

MONITORING AND RESEARCH DEPARTMENT

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CONTINUOUS DISSOLVED OXYGEN MONITORING IN THE SERVICE AREA OF THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO DURING 2024

October 2025

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LIST OF ABBREVIATIONS

CAWS	Chicago Area Waterway System
CDOM	Continuous Dissolved Oxygen Monitoring
COV	coefficient of variation
CRS	Chicago River System
CSC	Calumet-Sag Channel
CSSC	Chicago Sanitary and Ship Canal
District	Metropolitan Water Reclamation District of Greater Chicago
DO	dissolved oxygen
ft	feet
I-55	Interstate Highway 55
IPCB	Illinois Pollution Control Board
L	liter
LCR	Little Calumet River
mg	milligram
NBCR	North Branch Chicago River
NSC	North Shore Channel
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
SBCR	South Branch Chicago River
SEPA	Sidestream Elevated Pool Aeration
Solinst Eureka	Eureka Water Probes
Terrence J. O'Brien	O'Brien
WRPs	Water Reclamation Plants

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DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

INTRODUCTION

The Chicago Area Waterway System (CAWS) consists of 78 miles of canals within an approximately 740-square-mile watershed, which serves the Chicago area for two principal purposes: (1) the drainage of urban stormwater runoff and treated municipal wastewater effluent, and (2) the support of commercial navigation. Approximately 75 percent of the length is composed of man-made canals, and the remainder is composed of natural streams that have been deepened, straightened, and/or widened to such an extent that reversion to the natural state is not practical. The flow of water in the CAWS is artificially controlled by hydraulic structures, and over 70 percent of the annual flow is from the discharge of treated municipal wastewater effluents (Metropolitan Water Reclamation District of Greater Chicago [District], 2008). The CAWS has two river systems: the Calumet River System and the Chicago River System (CRS).

A third river system that traverses the Chicago area is the Upper Des Plaines River System. This system provides drainage for approximately 700 square miles and originates in the state of Wisconsin. The portion of the Des Plaines River within the District's jurisdiction flows southward from Lake Cook Road through western Cook County. One of its larger tributaries, Salt Creek, flows through western Cook and eastern DuPage Counties and meets the Des Plaines River in the village of Lyons. The system is composed of more natural streams than the CAWS but also receives stormwater runoff and treated wastewater. The entire Des Plaines River Watershed has been impacted by suburban sprawl with over six million people residing within it and having 58.7 percent of land use consisting of urban development and 33.2 percent agriculture (Illinois Department of Natural Resources, 2018).

In 1998, the Monitoring and Research Department initiated a comprehensive field-monitoring program in order to identify reaches in the CRS where the dissolved oxygen (DO) concentrations were below the applicable Illinois Pollution Control Board (IPCB) DO standard. Initially, the program was intended to focus on the CRS for a two-year period, but the duration of the monitoring program was extended, and the scope was expanded to include the Calumet River System in 2001 and the Chicago metropolitan area wadeable streams in 2005. The program is referred to as the District's Continuous Dissolved Oxygen Monitoring (CDOM) Program. The CDOM Program was conducted under the guidance of a Quality Assurance Project Plan (QAPP) which is available on the District website (www.mwrd.org). Currently, continuous DO monitoring in the CRS and Calumet River System is required in National Pollutant Discharge Elimination System permits for the Terrence J. O'Brien (O'Brien) and Calumet Water Reclamation Plants (WRPs), and data is submitted to the Illinois Environmental Protection Agency quarterly. The data are used to characterize the DO behavior in waterway systems receiving District WRP effluents.

This report summarizes the monitoring results for the period January 1 through December 31, 2024, for the deep-draft waterways and wadeable streams within the Chicago metropolitan area.

MONITORING LOCATIONS AND APPLICABLE DISSOLVED OXYGEN STANDARDS

Locations and Descriptions

The CDOM Program supplies the District with water quality data throughout the year for both the wadeable and deep-draft waterways within its jurisdiction. All of the 2024 CDOM stations are shown in Figure 1. Descriptions of the locations for the deep-draft and wadeable monitoring stations are listed in Table 1.

There are 15 deep-draft CDOM monitoring stations in the CAWS. The deep-draft monitoring stations included two locations in the North Shore Channel (NSC), two locations in the North Branch Chicago River (NBCR), one location in the Chicago River main stem, one location in the South Branch Chicago River (SBCR), two locations in Bubbly Creek, three locations in the Chicago Sanitary and Ship Canal (CSSC), two locations in the Little Calumet River (LCR), and two locations in the Calumet-Sag Channel (CSC).

There are five CDOM stations in the Chicago metropolitan area wadeable streams: four monitoring stations in the Upper Des Plaines River System, three stations on the Upper Des Plaines River, one on Salt Creek, and one in the Calumet River System on the LCR.

Designated Uses

The IPCB has established water use designations for water bodies within the state of Illinois. The Chicago River, Salt Creek, Des Plaines River, and the shallow portion of the LCR are designated as General Use Waters. The NSC, NBCR, SBCR, Grand Calumet River, the deep-draft portion of the LCR, and the CSC are designated as CAWS Aquatic Life Use A Waters. The CSSC is designated as CAWS and Brandon Pool Aquatic Life Use B Waters.

Dissolved Oxygen Water Quality Standards

The IPCB has established water quality standards for DO under Title 35 Procedural and Environmental Rules, Part 302: Water Quality Standards. In Bubbly Creek, the DO shall not be less than 4.0 milligrams per liter (mg/L) at any time. For the CAWS Aquatic Life Use A Waters, the DO shall not be less than 3.5 mg/L at any time and meet a 4.0 mg/L daily minimum averaged over seven days from August through February, and the DO shall not be below 5.0 mg/L at any time from March through July. For the CAWS and Brandon Pool Aquatic Life Use B Waters, the DO shall not be less than 3.5 mg/L at any time and meet a 4.0 mg/L daily minimum averaged over seven days. In General Use Waters, the DO shall not be less than 3.5 mg/L at any time, shall meet a 4.0 mg/L daily minimum averaged over seven days, and shall meet a 5.5 mg/L daily mean averaged over 30 days from August through February; and the DO shall not be less than 5.0 mg/L at any time and shall meet a 6.0 mg/L daily mean averaged over seven days from March through July.

FIGURE 1: 2024 CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS

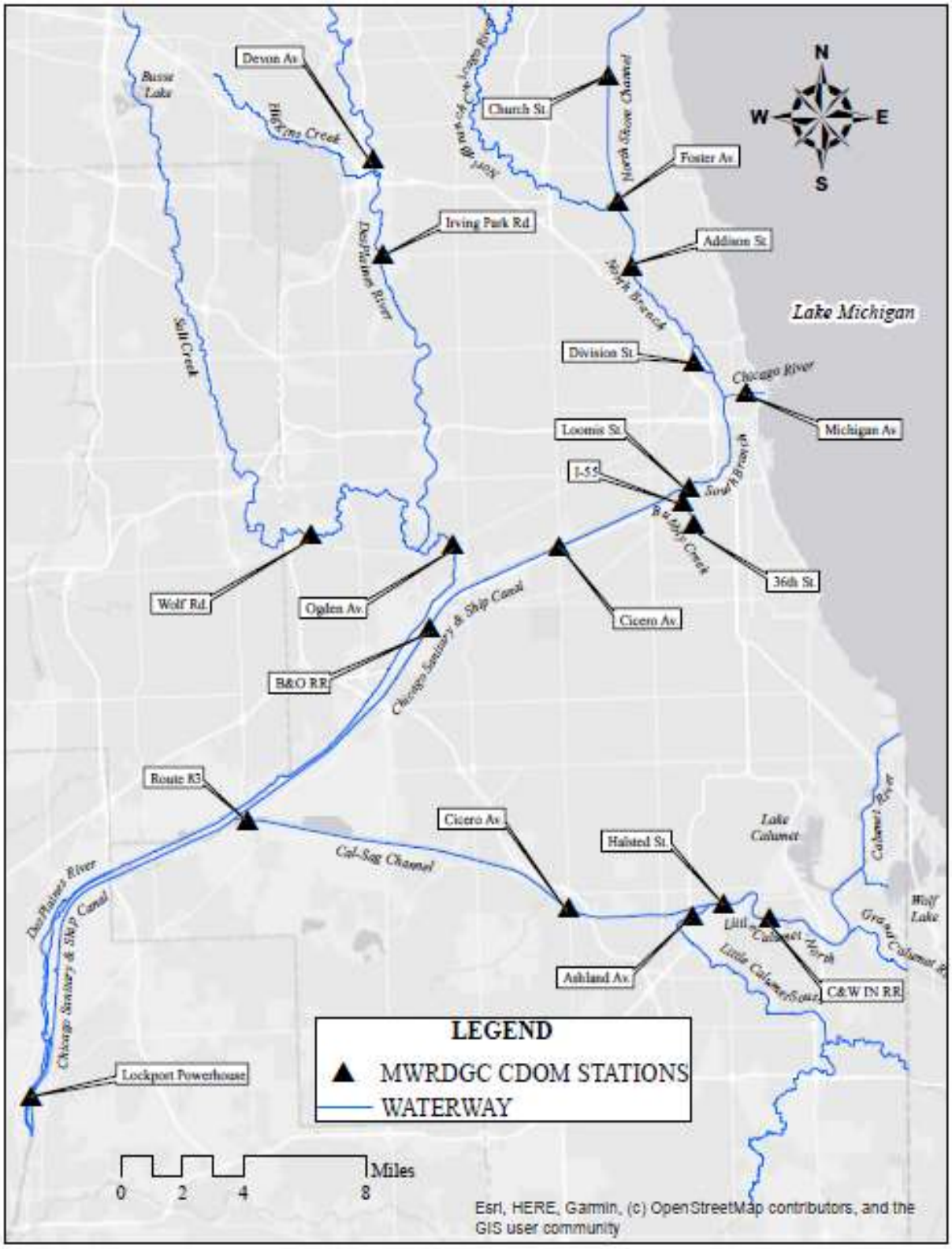


TABLE 1: CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS DURING 2024

Monitoring Station	Waterway	Description of Monitoring Station
	Chicago River System	
Church Street	North Shore Channel	1.8 miles above O'Brien WRP outfall, 2.4 miles below Wilmette Pumping Station, monitor on southwest side Church Street bridge, 1 foot below water surface.
Foster Avenue	North Shore Channel	3.2 miles below O'Brien WRP outfall, 1.5 miles below Devon Aeration Station, 0.1 mile above junction with North Branch Chicago River, monitor on northwest side Foster Avenue bridge, 3 feet below water surface.
Addison Street	North Branch Chicago River	5.2 miles below O'Brien WRP outfall, monitor on northwest side Addison Street bridge, 3 feet below water surface.
Division Street	North Branch Chicago River	8.8 miles below O'Brien WRP outfall; 1.4 miles below Webster Aeration Station; monitor on northeast side Division Street bridge, 3 feet below water surface.
Michigan Avenue	Chicago River	0.8 miles below Chicago River Controlling Works; 0.8 miles above junction with South Branch Chicago River; water quality monitor on northeast side Michigan Avenue bridge, 3 feet below water surface.
Loomis Street	South Branch Chicago River	3.6 miles below junction with Chicago River, monitor on northeast side Loomis Street bridge, 3 feet below water surface.

