

**UPPER DES PLAINES RIVER
WATER QUALITY ASSESSMENT**

(Excerpted from the August 2000 Watershed Restoration Action Strategy prepared by the Northeastern Illinois Planning Commission (NIPC) and the Liberty Prairie Foundation.)

The following assessment of water quality in the Upper Des Plaines River (Hydrologic Unit Code Number 07120004) is based on the IEPA's Illinois Water Quality Report of 1994-1995, the 1998 update to that report, and the professional assessments of NIPC staff. Instances where discrepancies exist are noted. Wisconsin data is not provided.

Indices of Biotic Integrity

The Illinois Department of Natural Resources and Illinois EPA use the following Biological Stream Characterization (BSC) method to 'grade' stream quality.

General Resource Description (IEPA/IDNR BSC) →	Unique Aquatic Resource	Highly Valued Aquatic Resource	Moderate Aquatic Resource	Limited Aquatic Resource	Restricted Aquatic Resource
U.S. EPA	Full Support	Full Support	Partial / Minor	Partial / Moderate	Nonsupport
Biotic Class	A	B	C	D	E
IBI/AIBI (fish) & PIBI (stream habitat)	60-51	50-41	40-31	30-21	<20
Water Quality Rating	Good	Good	Fair	Poor	Very Poor
MBI	<5.0	5.0-5.9	6.0-7.5	7.6-8.9	>9.0

Macroinvertebrate Biotic Index (MBI) is an indicator of stream conditions based on macroinvertebrate surveys. The MBI scale ranges from 1 (best) to 10 (worst). Figures for the Upper Des Plaines range from 4.1 in the lower reaches to 5.9 in the upper reaches (5.4 at the Illinois-Wisconsin border) indicating relatively good conditions.

(Note: The MBI of 4.1 for the lower reaches is based on just one sample. This score, suggesting excellent water quality, is generally not consistent with the water quality data or the IBI figures reported below. Generally, better conditions are found in upper reaches, and conditions decline as one moves downstream. This is to be expected considering the highly urbanized nature of the lower portions of the watershed.)

Index of Biotic Integrity (AIBI) is an indicator of stream conditions and habitat based on fish surveys and ranges from 12 (worst) to 60 (best). In the Upper Des Plaines, figures range from a low of 23 in the lower reaches to a high of 44 at the Illinois-Wisconsin border indicating a range of ratings from D to B. Generally, upper reaches were of higher quality than lower reaches.

Potential Index of Biotic Integrity (PIBI) is a predictive index of stream quality based on observed habitat conditions. The index ranges from 12 (worst) to 60 (best). Figures for the

Upper Des Plaines range from 35 to 45 predicting a C or B rated stream, but data was only recorded for upper reaches.

Designated Use

According to the Illinois Environmental Protection Agency, water pollution control programs are designed to protect the beneficial uses, also called designated uses, of the water resources of the state. The Illinois Water Quality Report describes water quality conditions in terms of the degree to which waters attain designated uses:

- ◆ *Full Support*: water quality meets the needs of all designated uses protected by applicable water standards.
- ◆ *Full Threatened*: water quality is presently adequate to maintain designated uses, but if a declining trend continues, only partial support may be attained in the future.
- ◆ *Partial Support/Minor Impairment*: water quality has been impaired, but only to a minor degree. These may be minor exceedences in applicable water quality standards or criteria for assessing the designated use attainment.
- ◆ *Partial Support/Moderate Impairment*: water quality conditions are impaired to a greater degree inhibiting the waterbody from meeting all the needs for that designated use.
- ◆ *Nonsupport*: water quality is severely impaired and not capable of supporting the designated use to any degree.

Four points along the mainstem of the Des Plaines River above the confluence with Salt Creek were monitored in 1997, and six in 1995, for a total of ten sampling points (summarized in tabular form at the end of this section). The results of the assessments for *designated use* are as follows (causes and sources of impairment are described below):

- **Overall Use**: Partial support with minor impairment for seven reaches (water quality has been impaired, but only to a minor degree) and full support for three reaches (G22, G07, G08).
- **Fish Consumption**: Full support at the northernmost point (G08—Illinois/Wisconsin border); no data for other points.
- **Aquatic Life**: Partial support with minor impairment for seven reaches (water quality has been impaired, but only to a minor degree) and full support for three reaches (G22, G07, and G08).
- **Swimming Use**: Nonsupport throughout.

