥9	<9	<8	<5	<2
Develop	Developed (Ust. WS)	Wtd. %	Fish	Head-Wade	2657	≤9.1	>9.1	>45.6	>63.6	>81.5
Imperv	Impervious (30 m)	Wtd. %	Fish	Head-Wade	2657	≤18.3	>18.3	>30.5	>53.4	>76.4
Imperv	Impervious (30 m Clipped)	Wtd. %	Fish	Head-Wade	2657	≤13.4	>13.4	>26.7	>50.9	>75.1
Imperv	Impervious (500 m)	Wtd. %	Fish	Head-Wade	2657	≤5.6	>5.6	>12.5	>41.4	>70.3
Urban	Urban (Ust. WS)	Wtd. %	Fish	Head-Wade	2657	≤8.8	>8.8	>45.0	>63.2	>81.3
Ag	Agricultural (30 m)	Wtd. %	Macros	Head-Wade	3096	≤87.2	<87.2	>43.2	>61.9	>80.7
Ag	Agricultural (Ust. WS)	Wtd. %	Macros	Head-Wade	3096	≤87.1	<87.1	>62.1	>74.6	>87.1
Heavurb	Heavy Urban (Ust. WS)	Wtd. %	Macros	Head-Wade	3096	≤7.7	>7.7	>29.3	>52.6	>76.0
Imperv	Impervious (Ust. WS)	Wtd. %	Macros	Head-Wade	3096	≤5.6	>5.6	>13.2	>41.8	>70.5

25 variables

APPENDIX B

Upper Des Plaines Year 2 2018 Fish Assemblage Data

B-1: Fish Index of Biotic Integrity (IBI) Metrics & Scores

B-2: Fish Species Grand (all sites combined)

B-3: Fish Species by Sampling Event

Appendix Table B-1. Fish IBI results for data collected in the upper Des Plaines River study area during 2018.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of						Percent				Rel.No. /(0.3km)	Modified	
							Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores		IBI	Iwb
DES PLAINES RIVER - (95656)																			
Year: 2018																			
13-6	109.30	P	07/25/2018	123.6	84.2	3	24(5)	6(6)	2(2)	1(1)	4(3)	3(2)	3(1)	25(5)	43(6)	5(2)	552	33.0	9.2
13-6	109.30	P	09/14/2018	123.6	84.2	3	24(5)	6(6)	2(2)	2(2)	4(3)	5(3)	4(1)	25(5)	55(6)	2(1)	502	34.0	8.3
13-5	106.60	P	07/25/2018	137.2	86.1	3	20(4)	7(6)	2(2)	1(1)	3(2)	3(2)	2(1)	30(5)	45(6)	1(1)	434	30.0	7.4
13-5	106.60	P	09/14/2018	137.2	86.1	3	19(4)	5(5)	2(2)	1(1)	2(2)	3(2)	2(1)	32(5)	34(6)	0(1)	524	29.0	8.1
13-4	102.90	P	07/25/2018	145.5	87.2	3	16(3)	7(6)	1(1)	1(1)	1(1)	1(1)	2(1)	19(5)	58(6)	0(0)	370	25.0	8.5
13-4	102.90	P	09/14/2018	145.5	87.2	3	20(4)	6(6)	2(2)	1(1)	1(1)	3(2)	3(1)	30(5)	36(6)	0(0)	706	28.0	8.8
13-19	99.72	P	07/25/2018	212.8	94.2	3	13(2)	6(6)	1(1)	1(1)	1(1)	1(1)	2(1)	23(5)	72(4)	0(0)	372	22.0	7.9
13-19	99.72	P	09/14/2018	212.8	94.2	3	15(3)	5(5)	2(2)	1(1)	1(1)	1(1)	4(1)	33(5)	68(4)	0(0)	342	23.0	8.8
13-18	99.30	P	09/18/2018	213.1	94.2	3	20(4)	6(6)	2(2)	2(2)	2(2)	4(3)	7(2)	35(4)	70(4)	0(1)	552	30.0	8.9
13-3	98.70	P	07/26/2018	220.2	94.8	3	24(5)	6(6)	2(2)	3(3)	4(3)	5(4)	7(2)	25(5)	68(4)	2(1)	1312	35.0	9.9
13-3	98.70	P	09/15/2018	220.2	94.8	3	20(4)	6(6)	2(2)	2(2)	2(2)	4(3)	7(2)	30(5)	60(5)	0(1)	454	32.0	8.8
13-2	96.82	P	07/26/2018	225.3	95.2	3	22(5)	6(6)	2(2)	2(2)	5(4)	5(4)	20(4)	32(5)	70(4)	2(1)	948	37.0	9.5
13-2	96.82	P	09/16/2018	225.3	95.2	3	18(4)	5(5)	2(2)	2(2)	2(2)	4(3)	16(3)	33(5)	57(6)	1(1)	470	33.0	7.8
13-1	94.20	P	07/26/2018	232.0	95.8	3	24(5)	6(6)	2(2)	4(4)	5(4)	8(5)	34(6)	21(5)	48(6)	8(3)	670	46.0	9.6
13-1	94.20	P	09/16/2018	232.0	95.8	3	23(5)	6(6)	2(2)	3(3)	3(2)	6(4)	19(4)	26(5)	58(6)	4(2)	406	39.0	9.2
13-16	90.60	P	09/18/2018	253.7	97.4	3	22(5)	6(6)	2(2)	3(3)	3(2)	7(5)	29(5)	27(5)	53(6)	4(2)	558	41.0	8.8
13-16	90.60	P	07/28/2018	253.7	97.4	3	25(5)	6(6)	2(2)	4(4)	4(3)	6(4)	19(4)	24(5)	65(5)	8(3)	1036	41.0	9.0
16-6	87.10	P	07/31/2018	261.4	98.0	3	26(5)	6(6)	2(2)	5(5)	4(3)	10(6)	26(5)	31(5)	60(5)	7(3)	1162	45.0	9.5
16-6	87.10	P	09/17/2018	261.4	98.0	3	23(5)	5(5)	2(2)	4(4)	3(2)	9(6)	24(4)	30(5)	63(5)	2(1)	446	39.0	7.9

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table B-1. Fish IBI results for data collected in the upper Des Plaines River study area during 2018.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of						Percent				Rel.No. /(0.3km)	Modified	
							Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores		IBI	Iwb
16-7	84.60	P	07/27/2018	266.4	98.3	3	26(5)	7(6)	2(2)	5(5)	5(4)	7(5)	15(3)	23(5)	60(5)	20(6)	658	46.0	9.4
16-7	84.60	P	09/15/2018	266.4	98.3	3	23(5)	6(6)	2(2)	4(4)	3(2)	8(5)	10(2)	30(5)	73(4)	4(2)	530	37.0	7.4
16-5	83.60	P	07/27/2018	268.0	98.4	3	21(4)	7(6)	2(2)	2(2)	3(2)	2(2)	10(2)	24(5)	81(3)	3(1)	992	29.0	8.8
16-5	83.60	P	09/15/2018	268.0	98.4	3	21(4)	6(6)	2(2)	4(4)	4(3)	6(4)	5(1)	29(5)	64(5)	5(2)	520	36.0	8.3
16-8	82.90	P	07/27/2018	268.9	98.5	3	23(5)	7(6)	2(2)	3(3)	3(2)	6(4)	9(2)	26(5)	78(3)	3(2)	656	34.0	8.8
16-8	82.90	P	09/15/2018	268.9	98.5	3	21(4)	6(6)	2(2)	3(3)	2(2)	7(5)	7(2)	29(5)	78(3)	1(1)	348	33.0	7.5
16-4	80.00	P	07/29/2018	273.2	98.8	3	17(3)	5(5)	1(1)	1(1)	4(3)	4(3)	21(4)	29(5)	60(5)	18(6)	620	36.0	7.6
16-4	80.00	P	09/19/2018	273.2	98.8	3	16(3)	4(4)	1(1)	2(2)	3(2)	5(4)	27(5)	31(5)	58(6)	23(6)	382	38.0	7.8
16-3	76.70	P	07/28/2018	314.6	101.4	3	23(5)	6(6)	2(2)	4(4)	4(3)	7(5)	8(2)	26(5)	67(5)	5(2)	524	39.0	8.8
16-3	76.70	P	09/16/2018	314.6	101.4	3	19(4)	7(6)	2(2)	2(2)	3(2)	3(2)	21(4)	26(5)	59(6)	12(4)	278	37.0	8.3
16-2	75.40	P	07/28/2018	323.9	101.9	3	23(5)	6(6)	2(2)	4(4)	6(4)	6(4)	29(5)	22(5)	33(6)	32(6)	520	47.0	8.0
16-2	75.40	P	09/16/2018	323.9	101.9	3	20(4)	5(5)	2(2)	5(5)	3(2)	7(5)	14(3)	25(5)	79(3)	8(3)	734	37.0	7.9
16-1	71.70	P	07/31/2018	358.6	103.8	3	23(5)	7(6)	2(2)	3(3)	6(4)	4(3)	22(4)	26(5)	60(5)	8(3)	526	40.0	8.7
16-1	71.70	P	09/17/2018	358.6	103.8	3	20(4)	6(6)	2(2)	3(3)	4(3)	5(4)	21(4)	30(5)	61(5)	12(5)	378	41.0	7.7
TRIB TO WERHANE LAKE DRAIN - (95718)																			
Year: 2018																			
16-10	0.10	F	08/16/2018	0.2	1.1 ^X	3	1(6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(6)	0(6)	0(0)	0**	1.00	0.0
UNNAMED TRIB TO DES PLAINES RIVER - (95721)																			
Year: 2018																			
16-9	0.40	F	08/16/2018	1.1	1.1 ^X	3	7(6)	3(6)	1(6)	0(0)	0(0)	1(6)	0(0)	43(4)	31(6)	0(0)	102 *	34.0	5.5
WERHANE LAKE DRAIN - (95722)																			

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table B-1. Fish IBI results for data collected in the upper Des Plaines River study area during 2018.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of						Percent				Rel.No. /(0.3km)	Modified	
							Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores		IBI	Iwb
Year: 2018																			
16-10B	0.80	F	08/16/2018	0.2	1.1 ^x	3	12(6)	4(6)	1(6)	0(0)	1(6)	2(6)	0(0)	50(4)	76(3)	1(1)	441	38.0	6.1

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix B-2: Midwest Biodiversity Institute

Fish Species List - Grand Totals

Rivers: *DesPlaines River; Trib to Werhane Lake Drain; Unnamed Trib to Des Plaines River*

Years: 2018

Number of Samples: 36 Data Sources: 99 Data Types: F; P

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		8	0.5	0.08	16	0.04	34.6
15-001	BOWFIN	P		C		37	2.2	0.38	1697	4.04	764.5
20-003	GIZZARD SHAD	O		M		102	6.1	1.03	384	0.92	62.8
34-001	CENTRAL MUDMINNOW	I	T	C		51	3.1	0.52	6	0.02	2.0
37-001	Redfin pickerel	P	P	M		3	0.2	0.03	1	0.00	10.0
37-003	NORTHERN PIKE	P		M	F	80	4.8	0.81	2543	6.05	529.8
40-016	WHITE SUCKER	O	T	S	W	375	22.5	3.80	6940	16.52	308.4
40-018	SPOTTED SUCKER	I		S	R	173	10.4	1.75	4060	9.67	391.1
43-001	COMMON CARP	O	T	M	G	379	22.7	3.84	11791	28.07	518.5
43-002	GOLDFISH	O	T	M	G	3	0.2	0.03	2	0.01	11.6
43-003	GOLDEN SHINER	I	T	M	N	216	13.0	2.19	67	0.16	5.2
43-004	HORNYHEAD CHUB	I	I	N	N	385	23.1	3.90	338	0.81	14.6
43-013	CREEK CHUB	G	T	N	N	7	0.4	0.07	5	0.01	12.7
43-026	COMMON SHINER	I		S	N	3	0.2	0.03	0	0.00	4.3
43-028	SPOTTAIL SHINER	I	P	M	N	11	0.7	0.11	3	0.01	5.1
43-029	BLACKCHIN SHINER	I	S	M	N	48	2.9	0.49	6	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	424	25.4	4.30	93	0.22	3.6
43-034	SAND SHINER	I	M	M	N	159	9.5	1.61	26	0.06	2.7
43-042	FATHEAD MINNOW	O	T	C	N	4	0.2	0.04	0	0.00	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1361	81.7	13.80	218	0.52	2.6
43-044	CENTRAL STONEROLLER	H		N	N	7	0.4	0.07	1	0.00	3.7
43-045	COMMON CARP X GOLDFISH	O	T		G	7	0.4	0.07	447	1.06	1064.2
43-117	CARMINE SHINER	I	I	S	N	65	3.9	0.66	7	0.02	1.9
47-002	CHANNEL CATFISH			C	F	70	4.2	0.71	4821	11.48	1147.8
47-004	YELLOW BULLHEAD	I	T	C		149	8.9	1.51	838	2.00	93.8
47-006	BLACK BULLHEAD	I	P	C		31	1.9	0.31	107	0.25	57.5
47-008	STONECAT MADTOM	I	I	C		10	0.6	0.10	19	0.05	32.5
47-013	TADPOLE MADTOM	I		C		13	0.8	0.13	5	0.01	7.2
47-015	BROWN BH X BLACK BH	I		C		1	0.1	0.01	18	0.04	300.0
54-000	WESTERN BANDED KILLIFISH	I	S	M		3	0.2	0.03	0	0.00	2.3
54-002	BLACKSTRIPE TOPMINNOW	I		M		543	32.6	5.50	27	0.07	0.8
68-001	PIRATE PERCH	I		C		4	0.2	0.04	0	0.00	3.7
70-001	BROOK SILVERSIDE	I	M	M		16	1.0	0.16	0	0.00	0.8
74-006	YELLOW BASS	P	P	M		3	0.2	0.03	8	0.02	46.6
77-001	WHITE CRAPPIE	I		C	S	6	0.4	0.06	1	0.00	2.8
77-002	BLACK CRAPPIE	I		C	S	57	3.4	0.58	278	0.66	81.4
77-003	ROCK BASS	C		C	S	420	25.2	4.26	916	2.18	36.3
77-004	SMALLMOUTH BASS	C	M	C	F	14	0.8	0.14	140	0.33	167.1
77-006	LARGEMOUTH BASS	C		C	F	784	47.0	7.95	1954	4.65	41.5
77-007	WARMOUTH SUNFISH	C		C	S	27	1.6	0.27	52	0.12	32.2

Appendix B-2: Midwest Biodiversity Institute

Fish Species List - Grand Totals

Rivers: *DesPlaines River; Trib to Werhane Lake Drain; Unnamed Trib to Des Plaines River*

Years: 2018

Number of Samples: 36 Data Sources: 99 Data Types: F; P

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
77-008	GREEN SUNFISH	I	T	C	S	910	54.6	9.22	537	1.28	9.8
77-009	BLUEGILL SUNFISH	I	P	C	S	1677	100.6	17.00	2208	5.26	21.9
77-010	ORANGESPOTTED SUNFISH	I		C	S	2	0.1	0.02	1	0.00	9.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	550	33.0	5.58	727	1.73	22.0
77-014	BLUEGILL X PUMPKINSEED					3	0.2	0.03	9	0.02	52.6
77-015	GREEN SF X BLUEGILL SF					19	1.1	0.19	30	0.07	26.8
77-016	GREEN SF X PUMPKINSEED					1	0.1	0.01	4	0.01	80.0
80-001	SAUGER	P		S	F	1	0.1	0.01	60	0.14	1000.0
80-002	WALLEYE	P		S	F	3	0.2	0.03	408	0.97	2266.6
80-003	YELLOW PERCH			M		64	3.8	0.65	56	0.13	14.6
80-005	BLACKSIDE DARTER	I		S	D	230	13.8	2.33	49	0.12	3.5
80-011	LOGPERCH	I	M	S	D	42	2.5	0.43	40	0.10	16.1
80-014	JOHNNY DARTER	I		C	D	304	18.2	3.08	16	0.04	0.9
99-997	Dry Site					0	0.0	0.00	0	0.00	*****

No Species: 54 **Nat. Species:** 47 **Hybrids:** 5 **Total Counted:** 9865 **Total Rel. Wt. :** 42002

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 71.70 Date: 07/31/2018
 Time Fished: 2087 Distance: 0.500 Drainge (sq mi): 358.6 Depth: 0
 Location: Ust. Palatine Rd. Lat: 42.11407 Long: -87.88930

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.38	1400	0.76	700.0
40-016	WHITE SUCKER	O	T	S	W	25	50.0	9.51	33600	18.20	672.0
40-018	SPOTTED SUCKER	I		S	R	4	8.0	1.52	6400	3.47	800.0
43-001	COMMON CARP	O	T	M	G	18	36.0	6.84	109400	59.25	3038.8
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	0.38	8	0.00	4.0
43-029	BLACKCHIN SHINER	I	S	M	N	19	38.0	7.22	60	0.03	1.5
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.38	8	0.00	4.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	7	14.0	2.66	30	0.02	2.1
47-002	CHANNEL CATFISH			C	F	6	12.0	2.28	17400	9.42	1450.0
47-004	YELLOW BULLHEAD	I	T	C		9	18.0	3.42	2400	1.30	133.3
47-008	STONECAT MADTOM	I	I	C		3	6.0	1.14	200	0.11	33.3
47-013	TADPOLE MADTOM	I		C		1	2.0	0.38	30	0.02	15.0
54-002	BLACKSTRIPED TOPMINNOW	I		M		1	2.0	0.38	4	0.00	2.0
77-002	BLACK CRAPPIE	I		C	S	5	10.0	1.90	880	0.48	88.0
77-003	ROCK BASS	C		C	S	36	72.0	13.69	5240	2.84	72.7
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.38	100	0.05	50.0
77-006	LARGEMOUTH BASS	C		C	F	7	14.0	2.66	340	0.18	24.2
77-008	GREEN SUNFISH	I	T	C	S	39	78.0	14.83	1420	0.77	18.2
77-009	BLUEGILL SUNFISH	I	P	C	S	49	98.0	18.63	5280	2.86	53.8
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	1.14	100	0.05	16.6
80-003	YELLOW PERCH			M		6	12.0	2.28	130	0.07	10.8
80-005	BLACKSIDE DARTER	I		S	D	12	24.0	4.56	60	0.03	2.5
80-011	LOGPERCH	I	M	S	D	5	10.0	1.90	140	0.08	14.0
80-014	JOHNNY DARTER	I		C	D	4	8.0	1.52	10	0.01	1.2

No Species: 24 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 263 **Total Rel. Wt. :** 184640
IBI: 36.0 **MIwb:** 8.7

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 71.70 Date: 09/17/2018
 Time Fished: 1711 Distance: 0.500 Drainge (sq mi): 358.6 Depth: 0
 Location: Ust. Palatine Rd. Lat: 42.11407 Long: -87.88930

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.53	1200	0.68	600.0
40-018	SPOTTED SUCKER	I		S	R	7	14.0	3.70	12620	7.14	901.4
43-001	COMMON CARP	O	T	M	G	28	56.0	14.81	139854	79.13	2497.3
43-004	HORNYHEAD CHUB	I	I	N	N	1	2.0	0.53	4	0.00	2.0
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.53	2	0.00	1.0
43-034	SAND SHINER	I	M	M	N	10	20.0	5.29	60	0.03	3.0
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.53	2	0.00	1.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	34	68.0	17.99	280	0.16	4.1
43-045	COMMON CARP X GOLDFISH	O	T		G	2	4.0	1.06	5000	2.83	1250.0
47-002	CHANNEL CATFISH			C	F	1	2.0	0.53	3600	2.04	1800.0
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	1.06	650	0.37	162.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	14.0	3.70	14	0.01	1.0
77-002	BLACK CRAPPIE	I		C	S	3	6.0	1.59	1610	0.91	268.3
77-003	ROCK BASS	C		C	S	12	24.0	6.35	2100	1.19	87.5
77-004	SMALLMOUTH BASS	C	M	C	F	3	6.0	1.59	2810	1.59	468.3
77-006	LARGEMOUTH BASS	C		C	F	22	44.0	11.64	6220	3.52	141.3
77-008	GREEN SUNFISH	I	T	C	S	17	34.0	8.99	220	0.12	6.4
77-009	BLUEGILL SUNFISH	I	P	C	S	11	22.0	5.82	310	0.18	14.0
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.53	6	0.00	3.0
80-003	YELLOW PERCH			M		2	4.0	1.06	20	0.01	5.0
80-005	BLACKSIDE DARTER	I		S	D	16	32.0	8.47	100	0.06	3.1
80-011	LOGPERCH	I	M	S	D	1	2.0	0.53	40	0.02	20.0
80-014	JOHNNY DARTER	I		C	D	6	12.0	3.17	12	0.01	1.0

No Species: 21 **Nat. Species:** 20 **Hybrids:** 2 **Total Counted:** 189 **Total Rel. Wt. :** 176734
IBI: 30.0 **MIwb:** 7.7

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 75.40 Date: 07/28/2018
 Time Fished: 1678 Distance: 0.500 Drainge (sq mi): 323.9 Depth: 0
 Location: Dst. Lake Cook Rd. Lat: 42.15282 Long: -87.91034

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.38	16	0.02	8.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.38	120	0.18	60.0
40-016	WHITE SUCKER	O	T	S	W	2	4.0	0.77	60	0.09	15.0
40-018	SPOTTED SUCKER	I		S	R	1	2.0	0.38	1600	2.35	800.0
43-001	COMMON CARP	O	T	M	G	8	16.0	3.08	51200	75.25	3200.0
43-004	HORNHEAD CHUB	I	I	N	N	14	28.0	5.38	880	1.29	31.4
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.38	4	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	9	18.0	3.46	60	0.09	3.3
43-034	SAND SHINER	I	M	M	N	19	38.0	7.31	120	0.18	3.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	6	12.0	2.31	40	0.06	3.3
43-117	CARMINE SHINER	I	I	S	N	21	42.0	8.08	100	0.15	2.3
47-004	YELLOW BULLHEAD	I	T	C		5	10.0	1.92	1400	2.06	140.0
47-008	STONECAT MADTOM	I	I	C		1	2.0	0.38	140	0.21	70.0
47-013	TADPOLE MADTOM	I		C		2	4.0	0.77	100	0.15	25.0
77-003	ROCK BASS	C		C	S	18	36.0	6.92	3320	4.88	92.2
77-006	LARGEMOUTH BASS	C		C	F	30	60.0	11.54	6340	9.32	105.6
77-008	GREEN SUNFISH	I	T	C	S	12	24.0	4.62	280	0.41	11.6
77-009	BLUEGILL SUNFISH	I	P	C	S	23	46.0	8.85	1740	2.56	37.8
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	2.0	0.38	16	0.02	8.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	4.0	0.77	40	0.06	10.0
80-003	YELLOW PERCH			M		1	2.0	0.38	50	0.07	25.0
80-005	BLACKSIDE DARTER	I		S	D	17	34.0	6.54	160	0.24	4.7
80-011	LOGPERCH	I	M	S	D	4	8.0	1.54	130	0.19	16.2
80-014	JOHNNY DARTER	I		C	D	61	122.0	23.46	120	0.18	0.9