TABLE 1 (Continued): CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS DURING 2024

Monitoring Station	Waterway	Description of Monitoring Station
	Chicago River System (Continued)	
36th Street	Bubbly Creek	0.2 mile below Racine Avenue Pumping Station, 1.2 miles above junction with South Branch of the Chicago River, monitor attached to concrete wall on west side of river, 3 feet below water surface.
Interstate Highway 55	Bubbly Creek	1.0 mile below Racine Avenue Pumping Station, 0.4 mile above junction with South Branch of the Chicago River, monitor on northwest side I-55 bridge, 3 feet below water surface.
Cicero Avenue	Chicago Sanitary and Ship Canal	1.5 miles above Stickney WRP outfall, monitor on northeast side Cicero Avenue bridge, 3 feet below water surface.
B&O Central Railroad	Chicago Sanitary and Ship Canal	3.6 miles below Stickney WRP outfall, monitor in center of canal, east side B&O Central RR[1] bridge, 3 feet below water surface.
Lockport Powerhouse	Chicago Sanitary and Ship Canal	0.1 mile above Lockport Powerhouse, 1.1 miles above junction with Des Plaines River, monitor on north side of canal, in forebay area on fender wall, 3 feet below water surface.
	Calumet River System	
C&W Indiana Railroad	Little Calumet River	5.2 miles below SEPA[2] 1, 1.5 miles above SEPA 2, 3.6 miles below Thomas J. O'Brien Lock and Dam, 1.3 miles above Calumet WRP outfall, monitor attached to northeast side C&W Indiana RR bridge, 3 feet below water surface.

TABLE 1 (Continued): CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS DURING 2024

Monitoring Station	Waterway	Description of Monitoring Station
Halsted Street	Little Calumet River	7.7 miles below SEPA 1, 1.0 mile below SEPA 2, 1.2 miles below Calumet WRP, 0.5 mile above junction with Calumet-Sag Channel, monitor attached to southeast side Halsted Street bridge, 3 feet below water surface.
Ashland Avenue	Little Calumet River	0.5 mile above junction with Calumet-Sag Channel, monitor attached to east side of Ashland Avenue bridge, 1 foot from streambed.
Cicero Avenue	Calumet-Sag Channel	3.1 miles below SEPA 3, 3.3 miles above SEPA 4, monitor attached to northwest side Cicero Avenue bridge, 3 feet below water surface.
Route 83	Calumet-Sag Channel	0.4 mile above junction with Chicago Sanitary and Ship Canal, 0.3 mile above Canal Junction SEPA Station, monitor on southwest side Illinois Central-Gulf RR bridge, 3 feet below water surface.
	Des Plaines River System	
Devon Avenue	Des Plaines River	0.7 mile above junction with Willow Creek, monitor on northwest side of Devon Avenue bridge, 2–4 inches from stream bed.
Irving Park Road	Des Plaines River	3.1 miles below junction with Willow Creek, water quality monitor on northeast side of Irving Park Road bridge, 2 feet below water surface.
Ogden Avenue	Des Plaines River	1.7 miles below junction with Salt Creek, 25.8 miles above junction with Chicago Sanitary and Ship Canal, monitor on center of south side of Ogden Avenue bridge, 2–4 inches from stream bed.

TABLE 1 (Continued): CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS DURING 2024

Monitoring Station	Waterway	Description of Monitoring Station
Wolf Road	Salt Creek	8.0 miles above junction with Des Plaines River, water quality monitor on northwest side of Wolf Road bridge, 2–4 inches from stream bed.

[1]RR = Railroad.
[2]SEPA = Sidestream Elevated Pool Aeration Station.

MATERIALS AND METHODS

Water Quality Monitors

The continuous water quality monitors (monitors) used to collect these data are manufactured by Solinst Eureka (Eureka) of Austin, Texas. The DO was measured hourly using a Eureka Manta2™ or Manta+™ multiprobe. In order to protect the monitors from marine navigation and vandalism, the monitors were deployed in the waterways in a stainless steel or polyvinyl chloride (PVC) housing. A fixed length of eight-inch diameter stainless steel or PVC pipe is mounted on a bridge abutment with multiple two-inch circular openings on the submerged end to allow sufficient flow of water through the pipe and an access hatch on the top end to allow for the exchange of monitors.

District personnel retrieve each monitor from the field following a typical 28-day deployment of continuous monitoring. Prior to retrieval, a DO measurement is taken next to the protective housing using a DO meter to compare with the monitor results. An additional monitor that had been previously calibrated and serviced in the laboratory is then deployed to replace the retrieved monitor. The retrieved monitors are returned to the laboratory for data downloading, exterior cleaning, servicing, and a calibration check of the DO sensors. The monitors are temporarily stored in holding tanks containing tap water for subsequent deployment during the following week.

Data Management and Review

The hourly DO data are directly exported electronically from individual monitors to AQUARIUS Time-Series Server 20.4 data management software from Aquatic Informatics Inc. All DO data are reviewed for accuracy following the QAPP. The review process included the following:

1. Conducting a post-deployment calibration check to 100 percent DO saturation by a monitor after retrieval from the field (DO rejection criteria = difference greater than 0.4 mg/L).

2. Comparing the last hourly DO concentration measured by the monitor retrieved in the field to the DO concentration measured with a DO meter taken at the time of retrieval (DO rejection criteria = relative percent difference greater than 20 percent and an absolute magnitude greater than 0.3 mg/L).

3. Inspecting for erroneous or missing data. Additional review is done to verify continuous monitoring data and identify instances where equipment malfunctioned or there was a technician error.

Criterion 1 would entail rejection of all hourly readings of one monitor deployment period, approximately four weeks. Criterion 2 could result in the rejection of all readings of one monitor deployment period, after a careful review of the data. However, if evidence suggests that waterway conditions at the time of the DO meter measurement could explain a difference greater than 20

percent, the data may be accepted. Criterion 3 could result in the rejection of all or portions of the data series.

A comprehensive description of methods is presented in Revision 2.2 of the CDOM Program QAPP, effective December 31, 2023.

Cross-Sectional Surveys

During the spring, summer, and fall of 2024, cross-sectional DO surveys were conducted in the CRS, Calumet River System, and Des Plaines River System to determine if the fixed continuous monitoring locations were representative of the DO concentrations across the waterway. The DO concentrations were measured directly with a monitor at multiple locations and depths across the waterway. The cross-sectional DO measurements were taken in the center of the waterway and at the right and left sides of the flow from a bridge, catwalk, or boat. The DO measurements were recorded at up to four depths for each location, including just above the bottom of the stream bed, one-half the total depth, three feet below the surface, and at the surface. If the overall depth was less than eight feet, then the one-half depth measurement was not recorded. If the overall depth was less than four feet, only bottom and surface measurements were recorded, and if the overall depth was less than two feet, only a bottom measurement was recorded.

RESULTS

The annual minimum, maximum, and mean DO concentrations measured at all 20 stations during 2024 are shown in Table 2.

The number and percentage of measured DO concentrations rejected and removed from the AQUARIUS Time-Series database following review during 2024 are summarized in Table 3. There was no data rejection for seven stations, and for the remaining stations data rejection ranged from less than one percent to 27 percent. Overall, three percent of the data was rejected. When a sonde is discovered to be malfunctioning, troubleshooting and adjustments are made as soon as possible. If needed, the sonde will be switched out with a new sonde as soon as practical. Some sonde locations are only accessible by boat and because the Section's boat was out of service for unexpected repairs in December 2024, an increased amount of data was rejected due to the inability to exchange a malfunctioning sonde. Examples of this occurred at Addison Street and Division Street on the North Branch Chicago River. Additionally, the region had a harsh winter resulting in frozen waterways that prevented the timely exchange of some sondes. Examples of this occurred at Devon Avenue on the Des Plaines River where the malfunctioning sonde could not be exchanged due to the frozen waterway.

The percent distribution of DO concentrations in ranges of 1 mg/L increments from <1.0 mg/L to >10.0 mg/L at the 20 monitoring stations during 2024 are presented in Table 4.

Individual graphs showing hourly DO concentrations at each monitoring station are presented in Figures 2 through 21.

Summary statistics for the DO measured during cross-sectional surveys are shown in Appendix A. The results from the surveys show that nearly all of the CDOM station variations in cross-section measured DO are minimal (coefficient of variation [COV] <10 percent), with 15 out of 20 stations having COV values less than five percent. The maximum COV values for all surveys at C&W Indiana Railroad and Halsted Street on the LCR and Route 83 on the CSC were greater than five percent but overall averaged five percent or less for all surveys. Historically, CDOM stations on Bubbly Creek (36th Street and I-55 stations) had large variations in cross-sectional DO concentrations. In 2024, this trend continued only at 36th Street, with two COV values that were greater than 10 percent during the spring and summer surveys. However, all the COV values at I-55 were less than 10 percent and averaged less than five percent for all surveys.