Ratings for three points, G22, G07, and G08, improved from partial/minor impairment and threatened to full support for overall and aquatic life support. This is somewhat surprising considering the increasing urbanization of the middle and upper (primarily Lake County) reaches of the river basin. Swimming use support for points G07 and G08 declined from partial minor to nonsupport. Reasons for these changes have not been specified in the IEPA report. In particular, pathogens (e.g., fecal coliform) have not been listed as a cause of swimming impairment, nor have any potential sources of the impairment been identified.

Water quality data collected by the IEPA (15 monitoring points in Lake County) and the Metropolitan Water Reclamation District (4 monitoring points in Cook County) along the Upper

Des Plaines River and its tributaries are summarized below. While this table presents average concentration over two time periods, a more meaningful assessment would require some discussion of minimum and maximum figures, as well the frequency with which water quality standards for the listed parameters are exceeded. Nonetheless, this table may be useful for identifying general trends in water quality.

Combined annual mean values for selected water quality parameters for the Upper Des Plaines River, 1976 to 1995.¹

Parameters	Illinois Standards (mg/L)	Lake Co. Sampling Results (mg/L)		Cook Co. Sampling Results (mg/L)	
		1986/1995	1976/1985	1986/1995	1976/1985
Dissolved Oxygen	5.0	9.4	9.2	7.8	7.2
Ammonia Nitrogen	2.5/4.0	0.2	0.8	0.4	0.7
Total Dissolved Solids	1,500.0	-	630.0	652.0	682.0
Fecal Coliform (cts/100ml)	0.0	2,335.0	166.0	1,944.0	4,582.0
Fats, Oils and Grease	15.0	1.6	0.7	8.8	11.0
Phenols	0.3	0.005	0.005	0.02	0.01
Total Iron	2.0	0.7	1.1	0.6	1.0
Total Cyanide	0.1	0.005	0.005	0.01	0.01
Total Copper	1.0	0.005	0.005	0.01	0.01
Total Lead	0.1	0.02	0.1	0.01	0.02

As this table indicates, dissolved oxygen levels generally decrease from north to south along the river, and fats, oils, and grease levels increase. These trends are consistent with increasing urbanization of the watershed moving downstream from Lake County to Cook County. The significant increase in fecal coliform levels in Lake County are likely due to increasing urbanization of the county, and the significant improvement in these figures for Cook County are due to improved point source pollution control.

Water quality indicators have generally improved in downstream reaches over the past 20 years, including dissolved oxygen, Ammonia-Nitrogen, Total Dissolved Solids (TDS), and Fecal Coliform. This was due to improvements in both combined sewer and wastewater discharges. As indicated in the IEPA 305(b) report, however, many reaches of the river do not fully support designated uses, and many show at least some degree of impairment. For the most part, other water quality indicators used by the IEPA such as Biotic Integrity Indices, as discussed above, indicate poor to good water quality, though most only rank as fair. Stream sediment contamination generally increases moving downstream as well, a result of increasing industrial discharges, municipal wastewater treatment plant discharges, and combined sewer overflows. Based on these figures, the majority of the Des Plaines is of only moderate to limited value for aquatic life support.

Causes and Sources of Water Quality Impairment

Causes and sources of water quality impairment are based largely on the IEPA Illinois Water Quality Report of 1994-95 and the 1998 update to that report. This information is supplemented

¹ *Interim Feasibility Report and Draft Environmental Impact Statement*, U.S. Army Corps of Engineers, Chicago District, 1999.

by additional causes and sources based on the IEPA report and professional judgement of NIPC staff. These additions are marked by an asterisk, and no magnitude is reported. Possible discrepancies between IEPA and NIPC assessments are discussed.

The area of concern for the Upper Des Plaines study extends from the Illinois-Wisconsin border to the confluence with Salt Creek near Riverside. The definitions of upper, middle, and lower reaches of the river for the purposes of this summary are roughly based on differences in the sources and causes of water quality impairment at the various monitoring points, and are defined as follows (see Map 1):

- ◆ upper reaches--generally the upper ¾ of Lake County, north of the confluence with Indian Creek (data points G07, G08, G26, G35);
- ◆ middle reaches--generally the lower ¼ of Lake County and northern Cook County to just below the confluence with McDonald Creek (data points G22, G28, G36);
- ◆ lower reaches--generally from McDonald Creek south to the confluence with Salt Creek (data points G15, G30, G32).