No Species: 24 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 260 **Total Rel. Wt. :** 68036
IBI: 48.0 **MIwb:** 8.0

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 75.40 Date: 09/16/2018
 Time Fished: 1650 Distance: 0.500 Drainge (sq mi): 323.9 Depth: 0
 Location: Dst. Lake Cook Rd. Lat: 42.15282 Long: -87.91034

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	34	68.0	9.26	3900	3.97	57.3
40-018	SPOTTED SUCKER	I		S	R	8	16.0	2.18	6268	6.38	391.7
43-001	COMMON CARP	O	T	M	G	11	22.0	3.00	67800	69.03	3081.8
43-004	HORNYHEAD CHUB	I	I	N	N	13	26.0	3.54	280	0.29	10.7
43-028	SPOTTAIL SHINER	I	P	M	N	2	4.0	0.54	20	0.02	5.0
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.27	4	0.00	2.0
43-032	SPOTFIN SHINER	I		M	N	13	26.0	3.54	60	0.06	2.3
43-034	SAND SHINER	I	M	M	N	48	96.0	13.08	320	0.33	3.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	144	288.0	39.24	1680	1.71	5.8
43-117	CARMINE SHINER	I	I	S	N	2	4.0	0.54	4	0.00	1.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.54	11400	11.61	2850.0
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	1.63	1640	1.67	136.6
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.0	0.82	6	0.01	1.0
77-003	ROCK BASS	C		C	S	11	22.0	3.00	2020	2.06	91.8
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.27	660	0.67	330.0
77-006	LARGEMOUTH BASS	C		C	F	15	30.0	4.09	600	0.61	20.0
77-008	GREEN SUNFISH	I	T	C	S	9	18.0	2.45	140	0.14	7.7
77-009	BLUEGILL SUNFISH	I	P	C	S	12	24.0	3.27	1020	1.04	42.5
80-003	YELLOW PERCH			M		4	8.0	1.09	260	0.26	32.5
80-005	BLACKSIDE DARTER	I		S	D	15	30.0	4.09	120	0.12	4.0
80-014	JOHNNY DARTER	I		C	D	13	26.0	3.54	20	0.02	0.7

No Species: 21 **Nat. Species:** 20 **Hybrids:** 0 **Total Counted:** 367 **Total Rel. Wt. :** 98222
IBI: 26.0 **MIwb:** 7.9

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 76.70 Date: 07/28/2018
 Time Fished: 2000 Distance: 0.500 Drainge (sq mi): 314.6 Depth: 0
 Location: Dst. Deerfield Rd. Lat: 42.16713 Long: -87.91372

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	8	16.0	3.05	13680	11.80	855.0
40-016	WHITE SUCKER	O	T	S	W	7	14.0	2.67	13300	11.47	950.0
40-018	SPOTTED SUCKER	I		S	R	3	6.0	1.15	5200	4.48	866.6
43-001	COMMON CARP	O	T	M	G	13	26.0	4.96	64700	55.80	2488.4
43-003	GOLDEN SHINER	I	T	M	N	4	8.0	1.53	10	0.01	1.2
43-004	HORNYHEAD CHUB	I	I	N	N	1	2.0	0.38	40	0.03	20.0
43-029	BLACKCHIN SHINER	I	S	M	N	2	4.0	0.76	8	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	45	90.0	17.18	390	0.34	4.3
43-034	SAND SHINER	I	M	M	N	2	4.0	0.76	6	0.01	1.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	19	38.0	7.25	100	0.09	2.6
43-117	CARMINE SHINER	I	I	S	N	1	2.0	0.38	4	0.00	2.0
47-002	CHANNEL CATFISH			C	F	1	2.0	0.38	3000	2.59	1500.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	1.53	640	0.55	80.0
47-013	TADPOLE MADTOM	I		C		1	2.0	0.38	8	0.01	4.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	8.0	1.53	8	0.01	1.0
77-002	BLACK CRAPPIE	I		C	S	4	8.0	1.53	708	0.61	88.5
77-003	ROCK BASS	C		C	S	7	14.0	2.67	780	0.67	55.7
77-006	LARGEMOUTH BASS	C		C	F	32	64.0	12.21	9800	8.45	153.1
77-008	GREEN SUNFISH	I	T	C	S	32	64.0	12.21	640	0.55	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	46	92.0	17.56	2300	1.98	25.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	11	22.0	4.20	380	0.33	17.2
77-016	GREEN SF X PUMPKINSEED					1	2.0	0.38	160	0.14	80.0
80-003	YELLOW PERCH			M		1	2.0	0.38	40	0.03	20.0
80-005	BLACKSIDE DARTER	I		S	D	9	18.0	3.44	50	0.04	2.7
80-014	JOHNNY DARTER	I		C	D	4	8.0	1.53	6	0.01	0.7

No Species: 24 **Nat. Species:** 23 **Hybrids:** 1 **Total Counted:** 262 **Total Rel. Wt. :** 115958
IBI: 40.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 76.70 Date: 09/16/2018
 Time Fished: 1735 Distance: 0.500 Drainge (sq mi): 314.6 Depth: 0
 Location: Dst. Deerfield Rd. Lat: 42.16713 Long: -87.91372

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	4	8.0	2.88	3160	3.61	395.0
40-016	WHITE SUCKER	O	T	S	W	6	12.0	4.32	6616	7.55	551.3
40-018	SPOTTED SUCKER	I		S	R	4	8.0	2.88	5208	5.94	651.0
43-001	COMMON CARP	O	T	M	G	10	20.0	7.19	55800	63.66	2790.0
43-032	SPOTFIN SHINER	I		M	N	15	30.0	10.79	80	0.09	2.6
43-034	SAND SHINER	I	M	M	N	2	4.0	1.44	8	0.01	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	6	12.0	4.32	40	0.05	3.3
47-002	CHANNEL CATFISH			C	F	1	2.0	0.72	4000	4.56	2000.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.72	10	0.01	5.0
47-013	TADPOLE MADTOM	I		C		1	2.0	0.72	6	0.01	3.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.72	2	0.00	1.0
77-002	BLACK CRAPPIE	I		C	S	3	6.0	2.16	1020	1.16	170.0
77-003	ROCK BASS	C		C	S	9	18.0	6.47	1100	1.25	61.1
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.72	900	1.03	450.0
77-006	LARGEMOUTH BASS	C		C	F	14	28.0	10.07	7140	8.15	255.0
77-008	GREEN SUNFISH	I	T	C	S	11	22.0	7.91	180	0.21	8.1
77-009	BLUEGILL SUNFISH	I	P	C	S	26	52.0	18.71	1900	2.17	36.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	2.16	140	0.16	23.3
80-003	YELLOW PERCH			M		6	12.0	4.32	240	0.27	20.0
80-005	BLACKSIDE DARTER	I		S	D	15	30.0	10.79	100	0.11	3.3

No Species: 20 **Nat. Species:** 19 **Hybrids:** 0 **Total Counted:** 139 **Total Rel. Wt. :** 87650
IBI: 38.0 **MIwb:** 8.3

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 80.00 Date: 07/29/2018
 Time Fished: 0 Distance: 0.500 Drainge (sq mi): 273.2 Depth: 0
 Location: Dst. Half Day Rd. Lat: 42.19812 Long: -87.91911

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.32	80	0.26	40.0
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.32	16	0.05	8.0
43-001	COMMON CARP	O	T	M	G	4	8.0	1.29	19420	62.01	2427.5
43-004	HORNYHEAD CHUB	I	I	N	N	21	42.0	6.77	480	1.53	11.4
43-032	SPOTFIN SHINER	I		M	N	3	6.0	0.97	20	0.06	3.3
43-034	SAND SHINER	I	M	M	N	7	14.0	2.26	40	0.13	2.8
43-043	BLUNTNOSE MINNOW	O	T	C	N	2	4.0	0.65	16	0.05	4.0
47-004	YELLOW BULLHEAD	I	T	C		9	18.0	2.90	1380	4.41	76.6
47-008	STONECAT MADTOM	I	I	C		2	4.0	0.65	140	0.45	35.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.32	4	0.01	2.0
77-003	ROCK BASS	C		C	S	16	32.0	5.16	1960	6.26	61.2
77-006	LARGEMOUTH BASS	C		C	F	22	44.0	7.10	1360	4.34	30.9
77-008	GREEN SUNFISH	I	T	C	S	86	172.0	27.74	1460	4.66	8.4
77-009	BLUEGILL SUNFISH	I	P	C	S	74	148.0	23.87	4460	14.24	30.1
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	4.0	0.65	100	0.32	25.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.65	40	0.13	10.0
80-005	BLACKSIDE DARTER	I		S	D	23	46.0	7.42	100	0.32	2.1
80-011	LOGPERCH	I	M	S	D	6	12.0	1.94	200	0.64	16.6
80-014	JOHNNY DARTER	I		C	D	28	56.0	9.03	40	0.13	0.7

No Species: 18 **Nat. Species:** 17 **Hybrids:** 1 **Total Counted:** 310 **Total Rel. Wt. :** 31316
IBI: 38.0 **MIwb:** 7.6

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 80.00 Date: 09/19/2018
 Time Fished: 1044 Distance: 0.500 Drainge (sq mi): 273.2 Depth: 0
 Location: Dst. Half Day Rd. Lat: 42.19812 Long: -87.91911

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	4	8.0	2.09	4200	12.59	525.0
43-001	COMMON CARP	O	T	M	G	2	4.0	1.05	17000	50.94	4250.0
43-004	HORNYHEAD CHUB	I	I	N	N	8	16.0	4.19	300	0.90	18.7
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.52	6	0.02	3.0
43-034	SAND SHINER	I	M	M	N	5	10.0	2.62	30	0.09	3.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	27	54.0	14.14	380	1.14	7.0
43-117	CARMINE SHINER	I	I	S	N	2	4.0	1.05	8	0.02	2.0
47-002	CHANNEL CATFISH			C	F	1	2.0	0.52	5700	17.08	2850.0
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	3.14	760	2.28	63.3
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.0	1.57	6	0.02	1.0
77-003	ROCK BASS	C		C	S	8	16.0	4.19	1260	3.78	78.7
77-006	LARGEMOUTH BASS	C		C	F	11	22.0	5.76	300	0.90	13.6
77-008	GREEN SUNFISH	I	T	C	S	43	86.0	22.51	880	2.64	10.2
77-009	BLUEGILL SUNFISH	I	P	C	S	22	44.0	11.52	1400	4.20	31.8
77-015	GREEN SF X BLUEGILL SF					4	8.0	2.09	160	0.48	20.0
80-005	BLACKSIDE DARTER	I		S	D	21	42.0	10.99	360	1.08	8.5
80-011	LOGPERCH	I	M	S	D	13	26.0	6.81	600	1.80	23.0
80-014	JOHNNY DARTER	I		C	D	10	20.0	5.24	20	0.06	1.0

No Species: 17 **Nat. Species:** 16 **Hybrids:** 1 **Total Counted:** 191 **Total Rel. Wt. :** 33370
IBI: 30.0 **MIwb:** 7.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 82.90 Date: 07/27/2018
 Time Fished: 2182 Distance: 0.500 Drainge (sq mi): 268.9 Depth: 0
 Location: Ust. dam site Lat: 42.23100 Long: -87.93410

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.30	580	0.46	290.0
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.30	10	0.01	5.0
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.61	6400	5.10	1600.0
40-016	WHITE SUCKER	O	T	S	W	11	22.0	3.35	20000	15.92	909.0
40-018	SPOTTED SUCKER	I		S	R	9	18.0	2.74	11704	9.32	650.2
43-001	COMMON CARP	O	T	M	G	12	24.0	3.66	64000	50.95	2666.6
43-003	GOLDEN SHINER	I	T	M	N	26	52.0	7.93	80	0.06	1.5
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.30	4	0.00	2.0
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.30	40	0.03	20.0
43-032	SPOTFIN SHINER	I		M	N	4	8.0	1.22	30	0.02	3.7
43-034	SAND SHINER	I	M	M	N	2	4.0	0.61	8	0.01	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	59	118.0	17.99	380	0.30	3.2
47-002	CHANNEL CATFISH			C	F	1	2.0	0.30	4400	3.50	2200.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.30	40	0.03	20.0
77-002	BLACK CRAPPIE	I		C	S	5	10.0	1.52	1380	1.10	138.0
77-003	ROCK BASS	C		C	S	11	22.0	3.35	2000	1.59	90.9
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.30	120	0.10	60.0
77-006	LARGEMOUTH BASS	C		C	F	18	36.0	5.49	3960	3.15	110.0
77-008	GREEN SUNFISH	I	T	C	S	42	84.0	12.80	760	0.61	9.0
77-009	BLUEGILL SUNFISH	I	P	C	S	88	176.0	26.83	8520	6.78	48.4
77-013	PUMPKINSEED SUNFISH	I	P	C	S	18	36.0	5.49	880	0.70	24.4
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.61	140	0.11	35.0
80-003	YELLOW PERCH			M		2	4.0	0.61	120	0.10	30.0
80-005	BLACKSIDE DARTER	I		S	D	7	14.0	2.13	50	0.04	3.5
80-011	LOGPERCH	I	M	S	D	3	6.0	0.91	6	0.00	1.0

No Species: 24 **Nat. Species:** 23 **Hybrids:** 1 **Total Counted:** 328 **Total Rel. Wt. :** 125612
IBI: 34.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 82.90 Date: 09/15/2018
 Time Fished: 1816 Distance: 0.500 Drainge (sq mi): 268.9 Depth: 0
 Location: Ust. dam site Lat: 42.23100 Long: -87.93410

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		2	4.0	1.15	800	0.73	200.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.57	1300	1.19	650.0
40-016	WHITE SUCKER	O	T	S	W	8	16.0	4.60	13000	11.87	812.5
40-018	SPOTTED SUCKER	I		S	R	7	14.0	4.02	11000	10.04	785.7
43-001	COMMON CARP	O	T	M	G	14	28.0	8.05	78900	72.04	2817.8
43-003	GOLDEN SHINER	I	T	M	N	8	16.0	4.60	60	0.05	3.7
43-004	HORNHEAD CHUB	I	I	N	N	1	2.0	0.57	6	0.01	3.0
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.57	6	0.01	3.0
43-032	SPOTFIN SHINER	I		M	N	18	36.0	10.34	144	0.13	4.0
43-034	SAND SHINER	I	M	M	N	5	10.0	2.87	22	0.02	2.2
43-043	BLUNTNOSE MINNOW	O	T	C	N	49	98.0	28.16	260	0.24	2.6
43-117	CARMINE SHINER	I	I	S	N	2	4.0	1.15	8	0.01	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.57	440	0.40	220.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		8	16.0	4.60	60	0.05	3.7
77-002	BLACK CRAPPIE	I		C	S	2	4.0	1.15	940	0.86	235.0
77-003	ROCK BASS	C		C	S	3	6.0	1.72	280	0.26	46.6
77-006	LARGEMOUTH BASS	C		C	F	11	22.0	6.32	1308	1.19	59.4
77-008	GREEN SUNFISH	I	T	C	S	12	24.0	6.90	110	0.10	4.5
77-009	BLUEGILL SUNFISH	I	P	C	S	11	22.0	6.32	600	0.55	27.2
77-013	PUMPKINSEED SUNFISH	I	P	C	S	6	12.0	3.45	40	0.04	3.3
77-014	BLUEGILL X PUMPKINSEED					1	2.0	0.57	210	0.19	105.0
80-003	YELLOW PERCH			M		1	2.0	0.57	16	0.01	8.0
80-014	JOHNNY DARTER	I		C	D	2	4.0	1.15	6	0.01	1.5

No Species: 22 **Nat. Species:** 21 **Hybrids:** 1 **Total Counted:** 174 **Total Rel. Wt. :** 109516
IBI: 30.0 **MIwb:** 7.5

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 83.60 Date: 07/27/2018
 Time Fished: 1700 Distance: 0.500 Drainge (sq mi): 268.0 Depth: 0
 Location: Dst. IL-60 Lat: 42.24004 Long: -87.93913

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.20	8	0.01	4.0
37-003	NORTHERN PIKE	P		M	F	6	12.0	1.21	8360	6.52	696.6
40-016	WHITE SUCKER	O	T	S	W	11	22.0	2.22	12380	9.66	562.7
40-018	SPOTTED SUCKER	I		S	R	7	14.0	1.41	3892	3.04	278.0
43-001	COMMON CARP	O	T	M	G	14	28.0	2.82	68500	53.44	2446.4
43-032	SPOTFIN SHINER	I		M	N	3	6.0	0.60	20	0.02	3.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	134	268.0	27.02	720	0.56	2.6
47-002	CHANNEL CATFISH			C	F	1	2.0	0.20	1300	1.01	650.0
47-004	YELLOW BULLHEAD	I	T	C		11	22.0	2.22	3000	2.34	136.3
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.20	300	0.23	150.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	0.40	10	0.01	2.5
77-002	BLACK CRAPPIE	I		C	S	5	10.0	1.01	1600	1.25	160.0
77-003	ROCK BASS	C		C	S	32	64.0	6.45	4780	3.73	74.6
77-004	SMALLMOUTH BASS	C	M	C	F	2	4.0	0.40	230	0.18	57.5
77-006	LARGEMOUTH BASS	C		C	F	25	50.0	5.04	2620	2.04	52.4
77-008	GREEN SUNFISH	I	T	C	S	76	152.0	15.32	2220	1.73	14.6
77-009	BLUEGILL SUNFISH	I	P	C	S	144	288.0	29.03	11060	8.63	38.4
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	0.60	140	0.11	23.3
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.40	160	0.12	40.0
80-002	WALLEYE	P		S	F	1	2.0	0.20	6800	5.31	3400.0
80-003	YELLOW PERCH			M		2	4.0	0.40	20	0.02	5.0
80-005	BLACKSIDE DARTER	I		S	D	6	12.0	1.21	40	0.03	3.3
80-014	JOHNNY DARTER	I		C	D	7	14.0	1.41	10	0.01	0.7

No Species: 22 **Nat. Species:** 21 **Hybrids:** 1 **Total Counted:** 496 **Total Rel. Wt. :** 128170
IBI: 34.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 83.60 Date: 09/15/2018
 Time Fished: 1988 Distance: 0.500 Drainge (sq mi): 268.0 Depth: 0
 Location: Dst. IL-60 Lat: 42.24004 Long: -87.93913

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.77	5000	7.65	1250.0
40-016	WHITE SUCKER	O	T	S	W	11	22.0	4.23	15940	24.40	724.5
40-018	SPOTTED SUCKER	I		S	R	5	10.0	1.92	3680	5.63	368.0
43-001	COMMON CARP	O	T	M	G	5	10.0	1.92	29200	44.70	2920.0
43-003	GOLDEN SHINER	I	T	M	N	5	10.0	1.92	80	0.12	8.0
43-004	HORNHEAD CHUB	I	I	N	N	1	2.0	0.38	6	0.01	3.0
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.38	4	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	11	22.0	4.23	60	0.09	2.7
43-034	SAND SHINER	I	M	M	N	3	6.0	1.15	12	0.02	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	64	128.0	24.62	400	0.61	3.1
47-002	CHANNEL CATFISH			C	F	2	4.0	0.77	6000	9.18	1500.0
47-004	YELLOW BULLHEAD	I	T	C		7	14.0	2.69	1000	1.53	71.4
47-013	TADPOLE MADTOM	I		C		1	2.0	0.38	4	0.01	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		47	94.0	18.08	90	0.14	0.9
77-003	ROCK BASS	C		C	S	3	6.0	1.15	560	0.86	93.3
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.38	320	0.49	160.0
77-006	LARGEMOUTH BASS	C		C	F	20	40.0	7.69	1136	1.74	28.4
77-008	GREEN SUNFISH	I	T	C	S	37	74.0	14.23	640	0.98	8.6
77-009	BLUEGILL SUNFISH	I	P	C	S	17	34.0	6.54	1100	1.68	32.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	4	8.0	1.54	60	0.09	7.5
80-005	BLACKSIDE DARTER	I		S	D	2	4.0	0.77	16	0.02	4.0
80-014	JOHNNY DARTER	I		C	D	11	22.0	4.23	20	0.03	0.9

No Species: 22 **Nat. Species:** 21 **Hybrids:** 0 **Total Counted:** 260 **Total Rel. Wt. :** 65328

IBI: 34.0 **MIwb:** 8.3

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 84.60 Date: 07/27/2018
 Time Fished: 1818 Distance: 0.500 Drainge (sq mi): 266.4 Depth: 0
 Location: Dst. dam site Lat: 42.25022 Long: -87.94044

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	4	8.0	1.22	10400	6.17	1300.0
40-016	WHITE SUCKER	O	T	S	W	36	72.0	10.94	47100	27.93	654.1
40-018	SPOTTED SUCKER	I		S	R	3	6.0	0.91	4000	2.37	666.6
43-001	COMMON CARP	O	T	M	G	13	26.0	3.95	73000	43.28	2807.6
43-003	GOLDEN SHINER	I	T	M	N	3	6.0	0.91	8	0.00	1.3
43-004	HORNHEAD CHUB	I	I	N	N	4	8.0	1.22	158	0.09	19.7
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.30	4	0.00	2.0
43-032	SPOTFIN SHINER	I		M	N	16	32.0	4.86	120	0.07	3.7
43-034	SAND SHINER	I	M	M	N	39	78.0	11.85	180	0.11	2.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	13	26.0	3.95	126	0.07	4.8
43-117	CARMINE SHINER	I	I	S	N	7	14.0	2.13	28	0.02	2.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.61	8800	5.22	2200.0
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	1.82	2600	1.54	216.6
47-008	STONECAT MADTOM	I	I	C		2	4.0	0.61	50	0.03	12.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.30	2	0.00	1.0
77-003	ROCK BASS	C		C	S	17	34.0	5.17	2750	1.63	80.8
77-004	SMALLMOUTH BASS	C	M	C	F	2	4.0	0.61	1180	0.70	295.0
77-006	LARGEMOUTH BASS	C		C	F	23	46.0	6.99	8880	5.27	193.0
77-008	GREEN SUNFISH	I	T	C	S	23	46.0	6.99	500	0.30	10.8
77-009	BLUEGILL SUNFISH	I	P	C	S	42	84.0	12.77	3580	2.12	42.6
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	2.0	0.30	20	0.01	10.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	0.91	100	0.06	16.6
80-001	SAUGER	P		S	F	1	2.0	0.30	2000	1.19	1000.0
80-002	WALLEYE	P		S	F	1	2.0	0.30	2800	1.66	1400.0
80-005	BLACKSIDE DARTER	I		S	D	12	24.0	3.65	100	0.06	4.1
80-011	LOGPERCH	I	M	S	D	2	4.0	0.61	50	0.03	12.5
80-014	JOHNNY DARTER	I		C	D	52	104.0	15.81	120	0.07	1.1