TABLE 2: MINIMUM, MAXIMUM, AND MEAN HOURLY DISSOLVED OXYGEN CONCENTRATIONS DURING 2024

Monitoring Station	Waterway	DO Concentration (mg/L) Minimum	Maximum	Mean
	Chicago River System			
Church Street	North Shore Channel	3.5	23.6	9.2
Foster Avenue	North Shore Channel	3.0	11.6	7.6
Addison Street	North Branch Chicago River	1.1	12.2	7.4
Division Street	North Branch Chicago River	1.2	12.0	7.3
Michigan Avenue	Chicago River	6.5	13.4	9.1
Loomis Street	South Branch Chicago River	3.2	11.5	7.2
36th Street	Bubbly Creek	2.1	24.1	11.7
Interstate Highway 55	Bubbly Creek	1.0	16.0	8.0
Cicero Avenue	Chicago Sanitary and Ship Canal	3.0	16.5	7.6
B&O Central Railroad	Chicago Sanitary and Ship Canal	2.4	13.5	7.6
Lockport Powerhouse	Chicago Sanitary and Ship Canal	1.4	11.6	6.3
	Calumet River System			
C&W Indiana Railroad	Little Calumet River	0.8	17.4	9.9
Halsted Street	Little Calumet River	1.9	17.9	7.8
Ashland Avenue	Little Calumet River	0.5	18.8	8.7
Cicero Avenue	Calumet-Sag Channel	1.3	20.0	7.6
Route 83	Calumet-Sag Channel	0.3	20.4	7.4
	Des Plaines River System			
Devon Avenue	Des Plaines River	3.8	16.0	8.8
Irving Park Road	Des Plaines River	4.1	16.6	9.1
Ogden Avenue	Des Plaines River	3.5	16.4	9.3
Wolf Road	Salt Creek	2.8	20.3	9.3

TABLE 3: NUMBER AND PERCENT OF DISSOLVED OXYGEN VALUES NOT MEETING ACCEPTANCE CRITERIA DURING 2024

Monitoring Station	Waterway	Number of DO Values Rejected	Percent of DO Values Rejected
Church Street	North Shore Channel	0	0
Foster Avenue	North Shore Channel	26	<1[a]
Addison Street	North Branch Chicago River	640	7[b]
Division Street	North Branch Chicago River	2,351	27[c]
Michigan Avenue	Chicago River	26	<1[d]
Loomis Street	South Branch Chicago River	2	<1[e]
36th Street	Bubbly Creek	249	3[f]
Interstate Highway 55	Bubbly Creek	0	0
Cicero Avenue	Chicago Sanitary and Ship Canal	113	1[g]
B&O Central Railroad	Chicago Sanitary and Ship Canal	0	0
Lockport Powerhouse	Chicago Sanitary and Ship Canal	21	<1[h]
C&W Indiana Railroad	Little Calumet River	0	0
Halsted Street	Little Calumet River	690	8[i]
Ashland Avenue	Little Calumet River	0	0
Cicero Avenue	Calumet-Sag Channel	0	0
Route 83	Calumet-Sag Channel	12	<1[j]
Devon Avenue	Des Plaines River	957	11[k]
Irving Park Road	Des Plaines River	189	2[l]
Ogden Avenue	Des Plaines River	92	1[m]
Wolf Road	Salt Creek	0	0

[a] 10/11 – 10/12/24 equipment failure, sonde malfunction.
[b] 12/5 – 12/31/24 equipment failure, fouled sonde and housing.
[c] 3/6 – 3/7/24 equipment failure, sonde not logging. 9/25 – 10/23/24 equipment failure, sonde not logging. 10/23 – 12/31/24 post deployment QC failure, fouled sonde and housing.
[d] 1/15 – 1/22/24 intermittent voltage issue, sonde not logging.
[e] 2/21/24 equipment failure, sonde not logging.
[f] 1/1 – 1/4/24 post deployment QC failure. 6/11 – 6/18/24 equipment failure, sonde malfunction.
[g] 10/28 – 12/5/24 intermittent equipment failures, temperature probe error and defective telemetry cable.
[h] 8/6 – 8/7/24 equipment failure, sonde not logging.
[i] 2/7 - 3/6/24, 5/1 – 5/2/24 equipment failure, sonde not logging.
[j] 1/7 – 1/10/24 intermittent voltage issue sonde not logging.
[k] 11/21 – 12/31/24 equipment failure, sonde malfunction.
[l] 11/30 – 12/17/24 intermittent voltage issue, sonde not logging.
[m] 10/10 – 10/15/24 intermittent equipment failure, sonde out of water due to low river stage.

TABLE 4: DISTRIBUTION OF DISSOLVED OXYGEN VALUES ACROSS RANGES DURING 2024

Monitoring Station	Waterway	Percent of DO Values in Range (mg/L)[a]										
		<1	1–<2	2–<3	3–<4	4–<5	5–<6	6–<7	7–<8	8–<9	9–<10	>10
Chicago River System												
Church Street	North Shore Channel	0	0	0	<1	2	6	13	21	19	12	28
Foster Avenue	North Shore Channel	0	0	<1	<1	1	10	21	26	29	10	2
Addison Street	North Branch Chicago River	0	<1	<1	<1	3	16	32	16	13	15	6
Division Street	North Branch Chicago River	0	<1	<1	1	6	20	20	17	18	13	6
Michigan Avenue	Chicago River	0	0	0	0	0	0	1	23	29	25	22
Loomis Street	South Branch Chicago River	0	0	0	<1	1	18	34	18	17	8	4
36th Street	Bubbly Creek	0	0	1	2	2	3	3	5	7	10	67
Interstate Highway 55	Bubbly Creek	<1	<1	<1	1	4	13	17	15	19	15	16
Cicero Avenue	Chicago Sanitary and Ship Canal	0	0	0	<1	3	19	21	15	19	17	8
B&O Central Railroad	Chicago Sanitary and Ship Canal	0	0	<1	<1	<1	8	27	27	27	8	3
Lockport Powerhouse	Chicago Sanitary and Ship Canal	0	<1	<1	5	20	26	14	16	11	5	3
Calumet River System												
C&W Indiana Railroad	Little Calumet River	<1	<1	<1	1	3	5	8	11	13	13	47
Halsted Street	Little Calumet River	0	<1	<1	<1	2	10	21	20	25	16	7
Ashland Avenue	Little Calumet River	<1	<1	<1	2	7	14	14	10	9	10	35
Cicero Avenue	Calumet-Sag Channel	0	<1	<1	3	7	13	15	18	18	15	10
Route 83	Calumet-Sag Channel	<1	<1	2	4	10	15	14	14	17	12	14
Des Plaines River System												
Devon Avenue	Des Plaines River	0	0	0	<1	3	12	18	12	12	10	33
Irving Park Road	Des Plaines River	0	0	0	0	3	13	16	10	9	10	38
Ogden Avenue	Des Plaines River	0	0	0	<1	2	12	16	11	8	10	42
Wolf Road	Salt Creek	0	0	<1	<1	2	13	12	10	11	12	40

[a]Values greater than one are rounded to the nearest whole number.

FIGURE 2: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT CHURCH STREET ON THE NORTH SHORE CHANNEL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

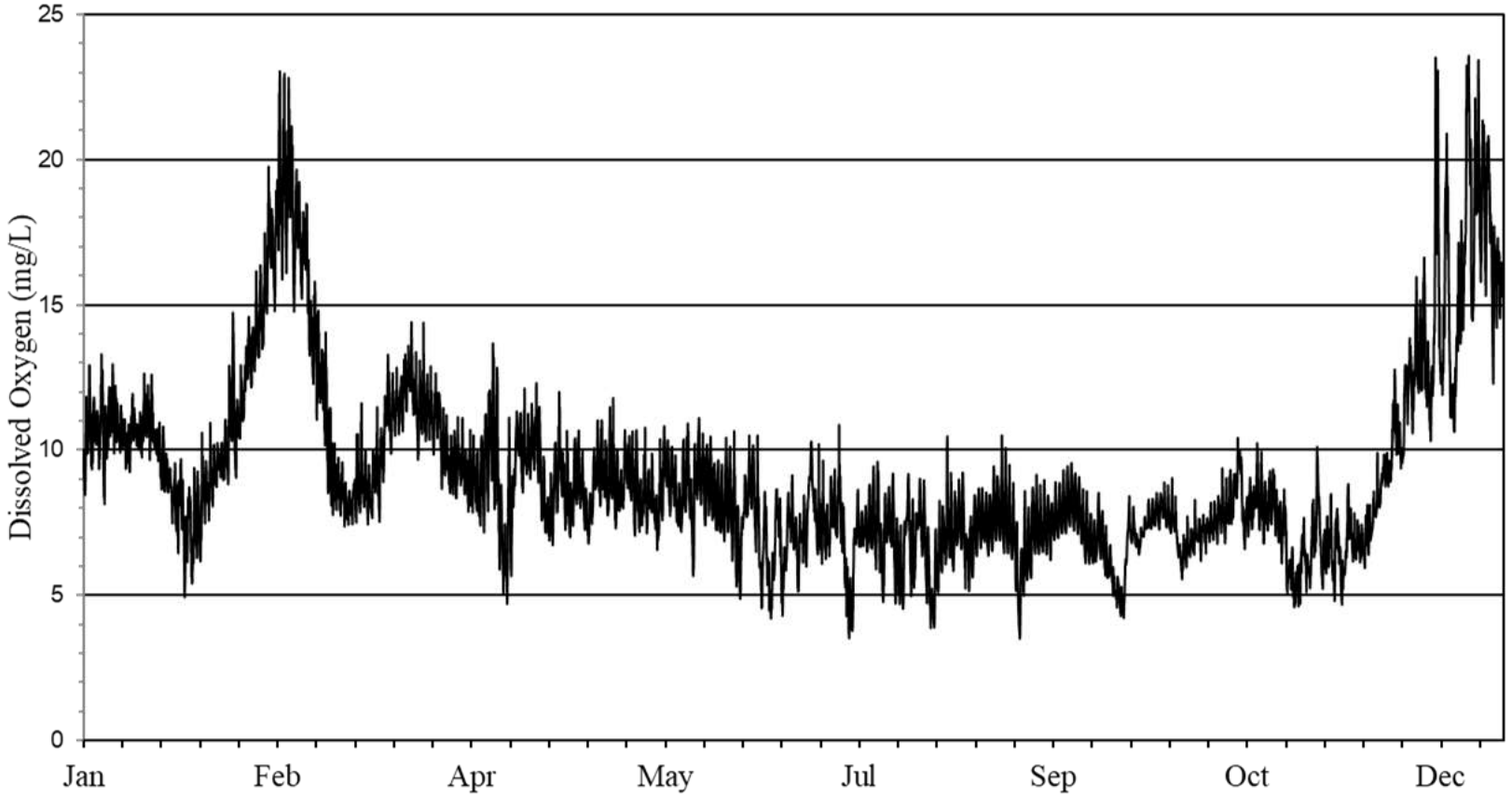


FIGURE 3: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT FOSTER AVENUE ON THE NORTH SHORE CHANNEL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