Upper Reaches

MBI figures range from 5.4 to 5.9 indicating relatively good conditions. AIBI figures range from 33 to 44 indicating a B or C stream. PIBI figures range from 35 to 45 predicting a B or C stream. These figures indicate that while the water quality may be sufficient to support a diversity of macroinvertebrates, the fish community and the habitat conditions to support those fish range from fair to good. This may be due to a number of habitat-related factors, including historical dredging, modification of channel banks, and sedimentation.

The major *causes of impairment* for the upper reaches of the Upper Des Plaines, and the magnitude to which the cause contributes to the use impairment, were identified as follows (numbers in parentheses indicate monitoring point(s) location):

Cause of Impairment	Magnitude
Nutrients	High (G35,G36)
Habitat Alterations	Moderate (G35)
Siltation	Moderate (G26,G35)
Metals	Slight (G35,G26)
Salinity/TDS/Chlorides	Slight (G26)
Ammonia	Slight (G35)
Chlorine	Slight (G35)
*Pesticides	
*Organic Enrichment/Dissolved Oxygen	
*Pathogens	
*Flow Alteration	
*Filling and Draining	
*Turbidity	
*Suspended Solids	

*These additions are based on assumptions about the impacts of land uses present in upper reaches of the Upper Des Plaines. Pesticides, organic enrichment, filling and draining, turbidity, and suspended solids are all associated with agricultural and construction (land development)

activities. Flow alteration (hydrologic alteration) is a factor in nearly all river systems in northeastern Illinois, including the Upper Des Plaines. As discussed above, pathogens are a primary cause of impairment for swimming use.

The *sources* that contribute to the causes listed above, and the magnitude to which the source contributes to the use impairment, were identified as follows (numbers in parentheses indicate monitoring point(s) location):

<u>Source of Impairment</u>	<u>Magnitude</u>
Urban runoff/storm sewers	Moderate (G26,G35)
Municipal point sources	Slight (G26) to moderate (G35)
Construction (land development)	Slight (G26,G35)
Agriculture (general)	Slight (G26,G35)
Agriculture (nonirrigated crop production)	Slight (G26,G35)
Agriculture (pasture land)	Slight (G26)
*Hydrologic/Habitat Modification (removal of riparian vegetation)	
*Hydrologic/Habitat Modification (filling and draining)	
*Carp Activity	

*Hydrologic/habitat modification is a source of the impairments caused by habitat alterations, flow alteration, filling and draining, turbidity, suspended solids, and siltation. Carp activity has been demonstrated to contribute to turbidity problems.

Middle Reaches

MBI of 5.8 (recorded at only one of three sampling points) indicates relatively good conditions, as far as macroinvertebrates are concerned. No AIBI or PIBI figures are available.

The major *causes of impairment* for the middle reaches of the Upper Des Plaines, and the magnitude to which the cause contributes to the use impairment, were identified by IEPA as follows (numbers in parentheses indicate monitoring point(s) location):

<u>Cause of Impairment</u>	<u>Magnitude</u>
Nutrients	High (G28,G36)
Suspended Solids	Moderate (G36)
Siltation	Slight (G28) to moderate (G36)
Salinity/TDS/Chlorides	Slight (G28)
Metals	Slight (G28)
Ammonia	Slight (G36)
*Pesticides	
*Organic Enrichment/Dissolved Oxygen	
*Flow Alterations	
*Pathogens	
*Turbidity	
*Hydrologic/Habitat Modifications (filling and draining)	

*It is likely that some pesticides and organic enrichment are impacting aquatic life due to agricultural operations, urban runoff/storm sewers, and point sources. Flow alterations and filling and draining are associated with urbanization and agricultural activities, and also are impacting water quality to some degree. Turbidity is associated with agricultural and development activities, as well as with hydrologic and habitat modifications. Pathogens are an assumed source of swimming use impairment.