No Species: 27 **Nat. Species:** 26 **Hybrids:** 0 **Total Counted:** 329 **Total Rel. Wt. :** 168656

IBI: 42.0 **MIwb:** 9.4

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 84.60 Date: 09/15/2018
 Time Fished: 2618 Distance: 0.500 Drainge (sq mi): 266.4 Depth: 0
 Location: Dst. dam site Lat: 42.25022 Long: -87.94044

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.38	10	0.01	5.0
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.38	10	0.01	5.0
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.75	4000	2.99	1000.0
40-016	WHITE SUCKER	O	T	S	W	12	24.0	4.53	14840	11.09	618.3
40-018	SPOTTED SUCKER	I		S	R	4	8.0	1.51	2640	1.97	330.0
43-001	COMMON CARP	O	T	M	G	18	36.0	6.79	105200	78.60	2922.2
43-003	GOLDEN SHINER	I	T	M	N	18	36.0	6.79	200	0.15	5.5
43-004	HORNHEAD CHUB	I	I	N	N	9	18.0	3.40	220	0.16	12.2
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.38	6	0.00	3.0
43-032	SPOTFIN SHINER	I		M	N	21	42.0	7.92	140	0.10	3.3
43-034	SAND SHINER	I	M	M	N	5	10.0	1.89	20	0.01	2.0
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.38	4	0.00	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	74	148.0	27.92	520	0.39	3.5
43-117	CARMINE SHINER	I	I	S	N	1	2.0	0.38	4	0.00	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.38	6	0.00	3.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		14	28.0	5.28	26	0.02	0.9
77-003	ROCK BASS	C		C	S	11	22.0	4.15	2300	1.72	104.5
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.38	160	0.12	80.0
77-006	LARGEMOUTH BASS	C		C	F	17	34.0	6.42	2652	1.98	78.0
77-008	GREEN SUNFISH	I	T	C	S	22	44.0	8.30	400	0.30	9.0
77-009	BLUEGILL SUNFISH	I	P	C	S	16	32.0	6.04	212	0.16	6.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	4	8.0	1.51	240	0.18	30.0
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.38	6	0.00	3.0
80-014	JOHNNY DARTER	I		C	D	10	20.0	3.77	20	0.01	1.0

No Species: 24 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 265 **Total Rel. Wt. :** 133836
IBI: 34.0 **MIwb:** 7.4

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 87.10 Date: 07/31/2018
 Time Fished: 2254 Distance: 0.500 Drainge (sq mi): 261.4 Depth: 0
 Location: Dst. Rockland Rd. Lat: 42.27628 Long: -87.93929

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.17	10	0.01	5.0
37-003	NORTHERN PIKE	P		M	F	7	14.0	1.20	16360	21.80	1168.5
40-016	WHITE SUCKER	O	T	S	W	32	64.0	5.51	260	0.35	4.0
40-018	SPOTTED SUCKER	I		S	R	12	24.0	2.07	80	0.11	3.3
43-001	COMMON CARP	O	T	M	G	6	12.0	1.03	31000	41.30	2583.3
43-003	GOLDEN SHINER	I	T	M	N	6	12.0	1.03	30	0.04	2.5
43-004	HORNYHEAD CHUB	I	I	N	N	53	106.0	9.12	1920	2.56	18.1
43-013	CREEK CHUB	G	T	N	N	3	6.0	0.52	16	0.02	2.6
43-029	BLACKCHIN SHINER	I	S	M	N	7	14.0	1.20	30	0.04	2.1
43-032	SPOTFIN SHINER	I		M	N	19	38.0	3.27	140	0.19	3.6
43-034	SAND SHINER	I	M	M	N	11	22.0	1.89	50	0.07	2.2
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.17	4	0.01	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	127	254.0	21.86	840	1.12	3.3
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	0.34	16	0.02	4.0
43-117	CARMINE SHINER	I	I	S	N	8	16.0	1.38	40	0.05	2.5
47-004	YELLOW BULLHEAD	I	T	C		10	20.0	1.72	3970	5.29	198.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	0.34	16	0.02	4.0
77-003	ROCK BASS	C		C	S	61	122.0	10.50	8480	11.30	69.5
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.17	160	0.21	80.0
77-006	LARGEMOUTH BASS	C		C	F	29	58.0	4.99	2700	3.60	46.5
77-008	GREEN SUNFISH	I	T	C	S	39	78.0	6.71	900	1.20	11.5
77-009	BLUEGILL SUNFISH	I	P	C	S	80	160.0	13.77	7000	9.33	43.7
77-013	PUMPKINSEED SUNFISH	I	P	C	S	21	42.0	3.61	760	1.01	18.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.34	100	0.13	25.0
80-003	YELLOW PERCH			M		1	2.0	0.17	10	0.01	5.0
80-005	BLACKSIDE DARTER	I		S	D	11	22.0	1.89	20	0.03	0.9
80-011	LOGPERCH	I	M	S	D	2	4.0	0.34	120	0.16	30.0
80-014	JOHNNY DARTER	I		C	D	27	54.0	4.65	20	0.03	0.3

No Species: 27 **Nat. Species:** 26 **Hybrids:** 1 **Total Counted:** 581 **Total Rel. Wt. :** 75052
IBI: 36.0 **MIwb:** 9.5

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 87.10 Date: 09/17/2018
 Time Fished: 1838 Distance: 0.500 Drainge (sq mi): 261.4 Depth: 0
 Location: Dst. Rockland Rd. Lat: 42.27628 Long: -87.93929

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.90	8000	8.05	2000.0
40-016	WHITE SUCKER	O	T	S	W	13	26.0	5.83	16564	16.66	637.0
40-018	SPOTTED SUCKER	I		S	R	3	6.0	1.35	6800	6.84	1133.3
43-001	COMMON CARP	O	T	M	G	8	16.0	3.59	61800	62.15	3862.5
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	0.45	6	0.01	3.0
43-004	HORNYHEAD CHUB	I	I	N	N	26	52.0	11.66	850	0.85	16.3
43-013	CREEK CHUB	G	T	N	N	1	2.0	0.45	6	0.01	3.0
43-029	BLACKCHIN SHINER	I	S	M	N	2	4.0	0.90	8	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	14	28.0	6.28	106	0.11	3.7
43-034	SAND SHINER	I	M	M	N	1	2.0	0.45	6	0.01	3.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	71	142.0	31.84	540	0.54	3.8
43-044	CENTRAL STONEROLLER	H		N	N	1	2.0	0.45	16	0.02	8.0
43-117	CARMINE SHINER	I	I	S	N	5	10.0	2.24	16	0.02	1.6
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.45	370	0.37	185.0
54-000	WESTERN BANDED KILLIFISH	I	S	M		1	2.0	0.45	6	0.01	3.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.45	2	0.00	1.0
77-003	ROCK BASS	C		C	S	17	34.0	7.62	2840	2.86	83.5
77-006	LARGEMOUTH BASS	C		C	F	17	34.0	7.62	380	0.38	11.1
77-008	GREEN SUNFISH	I	T	C	S	17	34.0	7.62	380	0.38	11.1
77-009	BLUEGILL SUNFISH	I	P	C	S	10	20.0	4.48	480	0.48	24.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	1.35	190	0.19	31.6
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.45	12	0.01	6.0
80-003	YELLOW PERCH			M		2	4.0	0.90	40	0.04	10.0
80-005	BLACKSIDE DARTER	I		S	D	2	4.0	0.90	12	0.01	3.0
80-014	JOHNNY DARTER	I		C	D	3	6.0	1.35	10	0.01	1.6

No Species: 24 **Nat. Species:** 23 **Hybrids:** 1 **Total Counted:** 223 **Total Rel. Wt. :** 99440
IBI: 34.0 **MIwb:** 7.9

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 90.60 Date: 07/28/2018
 Time Fished: 1821 Distance: 0.500 Drainge (sq mi): 253.7 Depth: 0
 Location: Dst. Buckley Rd. Lat: 42.30563 Long: -87.95434

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.19	10	0.01	5.0
20-003	GIZZARD SHAD	O		M		1	2.0	0.19	12	0.01	6.0
37-003	NORTHERN PIKE	P		M	F	7	14.0	1.35	9640	9.11	688.5
40-016	WHITE SUCKER	O	T	S	W	15	30.0	2.90	9710	9.17	323.6
40-018	SPOTTED SUCKER	I		S	R	4	8.0	0.77	6600	6.24	825.0
43-001	COMMON CARP	O	T	M	G	9	18.0	1.74	56800	53.66	3155.5
43-003	GOLDEN SHINER	I	T	M	N	8	16.0	1.54	20	0.02	1.2
43-004	HORNHEAD CHUB	I	I	N	N	34	68.0	6.56	1304	1.23	19.1
43-029	BLACKCHIN SHINER	I	S	M	N	4	8.0	0.77	10	0.01	1.2
43-032	SPOTFIN SHINER	I		M	N	8	16.0	1.54	40	0.04	2.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	183	366.0	35.33	1820	1.72	4.9
43-117	CARMINE SHINER	I	I	S	N	7	14.0	1.35	20	0.02	1.4
47-002	CHANNEL CATFISH			C	F	2	4.0	0.39	3404	3.22	851.0
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	1.16	1200	1.13	100.0
54-000	WESTERN BANDED KILLIFISH	I	S	M		2	4.0	0.39	8	0.01	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	8.0	0.77	16	0.02	2.0
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.19	8	0.01	4.0
77-003	ROCK BASS	C		C	S	38	76.0	7.34	6000	5.67	78.9
77-006	LARGEMOUTH BASS	C		C	F	29	58.0	5.60	2920	2.76	50.3
77-008	GREEN SUNFISH	I	T	C	S	45	90.0	8.69	740	0.70	8.2
77-009	BLUEGILL SUNFISH	I	P	C	S	54	108.0	10.42	5040	4.76	46.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	9	18.0	1.74	240	0.23	13.3
80-003	YELLOW PERCH			M		3	6.0	0.58	120	0.11	20.0
80-005	BLACKSIDE DARTER	I		S	D	13	26.0	2.51	80	0.08	3.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.19	20	0.02	10.0
80-014	JOHNNY DARTER	I		C	D	30	60.0	5.79	62	0.06	1.0

No Species: 26 **Nat. Species:** 25 **Hybrids:** 0 **Total Counted:** 518 **Total Rel. Wt. :** 105844
IBI: 38.0 **MIwb:** 9.0

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 90.60 Date: 09/18/2018
 Time Fished: 1827 Distance: 0.500 Drainge (sq mi): 253.7 Depth: 0
 Location: Dst. Buckley Rd. Lat: 42.30563 Long: -87.95434

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	3	6.0	1.08	2140	1.94	356.6
40-016	WHITE SUCKER	O	T	S	W	19	38.0	6.81	13380	12.14	352.1
40-018	SPOTTED SUCKER	I		S	R	6	12.0	2.15	70	0.06	5.8
43-001	COMMON CARP	O	T	M	G	11	22.0	3.94	62220	56.48	2828.1
43-003	GOLDEN SHINER	I	T	M	N	3	6.0	1.08	20	0.02	3.3
43-004	HORNYHEAD CHUB	I	I	N	N	42	84.0	15.05	1160	1.05	13.8
43-026	COMMON SHINER	I		S	N	1	2.0	0.36	6	0.01	3.0
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.36	8	0.01	4.0
43-032	SPOTFIN SHINER	I		M	N	9	18.0	3.23	60	0.05	3.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	49	98.0	17.56	500	0.45	5.1
43-117	CARMINE SHINER	I	I	S	N	8	16.0	2.87	30	0.03	1.8
47-002	CHANNEL CATFISH			C	F	4	8.0	1.43	19000	17.25	2375.0
47-004	YELLOW BULLHEAD	I	T	C		8	16.0	2.87	1790	1.62	111.8
54-002	BLACKSTRIPE TOPMINNOW	I		M		11	22.0	3.94	22	0.02	1.0
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.36	300	0.27	150.0
77-003	ROCK BASS	C		C	S	21	42.0	7.53	4660	4.23	110.9
77-006	LARGEMOUTH BASS	C		C	F	15	30.0	5.38	2580	2.34	86.0
77-008	GREEN SUNFISH	I	T	C	S	17	34.0	6.09	250	0.23	7.3
77-009	BLUEGILL SUNFISH	I	P	C	S	19	38.0	6.81	1620	1.47	42.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	15	30.0	5.38	260	0.24	8.6
80-003	YELLOW PERCH			M		4	8.0	1.43	60	0.05	7.5
80-005	BLACKSIDE DARTER	I		S	D	4	8.0	1.43	20	0.02	2.5
80-014	JOHNNY DARTER	I		C	D	8	16.0	2.87	16	0.01	1.0

No Species: 23 **Nat. Species:** 22 **Hybrids:** 0 **Total Counted:** 279 **Total Rel. Wt. :** 110172
IBI: 36.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 94.20 Date: 07/26/2018
 Time Fished: 1632 Distance: 0.500 Drainge (sq mi): 232.0 Depth: 0
 Location: Dst. River Rd. Lat: 42.34346 Long: -87.94112

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.60	6300	10.22	1575.0
40-016	WHITE SUCKER	O	T	S	W	8	16.0	2.39	1450	2.35	90.6
40-018	SPOTTED SUCKER	I		S	R	4	8.0	1.19	4500	7.30	562.5
43-001	COMMON CARP	O	T	M	G	1	2.0	0.30	5500	8.92	2750.0
43-004	HORNYHEAD CHUB	I	I	N	N	62	124.0	18.51	3340	5.42	26.9
43-026	COMMON SHINER	I		S	N	2	4.0	0.60	22	0.04	5.5
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.30	4	0.01	2.0
43-029	BLACKCHIN SHINER	I	S	M	N	2	4.0	0.60	4	0.01	1.0
43-032	SPOTFIN SHINER	I		M	N	7	14.0	2.09	80	0.13	5.7
43-043	BLUNTNOSE MINNOW	O	T	C	N	38	76.0	11.34	450	0.73	5.9
43-044	CENTRAL STONEROLLER	H		N	N	3	6.0	0.90	12	0.02	2.0
43-117	CARMINE SHINER	I	I	S	N	1	2.0	0.30	4	0.01	2.0
47-002	CHANNEL CATFISH			C	F	7	14.0	2.09	24200	39.25	1728.5
47-004	YELLOW BULLHEAD	I	T	C		5	10.0	1.49	1500	2.43	150.0
47-008	STONECAT MADTOM	I	I	C		1	2.0	0.30	40	0.06	20.0
77-003	ROCK BASS	C		C	S	26	52.0	7.76	3000	4.87	57.6
77-006	LARGEMOUTH BASS	C		C	F	33	66.0	9.85	3900	6.33	59.0
77-007	WARMOUTH SUNFISH	C		C	S	2	4.0	0.60	100	0.16	25.0
77-008	GREEN SUNFISH	I	T	C	S	8	16.0	2.39	120	0.19	7.5
77-009	BLUEGILL SUNFISH	I	P	C	S	80	160.0	23.88	6400	10.38	40.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	14	28.0	4.18	600	0.97	21.4
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.30	0	0.00	0.0
80-003	YELLOW PERCH			M		1	2.0	0.30	10	0.02	5.0
80-005	BLACKSIDE DARTER	I		S	D	13	26.0	3.88	40	0.06	1.5
80-011	LOGPERCH	I	M	S	D	2	4.0	0.60	60	0.10	15.0
80-014	JOHNNY DARTER	I		C	D	11	22.0	3.28	20	0.03	0.9

No Species: 25 **Nat. Species:** 24 **Hybrids:** 1 **Total Counted:** 335 **Total Rel. Wt. :** 61656
IBI: 46.0 **MIwb:** 9.6

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 94.20 Date: 09/16/2018
 Time Fished: 1789 Distance: 0.500 Drainge (sq mi): 232.0 Depth: 0
 Location: Dst. River Rd. Lat: 42.34346 Long: -87.94112

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		6	12.0	2.96	560	0.60	46.6
37-003	NORTHERN PIKE	P		M	F	3	6.0	1.48	1720	1.84	286.6
40-016	WHITE SUCKER	O	T	S	W	20	40.0	9.85	27360	29.19	684.0
40-018	SPOTTED SUCKER	I		S	R	6	12.0	2.96	5750	6.13	479.1
43-001	COMMON CARP	O	T	M	G	5	10.0	2.46	34300	36.59	3430.0
43-003	GOLDEN SHINER	I	T	M	N	5	10.0	2.46	40	0.04	4.0
43-004	HORNYHEAD CHUB	I	I	N	N	18	36.0	8.87	1000	1.07	27.7
43-028	SPOTTAIL SHINER	I	P	M	N	3	6.0	1.48	60	0.06	10.0
43-029	BLACKCHIN SHINER	I	S	M	N	3	6.0	1.48	12	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	19	38.0	9.36	210	0.22	5.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	20	40.0	9.85	200	0.21	5.0
47-002	CHANNEL CATFISH			C	F	4	8.0	1.97	13700	14.62	1712.5
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	0.99	540	0.58	135.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		6	12.0	2.96	10	0.01	0.8
70-001	BROOK SILVERSIDE	I	M	M		1	2.0	0.49	2	0.00	1.0
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.99	420	0.45	105.0
77-003	ROCK BASS	C		C	S	10	20.0	4.93	2680	2.86	134.0
77-006	LARGEMOUTH BASS	C		C	F	25	50.0	12.32	2700	2.88	54.0
77-008	GREEN SUNFISH	I	T	C	S	9	18.0	4.43	240	0.26	13.3
77-009	BLUEGILL SUNFISH	I	P	C	S	18	36.0	8.87	1780	1.90	49.4
77-013	PUMPKINSEED SUNFISH	I	P	C	S	6	12.0	2.96	300	0.32	25.0
80-003	YELLOW PERCH			M		3	6.0	1.48	80	0.09	13.3
80-005	BLACKSIDE DARTER	I		S	D	5	10.0	2.46	60	0.06	6.0
80-014	JOHNNY DARTER	I		C	D	4	8.0	1.97	8	0.01	1.0

No Species: 24 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 203 **Total Rel. Wt. :** 93732
IBI: 34.0 **MIwb:** 9.2

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 96.82 Date: 07/26/2018
 Time Fished: 1582 Distance: 0.400 Drainge (sq mi): 225.3 Depth: 0
 Location: Dst. McClare Ave. Lat: 42.36902 Long: -87.91774

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	3	7.5	0.79	6062	6.22	808.3
40-016	WHITE SUCKER	O	T	S	W	28	70.0	7.39	36062	37.03	515.1
40-018	SPOTTED SUCKER	I		S	R	3	7.5	0.79	2750	2.82	366.6
43-001	COMMON CARP	O	T	M	G	2	5.0	0.53	16750	17.20	3350.0
43-003	GOLDEN SHINER	I	T	M	N	2	5.0	0.53	10	0.01	2.0
43-004	HORNYHEAD CHUB	I	I	N	N	55	137.5	14.51	3987	4.09	29.0
43-013	CREEK CHUB	G	T	N	N	2	5.0	0.53	150	0.15	30.0
43-032	SPOTFIN SHINER	I		M	N	49	122.5	12.93	625	0.64	5.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	34	85.0	8.97	350	0.36	4.1
47-002	CHANNEL CATFISH			C	F	2	5.0	0.53	10750	11.04	2150.0
47-004	YELLOW BULLHEAD	I	T	C		10	25.0	2.64	2550	2.62	102.0
47-008	STONECAT MADTOM	I	I	C		1	2.5	0.26	100	0.10	40.0
47-013	TADPOLE MADTOM	I		C		1	2.5	0.26	12	0.01	5.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.5	0.26	2	0.00	1.0
77-002	BLACK CRAPPIE	I		C	S	1	2.5	0.26	50	0.05	20.0
77-003	ROCK BASS	C		C	S	10	25.0	2.64	2437	2.50	97.5
77-006	LARGEMOUTH BASS	C		C	F	12	30.0	3.17	3450	3.54	115.0
77-008	GREEN SUNFISH	I	T	C	S	45	112.5	11.87	1250	1.28	11.1
77-009	BLUEGILL SUNFISH	I	P	C	S	90	225.0	23.75	8625	8.86	38.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	18	45.0	4.75	1125	1.16	25.0
80-003	YELLOW PERCH			M		2	5.0	0.53	125	0.13	25.0
80-005	BLACKSIDE DARTER	I		S	D	5	12.5	1.32	67	0.07	5.4
80-011	LOGPERCH	I	M	S	D	3	7.5	0.79	100	0.10	13.3

No Species: 23 **Nat. Species:** 22 **Hybrids:** 0 **Total Counted:** 379 **Total Rel. Wt. :** 97392
IBI: 38.0 **MIwb:** 9.5

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 96.82 Date: 09/16/2018
 Time Fished: 2250 Distance: 0.400 Drainge (sq mi): 225.3 Depth: 0
 Location: Dst. McClare Ave. Lat: 42.36902 Long: -87.91774