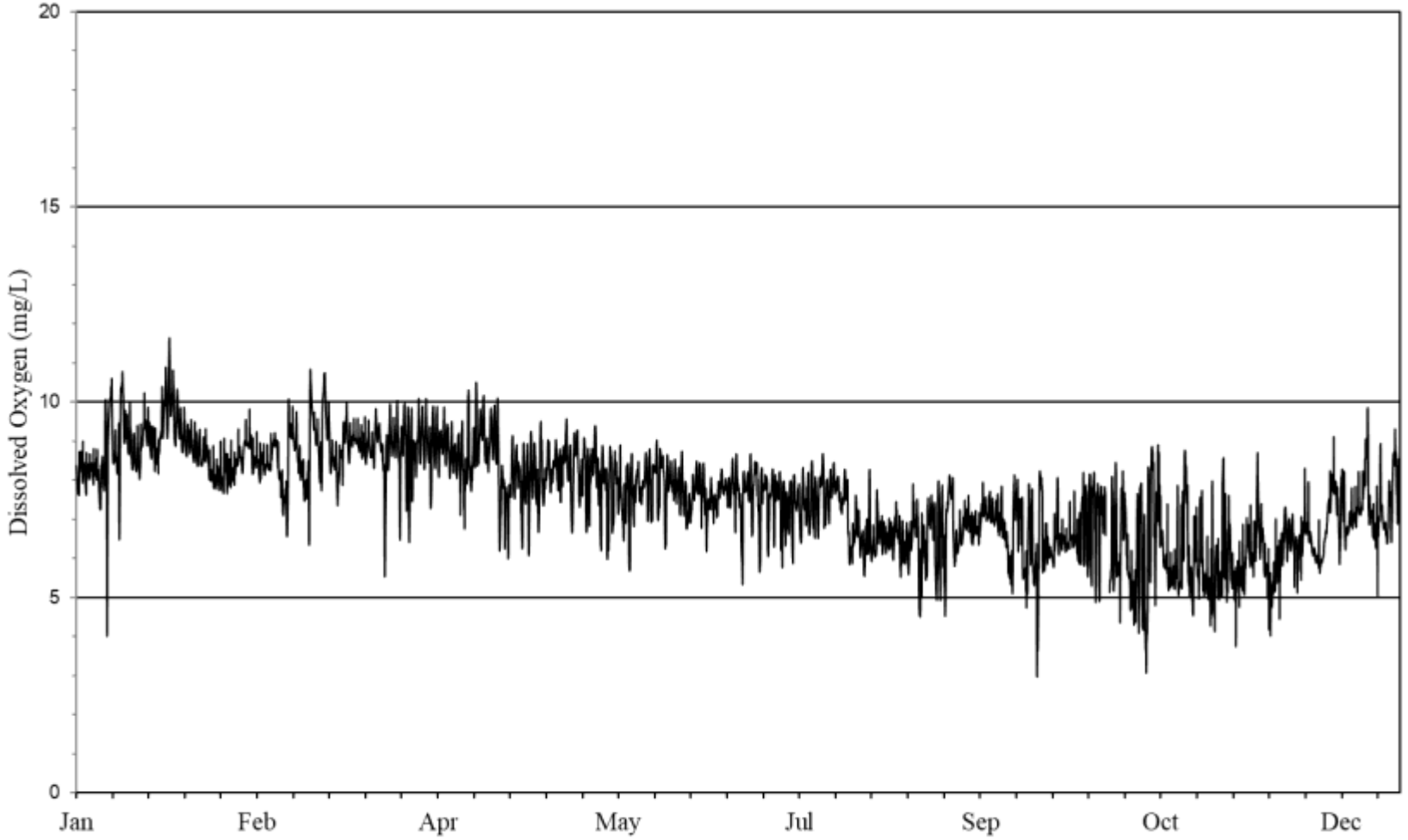


FIGURE 4: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT ADDISON STREET ON THE NORTH BRANCH CHICAGO RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

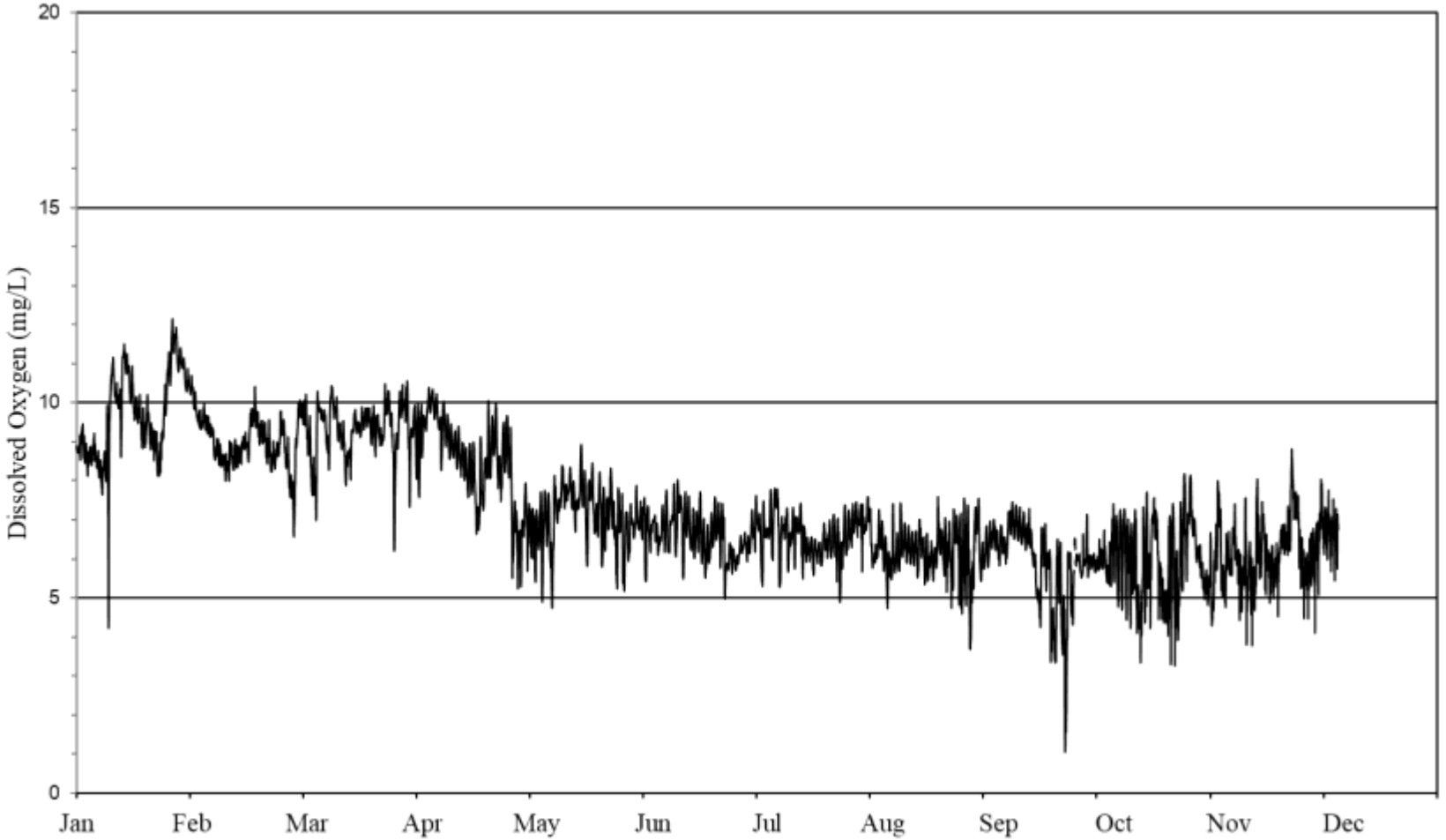


FIGURE 5: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT DIVISION STREET ON THE NORTH BRANCH CHICAGO RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

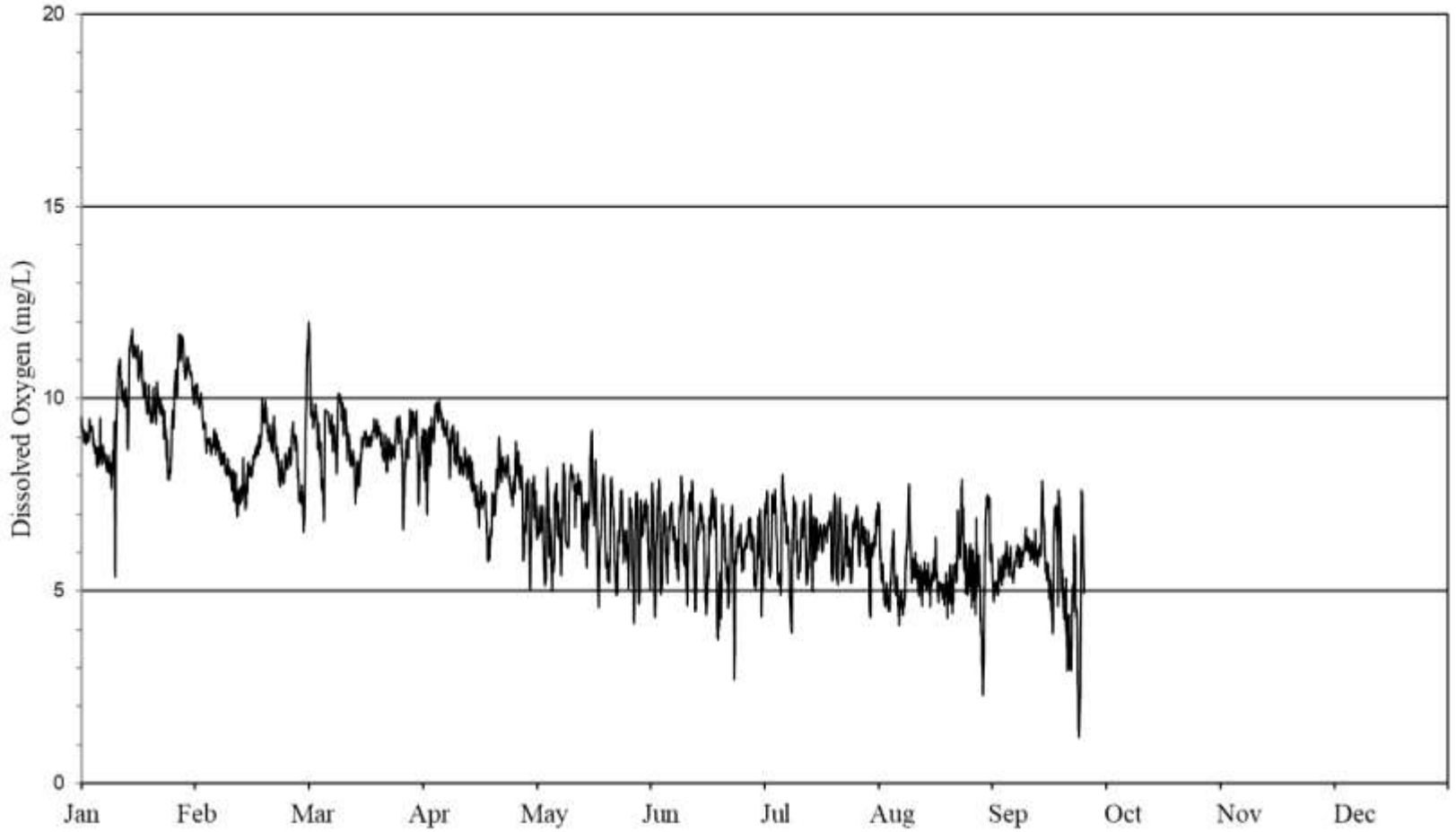


FIGURE 6: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT MICHIGAN AVENUE ON THE CHICAGO RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