The *sources* that contribute to the causes listed above, and the magnitude to which the source contributes to the use impairment, were identified by IEPA as follows (numbers in parentheses indicate monitoring point(s) location):

Source	Magnitude
Other (contaminated sediments)	Moderate (G28)
Urban runoff/storm sewers	Slight (G36) to moderate (G28)
Construction (land development)	Slight (G28) to moderate (G36)
Construction (general)	Slight (G28) to moderate (G36)
Construction (highway/road/bridge)	Slight (G28) to moderate (G36)
Municipal point sources	Slight (G28) to moderate (G36)
Hydrologic/habitat modification (general)	Slight (G28,G36)
Hydro/hab (streambank mod/destabiliz)	Slight (G28,G36)
Combined sewer overflows	Slight (G28)
Other (general)	Slight (G28)
*Agriculture	
*Land Disposal	
*Hydrologic/Habitat Modification (filling and draining)	
*Hydrologic/Habitat Modification (dam construction)	
*Carp Activity	

Lower Reaches

MBI of 4.1 indicates relatively good conditions, but, as noted earlier, this figure is based on just one sample and is inconsistent with IBI figures and water quality data. AIBI figures range from 23 to 34 indicating a D or C stream. No PIBI figures are available.

The major *causes of impairment* for the lower reaches of the Upper Des Plaines, and the magnitude to which the cause contributes to the use impairment, were identified by IEPA as follows (numbers in parentheses indicate monitoring point(s) location):

Cause of Impairment	Magnitude
Nutrients	High (G30,G32)
Siltation	Moderate (G32,G30)
Salinity/TDS/Chlorides	Slight (G15) to moderate (G30,G32)
Metals	Slight (G30,G32)
Ammonia	Slight (G30)
*Oil and Grease	
*Flow Alteration	
*Pathogens	

- *Suspended Solids
- *Turbidity
- *Habitat Alterations
- *Organic Enrichment/Dissolved Oxygen

The *sources* that contribute to the causes listed above, and the magnitude to which the source contributes to the use impairment, were identified by IEPA as follows (numbers in parentheses indicate monitoring point(s) location):

Source	Magnitude
Other (contaminated sediments)	Slight (G15) to heavy (G30,G32)
Combined sewer overflows	Slight (G15) to moderate (G30,G32)
Urban runoff/storm sewers	Slight (G15) to moderate (G30,G32)
Municipal point sources	Slight (G15,G32) to moderate (G30)
Construction (land development)	Slight (G15,G30,G32)
Other (general)	Slight (G15,G30,G32)
Other (highway maintenance and runoff)	Slight (G15,G30,G32)
*Hydrologic/Habitat Modifications (filling and draining)	
*Hydrologic/Habitat Modifications (removal of riparian vegetation)	
*Hydrologic/Habitat Modifications (dam construction)	
*Carp Activity	

*Hydrologic and habitat modifications are significant in these highly urbanized reaches of the basin, notably the presence of dams, disturbance of native riparian vegetation, streambank modification and destabilization, stream channelization, and flow alteration. Pathogens, which contribute to the nonsupport rating for swimming use, result from urban runoff and combined sewer overflows.

Relationship Between Causes and Sources of Impairment

Nutrients are a primary listed cause of impairment for all reaches of the Upper Des Plaines main stem. Inputs of nutrients generally originate from several primary sources: municipal point sources, urban runoff / storm sewers, and agriculture. Fertilizers and other organic nutrients found throughout the agricultural-urban development continuum flow into waterbodies. Combined sewer overflows also introduce nutrients and organic matter into the water column. Excessive nutrients lead to algal blooms that block sunlight from reaching into deeper portions of the water column, followed by excessive oxygen demand when these plants respire, or when they die and are decomposed by oxygen demanding organisms. Dissolved oxygen depletion also is caused by organic enrichment from the same sources listed above. As these decomposing organisms consume oxygen, water becomes oxygen-depleted, and aquatic animals are unable to breathe.

Siltation, suspended solids, and turbidity also rank high as causes of impairment for all reaches of the main stem. Siltation occurs when soil and other suspended solid particles in the water column settle out on streambeds. Sources of siltation include erosion-induced runoff from

agricultural and construction operations, channel erosion, as well as runoff from roads and highways where dirt and dust have settled. Habitat modifications, including streambank modification and destabilization, also contribute to erosion-siltation processes. Another suggested contributor to turbidity is the presence of carp, as documented by research at the Des Plaines River Wetlands Demonstration Project in Wadsworth. Carp are known to stir up bottom sediments via their feeding habits, and also are destructive of desirable rooted aquatic vegetation. Eroded soil increases water turbidity and settles in rivers, streams and wetlands where it is a major contributor to habitat degradation. Sediments that settle out of the water column can bury coarser bottom sediments necessary to support reproductive and feeding cycles of aquatic animals, reduce light penetration into the water necessary to support aquatic plants, and reduce food sources supporting numerous links in the food web.