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		2	5.0	1.06	125	0.16	25.0
37-003	NORTHERN PIKE	P		M	F	1	2.5	0.53	162	0.21	65.0
40-016	WHITE SUCKER	O	T	S	W	17	42.5	9.04	29950	37.98	704.7
40-018	SPOTTED SUCKER	I		S	R	3	7.5	1.60	2287	2.90	305.0
43-001	COMMON CARP	O	T	M	G	4	10.0	2.13	37000	46.93	3700.0
43-003	GOLDEN SHINER	I	T	M	N	4	10.0	2.13	137	0.17	13.7
43-004	HORNYHEAD CHUB	I	I	N	N	21	52.5	11.17	1675	2.12	31.9
43-032	SPOTFIN SHINER	I		M	N	16	40.0	8.51	175	0.22	4.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	29	72.5	15.43	337	0.43	4.6
47-004	YELLOW BULLHEAD	I	T	C		1	2.5	0.53	225	0.29	90.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		28	70.0	14.89	75	0.10	1.0
70-001	BROOK SILVERSIDE	I	M	M		1	2.5	0.53	2	0.00	1.0
77-003	ROCK BASS	C		C	S	5	12.5	2.66	1675	2.12	134.0
77-006	LARGEMOUTH BASS	C		C	F	11	27.5	5.85	1825	2.31	66.3
77-008	GREEN SUNFISH	I	T	C	S	17	42.5	9.04	925	1.17	21.7
77-009	BLUEGILL SUNFISH	I	P	C	S	15	37.5	7.98	1600	2.03	42.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	8	20.0	4.26	400	0.51	20.0
77-015	GREEN SF X BLUEGILL SF					1	2.5	0.53	225	0.29	90.0
80-003	YELLOW PERCH			M		2	5.0	1.06	25	0.03	5.0
80-005	BLACKSIDE DARTER	I		S	D	2	5.0	1.06	20	0.03	4.0

No Species: 19 **Nat. Species:** 18 **Hybrids:** 1 **Total Counted:** 188 **Total Rel. Wt. :** 78847
IBI: 32.0 **MIwb:** 7.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 98.70 Date: 07/26/2018
 Time Fished: 2467 Distance: 0.500 Drainge (sq mi): 220.2 Depth: 0
 Location: Ust. Skokie Hwy Lat: 42.38317 Long: -87.91460

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		1	2.0	0.15	1080	1.25	540.0
20-003	GIZZARD SHAD	O		M		1	2.0	0.15	10	0.01	5.0
37-003	NORTHERN PIKE	P		M	F	12	24.0	1.83	12840	14.91	535.0
40-016	WHITE SUCKER	O	T	S	W	3	6.0	0.46	340	0.39	56.6
40-018	SPOTTED SUCKER	I		S	R	12	24.0	1.83	5830	6.77	242.9
43-001	COMMON CARP	O	T	M	G	5	10.0	0.76	17490	20.31	1749.0
43-003	GOLDEN SHINER	I	T	M	N	6	12.0	0.91	40	0.05	3.3
43-004	HORNHEAD CHUB	I	I	N	N	1	2.0	0.15	20	0.02	10.0
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.15	2	0.00	1.0
43-032	SPOTFIN SHINER	I		M	N	29	58.0	4.42	190	0.22	3.2
43-043	BLUNTNOSE MINNOW	O	T	C	N	92	184.0	14.02	630	0.73	3.4
43-045	COMMON CARP X GOLDFISH	O	T		G	1	2.0	0.15	700	0.81	350.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.30	8000	9.29	2000.0
47-004	YELLOW BULLHEAD	I	T	C		9	18.0	1.37	2740	3.18	152.2
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.15	420	0.49	210.0
47-013	TADPOLE MADTOM	I		C		1	2.0	0.15	2	0.00	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	8.0	0.61	10	0.01	1.2
77-002	BLACK CRAPPIE	I		C	S	4	8.0	0.61	626	0.73	78.2
77-003	ROCK BASS	C		C	S	21	42.0	3.20	6750	7.84	160.7
77-006	LARGEMOUTH BASS	C		C	F	58	116.0	8.84	9320	10.83	80.3
77-008	GREEN SUNFISH	I	T	C	S	86	172.0	13.11	1220	1.42	7.0
77-009	BLUEGILL SUNFISH	I	P	C	S	202	404.0	30.79	14400	16.73	35.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	87	174.0	13.26	3260	3.79	18.7
77-014	BLUEGILL X PUMPKINSEED					1	2.0	0.15	90	0.10	45.0
80-003	YELLOW PERCH			M		4	8.0	0.61	40	0.05	5.0
80-005	BLACKSIDE DARTER	I		S	D	9	18.0	1.37	40	0.05	2.2
80-014	JOHNNY DARTER	I		C	D	3	6.0	0.46	6	0.01	1.0

No Species: 25 **Nat. Species:** 24 **Hybrids:** 2 **Total Counted:** 656 **Total Rel. Wt. :** 86096
IBI: 42.0 **MIwb:** 9.9

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 98.70 Date: 09/15/2018
 Time Fished: 1686 Distance: 0.500 Drainge (sq mi): 220.2 Depth: 0
 Location: Ust. Skokie Hwy Lat: 42.38317 Long: -87.91460

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.44	280	0.32	140.0
15-001	BOWFIN	P		C		1	2.0	0.44	5000	5.76	2500.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.44	2000	2.31	1000.0
40-016	WHITE SUCKER	O	T	S	W	10	20.0	4.41	16820	19.39	841.0
40-018	SPOTTED SUCKER	I		S	R	6	12.0	2.64	4830	5.57	402.5
43-001	COMMON CARP	O	T	M	G	5	10.0	2.20	35600	41.03	3560.0
43-003	GOLDEN SHINER	I	T	M	N	11	22.0	4.85	60	0.07	2.7
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.44	4	0.00	2.0
43-032	SPOTFIN SHINER	I		M	N	57	114.0	25.11	360	0.41	3.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	12	24.0	5.29	104	0.12	4.3
43-045	COMMON CARP X GOLDFISH	O	T		G	2	4.0	0.88	4000	4.61	1000.0
47-002	CHANNEL CATFISH			C	F	3	6.0	1.32	7000	8.07	1166.6
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	0.88	170	0.20	42.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		38	76.0	16.74	80	0.09	1.0
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.88	278	0.32	69.5
77-003	ROCK BASS	C		C	S	9	18.0	3.96	2220	2.56	123.3
77-006	LARGEMOUTH BASS	C		C	F	13	26.0	5.73	4860	5.60	186.9
77-008	GREEN SUNFISH	I	T	C	S	14	28.0	6.17	360	0.41	12.8
77-009	BLUEGILL SUNFISH	I	P	C	S	14	28.0	6.17	1480	1.71	52.8
77-013	PUMPKINSEED SUNFISH	I	P	C	S	22	44.0	9.69	1240	1.43	28.1
80-003	YELLOW PERCH			M		2	4.0	0.88	12	0.01	3.0
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.44	10	0.01	5.0

No Species: 21 **Nat. Species:** 20 **Hybrids:** 1 **Total Counted:** 227 **Total Rel. Wt. :** 86768
IBI: 36.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 99.30 Date: 09/18/2018
 Time Fished: 1913 Distance: 0.500 Drainge (sq mi): 213.1 Depth: 0
 Location: Ust. Wetland Riffle Lat: 42.40105 Long: -87.92828

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		5	10.0	1.75	14320	8.39	1432.0
20-003	GIZZARD SHAD	O		M		4	8.0	1.40	640	0.38	80.0
40-016	WHITE SUCKER	O	T	S	W	16	32.0	5.61	19560	11.47	611.2
40-018	SPOTTED SUCKER	I		S	R	11	22.0	3.86	2140	1.25	97.2
43-001	COMMON CARP	O	T	M	G	16	32.0	5.61	80100	46.95	2503.1
43-002	GOLDFISH	O	T	M	G	1	2.0	0.35	20	0.01	10.0
43-003	GOLDEN SHINER	I	T	M	N	7	14.0	2.46	90	0.05	6.4
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.35	2	0.00	1.0
43-032	SPOTFIN SHINER	I		M	N	19	38.0	6.67	70	0.04	1.8
43-043	BLUNTNOSE MINNOW	O	T	C	N	35	70.0	12.28	160	0.09	2.2
47-002	CHANNEL CATFISH			C	F	14	28.0	4.91	39800	23.33	1421.4
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	2.11	1420	0.83	118.3
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.35	400	0.23	200.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		10	20.0	3.51	20	0.01	1.0
70-001	BROOK SILVERSIDE	I	M	M		13	26.0	4.56	20	0.01	0.7
74-006	YELLOW BASS	P	P	M		3	6.0	1.05	428	0.25	71.3
77-003	ROCK BASS	C		C	S	8	16.0	2.81	2210	1.30	138.1
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	3.51	1850	1.08	92.5
77-007	WARMOUTH SUNFISH	C		C	S	1	2.0	0.35	24	0.01	12.0
77-008	GREEN SUNFISH	I	T	C	S	5	10.0	1.75	120	0.07	12.0
77-009	BLUEGILL SUNFISH	I	P	C	S	63	126.0	22.11	5620	3.29	44.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	31	62.0	10.88	1560	0.91	25.1
80-003	YELLOW PERCH			M		4	8.0	1.40	20	0.01	2.5
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.35	6	0.00	3.0

No Species: 0 **Nat. Species:** 22 **Hybrids:** 0 **Total Counted:** 285 **Total Rel. Wt. :** 170600
IBI: 0.0 **MIwb:** 0.0

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 99.72 Date: 07/25/2018
 Time Fished: 1834 Distance: 0.500 Drainge (sq mi): 212.8 Depth: 0
 Location: Dst. Wetland Riffle Lat: 42.39716 Long: -87.92419

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.54	10	0.01	5.0
15-001	BOWFIN	P		C		6	12.0	3.23	15500	12.29	1291.6
20-003	GIZZARD SHAD	O		M		2	4.0	1.08	560	0.44	140.0
40-018	SPOTTED SUCKER	I		S	R	4	8.0	2.15	3320	2.63	415.0
43-001	COMMON CARP	O	T	M	G	17	34.0	9.14	76000	60.25	2235.2
43-003	GOLDEN SHINER	I	T	M	N	5	10.0	2.69	60	0.05	6.0
47-002	CHANNEL CATFISH			C	F	4	8.0	2.15	11200	8.88	1400.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	1.08	4	0.00	1.0
77-002	BLACK CRAPPIE	I		C	S	2	4.0	1.08	940	0.75	235.0
77-006	LARGEMOUTH BASS	C		C	F	23	46.0	12.37	8460	6.71	183.9
77-007	WARMOUTH SUNFISH	C		C	S	1	2.0	0.54	260	0.21	130.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.54	30	0.02	15.0
77-009	BLUEGILL SUNFISH	I	P	C	S	100	200.0	53.76	8800	6.98	44.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	18	36.0	9.68	1000	0.79	27.7

No Species: 0 **Nat. Species:** 13 **Hybrids:** 0 **Total Counted:** 186 **Total Rel. Wt. :** 126144
IBI: 0.0 **MIwb:** 0.0

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 99.72 Date: 09/14/2018
 Time Fished: 1612 Distance: 0.500 Drainge (sq mi): 212.8 Depth: 0
 Location: Dst. Wetland Riffle Lat: 42.39716 Long: -87.92419

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		5	10.0	2.92	17300	21.69	1730.0
20-003	GIZZARD SHAD	O		M		30	60.0	17.54	3000	3.76	50.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.58	240	0.30	120.0
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.58	2000	2.51	1000.0
40-018	SPOTTED SUCKER	I		S	R	5	10.0	2.92	4900	6.14	490.0
43-001	COMMON CARP	O	T	M	G	7	14.0	4.09	25900	32.47	1850.0
43-002	GOLDFISH	O	T	M	G	1	2.0	0.58	40	0.05	20.0
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	0.58	10	0.01	5.0
47-002	CHANNEL CATFISH			C	F	3	6.0	1.75	4800	6.02	800.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.58	460	0.58	230.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		20	40.0	11.70	30	0.04	0.7
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.58	260	0.33	130.0
77-006	LARGEMOUTH BASS	C		C	F	13	26.0	7.60	9880	12.39	380.0
77-007	WARMOUTH SUNFISH	C		C	S	5	10.0	2.92	290	0.36	29.0
77-009	BLUEGILL SUNFISH	I	P	C	S	67	134.0	39.18	6380	8.00	47.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	9	18.0	5.26	270	0.34	15.0
80-002	WALLEYE	P		S	F	1	2.0	0.58	4000	5.02	2000.0

No Species: 0 **Nat. Species:** 15 **Hybrids:** 0 **Total Counted:** 171 **Total Rel. Wt. :** 79760

IBI: 0.0 **MIwb:** 0.0

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 102.90 Date: 07/25/2018
 Time Fished: 1649 Distance: 0.500 Drainge (sq mi): 145.5 Depth: 0
 Location: Dst. Wadsworth Rd. Lat: 42.42857 Long: -87.93021

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		9	18.0	4.86	28400	51.94	1577.7
20-003	GIZZARD SHAD	O		M		8	16.0	4.32	3184	5.82	199.0
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.54	14	0.03	7.0
37-001	Redfin pickerel	P	P	M		2	4.0	1.08	20	0.04	5.0
37-003	NORTHERN PIKE	P		M	F	3	6.0	1.62	2060	3.77	343.3
40-018	SPOTTED SUCKER	I		S	R	3	6.0	1.62	3900	7.13	650.0
43-001	COMMON CARP	O	T	M	G	2	4.0	1.08	6400	11.70	1600.0
43-003	GOLDEN SHINER	I	T	M	N	19	38.0	10.27	320	0.59	8.4
54-002	BLACKSTRIPE TOPMINNOW	I		M		5	10.0	2.70	10	0.02	1.0
77-001	WHITE CRAPPIE	I		C	S	4	8.0	2.16	20	0.04	2.5
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.54	300	0.55	150.0
77-006	LARGEMOUTH BASS	C		C	F	13	26.0	7.03	3440	6.29	132.3
77-007	WARMOUTH SUNFISH	C		C	S	1	2.0	0.54	50	0.09	25.0
77-008	GREEN SUNFISH	I	T	C	S	2	4.0	1.08	20	0.04	5.0
77-009	BLUEGILL SUNFISH	I	P	C	S	74	148.0	40.00	4500	8.23	30.4
77-013	PUMPKINSEED SUNFISH	I	P	C	S	36	72.0	19.46	2000	3.66	27.7
80-003	YELLOW PERCH			M		2	4.0	1.08	40	0.07	10.0

No Species: 17 **Nat. Species:** 16 **Hybrids:** 0 **Total Counted:** 185 **Total Rel. Wt. :** 54678
IBI: 40.0 **MIwb:** 8.5

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 102.90 Date: 09/14/2018
 Time Fished: 1855 Distance: 0.500 Drainge (sq mi): 145.5 Depth: 0
 Location: Dst. Wadsworth Rd. Lat: 42.42857 Long: -87.93021

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.28	200	0.31	100.0
15-001	BOWFIN	P		C		2	4.0	0.57	6000	9.33	1500.0
20-003	GIZZARD SHAD	O		M		24	48.0	6.80	7080	11.01	147.5
34-001	CENTRAL MUDMINNOW	I	T	C		9	18.0	2.55	80	0.12	4.4
37-001	Redfin pickerel	P	P	M		1	2.0	0.28	40	0.06	20.0
40-016	WHITE SUCKER	O	T	S	W	3	6.0	0.85	4900	7.62	816.6
40-018	SPOTTED SUCKER	I		S	R	12	24.0	3.40	10820	16.82	450.8
43-001	COMMON CARP	O	T	M	G	6	12.0	1.70	19360	30.10	1613.3
43-003	GOLDEN SHINER	I	T	M	N	24	48.0	6.80	220	0.34	4.5
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.57	4	0.01	1.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	3	6.0	0.85	14	0.02	2.3
43-045	COMMON CARP X GOLDFISH	O	T		G	1	2.0	0.28	3800	5.91	1900.0
47-002	CHANNEL CATFISH			C	F	1	2.0	0.28	4000	6.22	2000.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	0.85	1100	1.71	183.3
54-002	BLACKSTRIPE TOPMINNOW	I		M		178	356.0	50.42	240	0.37	0.6
68-001	PIRATE PERCH	I		C		1	2.0	0.28	20	0.03	10.0
77-002	BLACK CRAPPIE	I		C	S	4	8.0	1.13	546	0.85	68.2
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	2.83	2560	3.98	128.0
77-007	WARMOUTH SUNFISH	C		C	S	3	6.0	0.85	26	0.04	4.3
77-008	GREEN SUNFISH	I	T	C	S	4	8.0	1.13	70	0.11	8.7
77-009	BLUEGILL SUNFISH	I	P	C	S	45	90.0	12.75	2700	4.20	30.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	16	32.0	4.53	540	0.84	16.8

No Species: 21 **Nat. Species:** 20 **Hybrids:** 1 **Total Counted:** 353 **Total Rel. Wt. :** 64320
IBI: 36.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 106.60 Date: 07/25/2018
 Time Fished: 1116 Distance: 0.500 Drainge (sq mi): 137.2 Depth: 0
 Location: Dst. IL-173 Lat: 42.46471 Long: -87.94287

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.46	220	0.32	110.0
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.46	6	0.01	3.0
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.46	1020	1.48	510.0
40-018	SPOTTED SUCKER	I		S	R	3	6.0	1.38	2800	4.06	466.6
43-001	COMMON CARP	O	T	M	G	12	24.0	5.53	52000	75.33	2166.6
43-003	GOLDEN SHINER	I	T	M	N	7	14.0	3.23	200	0.29	14.2
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.46	10	0.01	5.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.46	8	0.01	4.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.46	520	0.75	260.0
47-006	BLACK BULLHEAD	I	P	C		3	6.0	1.38	1070	1.55	178.3
47-013	TADPOLE MADTOM	I		C		1	2.0	0.46	2	0.00	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	0.92	4	0.01	1.0
77-001	WHITE CRAPPIE	I		C	S	2	4.0	0.92	14	0.02	3.5
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.92	510	0.74	127.5
77-006	LARGEMOUTH BASS	C		C	F	47	94.0	21.66	1590	2.30	16.9
77-007	WARMOUTH SUNFISH	C		C	S	3	6.0	1.38	200	0.29	33.3
77-008	GREEN SUNFISH	I	T	C	S	25	50.0	11.52	240	0.35	4.8
77-009	BLUEGILL SUNFISH	I	P	C	S	42	84.0	19.35	3240	4.69	38.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	59	118.0	27.19	5260	7.62	44.5
80-003	YELLOW PERCH			M		2	4.0	0.92	110	0.16	27.5
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.46	4	0.01	2.0

No Species: 21 **Nat. Species:** 20 **Hybrids:** 0 **Total Counted:** 217 **Total Rel. Wt. :** 69028
IBI: 38.0 **MIwb:** 7.4

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 106.60 Date: 09/14/2018
 Time Fished: 1343 Distance: 0.500 Drainge (sq mi): 137.2 Depth: 0
 Location: Dst. IL-173 Lat: 42.46471 Long: -87.94287

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		2	4.0	0.76	8400	9.92	2100.0
20-003	GIZZARD SHAD	O		M		16	32.0	6.11	1450	1.71	45.3
34-001	CENTRAL MUDMINNOW	I	T	C		1	2.0	0.38	4	0.00	2.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.38	2300	2.71	1150.0
40-016	WHITE SUCKER	O	T	S	W	2	4.0	0.76	1680	1.98	420.0
40-018	SPOTTED SUCKER	I		S	R	5	10.0	1.91	2880	3.40	288.0
43-001	COMMON CARP	O	T	M	G	18	36.0	6.87	55600	65.63	1544.4
43-003	GOLDEN SHINER	I	T	M	N	7	14.0	2.67	100	0.12	7.1
43-028	SPOTTAIL SHINER	I	P	M	N	1	2.0	0.38	6	0.01	3.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	4	8.0	1.53	8	0.01	1.0
43-045	COMMON CARP X GOLDFISH	O	T		G	1	2.0	0.38	1400	1.65	700.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.76	5200	6.14	1300.0
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	0.76	700	0.83	175.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		97	194.0	37.02	140	0.17	0.7
77-002	BLACK CRAPPIE	I		C	S	5	10.0	1.91	420	0.50	42.0
77-006	LARGEMOUTH BASS	C		C	F	20	40.0	7.63	960	1.13	24.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	1.15	140	0.17	23.3
77-009	BLUEGILL SUNFISH	I	P	C	S	29	58.0	11.07	1140	1.35	19.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	42	84.0	16.03	1820	2.15	21.6
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.38	180	0.21	90.0
80-003	YELLOW PERCH			M		2	4.0	0.76	180	0.21	45.0
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.38	10	0.01	5.0

No Species: 20 **Nat. Species:** 19 **Hybrids:** 2 **Total Counted:** 262 **Total Rel. Wt. :** 84718

IBI: 38.0 **MIwb:** 8.1

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 109.30 Date: 07/25/2018
 Time Fished: 1686 Distance: 0.500 Drainge (sq mi): 123.6 Depth: 0
 Location: Dst. W. Russell Rd. Lat: 42.48911 Long: -87.92570

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	0.72	30	0.05	7.5
15-001	BOWFIN	P		C		5	10.0	1.81	11400	18.88	1140.0
20-003	GIZZARD SHAD	O		M		1	2.0	0.36	420	0.70	210.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.36	900	1.49	450.0
40-016	WHITE SUCKER	O	T	S	W	5	10.0	1.81	2310	3.83	231.0
40-018	SPOTTED SUCKER	I		S	R	2	4.0	0.72	1630	2.70	407.5
43-001	COMMON CARP	O	T	M	G	29	58.0	10.51	22460	37.20	387.2
43-002	GOLDFISH	O	T	M	G	1	2.0	0.36	10	0.02	5.0
43-003	GOLDEN SHINER	I	T	M	N	13	26.0	4.71	324	0.54	12.4
43-032	SPOTFIN SHINER	I		M	N	4	8.0	1.45	28	0.05	3.5
43-044	CENTRAL STONEROLLER	H		N	N	1	2.0	0.36	8	0.01	4.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.72	5000	8.28	1250.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	1.45	810	1.34	101.2
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.36	300	0.50	150.0
47-013	TADPOLE MADTOM	I		C		3	6.0	1.09	24	0.04	4.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		5	10.0	1.81	12	0.02	1.2
68-001	PIRATE PERCH	I		C		3	6.0	1.09	10	0.02	1.6
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.72	320	0.53	80.0
77-006	LARGEMOUTH BASS	C		C	F	80	160.0	28.99	6550	10.85	40.9
77-007	WARMOUTH SUNFISH	C		C	S	6	12.0	2.17	520	0.86	43.3
77-008	GREEN SUNFISH	I	T	C	S	12	24.0	4.35	220	0.36	9.1
77-009	BLUEGILL SUNFISH	I	P	C	S	46	92.0	16.67	4330	7.17	47.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	36	72.0	13.04	2580	4.27	35.8
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.36	30	0.05	15.0
80-003	YELLOW PERCH			M		1	2.0	0.36	120	0.20	60.0
80-005	BLACKSIDE DARTER	I		S	D	4	8.0	1.45	16	0.03	2.0
80-014	JOHNNY DARTER	I		C	D	6	12.0	2.17	12	0.02	1.0