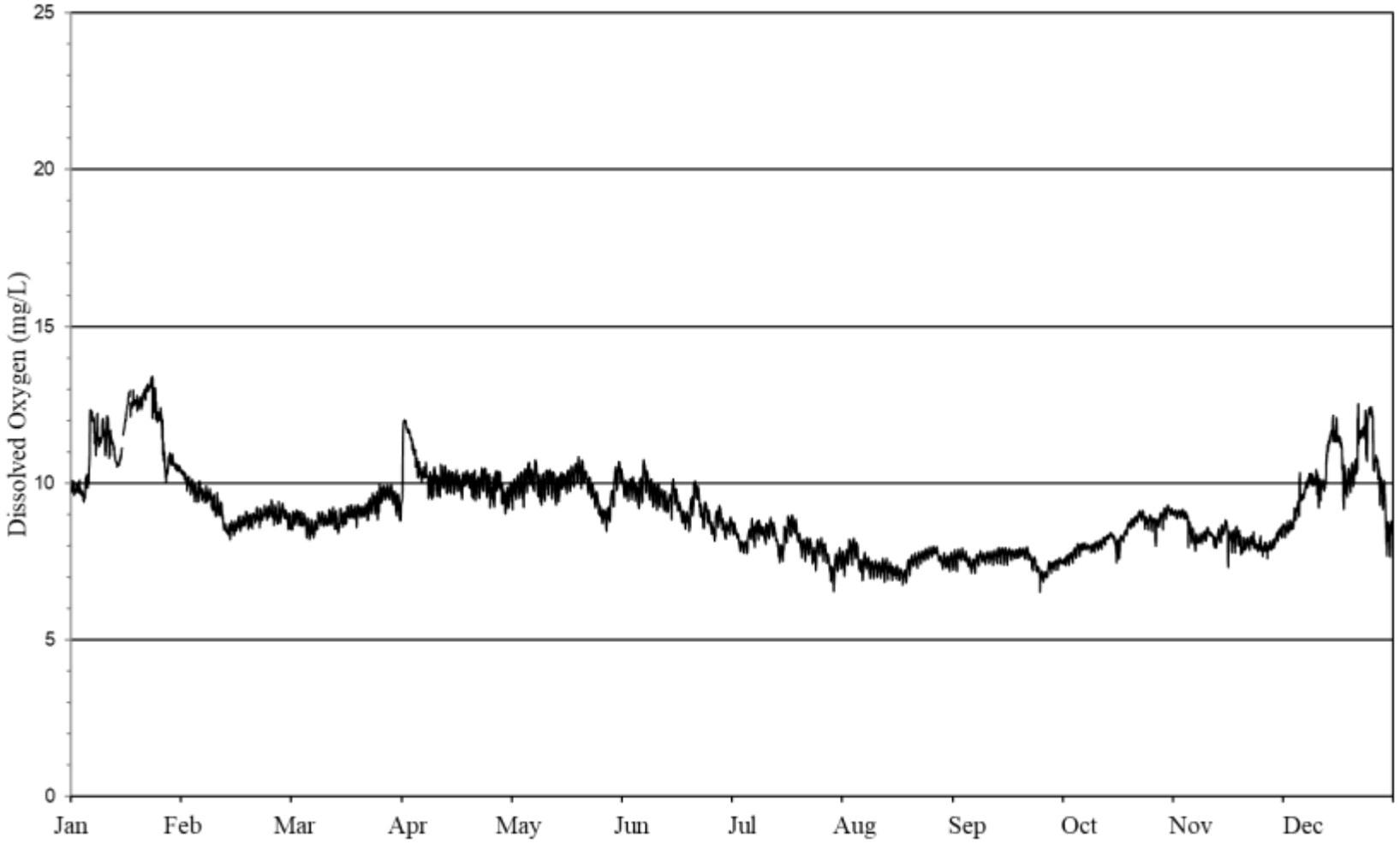


FIGURE 7: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT LOOMIS STREET ON THE SOUTH BRANCH OF THE CHICAGO RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

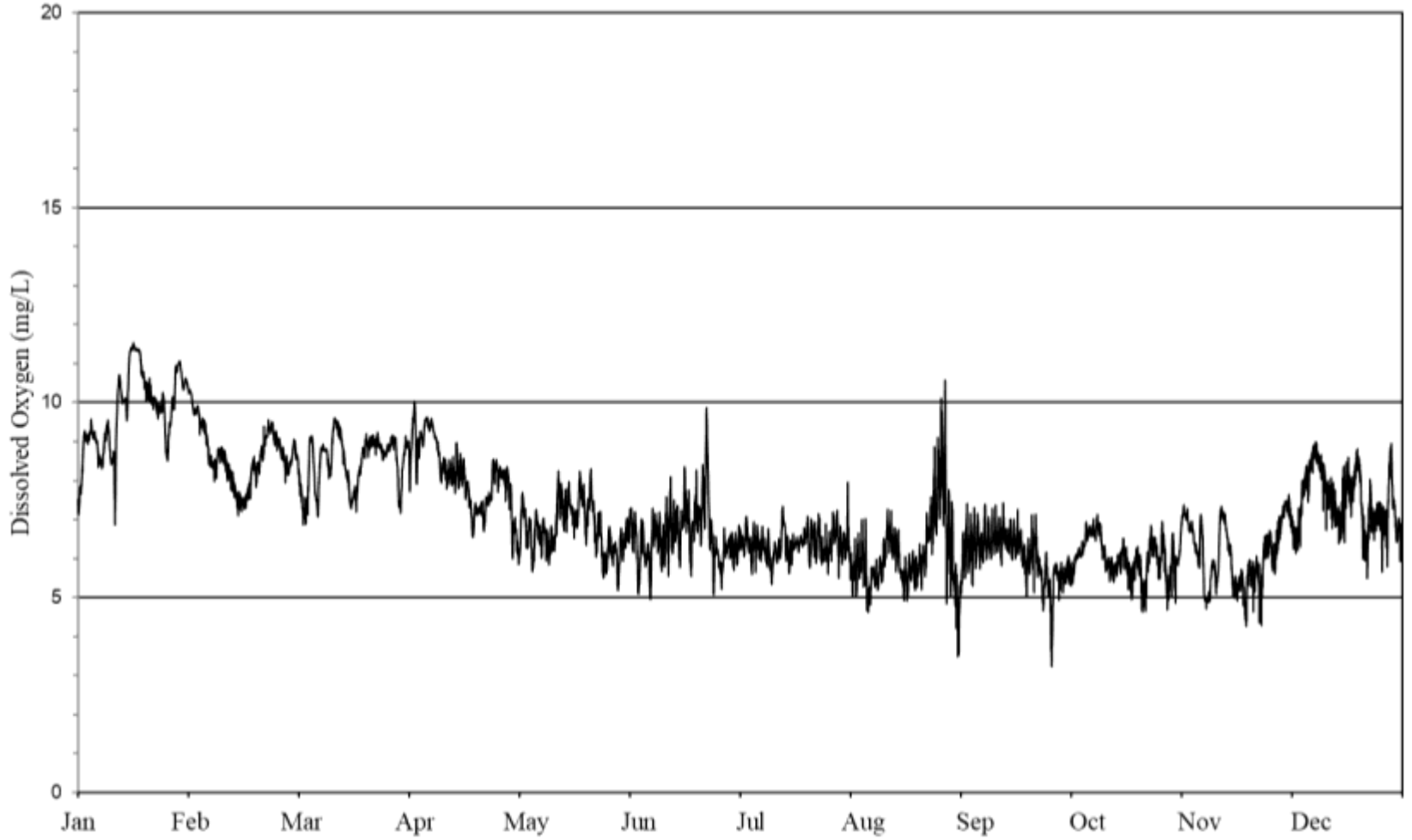


FIGURE 8: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT 36TH STREET ON BUBBLY CREEK FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

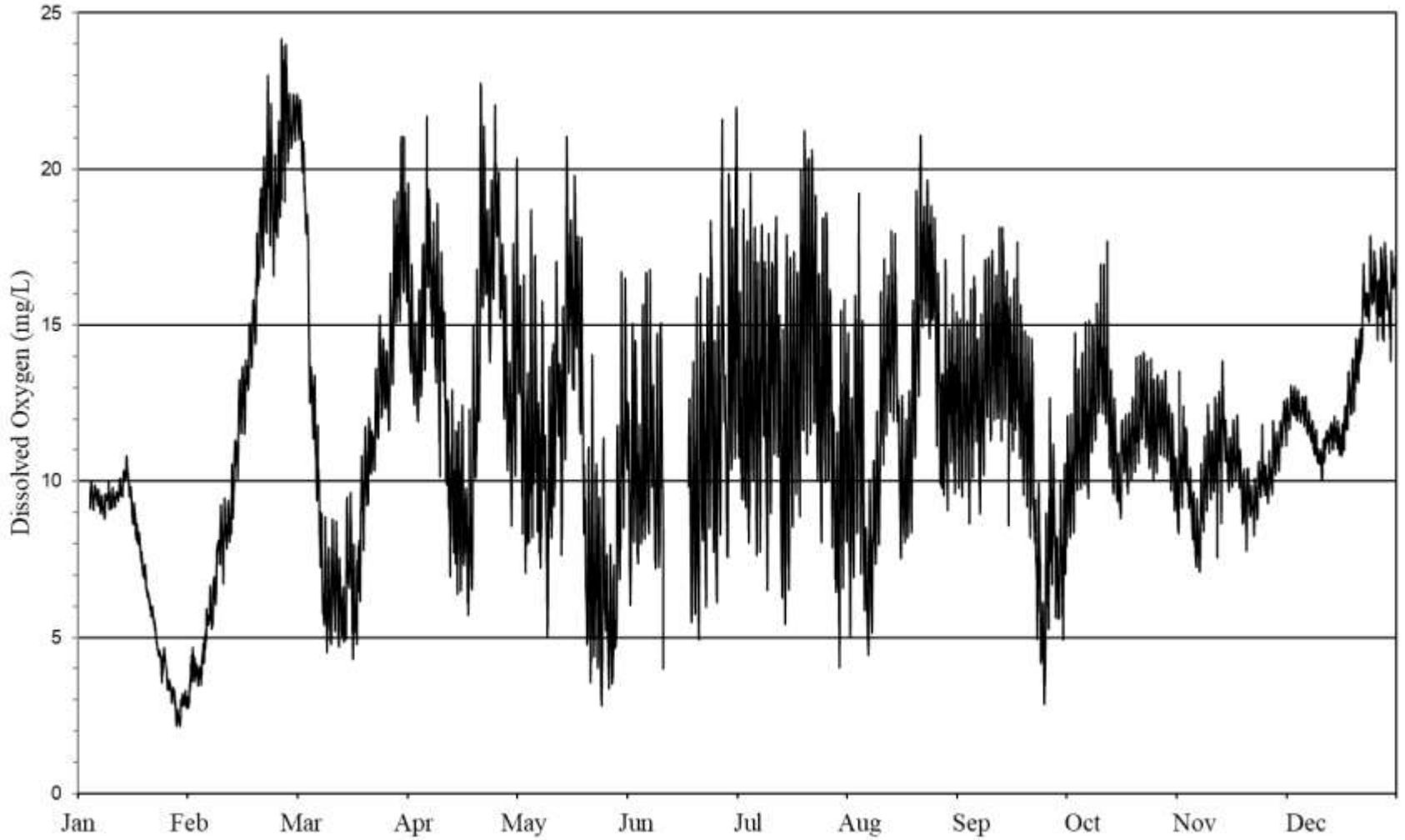


FIGURE 9: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT INTERSTATE HIGHWAY 55 ON BUBBLY CREEK FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