Toxic substances have numerous deleterious effects on aquatic ecosystems, from death of plants and animals due to poisoning, to genetic disruption and mutation. Water quality impacts that fall within the general category of toxics include metals, oil and grease, salinity/TDS/chlorides, ammonia, chlorine, and pesticides. Metals and salinity/TDS/chlorides primarily come from urban runoff / storm sewers, and are due to automobile use and application of salt on roadways. Ammonia and chlorine are byproducts of the wastewater treatment process and enter the river via municipal point source discharges. Contaminated sediments also contribute to the impact of toxic chemicals on water quality. Pathogens, which are contributed by combined sewer overflows, urban runoff, and pet wastes, prevent the river's use for swimming.

Habitat modification can be traced to numerous sources, including agriculture and construction, filling and draining of wetlands, modification and destabilization of stream channels, construction of channel dams, and removal or degradation of native riparian vegetation. These activities can lead to flow alteration, thermal modification, turbidity, suspended solids, and siltation, all of which seriously impact the river's ability to support a diversity of high quality plants and animals.

Tributaries

A number of tributaries of the Upper Des Plaines also were monitored with the following results (listed in order from north to south; s=slight, m=moderate, h=high):

Mill Creek, monitored in 1990, rated full support for both overall use and aquatic life. No causes or sources of impairment were reported. MBI=5.4 (good conditions); AIBI=40 (C rating); PIBI=38 (C rating predicted).

Bull Creek, monitored in 1983, rated partial support with moderate impairment for overall use and aquatic life. Causes of impairment include habitat alterations (m), metals (s), nutrients (s), siltation (s), organic enrichment/dissolved oxygen (s), and pathogens (s). Sources of these causes include hydrological/habitat modification (m), channelization (m), municipal point sources (s), agriculture (s), nonirrigated crop production (s), construction (s), land development (s), urban runoff/storm sewers (s), and streambank modification and destabilization (s). MBI=5.3 (good conditions); AIBI=25 (D rating); PIBI=42 (B rating predicted).

Indian Creek, monitored in 1983, rated partial support with minor impairment for overall use and aquatic life. Causes of impairment include habitat alterations (m), metals (s), ammonia (s), chlorine (s), nutrients (s), and siltation (s). Sources contributing to these causes

include construction (m), land development (m), hydrologic/habitat modification (m), channelization (m), municipal point sources (s), agriculture (s), nonirrigated crop production (s), urban runoff/storm sewers (s), and streambank modification and destabilization (s). MBI=5.8 (good conditions); AIBI=32 (C rating); PIBI=42 (B rating predicted).

Buffalo Creek, monitored in 1988, rated partial support with minor impairment for overall use and aquatic life. Causes of impairment include nutrients (h) and salinity/TDS/chlorides (h). The source of these causes was identified as municipal point sources (h). MBI=6.4 (fair conditions).

Wheeling Ditch, monitored in 1995, rated full support for overall use and aquatic life. No causes, sources, MBI, AIBI, or PIBI figures were reported. (Note: this use support rating is surprising in light of the heavily urbanized nature of this watershed.)

McDonald Creek was last monitored in 1976 and rated partial support and moderate impairment for overall use and aquatic life. Causes of impairment were not determined, but urban runoff / storm sewers (m) were identified as sources contributing to impairment. An AIBI of 29 indicates a D rating.

Willow Creek, monitored in 1983, rated partial support with moderate impairment for overall use and aquatic life. Causes of impairment include chlorine (h), nutrients (h), habitat alterations (h), organic enrichment/dissolved oxygen (m), pathogens (m), and oil and grease (m). Sources that contributed to the causes include municipal point sources (m), urban runoff/storm sewers (m), hydrologic/habitat modification (m), removal of riparian vegetation (m), streambank modification and destabilization (m), and channelization (s). MBI=6.4 (fair conditions); AIBI=28 (D rating).

Crystal Creek, monitored in 1995, rated full support for overall use and aquatic life. No causes, sources, MBI, AIBI, or PIBI figures were reported. (Note: this use support rating is surprising in light of the heavily urbanized nature of this watershed.)

Silver Creek was last monitored in 1976 and provided partial support and moderate impairment for overall use and aquatic life. Causes of impairment were not determined, but urban runoff / storm sewers (m) were identified as sources contributing to impairment. An AIBI of 23 indicates a D rating.