No Species: 26 **Nat. Species:** 24 **Hybrids:** 1 **Total Counted:** 276 **Total Rel. Wt. :** 60374
IBI: 40.0 **MIwb:** 9.2

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-656 DesPlaines River RM: 109.30 Date: 09/14/2018
 Time Fished: 1756 Distance: 0.500 Drainge (sq mi): 123.6 Depth: 0
 Location: Dst. W. Russell Rd. Lat: 42.48911 Long: -87.92570

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		1	2.0	0.40	1000	1.21	500.0
20-003	GIZZARD SHAD	O		M		2	4.0	0.80	60	0.07	15.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.40	1800	2.19	900.0
40-016	WHITE SUCKER	O	T	S	W	6	12.0	2.39	6920	8.40	576.6
40-018	SPOTTED SUCKER	I		S	R	7	14.0	2.79	9820	11.93	701.4
43-001	COMMON CARP	O	T	M	G	24	48.0	9.56	54000	65.58	1125.0
43-003	GOLDEN SHINER	I	T	M	N	19	38.0	7.57	260	0.32	6.8
43-029	BLACKCHIN SHINER	I	S	M	N	1	2.0	0.40	4	0.00	2.0
43-032	SPOTFIN SHINER	I		M	N	10	20.0	3.98	60	0.07	3.0
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.40	6	0.01	3.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	24	48.0	9.56	60	0.07	1.2
47-002	CHANNEL CATFISH			C	F	2	4.0	0.80	2200	2.67	550.0
47-006	BLACK BULLHEAD	I	P	C		2	4.0	0.80	700	0.85	175.0
47-013	TADPOLE MADTOM	I		C		1	2.0	0.40	2	0.00	1.0
47-015	BROWN BH X BLACK BH	I		C		1	2.0	0.40	600	0.73	300.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		28	56.0	11.16	20	0.02	0.3
70-001	BROOK SILVERSIDE	I	M	M		1	2.0	0.40	2	0.00	1.0
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.80	260	0.32	65.0
77-006	LARGEMOUTH BASS	C		C	F	29	58.0	11.55	900	1.09	15.5
77-007	WARMOUTH SUNFISH	C		C	S	5	10.0	1.99	360	0.44	36.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	1.20	40	0.05	6.6
77-009	BLUEGILL SUNFISH	I	P	C	S	37	74.0	14.74	1100	1.34	14.8
77-013	PUMPKINSEED SUNFISH	I	P	C	S	37	74.0	14.74	2000	2.43	27.0
80-003	YELLOW PERCH			M		4	8.0	1.59	140	0.17	17.5
80-005	BLACKSIDE DARTER	I		S	D	2	4.0	0.80	20	0.02	5.0
80-014	JOHNNY DARTER	I		C	D	1	2.0	0.40	2	0.00	1.0

No Species: 25 **Nat. Species:** 24 **Hybrids:** 1 **Total Counted:** 251 **Total Rel. Wt. :** 82336
IBI: 36.0 **MIwb:** 8.3

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-718 Trib to Werhane Lake Drain RM: 0.10 Date: 08/16/2018
 Time Fished: 0 Distance: 0.150 Drainge (sq mi): 0.2 Depth: 0
 Location: St. Marys Rd. Lat: 42.25076 Long: -87.92458

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-997	Dry Site					0	0.0	***.**	0	0.00	*****

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0
IBI: 12.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-721 Unnamed Trib to Des Plaines River RM: 0.40 Date: 08/16/2018
 Time Fished: 410 Distance: 0.150 Drainge (sq mi): 1.1 Depth: 0
 Location: Timberleaf Lane Lat: 42.17149 Long: -87.90765

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		9	18.0	17.65	70	18.13	3.8
40-016	WHITE SUCKER	O	T	S	W	3	6.0	5.88	18	4.66	3.0
43-013	CREEK CHUB	G	T	N	N	1	2.0	1.96	40	10.36	20.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		6	12.0	11.76	54	13.99	4.5
77-006	LARGEMOUTH BASS	C		C	F	20	40.0	39.22	96	24.87	2.4
77-008	GREEN SUNFISH	I	T	C	S	10	20.0	19.61	80	20.73	4.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	3.92	28	7.25	7.0

No Species: 7 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 51 **Total Rel. Wt. :** 386

IBI: 36.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute Fish Species List

Site ID: River: 95-722 Werhane Lake Drain RM: 0.80 Date: 08/16/2018
 Time Fished: 741 Distance: 0.140 Drainge (sq mi): 0.2 Depth: 0
 Location: Dst. bike path Lat: 42.24963 Long: -87.92672

Species Code:	Species Name:	Feed Guild	Tolerance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		27	57.9	13.11	135	2.72	2.3
40-016	WHITE SUCKER	O	T	S	W	4	8.6	1.94	21	0.43	2.5
43-001	COMMON CARP	O	T	M	G	22	47.2	10.68	261	5.26	5.5
43-003	GOLDEN SHINER	I	T	M	N	3	6.4	1.46	38	0.78	6.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.1	0.49	4	0.09	2.0
47-004	YELLOW BULLHEAD	I	T	C		9	19.3	4.37	47	0.95	2.4
47-006	BLACK BULLHEAD	I	P	C		22	47.2	10.68	2764	55.65	58.6
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.4	1.46	15	0.30	2.3
77-006	LARGEMOUTH BASS	C		C	F	10	21.4	4.85	90	1.81	4.2
77-008	GREEN SUNFISH	I	T	C	S	87	186.4	42.23	1416	28.52	7.5
77-009	BLUEGILL SUNFISH	I	P	C	S	9	19.3	4.37	90	1.81	4.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	4	8.6	1.94	42	0.86	5.0
77-014	BLUEGILL X PUMPKINSEED					1	2.1	0.49	17	0.35	8.0
77-015	GREEN SF X BLUEGILL SF					1	2.1	0.49	15	0.30	7.0
80-014	JOHNNY DARTER	I		C	D	3	6.4	1.46	8	0.17	1.3

No Species: 13 **Nat. Species:** 12 **Hybrids:** 2 **Total Counted:** 206 **Total Rel. Wt. :** 4967
IBI: 38.0 **MIwb:** N/A

APPENDIX C

Upper Des Plaines Year 2 2018 Macroinvertebrate Assemblage Data

C-1: Macroinvertebrate IBI Metrics and Scores

C-2: Macroinvertebrate Taxa by Site and Sample

Appndex Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample Date	Drainage Area (sq mi)	Sub-samp	Number of				Percent:			MIBI	Rating
					Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	MBI	Percent Scrapers	Percent EPT		
DesPlaines River (95-656)													
Year: 2016													
109.30	13-6	08/08/2016	123.67		16(35.0)	0(0.0)	2(19.6)	0(0.0)	5.3(93.4)	0.3(1.1)	3.2(4.3)	21.9	Fair
106.60	13-5	08/08/2016	137.29		20(43.0)	1(20.0)	2(19.6)	1(11.1)	5.3(93.4)	1.4(4.7)	11.0(14.9)	29.5	Fair
102.90	13-4	08/06/2016	145.55		17(37.0)	1(20.0)	2(19.6)	1(11.1)	5.4(91.8)	0.3(1.1)	49.2(66.5)	35.3	Fair
98.70	13-3	08/05/2016	220.29		34(74.0)	4(80.0)	4(39.2)	3(33.3)	5.4(91.8)	16.5(55.8)	22.8(30.8)	57.9	Good
96.82	13-2	07/30/2016	225.36		34(74.0)	4(80.0)	3(29.4)	4(44.4)	5.7(86.9)	7.4(24.9)	4.5(6.1)	49.4	Good
94.20	13-1	07/30/2016	232.03		25(54.0)	2(40.0)	4(39.2)	2(22.2)	4.7(100)	8.6(29.1)	8.0(10.8)	42.2	Good
90.60	13-16	08/04/2016	253.75		23(50.0)	1(20.0)	3(29.4)	5(55.6)	5.1(96.7)	11.8(39.9)	16.2(21.8)	44.8	Good
84.60	16-7	08/03/2016	266.48		32(70.0)	3(60.0)	5(49.0)	5(55.6)	4.8(100)	5.0(16.8)	7.3(9.9)	51.6	Good
83.60	16-5	2 06/29/2016	268.07		29(63.0)	3(60.0)	3(29.4)	4(44.4)	5.0(98.4)	7.9(26.7)	43.4(58.6)	54.4	Good
83.60	16-5	07/25/2016	268.07		34(74.0)	3(60.0)	5(49.0)	4(44.4)	4.7(100)	11.8(39.9)	15.5(21.0)	55.5	Good
82.90	16-8	08/01/2016	268.90		36(78.0)	3(60.0)	4(39.2)	5(55.6)	5.7(86.9)	5.0(16.8)	8.7(11.8)	49.8	Good
80.00	16-4	07/30/2016	273.21		28(61.0)	3(60.0)	5(49.0)	6(66.7)	5.0(98.4)	3.7(12.6)	47.3(63.9)	58.8	Good
76.70	16-3	07/30/2016	314.68		32(70.0)	3(60.0)	6(58.8)	5(55.6)	3.4(100)	6.3(21.1)	27.0(36.4)	57.4	Good
75.40	16-2	07/30/2016	323.96		21(46.0)	2(40.0)	4(39.2)	3(33.3)	4.4(100)	2.2(7.5)	38.2(51.6)	45.4	Good
71.70	16-1	07/30/2016	358.68		28(61.0)	3(60.0)	3(29.4)	6(66.7)	5.1(96.7)	2.0(6.8)	38.1(51.4)	53.2	Good
Year: 2018													
106.60	13-5	08/03/2018	137.29		21(46.0)	1(20.0)	0(0.0)	2(22.2)	7.9(50.8)	0.7(2.3)	2.4(3.3)	20.7	Poor
102.90	13-4	08/03/2018	145.55		22(48.0)	2(40.0)	2(19.6)	1(11.1)	6.1(80.3)	0.6(2.1)	5.9(7.9)	29.9	Fair
99.30	13-19	08/03/2018	212.87		29(63.0)	2(40.0)	3(29.4)	1(11.1)	5.7(86.9)	2.1(7.0)	10.1(13.6)	35.9	Fair
98.70	13-3	08/03/2018	220.29		35(76.0)	3(60.0)	3(29.4)	5(55.6)	5.7(86.9)	10.0(33.8)	25.2(34.0)	53.7	Good
96.82	13-2	08/02/2018	225.36		31(67.0)	2(40.0)	4(39.2)	3(33.3)	5.6(88.5)	4.6(15.4)	40.3(54.5)	48.3	Good
94.20	13-1	08/02/2018	232.03		32(70.0)	3(60.0)	5(49.0)	5(55.6)	5.1(96.7)	13.9(47.1)	34.3(46.3)	60.7	Good

Appndex Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample Date	Drainage Area (sq mi)	Sub-samp	Number of				Percent:			MIBI	Rating
					Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	MBI	Percent Scrapers	Percent EPT		
90.60	13-16	08/02/2018	253.75		24(52.0)	3(60.0)	3(29.4)	6(66.7)	4.8(100)	3.7(12.6)	48.8(65.9)	55.2	Good
87.10	16-6	08/02/2018	261.41		32(70.0)	4(80.0)	5(49.0)	5(55.6)	5.6(88.5)	1.9(6.3)	24.9(33.7)	54.7	Good
84.60	16-7	08/02/2018	266.48		26(57.0)	2(40.0)	3(29.4)	3(33.3)	5.5(90.2)	2.4(8.0)	55.2(74.6)	47.5	Good
83.60	16-5	08/01/2018	268.07		25(54.0)	4(80.0)	3(29.4)	5(55.6)	5.4(91.8)	2.3(7.9)	54.3(73.4)	56.0	Good
82.90	16-8	08/01/2018	268.90		25(54.0)	2(40.0)	5(49.0)	4(44.4)	6.2(78.7)	1.0(3.4)	16.7(22.6)	41.7	Good
80.00	16-4	08/01/2018	273.21		30(65.0)	3(60.0)	3(29.4)	4(44.4)	5.5(90.2)	4.6(15.5)	44.0(59.5)	52.0	Good
76.70	16-3	08/01/2018	314.68		29(63.0)	3(60.0)	3(29.4)	4(44.4)	5.2(95.1)	2.1(7.0)	59.9(80.9)	54.3	Good
75.40	16-2	08/01/2018	323.96		24(52.0)	3(60.0)	3(29.4)	4(44.4)	5.2(95.1)	2.6(8.8)	71.5(96.6)	55.2	Good
71.70	16-1	08/01/2018	358.68		21(46.0)	1(20.0)	3(29.4)	2(22.2)	5.7(86.9)	0.3(1.1)	33.1(44.8)	35.8	Fair
Aptakisc Creek (95-701)													
Year: 2016													
4.70	18-4	07/31/2016	1.09		13(28.0)	0(0.0)	0(0.0)	0(0.0)	6.1(80.3)	6.2(20.9)	0.0(0.0)	18.5	Poor
4.30	18-3	07/31/2016	2.30		23(50.0)	0(0.0)	0(0.0)	1(11.1)	6.0(82.0)	10.7(36.2)	0.0(0.0)	25.6	Fair
0.80	18-2	07/31/2016	4.94		27(59.0)	1(20.0)	2(19.6)	2(22.2)	6.3(77.1)	2.6(8.9)	6.2(8.4)	30.7	Fair
0.50	18-1	07/31/2016	5.50		22(48.0)	1(20.0)	0(0.0)	2(22.2)	6.9(67.2)	1.0(3.4)	0.0(0.0)	23.0	Fair
Hastings Creek (95-702)													
Year: 2016													
3.12	10-5	08/07/2016	3.91		17(37.0)	1(20.0)	1(9.8)	1(11.1)	8.4(42.6)	40.5(100)	0.4(0.5)	31.6	Fair
1.68	10-4	08/07/2016	6.80		9(20.0)	0(0.0)	0(0.0)	3(33.3)	6.8(68.9)	0.0(0.0)	0.0(0.0)	17.5	Poor
Buffalo Creek (95-703)													
Year: 2016													
14.00	17-5	08/02/2016	1.37		18(39.0)	2(40.0)	0(0.0)	1(11.1)	6.4(75.4)	2.0(6.6)	0.0(0.0)	24.6	Fair
7.70	17-3	07/31/2016	9.61		26(57.0)	3(60.0)	2(19.6)	1(11.1)	6.0(82.0)	24.9(84.2)	17.1(23.1)	48.1	Good
6.10	17-2	07/31/2016	22.10		28(61.0)	2(40.0)	3(29.4)	5(55.6)	5.8(85.3)	22.9(77.4)	3.4(4.6)	50.5	Good

Appndex Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample	Date	Drainage Area (sq mi)	Sub-samp	Number of			Percent:			MIBI	Rating	
						Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	Percent Scrapers	Percent EPT			
0.75	17-1	2	06/30/2016	29.14		40(87.0)	2(40.0)	4(39.2)	3(33.3)	6.3(77.1)	8.8(29.6)	2.9(4.0)	44.3	Good
0.75	17-1		07/24/2016	29.14		26(57.0)	2(40.0)	2(19.6)	3(33.3)	5.8(85.3)	13.6(45.9)	3.7(5.0)	40.9	Fair
Bull's Brook (95-704)														
Year: 2016														
1.95	13-15		08/02/2016	1.92		29(63.0)	1(20.0)	2(19.6)	3(33.3)	6.4(75.4)	1.7(5.7)	7.3(9.9)	32.4	Fair
0.25	13-7	2	06/30/2016	2.69		12(26.0)	3(60.0)	1(9.8)	1(11.1)	3.3(100)	3.1(10.5)	5.6(7.6)	32.1	Fair
0.25	13-7		08/04/2016	2.69		23(50.0)	4(80.0)	2(19.6)	5(55.6)	4.0(100)	7.6(25.5)	2.2(3.0)	47.7	Good
Forest Lake Drain (95-705)														
Year: 2016														
0.83	15-11		08/02/2016	1.70		17(37.0)	1(20.0)	1(9.8)	1(11.1)	5.7(86.9)	9.7(32.8)	1.3(1.7)	28.5	Fair
Indian Creek (95-706)														
Year: 2016														
10.83	15-9		08/02/2016	2.68		13(28.0)	0(0.0)	0(0.0)	2(22.2)	7.6(55.7)	11.9(40.2)	0.0(0.0)	20.9	Fair
9.83	15-6		08/02/2016	3.70		22(48.0)	0(0.0)	1(9.8)	2(22.2)	5.9(83.6)	0.0(0.0)	1.7(2.2)	23.7	Fair
5.40	15-5		08/01/2016	17.26		24(52.0)	3(60.0)	1(9.8)	3(33.3)	5.5(90.2)	4.7(16.0)	1.8(2.4)	37.7	Fair
2.41	15-2		08/01/2016	35.02		36(78.0)	4(80.0)	4(39.2)	4(44.4)	6.1(80.3)	24.5(82.8)	3.6(4.9)	58.5	Good
0.17	15-1	2	07/01/2016	36.43		36(78.0)	4(80.0)	3(29.4)	4(44.4)	6.6(72.1)	22.3(75.3)	5.9(8.0)	55.3	Good
0.17	15-1		07/29/2016	36.43		35(76.0)	4(80.0)	4(39.2)	4(44.4)	5.9(83.6)	20.9(70.5)	15.3(20.7)	59.2	Good
Kildeer Creek (95-707)														
Year: 2016														
5.20	15-12		08/01/2016	2.08		29(63.0)	2(40.0)	2(19.6)	2(22.2)	6.4(75.4)	11.2(37.7)	0.9(1.3)	37.0	Fair
4.60	15-7		08/01/2016	2.86		20(43.0)	2(40.0)	2(19.6)	1(11.1)	5.3(93.4)	1.7(5.7)	10.1(13.7)	32.4	Fair
2.21	15-13		08/01/2016	5.01		33(72.0)	3(60.0)	3(29.4)	3(33.3)	6.3(77.1)	20.6(69.5)	38.0(51.4)	56.1	Good
0.17	15-4		08/01/2016	6.80		35(76.0)	3(60.0)	2(19.6)	1(11.1)	6.0(82.0)	10.9(36.8)	6.5(8.7)	42.0	Good

Appndex Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample Date	Drainage Area (sq mi)	Sub-samp	Number of				Percent:			MIBI	Rating
					Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	MBI	Percent Scrapers	Percent EPT		
Newport Drainage Ditch (95-708)													
Year: 2016													
3.03	12-2	08/08/2016	2.81		23(50.0)	1(20.0)	1(9.8)	0(0.0)	7.6(55.7)	28.7(97.0)	2.4(3.3)	33.7	Fair
0.70	12-1	08/08/2016	7.35		32(70.0)	2(40.0)	2(19.6)	4(44.4)	5.7(86.9)	18.0(61.0)	2.5(3.4)	46.5	Good
Stoneroller Creek (95-709)													
Year: 2016													
0.42	13-9	08/09/2016	4.08		37(80.0)	3(60.0)	4(39.2)	3(33.3)	6.2(78.7)	33.8(100)	10.6(14.3)	57.9	Good
Suburban Country Club Tributary (95-710)													
Year: 2016													
2.75	13-12	08/06/2016	2.37		15(33.0)	0(0.0)	1(9.8)	0(0.0)	7.0(65.6)	40.0(100)	9.7(13.1)	31.6	Fair
2.00	13-10	08/06/2016	4.02		14(30.0)	1(20.0)	2(19.6)	0(0.0)	7.2(62.3)	0.3(1.1)	0.9(1.3)	19.2	Poor
Slocum Conrners Creek (95-711)													
Year: 2016													
1.36	13-11	08/06/2016	2.39		29(63.0)	3(60.0)	2(19.6)	3(33.3)	6.2(78.7)	9.2(31.1)	3.2(4.3)	41.4	Fair
Unnamed Trib to Aptakistic Creek @ RM4.64 (95-712)													
Year: 2016													
0.05	18-5	2 07/01/2016	0.99		11(24.0)	0(0.0)	0(0.0)	1(11.1)	6.0(82.0)	6.0(20.3)	0.0(0.0)	19.6	Poor
0.05	18-5	07/29/2016	0.99		10(22.0)	1(20.0)	0(0.0)	0(0.0)	6.2(78.7)	13.5(45.7)	0.0(0.0)	23.8	Fair
Unnamed Trib to Buffalo Creek @ RM 7.56 (95-713)													
Year: 2016													
0.68	17-4	08/01/2016	8.55		1(2.0)	0(0.0)	0(0.0)	0(0.0)	6.5(73.8)	100(100)	0.0(0.0)	25.1	Fair
0.68	17-4	07/31/2016	8.55		23(50.0)	2(40.0)	1(9.8)	2(22.2)	6.7(70.5)	10.5(35.6)	1.9(2.5)	32.9	Fair

Appendix Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample Date	Drainage Area (sq mi)	Sub-samp	Number of				Percent:			MIBI	Rating
					Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	MBI	Percent Scrapers	Percent EPT		
Unnamed Trib to DesPlaines River (95-714)													
Year: 2016													
0.13	13-17	08/04/2016	0.86		12(26.0)	1(20.0)	1(9.8)	0(0.0)	6.5(73.8)	8.9(30.0)	0.7(0.9)	22.9	Fair
Unnamed Trib to N. Mill Creek (95-715)													
Year: 2016													
0.04	10-6	08/07/2016	0.99		22(48.0)	0(0.0)	1(9.8)	2(22.2)	4.4(100)	0.3(1.1)	4.8(6.5)	26.8	Fair
Unnamed Trib - Greenleaf Creek (95-716)													
Year: 2016													
0.40	13-13	08/05/2016	1.06		12(26.0)	0(0.0)	1(9.8)	2(22.2)	5.9(83.6)	0.0(0.0)	0.3(0.5)	20.3	Poor
W. Branch Indian Creek (95-717)													
Year: 2016													
0.80	15-10	08/02/2016	2.22		18(39.0)	1(20.0)	1(9.8)	2(22.2)	5.6(88.5)	0.3(1.1)	0.7(0.9)	25.9	Fair
West Branch Bull Creek (95-719)													
Year: 2016													
2.54	14-4	08/03/2016	5.10		24(52.0)	0(0.0)	2(19.6)	1(11.1)	8.8(36.1)	2.4(8.2)	3.0(4.1)	18.7	Poor
1.60	14-3	08/04/2016	7.05		29(63.0)	5(100)	5(49.0)	3(33.3)	5.5(90.2)	39.3(100)	9.8(13.3)	64.1	Good
West Fork Belvidere Rd. Trib (95-720)													
Year: 2016													
0.21	13-14	08/05/2016	2.30		13(28.0)	2(40.0)	0(0.0)	1(11.1)	6.2(78.7)	12.0(40.5)	0.0(0.0)	28.3	Fair
0.15	13-8	08/05/2016	3.75		26(57.0)	3(60.0)	2(19.6)	2(22.2)	6.0(82.0)	46.9(100)	1.3(1.7)	48.9	Good
Unnamed Trib to Des Plaines River (95-721)													
Year: 2016													
0.40	16-9	07/31/2016	1.19		35(76.0)	1(20.0)	2(19.6)	4(44.4)	5.9(83.6)	12.7(42.9)	2.5(3.4)	41.4	Fair

Appndex Table C-1. Macroinvertebrate IBI result from the Des Plaines River study area during 2016 and 2018..