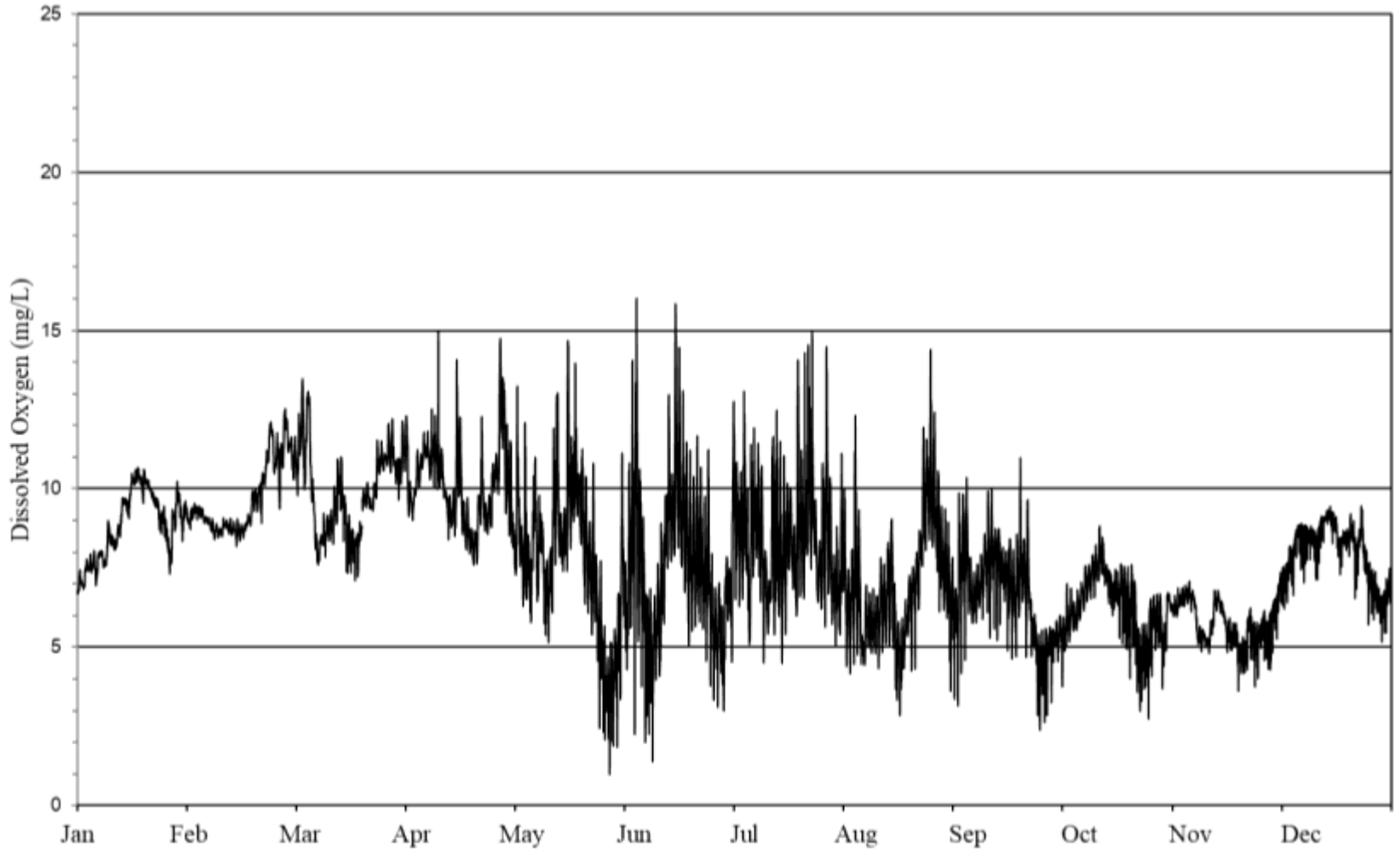


FIGURE 10: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT CICERO AVENUE ON THE CHICAGO SANITARY AND SHIP CANAL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

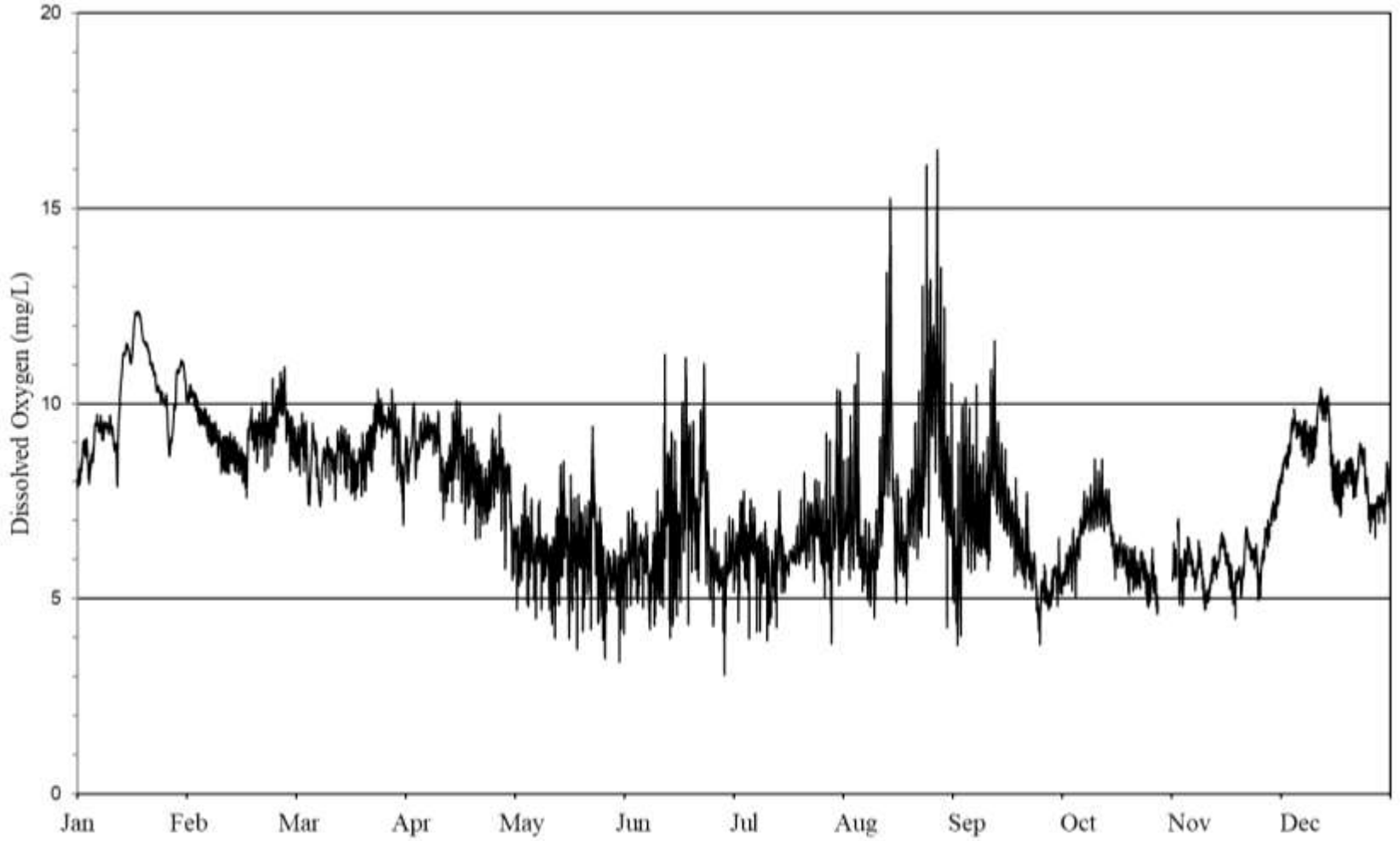


FIGURE 11: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT THE BALTIMORE & OHIO RAILROAD ON THE SANITARY AND SHIP CANAL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