River Mile	Site ID	Sample	Date	Drainage Area (sq mi)	Sub-samp	Number of			Percent:			MIBI	Rating	
						Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	Percent Scrapers	Percent EPT			
Werhane Lake Drain (95-722)														
Year: 2016														
0.80	16-10B		07/01/2016	0.22		27(59.0)	2(40.0)	0(0.0)	3(33.3)	5.1(96.7)	22.7(76.6)	0.3(0.5)	43.7	Good
0.80	16-10B	2	07/01/2016	0.22		27(59.0)	2(40.0)	0(0.0)	3(33.3)	5.1(96.7)	22.7(76.6)	0.3(0.5)	43.7	Good
0.80	16-10B		07/29/2016	0.22		25(54.0)	2(40.0)	0(0.0)	2(22.2)	5.8(85.3)	32.7(100)	0.3(0.5)	43.1	Good

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Willow Rd					Site ID: 16-1				
Collection Date: 07/30/2016					Sample:				
River Code: 95-656					River: Des Plaines River				
					RM: 71.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	42					
04664	Helobdella stagnalis	PR	8	1					
04666	Helobdella papillata	PA	8	1					
06201	Hyaella azteca	CG	5	26					
06800	Gammarus sp			22					
11130	Baetis intercalaris		7	6					
13400	Stenacron sp			1					
16700	Tricorythodes sp			68					
21300	Hetaerina sp			2					
22001	Coenagrionidae	PR	5.5	3					
52200	Cheumatopsyche sp			32					
53800	Hydroptila sp			1					
59407	Nectopsyche candida		3	2					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			3					
68700	Dubiraphia sp			1					
68901	Macronychus glabratus		2	2					
69400	Stenelmis sp			1					
74100	Simulium sp			2					
78599	Pentaneura sp			10					
78655	Procladius (Holotanypus) sp			2					
82820	Cryptochironomus sp			2					
83040	Dicrotendipes neomodestus	CG	6	1					
84450	Polypedilum (Uresipedilum) flavum			5					
84470	Polypedilum (P.) illinoense			1					
84520	Polypedilum (Tripodura) halterale group			3					
84540	Polypedilum (Tripodura) scalaenum group			2					
85265	Cladotanytarsus vanderwulpi group sp 5			8					
85625	Rheotanytarsus sp			10					
93200	Hydrobiidae	SC	6	2					
95100	Physella sp			1					
97601	Corbicula fluminea			32					
98001	Pisidiidae		5	2					
No. Quantitative Taxa:		32	Total Taxa:		32				
Number of Organisms:		297	mIBI:		53.15				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Willow Rd					Site ID: 16-1				
Collection Date: 08/01/2018					River: Des Plaines River				
River Code: 95-656					Sample: RM: 71.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	5					
03600	Oligochaeta	CG	10	2					
06800	Gammarus sp			11					
11130	Baetis intercalaris		7	22					
11620	Paracloeodes minutus			4					
16700	Tricorythodes sp			40					
52200	Cheumatopsyche sp			39					
68708	Dubiraphia vittata group			2					
77750	Hayesomyia senata or Thienemannimyia norena			6					
80410	Cricotopus (C.) sp			1					
80420	Cricotopus (C.) bicinctus			10					
80440	Cricotopus (C.) trifascia			1					
82820	Cryptochironomus sp			3					
83040	Dicrotendipes neomodestus	CG	6	11					
84450	Polypedilum (Uresipedilum) flavum			26					
84470	Polypedilum (P.) illinoense			9					
84520	Polypedilum (Tripodura) halterale group			2					
84540	Polypedilum (Tripodura) scalaenum group			11					
84612	Saetheria tylus			9					
84700	Stenochironomus sp			3					
85230	Cladotanytarsus mancus group			2					
85265	Cladotanytarsus vanderwulpi group sp 5			68					
85625	Rheotanytarsus sp			1					
85800	Tanytarsus sp			1					
85814	Tanytarsus glabrescens group			1					
95100	Physella sp			1					
97601	Corbicula fluminea			16					
98200	Pisidium sp			10					
No. Quantitative Taxa:		28	Total Taxa:		28				
Number of Organisms:		317	mIBI:		35.77				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Lake Cook Rd					Site ID: 16-2				
Collection Date: 07/30/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 75.40				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	8					
06201	Hyalella azteca	CG	5	35					
06800	Gammarus sp			85					
11130	Baetis intercalaris		7	60					
13570	Maccaffertium terminatum	SC	4	1					
16700	Tricorythodes sp			52					
17200	Caenis sp			1					
21200	Calopteryx sp			3					
22300	Argia sp	PR	5	2					
52200	Cheumatopsyche sp			7					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			5					
74100	Simulium sp			38					
78599	Pentaneura sp			4					
82820	Cryptochironomus sp			1					
83040	Dicrotendipes neomodestus	CG	6	1					
83840	Microtendipes pedellus group			1					
84470	Polypedilum (P.) illinoense			1					
84540	Polypedilum (Tripodura) scalaenum group			1					
85625	Rheotanytarsus sp			2					
96900	Ferrissia sp			1					
97601	Corbicula fluminea			7					
No. Quantitative Taxa:		22	Total Taxa:		22				
Number of Organisms:		317	mIBI:		45.37				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Lake Cook Rd					Site ID: 16-2				
Collection Date: 08/01/2018					River: Des Plaines River				
River Code: 95-656					Sample: RM: 75.40				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	9					
06800	Gammarus sp			11					
11130	Baetis intercalaris		7	22					
13400	Stenacron sp			2					
16700	Tricorythodes sp			189					
21300	Hetaerina sp			1					
22001	Coenagrionidae	PR	5.5	1					
52200	Cheumatopsyche sp			34					
59407	Nectopsyche candida		3	1					
68708	Dubiraphia vittata group			1					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			5					
77750	Hayesomyia senata or Thienemannimyia norena			10					
80420	Cricotopus (C.) bicinctus			5					
82730	Chironomus (C.) decorus group			1					
83040	Dicrotendipes neomodestus	CG	6	4					
84300	Phaenopsectra obediens group			1					
84450	Polypedilum (Uresipedilum) flavum			5					
84470	Polypedilum (P.) illinoense			27					
84520	Polypedilum (Tripodura) halterale group			1					
84540	Polypedilum (Tripodura) scalaenum group			3					
85265	Cladotanytarsus vanderwulpi group sp 5			1					
85625	Rheotanytarsus sp			2					
85840	Tanytarsus sepp			1					
93900	Elimia sp			1					
97601	Corbicula fluminea			3					
98600	Sphaerium sp			5					
No. Quantitative Taxa:		27	Total Taxa:		27				
Number of Organisms:		347	mIBI:		55.18				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Deerfield Rd					Site ID: 16-3				
Collection Date: 07/30/2016					River: Des Plaines River				
River Code: 95-656					Sample: RM: 76.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	5					
03600	Oligochaeta	CG	10	1					
05800	Caecidotea sp			1					
06201	Hyalella azteca	CG	5	16					
06800	Gammarus sp			26					
11130	Baetis intercalaris		7	1					
11670	Proclleon viridoculare			3					
13400	Stenacron sp			2					
13570	Maccaffertium terminatum	SC	4	1					
16700	Tricorythodes sp			47					
18100	Anthopotamus sp		4	1					
21300	Hetaerina sp			4					
22001	Coenagrionidae	PR	5.5	13					
22300	Argia sp	PR	5	3					
52200	Cheumatopsyche sp			7					
53800	Hydroptila sp			1					
59407	Nectopsyche candida		3	2					
59500	Oecetis sp			2					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			2					
67901				78					
68700	Dubiraphia sp			9					
68901	Macronychus glabratus		2	5					
69400	Stenelmis sp			4					
78655	Procladius (Holotanypus) sp			2					
82820	Cryptochironomus sp			3					
83040	Dicrotendipes neomodestus	CG	6	3					
83840	Microtendipes pedellus group			1					
84450	Polypedilum (Uresipedilum) flavum			1					
84520	Polypedilum (Tripodura) halterale group			1					
85265	Cladotanytarsus vanderwulpi group sp 5			1					
85625	Rheotanytarsus sp			2					
93200	Hydrobiidae	SC	6	4					
95100	Physella sp			3					
96900	Ferrissia sp			1					
No. Quantitative Taxa: 34		Total Taxa: 34							
Number of Organisms: 256		mIBI: 57.42							

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Deerfield Rd					Site ID: 16-3				
Collection Date: 08/01/2018					Sample:				
River Code: 95-656					River: Des Plaines River				
					RM: 76.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	6					
03600	Oligochaeta	CG	10	8					
06800	Gammarus sp			13					
11130	Baetis intercalaris		7	15					
13400	Stenacron sp			3					
13550	Maccaffertium mexicanum integrum			1					
16700	Tricorythodes sp			130					
52200	Cheumatopsyche sp			19					
59407	Nectopsyche candida		3	5					
59500	Oecetis sp			1					
68708	Dubiraphia vittata group			1					
68901	Macronychus glabratus		2	3					
69400	Stenelmis sp			2					
77750	Hayesomyia senata or Thienemannimyia norena			10					
78655	Procladius (Holotanypus) sp			1					
80420	Cricotopus (C.) bicinctus			1					
81825	Rheocricotopus (Psilocricotopus) robacki			2					
82730	Chironomus (C.) decorus group			1					
82820	Cryptochironomus sp			4					
82880	Cryptotendipes sp			2					
83002	Dicrotendipes modestus	CG	6	2					
83040	Dicrotendipes neomodestus	CG	6	10					
83400	Harnischia sp			1					
84450	Polypedilum (Uresipedilum) flavum			6					
84470	Polypedilum (P.) illinoense			3					
84520	Polypedilum (Tripodura) halterale group			3					
84540	Polypedilum (Tripodura) scalaenum group			7					
84700	Stenochironomus sp			2					
85265	Cladotanytarsus vanderwulpi group sp 5			5					
85800	Tanytarsus sp			3					
85814	Tanytarsus glabrescens group			2					
93900	Elimia sp			1					
97601	Corbicula fluminea			11					
98001	Pisidiidae		5	4					
98200	Pisidium sp			1					

No. Quantitative Taxa: 35 Total Taxa: 35
 Number of Organisms: 289 mIBI: 54.26

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt 22 (Half Day Rd)					Site ID: 16-4				
Collection Date: 07/30/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 80.00				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	6					
03600	Oligochaeta	CG	10	4					
06201	Hyalella azteca	CG	5	39					
06800	Gammarus sp			43					
11130	Baetis intercalaris		7	17					
11200	Callibaetis sp			1					
13400	Stenacron sp			3					
16700	Tricorythodes sp			39					
17200	Caenis sp			5					
21300	Hetaerina sp			2					
22001	Coenagrionidae	PR	5.5	15					
52200	Cheumatopsyche sp			69					
53501	Hydroptilidae	PH	3.5	2					
59407	Nectopsyche candida		3	3					
59500	Oecetis sp			1					
68700	Dubiraphia sp			5					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			4					
74100	Simulium sp			1					
77750	Hayesomyia senata or Thienemannimyia norena			1					
78600	Pentaneura inconspicua			14					
81825	Rheocricotopus (Psilocricotopus) robacki			4					
82130	Thienemanniella similis			1					
83040	Dicrotendipes neomodestus	CG	6	5					
84450	Polypedilum (Uresipedilum) flavum			1					
85500	Paratanytarsus sp			1					
85625	Rheotanytarsus sp			5					
95100	Physella sp			4					
No. Quantitative Taxa:		28	Total Taxa:		28				
Number of Organisms:		296	mIBI:		58.79				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt 22 (Half Day Rd)					Site ID: 16-4				
Collection Date: 08/01/2018					River Code: 95-656				
River: Des Plaines River					Sample: RM: 80.00				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
03600	Oligochaeta	CG	10	3					
06201	Hyalella azteca	CG	5	1					
06800	Gammarus sp			24					
11130	Baetis intercalaris		7	9					
13400	Stenacron sp			1					
16700	Tricorythodes sp			97					
22300	Argia sp	PR	5	2					
52200	Cheumatopsyche sp			32					
59407	Nectopsyche candida		3	4					
59724	Trienodes injustus		3	1					
68708	Dubiraphia vittata group			2					
68901	Macronychus glabratus		2	2					
69400	Stenelmis sp			14					
77130	Ablabesmyia rhamphe group			1					
77500	Conchapelopia sp			1					
77750	Hayesomyia senata or Thienemannimyia norena			12					
78655	Procladius (Holotanypus) sp			2					
80410	Cricotopus (C.) sp			1					
80420	Cricotopus (C.) bicinctus			7					
81825	Rheocricotopus (Psilocricotopus) robacki			5					
82730	Chironomus (C.) decorus group			2					
82820	Cryptochironomus sp			1					
82880	Cryptotendipes sp			1					
83040	Dicrotendipes neomodestus	CG	6	3					
84450	Polypedilum (Uresipedilum) flavum			15					
84470	Polypedilum (P.) illinoense			16					
84520	Polypedilum (Tripodura) halterale group			2					
84540	Polypedilum (Tripodura) scalaenum group			28					
85230	Cladotanytarsus mancus group			1					
85265	Cladotanytarsus vanderwulpi group sp 5			11					
85625	Rheotanytarsus sp			2					
85800	Tanytarsus sp			3					
85814	Tanytarsus glabrescens group			4					
85821	Tanytarsus glabrescens group sp 7			6					
97601	Corbicula fluminea			7					
98001	Pisidiidae		5	2					

No. Quantitative Taxa: 37 Total Taxa: 37
 Number of Organisms: 327 mIBI: 52.00

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Collection Date: 08/01/2016					River Code: 95-656					River: Des Plaines River					RM: 82.90				
Taxa										Taxa									
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	7	97601	Corbicula fluminea			13										
03600	Oligochaeta	CG	10	32															
05800	Caecidotea sp			1	No. Quantitative Taxa:		40	Total Taxa:		40									
06201	Hyalella azteca	CG	5	93	Number of Organisms:		322	mIBI:		49.75									
06700	Crangonyx sp			12															
11200	Callibaetis sp			1															
13400	Stenacron sp			1															
16700	Tricorythodes sp			5															
17200	Caenis sp			2															
22001	Coenagrionidae	PR	5.5	45															
22300	Argia sp	PR	5	1															
23700	Anax sp	PR	5	1															
27400	Neurocordulia sp			3															
52200	Cheumatopsyche sp			11															
53800	Hydroptila sp			2															
59407	Nectopsyche candida		3	1															
59500	Oecetis sp			5															
68708	Dubiraphia vittata group			3															
68901	Macronychus glabratus		2	9															
69400	Stenelmis sp			1															
77120	Ablabesmyia mallochi		6	1															
77750	Hayesomyia senata or Thienemannimyia norena			2															
78600	Pentaneura inconspicua			15															
78655	Procladius (Holotanypus) sp			1															
82820	Cryptochironomus sp			3															
83040	Dicrotendipes neomodestus	CG	6	10															
84470	Polypedilum (P.) illinoense			2															
84520	Polypedilum (Tripodura) halterale group			4															
84540	Polypedilum (Tripodura) scalaenum group			5															
84960	Pseudochironomus sp			1															
85230	Cladotanytarsus mancus group			4															
85265	Cladotanytarsus vanderwulpi group sp 5			10															
85500	Paratanytarsus sp			1															
85821	Tanytarsus glabrescens group sp 7			1															
85840	Tanytarsus sepp			1															
93200	Hydrobiidae	SC	6	1															
94201	Lymnaeidae	SC	7	1															
95100	Physella sp			8															
95501	Planorbidae	SC	6.5	2															

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Wright Woods Dam site - immediately ust. bike bridge					Site ID: 16-8					
Collection Date: 08/01/2018					River Code: 95-656		River: Des Plaines River		Sample: RM: 82.90	
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.	
01801	Turbellaria	PR	6	1						
03600	Oligochaeta	CG	10	2						
06800	Gammarus sp			20						
11130	Baetis intercalaris		7	3						
11620	Paracloeodes minutus			7						
11670	Proclaeon viridoculare			1						
13400	Stenacron sp			1						
16700	Tricorythodes sp			16						
22001	Coenagrionidae	PR	5.5	1						
22300	Argia sp	PR	5	2						
42700	Belostoma sp			1						
52200	Cheumatopsyche sp			20						
53800	Hydroptila sp			2						
68708	Dubiraphia vittata group			1						
68901	Macronychus glabratus		2	1						
77750	Hayesomyia senata or Thienemannimyia norena			10						
78655	Procladius (Holotanypus) sp			3						
80420	Cricotopus (C.) bicinctus			20						
82730	Chironomus (C.) decorus group			13						
82820	Cryptochironomus sp			1						
83002	Dicrotendipes modestus	CG	6	3						
83040	Dicrotendipes neomodestus	CG	6	17						
84450	Polypedilum (Uresipedilum) flavum			5						
84470	Polypedilum (P.) illinoense			54						
84520	Polypedilum (Tripodura) halterale group			1						
84540	Polypedilum (Tripodura) scalaenum group			32						
84700	Stenochironomus sp			1						
85230	Cladotanytarsus mancus group			2						
85265	Cladotanytarsus vanderwulpi group sp 5			46						
85800	Tanytarsus sp			6						
85814	Tanytarsus glabrescens group			3						
85821	Tanytarsus glabrescens group sp 7			1						
97601	Corbicula fluminea			3						
No. Quantitative Taxa: 33		Total Taxa: 33								
Number of Organisms: 300		mIBI: 41.73								

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 60					Site ID: 16-5				
Collection Date: 06/29/2016					River Code: 95-656				
River: Des Plaines River					Sample: 2				
RM: 83.60									
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	8					
03600	Oligochaeta	CG	10	2					
06201	Hyalella azteca	CG	5	8					
06800	Gammarus sp			17					
11130	Baetis intercalaris		7	54					
13400	Stenacron sp			3					
16700	Tricorythodes sp			46					
22001	Coenagrionidae	PR	5.5	10					
52200	Cheumatopsyche sp			32					
53800	Hydroptila sp			1					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			1					
68700	Dubiraphia sp			1					
68901	Macronychus glabratus		2	3					
69400	Stenelmis sp			4					
74100	Simulium sp			13					
77130	Ablabesmyia rhamphe group			1					
77500	Conchapelopia sp			1					
77750	Hayesomyia senata or Thienemannimyia norena			18					
78600	Pentaneura inconspicua			15					
80420	Cricotopus (C.) bicinctus			4					
80510	Cricotopus (Isocladius) sylvestris group			8					
81825	Rheocricotopus (Psilocricotopus) robacki			1					
83040	Dicrotendipes neomodestus	CG	6	6					
84450	Polypedilum (Uresipedilum) flavum			3					
84470	Polypedilum (P.) illinoense			1					
84540	Polypedilum (Tripodura) scalaenum group			1					
85625	Rheotanytarsus sp			3					
93200	Hydrobiidae	SC	6	5					
95100	Physella sp			11					
96900	Ferrissia sp			1					
97601	Corbicula fluminea			32					
98001	Pisidiidae		5	2					

No. Quantitative Taxa: 32 Total Taxa: 32
 Number of Organisms: 316 mIBI: 0.00

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 60					Site ID: 16-5				
Collection Date: 07/25/2016					River: Des Plaines River				
River Code: 95-656					Sample: RM: 83.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
03600	Oligochaeta	CG	10	9	No. Quantitative Taxa: 38		Total Taxa: 38		
06201	Hyalella azteca	CG	5	72	Number of Organisms: 296		mIBI: 54.36		
06800	Gammarus sp			46					
08451	Palaemonetes kadiakensis		4	1					
11130	Baetis intercalaris		7	2					
11200	Callibaetis sp			5					
13400	Stenacron sp			1					
16700	Tricorythodes sp			8					
17200	Caenis sp			2					
22001	Coenagrionidae	PR	5.5	30					
23700	Anax sp	PR	5	1					
52200	Cheumatopsyche sp			5					
53800	Hydroptila sp			23					
68700	Dubiraphia sp			1					
68901	Macronychus glabratus		2	7					
69400	Stenelmis sp			1					
77130	Ablabesmyia rhamphe group			4					
77355	Clinotanypus pinguis	PR	6	2					
77750	Hayesomyia senata or Thienemannimyia norena			1					
78599	Pentaneura sp			18					
78655	Procladius (Holotanypus) sp			2					
80420	Cricotopus (C.) bicinctus			3					
82820	Cryptochironomus sp			1					
83040	Dicrotendipes neomodestus	CG	6	11					
83158	Endochironomus nigricans	SH	6	1					
84450	Polypedilum (Uresipedilum) flavum			5					
84470	Polypedilum (P.) illinoense			4					
84500	Polypedilum (P.) trigonus			2					
84520	Polypedilum (Tripodura) halterale group			1					
85265	Cladotanytarsus vanderwulpi group sp 5			2					
85625	Rheotanytarsus sp			5					
85800	Tanytarsus sp			1					
85821	Tanytarsus glabrescens group sp 7			1					
93200	Hydrobiidae	SC	6	4					
95100	Physella sp			5					
96900	Ferrissia sp			1					
97601	Corbicula fluminea			6					