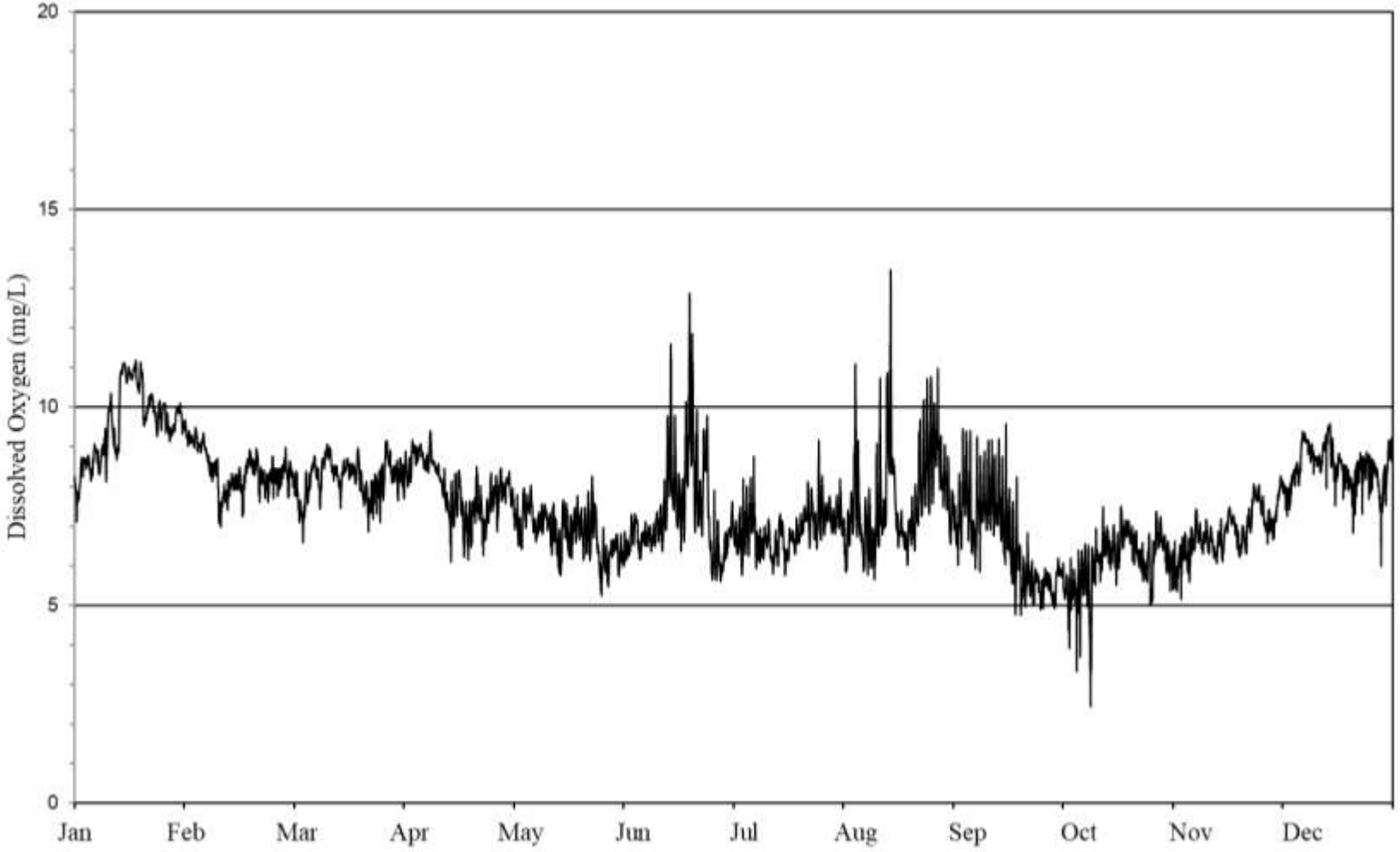


FIGURE 12: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT LOCKPORT POWERHOUSE ON THE CHICAGO SANITARY AND SHIP CANAL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

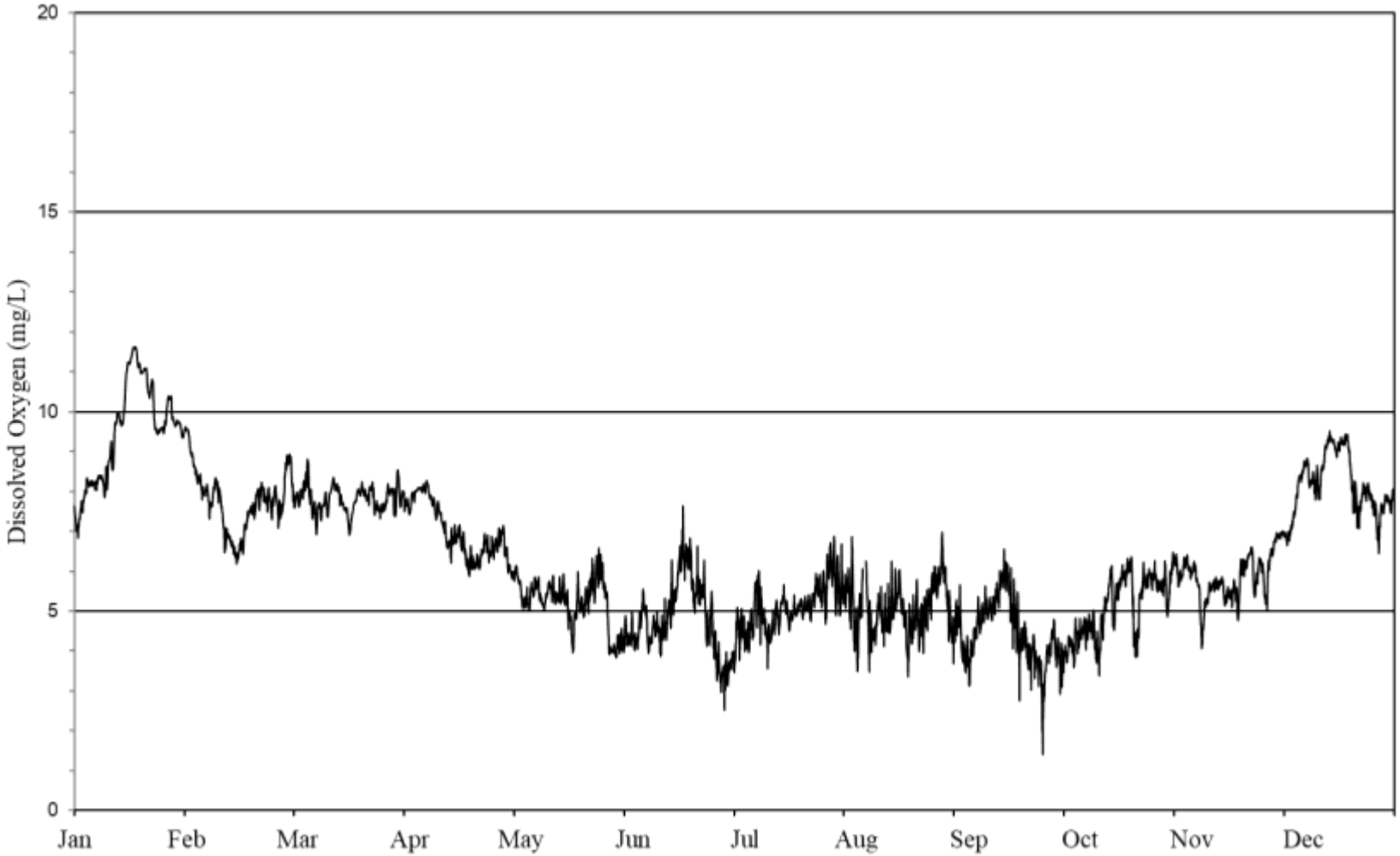


FIGURE 13: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT THE CHICAGO AND WESTERN INDIANA RAILROAD ON THE LITTLE CALUMET RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

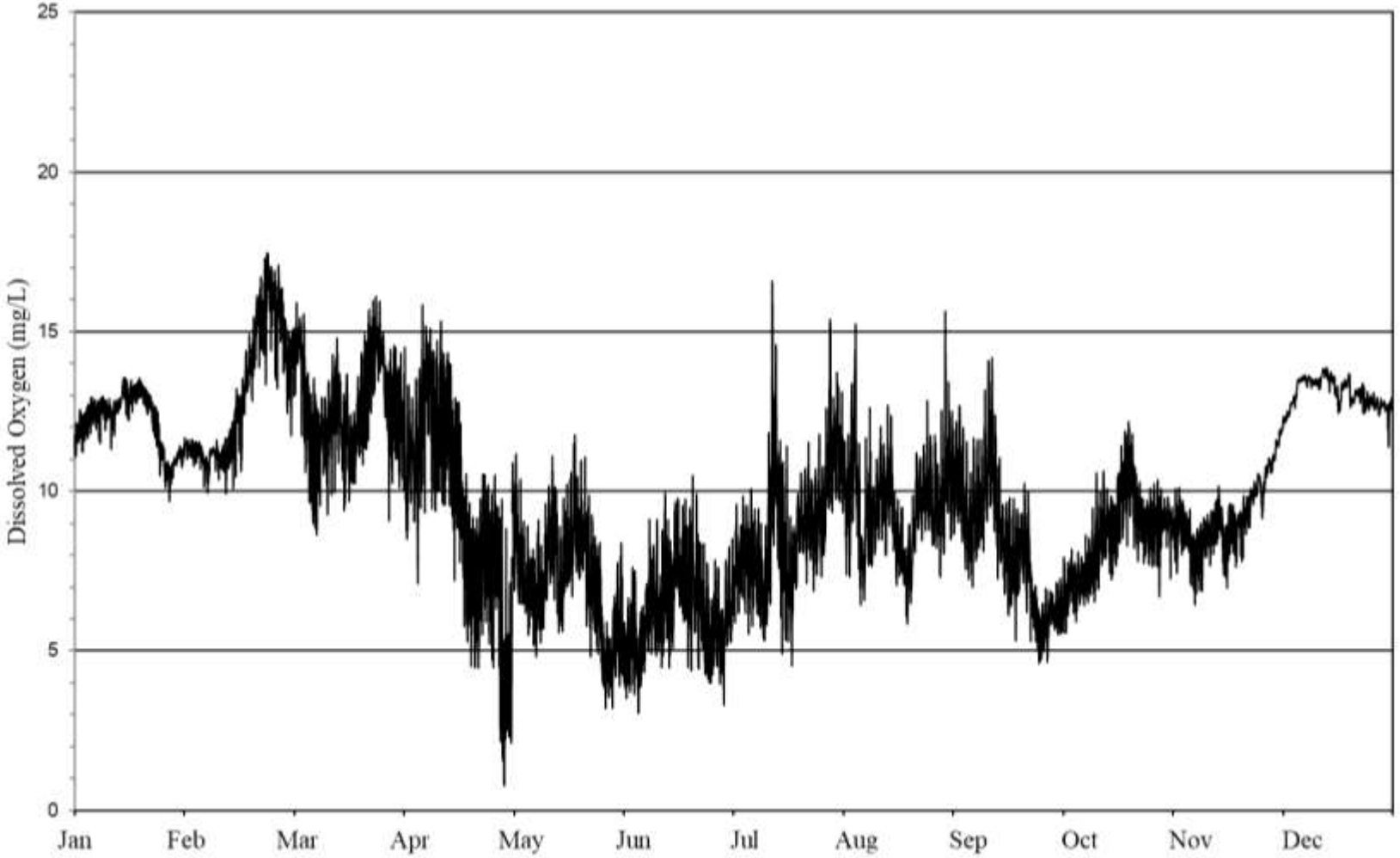


FIGURE 14: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT HALSTED STREET ON THE LITTLE CALUMET RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