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 60					Site ID: 16-5				
Collection Date: 08/01/2018					River: Des Plaines River				
River Code: 95-656					Sample: RM: 83.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
06201	Hyalella azteca	CG	5	1					
06800	Gammarus sp			7					
11130	Baetis intercalaris		7	43					
13400	Stenacron sp			2					
16700	Tricorythodes sp			45					
22300	Argia sp	PR	5	2					
52200	Cheumatopsyche sp			69					
59407	Nectopsyche candida		3	4					
68601	Ancyronyx variegata	CG	2	1					
68700	Dubiraphia sp			2					
68708	Dubiraphia vittata group			5					
68901	Macronychus glabratus		2	3					
69400	Stenelmis sp			4					
77130	Ablabesmyia rhamphe group			2					
77750	Hayesomyia senata or Thienemannimyia norena			7					
80420	Cricotopus (C.) bicinctus			6					
80440	Cricotopus (C.) trifascia			1					
82100	Thienemanniella sp			2					
83002	Dicrotendipes modestus	CG	6	3					
83040	Dicrotendipes neomodestus	CG	6	1					
84450	Polypedilum (Uresipedilum) flavum			13					
84470	Polypedilum (P.) illinoense			23					
84520	Polypedilum (Tripodura) halterale group			2					
84540	Polypedilum (Tripodura) scalaenum group			30					
85263	Cladotanytarsus vanderwulpi group sp 3			1					
85265	Cladotanytarsus vanderwulpi group sp 5			6					
85625	Rheotanytarsus sp			1					
85840	Tanytarsus sepp			2					
93200	Hydrobiidae	SC	6	1					
97601	Corbicula fluminea			3					
98001	Pisidiidae		5	6					
No. Quantitative Taxa:		32	Total Taxa:		32				
Number of Organisms:		300	mIBI:		56.01				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Hollister Dam site - adj. to Hollister Intl.					Site ID: 16-7					
Collection Date: 08/02/2018					River Code: 95-656		River: Des Plaines River		Sample: RM: 84.60	
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.	
01801	Turbellaria	PR	6	37						
03600	Oligochaeta	CG	10	3						
06800	Gammarus sp			3						
11130	Baetis intercalaris		7	59						
13570	Maccaffertium terminatum	SC	4	1						
16700	Tricorythodes sp			61						
22300	Argia sp	PR	5	1						
52200	Cheumatopsyche sp			63						
59407	Nectopsyche candida		3	2						
68901	Macronychus glabratus		2	2						
69400	Stenelmis sp			3						
74501	Ceratopogonidae	PR	5	1						
77130	Ablabesmyia rhamphe group			1						
77750	Hayesomyia senata or Thienemannimyia norena			12						
78655	Procladius (Holotanypus) sp			1						
80420	Cricotopus (C.) bicinctus			16						
81825	Rheocricotopus (Psilocricotopus) robacki			1						
82730	Chironomus (C.) decorus group			6						
83040	Dicrotendipes neomodestus	CG	6	1						
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)			1						
84450	Polypedilum (Uresipedilum) flavum			13						
84470	Polypedilum (P.) illinoense			2						
84540	Polypedilum (Tripodura) scalaenum group			17						
85265	Cladotanytarsus vanderwulpi group sp 5			4						
85800	Tanytarsus sp			1						
85814	Tanytarsus glabrescens group			1						
93200	Hydrobiidae	SC	6	4						
97601	Corbicula fluminea			8						
98001	Pisidiidae		5	12						
No. Quantitative Taxa: 29					Total Taxa: 29					
Number of Organisms: 337					mIBI: 47.50					

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Hollister Dam site - adj. to Hollister Intl.					Site ID: 16-7				
Collection Date: 08/03/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 84.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	12					
03600	Oligochaeta	CG	10	5					
04660	Helobdella sp			2					
06201	Hyalella azteca	CG	5	80					
06800	Gammarus sp			56					
11130	Baetis intercalaris		7	1					
11200	Callibaetis sp			1					
11670	Proclleon viridoculare			1					
16700	Tricorythodes sp			4					
17200	Caenis sp			1					
21300	Hetaerina sp			1					
22001	Coenagrionidae	PR	5.5	28					
52200	Cheumatopsyche sp			2					
53800	Hydroptila sp			11					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			1					
59970	Petrophila sp			1					
68700	Dubiraphia sp			1					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			1					
77130	Ablabesmyia rhamphe group			1					
77750	Hayesomyia senata or Thienemannimyia norena			1					
78599	Pentaneura sp			26					
78655	Procladius (Holotanypus) sp			3					
80420	Cricotopus (C.) bicinctus			3					
82730	Chironomus (C.) decorus group			1					
83000	Dicrotendipes sp			1					
83040	Dicrotendipes neomodestus	CG	6	14					
84470	Polypedilum (P.) illinoense			14					
85265	Cladotanytarsus vanderwulpi group sp 5			1					
85625	Rheotanytarsus sp			19					
93200	Hydrobiidae	SC	6	1					
95100	Physella sp			1					
97601	Corbicula fluminea			5					

No. Quantitative Taxa: 33 Total Taxa: 33
 Number of Organisms: 301 mIBI: 51.61

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rockland Rd.					Site ID: 16-6				
Collection Date: 08/02/2018					River: Des Plaines River				
River Code: 95-656					Sample: RM: 87.10				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
06201	Hyalella azteca	CG	5	3	No. Quantitative Taxa: 37		Total Taxa: 37		
06800	Gammarus sp			21	Number of Organisms: 321		mIBI: 54.73		
08200	Orconectes sp			1					
11130	Baetis intercalaris		7	13					
11670	Proclleon viridoculare			5					
13400	Stenacron sp			1					
16700	Tricorythodes sp			46					
17200	Caenis sp			1					
22300	Argia sp	PR	5	1					
48200	Chauliodes sp			1					
52200	Cheumatopsyche sp			8					
53800	Hydroptila sp			3					
59407	Nectopsyche candida		3	3					
60400	Gyrinus sp			2					
68201	Scirtidae			1					
68700	Dubiraphia sp			3					
68708	Dubiraphia vittata group			3					
68901	Macronychus glabratus		2	2					
69400	Stenelmis sp			1					
77130	Ablabesmyia rhamphe group			3					
77750	Hayesomyia senata or Thienemannimyia norena			11					
78655	Procladius (Holotanypus) sp			2					
80420	Cricotopus (C.) bicinctus			20					
82730	Chironomus (C.) decorus group			1					
82820	Cryptochironomus sp			1					
83040	Dicrotendipes neomodestus	CG	6	3					
84450	Polypedilum (Uresipedilum) flavum			6					
84470	Polypedilum (P.) illinoense			80					
84520	Polypedilum (Tripodura) halterale group			1					
84540	Polypedilum (Tripodura) scalaenum group			39					
84700	Stenochironomus sp			3					
85265	Cladotanytarsus vanderwulpi group sp 5			19					
85625	Rheotanytarsus sp			1					
85800	Tanytarsus sp			7					
85821	Tanytarsus glabrescens group sp 7			2					
97601	Corbicula fluminea			1					

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Route 137 (Buckley Rd)					Site ID: 13-16				
Collection Date: 08/02/2018					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 90.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
06800	Gammarus sp			42					
11130	Baetis intercalaris		7	90					
13400	Stenacron sp			1					
16700	Tricorythodes sp			37					
52200	Cheumatopsyche sp			26					
53800	Hydroptila sp			1					
59407	Nectopsyche candida		3	2					
68708	Dubiraphia vittata group			7					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			4					
74100	Simulium sp			1					
77130	Ablabesmyia rhamphe group			2					
77750	Hayesomyia senata or Thienemannimyia norena			14					
80420	Cricotopus (C.) bicinctus			11					
80430	Cricotopus (C.) tremulus group			1					
80490	Cricotopus (Isocladius) intersectus group			1					
82100	Thienemanniella sp			1					
82820	Cryptochironomus sp			2					
83000	Dicrotendipes sp			1					
83040	Dicrotendipes neomodestus	CG	6	3					
84450	Polypedilum (Uresipedilum) flavum			7					
84470	Polypedilum (P.) illinoense			12					
84540	Polypedilum (Tripodura) scalaenum group			19					
84700	Stenochironomus sp			2					
85265	Cladotanytarsus vanderwulpi group sp 5			2					
85625	Rheotanytarsus sp			2					
85821	Tanytarsus glabrescens group sp 7			2					
93200	Hydrobiidae	SC	6	6					
97601	Corbicula fluminea			22					

No. Quantitative Taxa: 29 Total Taxa: 29
 Number of Organisms: 322 mIBI: 55.22

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Route 137 (Buckley Rd)					Site ID: 13-16				
Collection Date: 08/04/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 90.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	5					
05800	Caecidotea sp			1					
06201	Hyaella azteca	CG	5	17					
06800	Gammarus sp			77					
11130	Baetis intercalaris		7	14					
16700	Tricorythodes sp			9					
17200	Caenis sp			2					
21300	Hetaerina sp			1					
52200	Cheumatopsyche sp			2					
53800	Hydroptila sp			25					
69400	Stenelmis sp			3					
77750	Hayesomyia senata or Thienemannimyia norena			1					
78599	Pentaneura sp			3					
80410	Cricotopus (C.) sp			1					
80420	Cricotopus (C.) bicinctus			59					
80510	Cricotopus (Isocladius) sylvestris group			1					
81825	Rheocricotopus (Psilocricotopus) robacki			2					
82130	Thienemanniella similis			3					
82141	Thienemanniella xena	CG	2	1					
82820	Cryptochironomus sp			1					
83040	Dicrotendipes neomodestus	CG	6	12					
84450	Polypedilum (Uresipedilum) flavum			23					
84470	Polypedilum (P.) illinoense			19					
85625	Rheotanytarsus sp			25					
87540	Hemerodromia sp			1					
93200	Hydrobiidae	SC	6	10					
97601	Corbicula fluminea			4					
No. Quantitative Taxa:		27	Total Taxa:		27				
Number of Organisms:		322	mIBI:		44.77				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: RT 120 BR W OF GURNEE					Site ID: 13-1				
Collection Date: 07/30/2016					River Code: 95-656				
					River: DES PLAINES RIVER				
					Sample: RM: 94.20				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	3					
03600	Oligochaeta	CG	10	21					
04637	Placobdella phalera		8	1					
05800	Caecidotea sp			1					
06201	Hyaella azteca	CG	5	27					
06800	Gammarus sp			145					
11130	Baetis intercalaris		7	4					
11200	Callibaetis sp			2					
13400	Stenacron sp			4					
17200	Caenis sp			2					
22001	Coenagrionidae	PR	5.5	58					
23700	Anax sp	PR	5	2					
52200	Cheumatopsyche sp			5					
52570	Hydropsyche simulans	CF	5	1					
53800	Hydroptila sp			9					
68700	Dubiraphia sp			7					
69400	Stenelmis sp			8					
78655	Procladius (Holotanypus) sp			2					
83040	Dicrotendipes neomodestus	CG	6	9					
83158	Endochironomus nigricans	SH	6	1					
84450	Polypedilum (Uresipedilum) flavum			2					
84470	Polypedilum (P.) illinoense			1					
85625	Rheotanytarsus sp			12					
93200	Hydrobiidae	SC	6	1					
95100	Physella sp			7					
97601	Corbicula fluminea			2					
No. Quantitative Taxa: 26		Total Taxa: 26							
Number of Organisms: 337		mIBI: 42.19							

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: RT 120 BR W OF GURNEE					Site ID: 13-1				
Collection Date: 08/02/2018					River Code: 95-656				
					River: DES PLAINES RIVER				
					Sample: RM: 94.20				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
03600	Oligochaeta	CG	10	1					
06201	Hyalella azteca	CG	5	1					
06800	Gammarus sp			43					
11130	Baetis intercalaris		7	21					
11200	Callibaetis sp			5					
11670	Procloeon viridoculare			1					
13400	Stenacron sp			1					
16700	Tricorythodes sp			7					
22001	Coenagrionidae	PR	5.5	1					
52200	Cheumatopsyche sp			50					
53800	Hydroptila sp			9					
59100	Ceraclea sp			1					
59500	Oecetis sp			1					
68708	Dubiraphia vittata group			3					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			9					
77130	Ablabesmyia rhamphe group			5					
77750	Hayesomyia senata or Thienemannimyia norena			6					
78600	Pentaneura inconspicua			1					
78655	Procladius (Holotanypus) sp			1					
80510	Cricotopus (Isocladius) sylvestris group			4					
82730	Chironomus (C.) decorus group			3					
83040	Dicrotendipes neomodestus	CG	6	4					
83158	Endochironomus nigricans	SH	6	4					
84450	Polypedilum (Uresipedilum) flavum			12					
84470	Polypedilum (P.) illinoense			19					
84540	Polypedilum (Tripodura) scalaenum group			6					
85625	Rheotanytarsus sp			10					
93200	Hydrobiidae	SC	6	12					
94400	Fossaria sp			1					
95100	Physella sp			6					
95900	Gyraulus sp			1					
97601	Corbicula fluminea			22					
98200	Pisidium sp			8					
No. Quantitative Taxa:		34	Total Taxa:		34				
Number of Organisms:		280	mIBI:		60.67				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: McClure Ave					Site ID: 13-2				
Collection Date: 07/30/2016					River: Des Plaines River				
River Code: 95-656					Sample: RM: 96.82				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
03600	Oligochaeta	CG	10	16					
05800	Caecidotea sp			13					
06201	Hyalella azteca	CG	5	14					
06800	Gammarus sp			44					
08200	Orconectes sp			1					
11200	Callibaetis sp			1					
13400	Stenacron sp			2					
17200	Caenis sp			6					
22001	Coenagrionidae	PR	5.5	11					
52200	Cheumatopsyche sp			5					
68201	Scirtidae			1					
68700	Dubiraphia sp			7					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			4					
77130	Ablabesmyia rhamphe group			15					
77355	Clinotanypus pinguis	PR	6	6					
77500	Conchapelopia sp			1					
77750	Hayesomyia senata or Thienemannimyia norena			3					
78200	Larsia sp			27					
78600	Pentaneura inconspicua			5					
78655	Procladius (Holotanypus) sp			1					
81825	Rheocricotopus (Psilocricotopus) robacki			1					
82730	Chironomus (C.) decorus group			5					
82820	Cryptochironomus sp			1					
83158	Endochironomus nigricans	SH	6	36					
84210	Paratendipes albimanus or P. duplicatus			1					
84450	Polypedilum (Uresipedilum) flavum			3					
84470	Polypedilum (P.) illinoense			28					
84500	Polypedilum (P.) trigonus			13					
84520	Polypedilum (Tripodura) halterale group			13					
85230	Cladotanytarsus mancus group			2					
93200	Hydrobiidae	SC	6	5					
94400	Fossaria sp			8					
95100	Physella sp			3					
97601	Corbicula fluminea			2					
98001	Pisidiidae		5	5					

No. Quantitative Taxa: 37 Total Taxa: 37
 Number of Organisms: 312 mIBI: 49.39

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: McClure Ave					Site ID: 13-2				
Collection Date: 08/02/2018					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 96.82				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	1					
03600	Oligochaeta	CG	10	12					
05800	Caecidotea sp			13					
06800	Gammarus sp			50					
11130	Baetis intercalaris		7	10					
11200	Callibaetis sp			1					
13400	Stenacron sp			3					
17200	Caenis sp			5					
22001	Coenagrionidae	PR	5.5	1					
22300	Argia sp	PR	5	5					
27000	Corduliidae or Libellulidae			1					
48200	Chauliodes sp			2					
52200	Cheumatopsyche sp			122					
68201	Scirtidae			1					
68708	Dubiraphia vittata group			4					
69400	Stenelmis sp			3					
77130	Ablabesmyia rhamphe group			3					
77750	Hayesomyia senata or Thienemannimyia norena			4					
78350	Meropelopia sp			1					
78655	Procladius (Holotanypus) sp			2					
82820	Cryptochironomus sp			1					
83040	Dicrotendipes neomodestus	CG	6	1					
83158	Endochironomus nigricans	SH	6	5					
83300	Glyptotendipes (G.) sp			3					
84450	Polypedilum (Uresipedilum) flavum			14					
84470	Polypedilum (P.) illinoense			1					
84540	Polypedilum (Tripodura) scalaenum group			6					
84700	Stenochironomus sp			4					
85625	Rheotanytarsus sp			53					
93200	Hydrobiidae	SC	6	2					
95100	Physella sp			7					
97601	Corbicula fluminea			3					
98200	Pisidium sp			2					
98600	Sphaerium sp			4					
No. Quantitative Taxa: 34					Total Taxa: 34				
Number of Organisms: 350					mIBI: 48.28				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 41					Site ID: 13-3				
Collection Date: 08/03/2018					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 98.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01900	Nemertea			1	93200	Hydrobiidae	SC	6	8
03600	Oligochaeta	CG	10	9	94201	Lymnaeidae	SC	7	1
05800	Caecidotea sp			1	97601	Corbicula fluminea			1
06201	Hyalella azteca	CG	5	3	98200	Pisidium sp			13
06800	Gammarus sp			35					
08200	Orconectes sp			1	No. Quantitative Taxa:		43	Total Taxa: 43	
11130	Baetis intercalaris		7	4	Number of Organisms:		312	mIBI: 53.66	
13400	Stenacron sp			14					
17200	Caenis sp			3					
22001	Coenagrionidae	PR	5.5	1					
22300	Argia sp	PR	5	21					
23501	Aeshnidae	PR	4.5	2					
43300	Ranatra sp			1					
48200	Chauliodes sp			2					
52200	Cheumatopsyche sp			47					
53800	Hydroptila sp			4					
59100	Ceraclea sp			1					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			3					
59570	Oecetis nocturna		5	2					
68201	Scirtidae			3					
68700	Dubiraphia sp			4					
68708	Dubiraphia vittata group			1					
68901	Macronychus glabratus		2	1					
69400	Stenelmis sp			1					
77115	Ablabesmyia janta		6	1					
77130	Ablabesmyia rhamphe group			4					
77750	Hayesomyia senata or Thienemannimyia norena			11					
78655	Procladius (Holotanypus) sp			2					
82880	Cryptotendipes sp			1					
83158	Endochironomus nigricans	SH	6	20					
83300	Glyptotendipes (G.) sp			27					
84155	Paralauterborniella nigrohalteralis		6	2					
84450	Polypedilum (Uresipedilum) flavum			2					
84470	Polypedilum (P.) illinoense			7					
84520	Polypedilum (Tripodura) halterale group			2					
84540	Polypedilum (Tripodura) scalaenum group			30					
84700	Stenochironomus sp			3					
85625	Rheotanytarsus sp			11					
85814	Tanytarsus glabrescens group			1					

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 41					Site ID: 13-3				
Collection Date: 08/05/2016					River Code: 95-656				
River: Des Plaines River					Sample: RM: 98.70				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	2					
03600	Oligochaeta	CG	10	6					
05800	Caecidotea sp			2					
06201	Hyalella azteca	CG	5	24					
06800	Gammarus sp			46					
08200	Orconectes sp			3					
11130	Baetis intercalaris		7	3					
11200	Callibaetis sp			3					
13400	Stenacron sp			8					
17200	Caenis sp			8					
22001	Coenagrionidae	PR	5.5	29					
52200	Cheumatopsyche sp			51					
52520	Hydropsyche bidens		5	1					
59500	Oecetis sp			2					
68201	Scirtidae			1					
68700	Dubiraphia sp			29					
68901	Macronychus glabratus		2	2					
69400	Stenelmis sp			39					
77120	Ablabesmyia mallochi		6	1					
77130	Ablabesmyia rhamphe group			1					
77355	Clinotanypus pinguis	PR	6	2					
77750	Hayesomyia senata or Thienemannimyia norena			6					
78655	Procladius (Holotanypus) sp			1					
82820	Cryptochironomus sp			2					
83040	Dicrotendipes neomodestus	CG	6	1					
83158	Endochironomus nigricans	SH	6	24					
84450	Polypedilum (Uresipedilum) flavum			2					
84470	Polypedilum (P.) illinoense			10					
84540	Polypedilum (Tripodura) scalaenum group			4					
84700	Stenochironomus sp			1					
84800	Tribelos jucundum			1					
85625	Rheotanytarsus sp			2					
86100	Chrysops sp			1					
93200	Hydrobiidae	SC	6	4					
95100	Physella sp			3					
97601	Corbicula fluminea			5					
98001	Pisidiidae		5	3					

No. Quantitative Taxa: 37 Total Taxa: 37
 Number of Organisms: 333 mIBI: 57.86

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Ust. Wetland Riffle					Site ID: 13-19				
Collection Date: 08/03/2018					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 99.30				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	7					
03600	Oligochaeta	CG	10	2					
05800	Caecidotea sp			6					
06201	Hyalella azteca	CG	5	3					
06800	Gammarus sp			88					
13400	Stenacron sp			1					
16700	Tricorythodes sp			3					
17200	Caenis sp			10					
22001	Coenagrionidae	PR	5.5	4					
22300	Argia sp	PR	5	1					
52200	Cheumatopsyche sp			18					
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)			2					
68700	Dubiraphia sp			6					
68708	Dubiraphia vittata group			11					
69400	Stenelmis sp			2					
77130	Ablabesmyia rhamphe group			3					
78655	Procladius (Holotanypus) sp			3					
82820	Cryptochironomus sp			2					
83040	Dicrotendipes neomodestus	CG	6	2					
83158	Endochironomus nigricans	SH	6	3					
83300	Glyptotendipes (G.) sp			49					
84039	Parachironomus frequens group			1					
84450	Polypedilum (Uresipedilum) flavum			30					
84540	Polypedilum (Tripodura) scalaenum group			23					
85265	Cladotanytarsus vanderwulpi group sp 5			1					
85625	Rheotanytarsus sp			37					
87540	Hemerodromia sp			1					
93200	Hydrobiidae	SC	6	2					
95100	Physella sp			2					
97601	Corbicula fluminea			3					
98200	Pisidium sp			5					
98600	Sphaerium sp			6					
<hr/>									
No. Quantitative Taxa:		32	Total Taxa:		32				
Number of Organisms:		337	mIBI:		35.87				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: WADSWORTH RD WADSWORTH					Site ID: 13-4				
Collection Date: 08/03/2018					River: DES PLAINES RIVER				
River Code: 95-656					Sample:				
					RM: 102.90				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	1					
03600	Oligochaeta	CG	10	40					
04664	Helobdella stagnalis	PR	8	2					
05800	Caecidotea sp			1					
06201	Hyaella azteca	CG	5	19					
06800	Gammarus sp			37					
11200	Callibaetis sp			6					
17200	Caenis sp			10					
22001	Coenagrionidae	PR	5.5	35					
43300	Ranatra sp			2					
52200	Cheumatopsyche sp			1					
59500	Oecetis sp			2					
68708	Dubiraphia vittata group			3					
69400	Stenelmis sp			1					
77130	Ablabesmyia rhamphe group			1					
78655	Procladius (Holotanypus) sp			18					
83051	Dicrotendipes simpsoni		6	1					
83158	Endochironomus nigricans	SH	6	122					
83300	Glyptotendipes (G.) sp			7					
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)			1					
84450	Polypedilum (Uresipedilum) flavum			1					
84470	Polypedilum (P.) illinoense			9					
95100	Physella sp			1					
98200	Pisidium sp			5					
No. Quantitative Taxa:		24	Total Taxa:		24				
Number of Organisms:		326	mIBI:		29.87				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: WADSWORTH RD WADSWORTH					Site ID: 13-4				
Collection Date: 08/06/2016					River Code: 95-656				
					River: DES PLAINES RIVER				
					Sample: RM: 102.90				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
01801	Turbellaria	PR	6	1					
03600	Oligochaeta	CG	10	2					
06201	Hyaella azteca	CG	5	93					
06800	Gammarus sp			5					
11200	Callibaetis sp			30					
17200	Caenis sp			124					
22001	Coenagrionidae	PR	5.5	35					
59500	Oecetis sp			1					
68700	Dubiraphia sp			3					
77700	Guttipelopia guttipennis			4					
78130	Labrundinia neopilosella			1					
78200	Larsia sp			5					
78655	Procladius (Holotanypus) sp			2					
83040	Dicrotendipes neomodestus	CG	6	5					
84500	Polypedilum (P.) trigonus			2					
84960	Pseudochironomus sp			1					
95100	Physella sp			1					
No. Quantitative Taxa:		17	Total Taxa:		17				
Number of Organisms:		315	mIBI:		35.30				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site:					Site ID: 13-6				
Collection Date: 08/03/2018					River Code: 95-656				
River:					Sample:				
RM: 103.90									
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
03600	Oligochaeta	CG	10	17					
06201	Hyalella azteca	CG	5	92					
06800	Gammarus sp			49					
11200	Callibaetis sp			20					
17200	Caenis sp			12					
18700	Hexagenia sp			1					
22001	Coenagrionidae	PR	5.5	16					
48200	Chauliodes sp			1					
59500	Oecetis sp			1					
68700	Dubiraphia sp			1					
77130	Ablabesmyia rhamphe group			1					
77140	Ablabesmyia peleensis		6	3					
77355	Clinotanypus pinguis	PR	6	1					
78601	Pentaneura inyoensis			5					
78655	Procladius (Holotanypus) sp			19					
79000	Tanypus sp			2					
82820	Cryptochironomus sp			1					
83158	Endochironomus nigricans	SH	6	67					
83300	Glyptotendipes (G.) sp			1					
84470	Polypedilum (P.) illinoense			1					
84500	Polypedilum (P.) trigonus			7					
95100	Physella sp			2					
98200	Pisidium sp			2					
No. Quantitative Taxa: 23		Total Taxa: 23							
Number of Organisms: 322		mIBI: 32.96							

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 173					Site ID: 13-5				
Collection Date: 08/03/2018					River: Des Plaines River				
River Code: 95-656					Sample: RM: 106.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
03600	Oligochaeta	CG	10	92					
06201	Hyalella azteca	CG	5	1					
06800	Gammarus sp			21					
44501	Corixidae	PR	99.9	1					
52200	Cheumatopsyche sp			2					
53800	Hydroptila sp			1					
59500	Oecetis sp			4					
68708	Dubiraphia vittata group			10					
77130	Ablabesmyia rhamphe group			1					
77355	Clinotanypus pinguis	PR	6	3					
77750	Hayesomyia senata or Thienemannimyia norena			1					
78655	Procladius (Holotanypus) sp			125					
79000	Tanypus sp			1					
82730	Chironomus (C.) decorus group			1					
82800	Cladopelma sp			4					
82820	Cryptochironomus sp			3					
82880	Cryptotendipes sp			4					
84450	Polypedilum (Uresipedilum) flavum			1					
84520	Polypedilum (Tripodura) halterale group			4					
84540	Polypedilum (Tripodura) scalaenum group			1					
85625	Rheotanytarsus sp			1					
85800	Tanytarsus sp			4					
95100	Physella sp			1					
98200	Pisidium sp			5					
No. Quantitative Taxa:		24	Total Taxa:		24				
Number of Organisms:		292	mIBI:		20.66				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Rt. 173					Site ID: 13-5				
Collection Date: 08/08/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 106.60				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
06201	Hyalella azteca	CG	5	96					
06700	Crangonyx sp			1					
11200	Callibaetis sp			14					
17200	Caenis sp			15					
22001	Coenagrionidae	PR	5.5	59					
27000	Corduliidae or Libellulidae			3					
51600	Polycentropus sp			1					
59500	Oecetis sp			2					
59520	Oecetis cinerascens	PR	5	1					
69400	Stenelmis sp			3					
74501	Ceratopogonidae	PR	5	3					
77140	Ablabesmyia peleensis		6	1					
78200	Larsia sp			10					
83040	Dicrotendipes neomodestus	CG	6	46					
84470	Polypedilum (P.) illinoense			2					
84500	Polypedilum (P.) trigonus			1					
84960	Pseudochironomus sp			22					
85500	Paratanytarsus sp			2					
85820	Tanytarsus glabrescens group sp 6			3					
85821	Tanytarsus glabrescens group sp 7			1					
87200	Odontomyia (O.) sp or Hedriodiscus sp			2					
89501	Ephydriidae	CG	8	1					
95100	Physella sp			1					
No. Quantitative Taxa:		23	Total Taxa:		23				
Number of Organisms:		290	mIBI:		29.53				

Appendix Table C-3. Macroinvertebrate taxa collected by MBI in the main stem Des Plaine River study area in 2016 and 2018.

Site: Russel Rd					Site ID: 13-6				
Collection Date: 08/08/2016					River Code: 95-656				
					River: Des Plaines River				
					Sample: RM: 109.30				
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.
03600	Oligochaeta	CG	10	2					
06201	Hyalella azteca	CG	5	168					
11200	Callibaetis sp			2					
17200	Caenis sp			8					
22001	Coenagrionidae	PR	5.5	44					
27000	Corduliidae or Libellulidae			2					
28208	Erythemis simplicicollis	PR	5	1					
72700	Anopheles sp	CF	6	1					
74501	Ceratopogonidae	PR	5	6					
77140	Ablabesmyia peleensis		6	2					
78200	Larsia sp			38					
83003	Dicrotendipes fumidus			23					
84500	Polypedilum (P.) trigonus			6					
84960	Pseudochironomus sp			8					
89501	Ephydriidae	CG	8	3					
95900	Gyraulus sp			1					
No. Quantitative Taxa:		16	Total Taxa:		16				
Number of Organisms:		315	mIBI:		21.92				

APPENDIX D

Upper Des Plaines Year 2 2018 Habitat Data

D-1: Upper Des Plaines 2018 QHEI Metrics and Scores

D-2: QHEI Field Sheets 2018

Appendix D-1. QHEI metric scores for sites in the upper Des Plaines River study area in 2018.

River Mile	QHEI	QHEI Metrics:						Gradient & Score	Narrative
		Substrate	Cover	Channel	Riparian	Pool	Riffle		
(95656) Des Plaines River									
Year:2018									
109.30	58.50	9.5	16.0	8.0	9.00	6.0	0.0	5.64 - (10)	Fair
106.60	50.00	9.0	11.0	7.0	8.00	5.0	0.0	5.15 - (10)	Fair
102.90	59.00	9.0	17.0	7.0	8.00	8.0	0.0	4.67 - (10)	Fair
99.72	47.00	4.0	16.0	5.0	8.00	6.0	0.0	2.63 - (8)	Fair
99.30	79.00	14.0	16.0	17.0	8.00	9.0	7.0	2.63 - (8)	Excellent
98.70	74.00	14.5	16.0	14.5	7.00	9.0	3.0	4.26 - (10)	Good
96.82	84.50	16.0	17.0	16.0	7.00	12.0	6.5	4.03 - (10)	Excellent
94.20	78.50	16.0	17.0	15.5	10.00	11.0	1.0	3.61 - (8)	Excellent
90.60	72.50	14.0	16.0	15.0	5.50	12.0	2.0	3.32 - (8)	Good
87.10	74.00	16.0	16.0	15.5	5.50	10.0	3.0	2.70 - (8)	Good
84.60	80.50	16.0	16.0	18.0	8.50	11.0	3.0	2.77 - (8)	Excellent
83.60	67.00	13.0	16.0	12.0	7.50	9.0	1.5	2.72 - (8)	Good
82.90	72.50	16.0	16.0	15.0	6.50	10.0	1.0	2.63 - (8)	Good
80.00	70.00	16.0	17.0	12.0	5.00	9.0	3.0	2.38 - (8)	Good
76.70	73.00	16.0	16.0	13.5	9.50	9.0	1.0	2.23 - (8)	Good
75.40	59.75	10.0	10.0	11.0	7.75	11.0	2.0	2.19 - (8)	Fair
71.70	74.50	15.0	17.0	16.5	7.00	10.0	1.0	2.13 - (8)	Good
(95721) Unnamed Trib to Des Plaines River									
Year:2018									
0.40	60.50	14.0	16.0	13.5	8.00	1.0	0.0	13.85 - (8)	Excellent
(95722) Werhane Lake Drain									
Year:2018									
0.80	61.25	11.0	16.0	8.5	9.75	7.0	1.0	11.24 - (8)	Excellent

APPENDIX E

- E-1: FIT Factors for Deriving Primary, Secondary, and Tertiary Causes of Impairment**
- E-2: Northeast Illinois IPS Nutrient Ranking Index**

Appendix E-1: Development of FIT Factors for Deriving Primary, Secondary, and Tertiary Causes of Impairment

For the NE IL IPS thresholds were developed for the primary nutrient and nutrient-related parameters based on grab sample data. The thresholds were based on relationships between that data and stressor-specific sensitive fish species and macroinvertebrate taxa. The relationship between the sensitive species/taxa with the fIBI and mIBI supported benchmarking these thresholds to the General Use criteria and an “Excellent” level of biological performance.

The FIT weighting score influences the categories of narrative condition (i.e., very poor, poor, or fair) each cause of impairment is placed. Each stressor is ranked from 0.1 (excellent) to 10 (very poor) based on the respective relationships with the number of stressor-sensitive fish species

Appendix Table E-1. FIT weighting scores based on FIT coefficients.	or macroinvertebrate taxa as the response variable with a particular stressor. Where the association is very strong (i.e., FIT value < 0.1) it means there were few outliers and a stronger power of prediction. The weighting factor is 1 and stressors that scored as very poor are still considered to be predictive of very poor biological assemblages. As the FIT value increases (i.e., >0.1 to 0.3) it signals increased variability (more outliers are observed) the weighting factor declines to 0.8 and a stressor value of 9 (very poor) would be down weighted to a score of 7.2 (poor) because the stress:response relationship had more outliers, the ability to distinguish poor vs. very poor assemblages is reduced, but still reflects an impairment. A FIT value of >0.3-1 indicates a weaker causative relationship and has lower weighting factor (X 0.6). This would change a stressor score of 9 (very poor) to a score of 5.4 (fair). Parameters with FIT vales of >3 were not used to identify causes of impairment. A summary of FIT values for 69 variables is in Appendix Table E-2.
FIT (< 0.10) X 1;	
FIT (> 0.10 – <0.3) X 0.8	
FIT (> 0.30 – < 1.0) X 0.6	
FIT (> 1.00 – < 3.0) X 0.5	
FIT (> 3.00 – < 10.0) X 0.2	
FIT (> 10.0) X 0.1	

Stressor relationships can become stronger as more data is added to the IPS databases hence the need for continued monitoring. Some parameters that have weak FIT scores are because of a lack of data along a complete stressor gradient. For example, there are fewer data points at excellent biological sites for parameters such as sediment PAHs and sediment metals. This weakens the FIT values for the excellent narrative range thus in these situations only a good narrative threshold is derived. There are other important variables (e.g., benthic chlorophyll a) where the current datasets are insufficient to develop a ranking thus highlighting the need to build up the dataset.

The severity of effect of some stressors (e.g., FIT Scores <0.1) could possibly mask the effects of other stressors. As more data is collected and as some of the more prevalent stressors are abated, the influence of masked stressors may become more evident. As such, the FIT values and scores could change in future iterations of the IPS. More data will also improve the accuracy of assigning species and taxa as sensitive or tolerant to a particular stressor.

Appendix Table E-2. FIT values based on the deviation between ambient stressor rank vs. predicted stressor rank based on fish species or macroinvertebrate taxa for streams in the NE IL IPS study area. The algorithm for FIT calculation is summarized in the text. The cell shading is related to FIT weighting coefficients: □ 1.0; □ 0.8; □ 0.6; □ 0.5; □ 0.2.

Stressor	FIT Value	Stressor	FIT Value
Impervious Land Use (500m)	0.01	Copper (Wat.)	1.75
QHEI Embeddedness Score	0.03	Lead (Wat.)	2.11
Urban Land Uses (WS)	0.03	Zinc (Sed.)	2.22
QHEI Overall Score	0.04	Benzo(g,h,i)perylene	2.32
QHEI Substrate Score	0.04	Indeno(1,2,3-cd)pyrene (Sed.)	2.41
QHEI Good Attributes	0.04	Copper (Sed.)	2.42
Total Phosphorus	0.04	Benzo(b)fluoranthene (Sed.)	2.51
Impervious Land Use (30m)	0.04	Turbidity	2.61
Impervious Land Use (30m Clipped)	0.04	Nickel (Sed.)	2.67
Conductivity	0.05	Manganese (Wat.)	2.74
QHEI Channel Score	0.07	Benzo(a)pyrene (Sed.)	2.85
QHEI Silt Cover Score	0.07	Pyrene (Sed.)	2.85
Developed Land Use (WS)	0.07	Voluble Suspended Solids	2.81
Minimum Dissolved Oxygen	0.10	Lead (Sed.)	3.01
Total Dissolved Solids	0.10	Nickel (Wat.)	3.26
Impervious Land Use (WS)	0.10	Benzo(a)anthracene (Sed.)	3.48
Hydro-QHEI Depth Score	0.11	Chrysene (Sed.)	3.51
QHEI Poor Habitat Attributes	0.12	Fluoranthene (Sed.)	3.91
Hydro-QHEI Overall Score	0.13	Strontium (Sed.)	4.44
Zinc (Wat.)	0.13	Dibenz(a,h)anthracene (Sed.)	4.57
Hydro-QHEI Current Score	0.14	Agricultural Land Use (WS)	4.82
TKN	0.14	Anthracene (Sed.)	5.10
QHEI Pool Score	0.15	Phenanthrene (Sed.)	5.10
Heavy Urban Land Use (WS)	0.17	Arsenic (Sed.)	6.21
Chloride	0.17	Chromium (Sed.)	6.29
QHEI Cover Score	0.17	Sulfate	6.49
BOD (5-Day)	0.21	Manganese (Sed.)	7.08
QHEI Riffle Score	0.27	Silver (Sed.)	7.11
Total Ammonia	0.28	Aluminum (Sed.)	8.26
Nitrate	0.29	Barium (Sed.)	8.88
Sodium	0.29	Arsenic (Wat.)	9.19
QHEI Gradient Score	0.31	Potassium (Wat.)	10.13
Total Suspended Solids	0.32	Cadmium (Sed.)	11.0
Maximum Dissolved Oxygen	0.94		
Cadmium (Wat.)	0.93		
Arsenic (Sed.)	1.26		

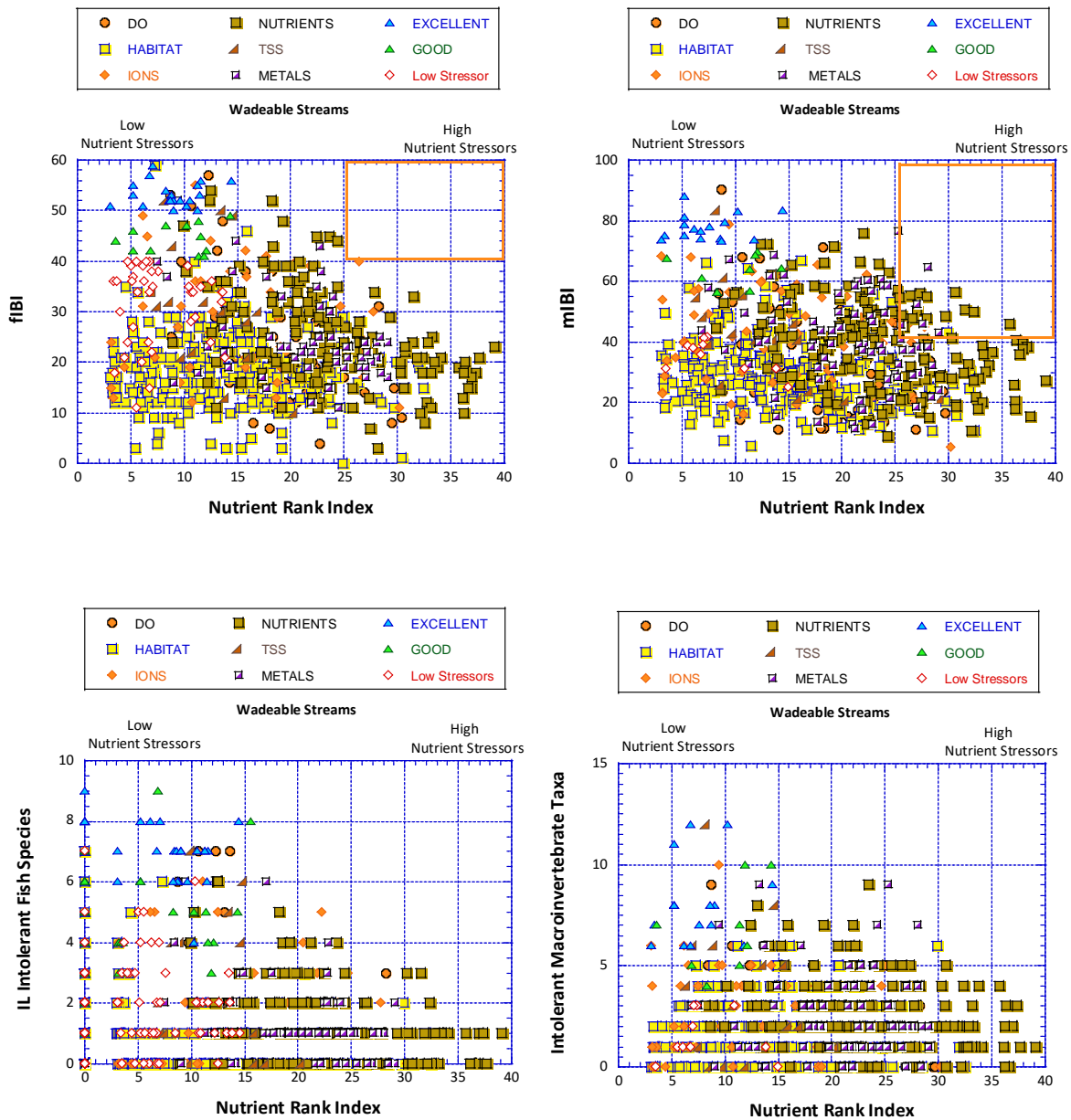
Appendix E-2: Northeast Illinois IPS Nutrient Ranking Index

With the emphasis on nutrients in NE Illinois a Nutrient Ranking Index (NRI) was developed by summing the ranking of each of the individual primary nutrient or nutrient-related parameters with each weighted based on the FIT coefficient (Appendix Table E-2). The equation is as follows:

$$\text{Nutrient Rank Index} = (\text{TPR} \times 1) + (\text{Min. DOR} \times 1) + (\text{TKNR} \times 0.8) + (\text{BODR} \times 0.8) + (\text{NITRR} \times 0.8) + (\text{Max. DOR} \times 0.6)$$

Where; TPR = Total Phosphorus Rank
Min. DOR = Minimum Dissolved Oxygen Rank
TKNR = Total Kjeldahl Nitrogen Rank
BODR = Biochemical Oxygen Demand (5-day) Rank
NITRR = Nitrate Rank
Max. DOR = Maximum Dissolved Oxygen Rank

Appendix Figure E-1 illustrates the correlation between the Nutrient Rank Index (NRI) and the fIBI (top, left), mIBI (top, right), the number of Illinois intolerant fish species (bottom, left) and the number of Illinois intolerant macroinvertebrate taxa (bottom, right). In these graphs points were coded to the strongest stressor rank for all categories of stressors (excluding land use parameters) and where the most limiting stressor rank was greater than a score of four (i.e., General Use benchmark). Boxes in the upper right corner reflect Nutrient Rank Index ranges where biological performance is clearly limited. In these plots fish appear a bit more limited than macroinvertebrates. We expect the relationship between the NRI and biological response variables to improve other indicators such as continuous dissolved oxygen-based maximum daily D.O. swings and algal indicators (benthic chlorophyll). Even so there is a strong enough relationship to make this indicator a useful marker for stressor identification efforts eutrophication in a study area. NRI values of > 25 and always associated with degraded fish assemblages and often associated with degraded macroinvertebrate indices (Figure XX). Where a biological assemblage is of excellent quality NRI values are nearly always less than 15. The Power BI dashboard for nutrients will provide this data for all sites where it is available and will also provide individual parameter (e.g., TP, TKN, min D.O.) rankings for nutrients and other parameter categories as well. Such data can be matched to recent local data on continuous D.O., and benthic and sestonic chlorophyll where it exists. Sites with high NRI values and high D.O. swings from continuous data can be examined along with biological data responses to see if patterns of response are similar. The Power BI will also have NRI values, among other data, summarized at both the reach and Huc12 scale to determine whether nutrient signatures are rare or prevalent nearby and across the watershed. The goal for developing the NRI is to have a screening value that can then be matched to more site specific data to conduct a stressor identification analysis.



Appendix Figure E-1. Correlation between the Nutrient Rank Index and the fIBI (top, left), mIBI (top, right), the number of Illinois intolerant fish species (bottom, left) and the number of Illinois intolerant macroinvertebrate taxa (bottom, right). In these graphs points are coded by the strongest stressor rank for all categories of stressors (excluding land use) and where the most limiting stressor rank was greater than a score of four (i.e., General Use benchmark).