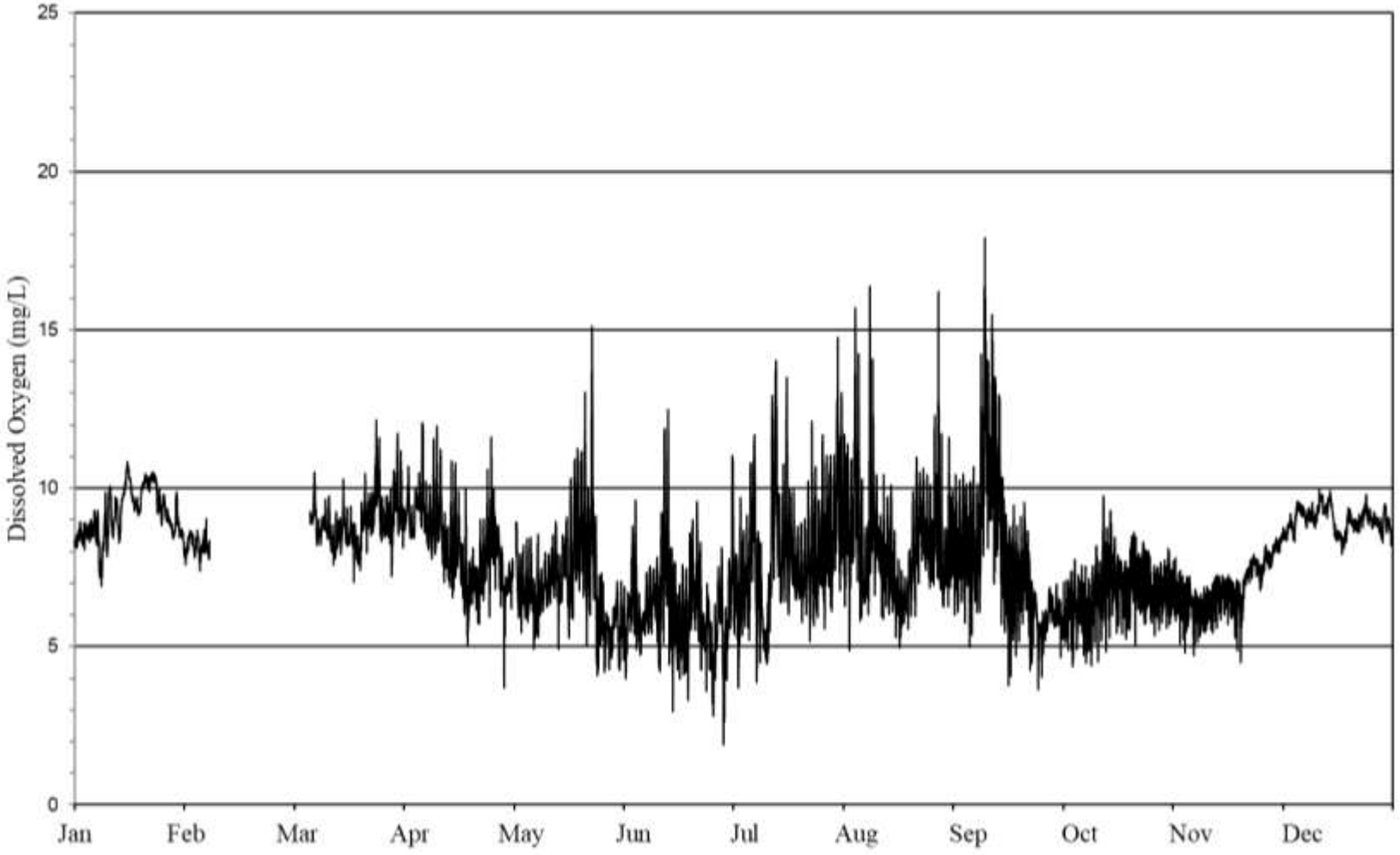


FIGURE 15: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT ASHLAND AVENUE ON THE LITTLE CALUMET RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

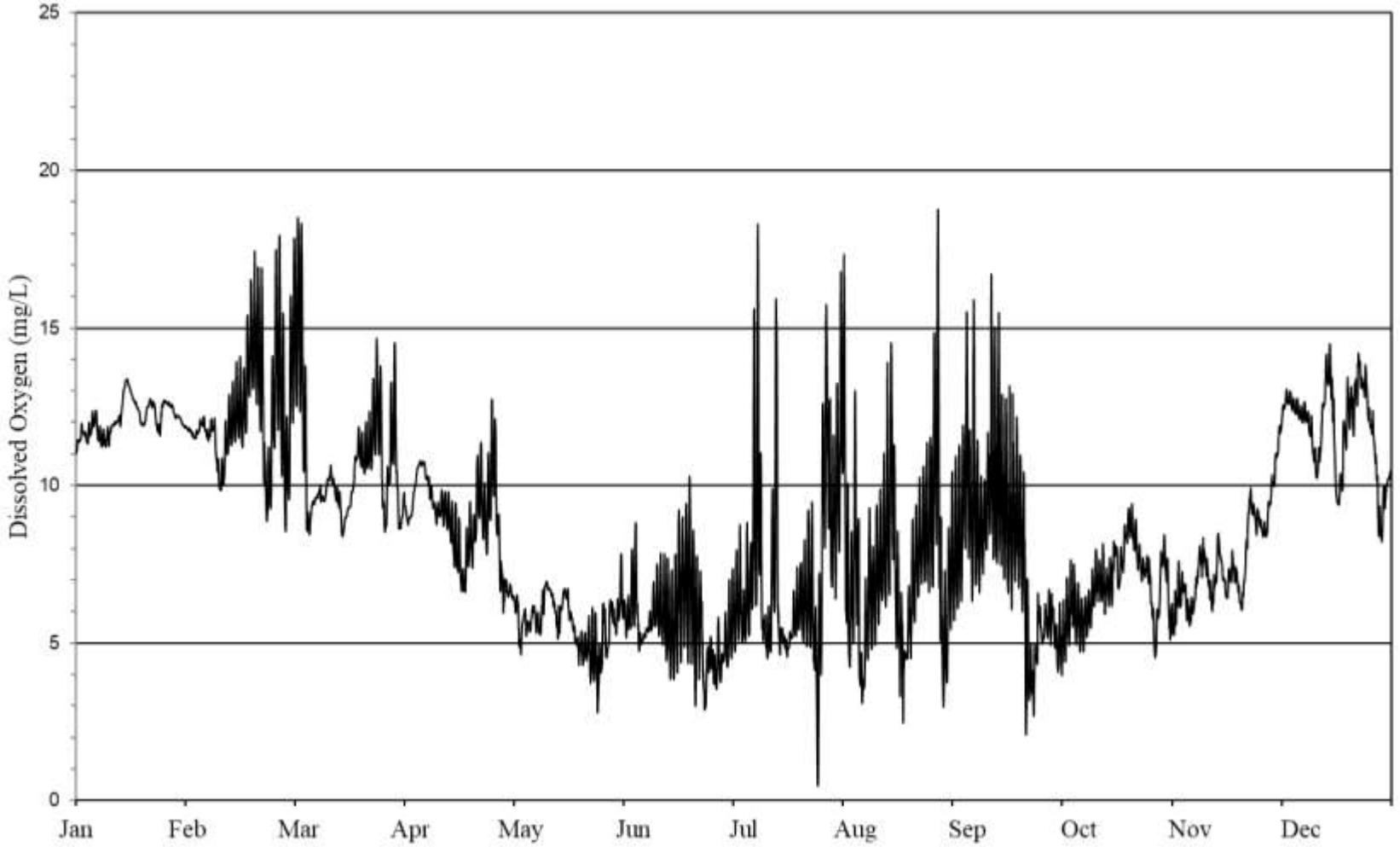


FIGURE 16: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT CICERO AVENUE ON THE CALUMET- SAG CHANNEL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

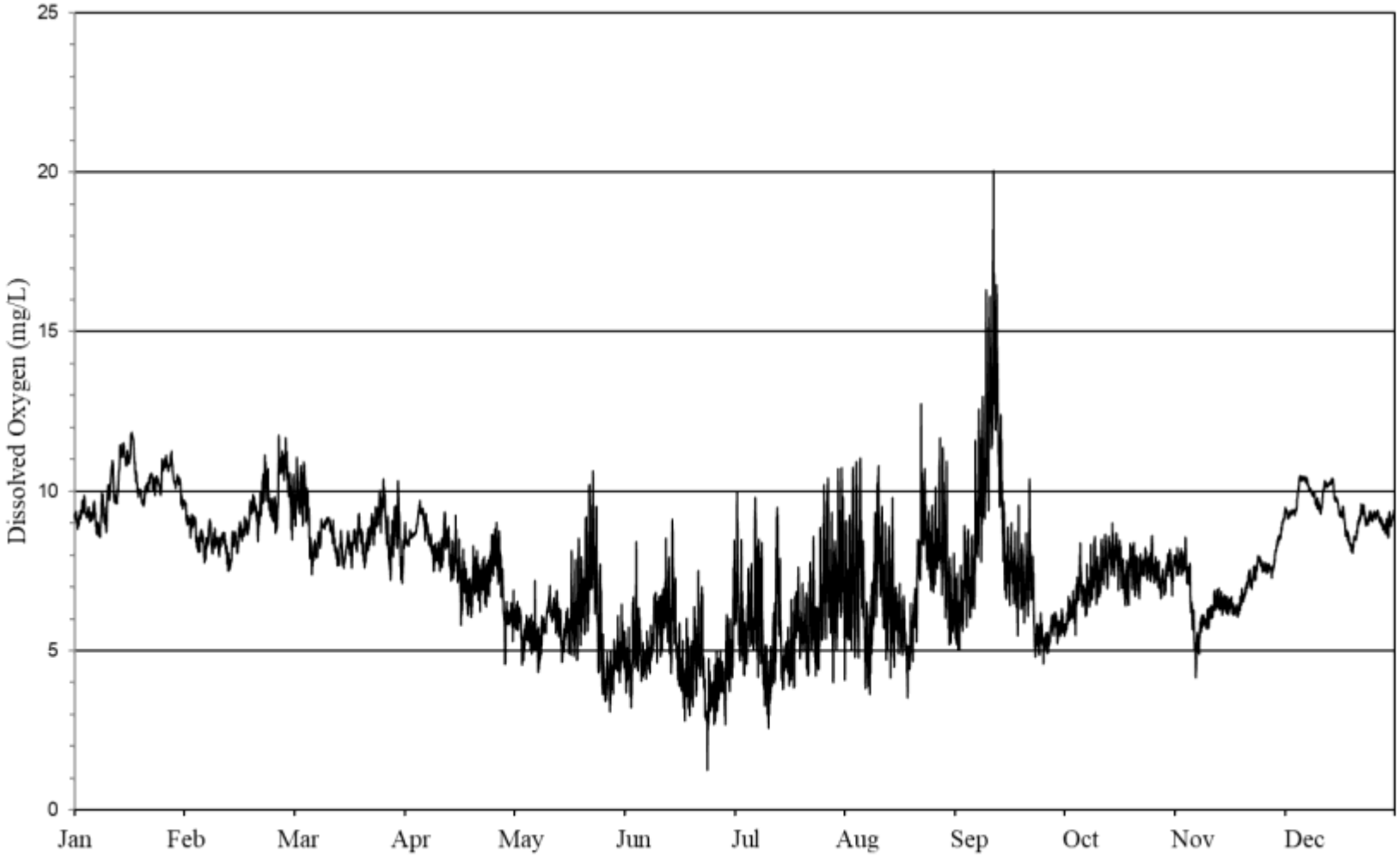


FIGURE 17: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT ROUTE 83 ON THE CALUMET-SAG CHANNEL FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

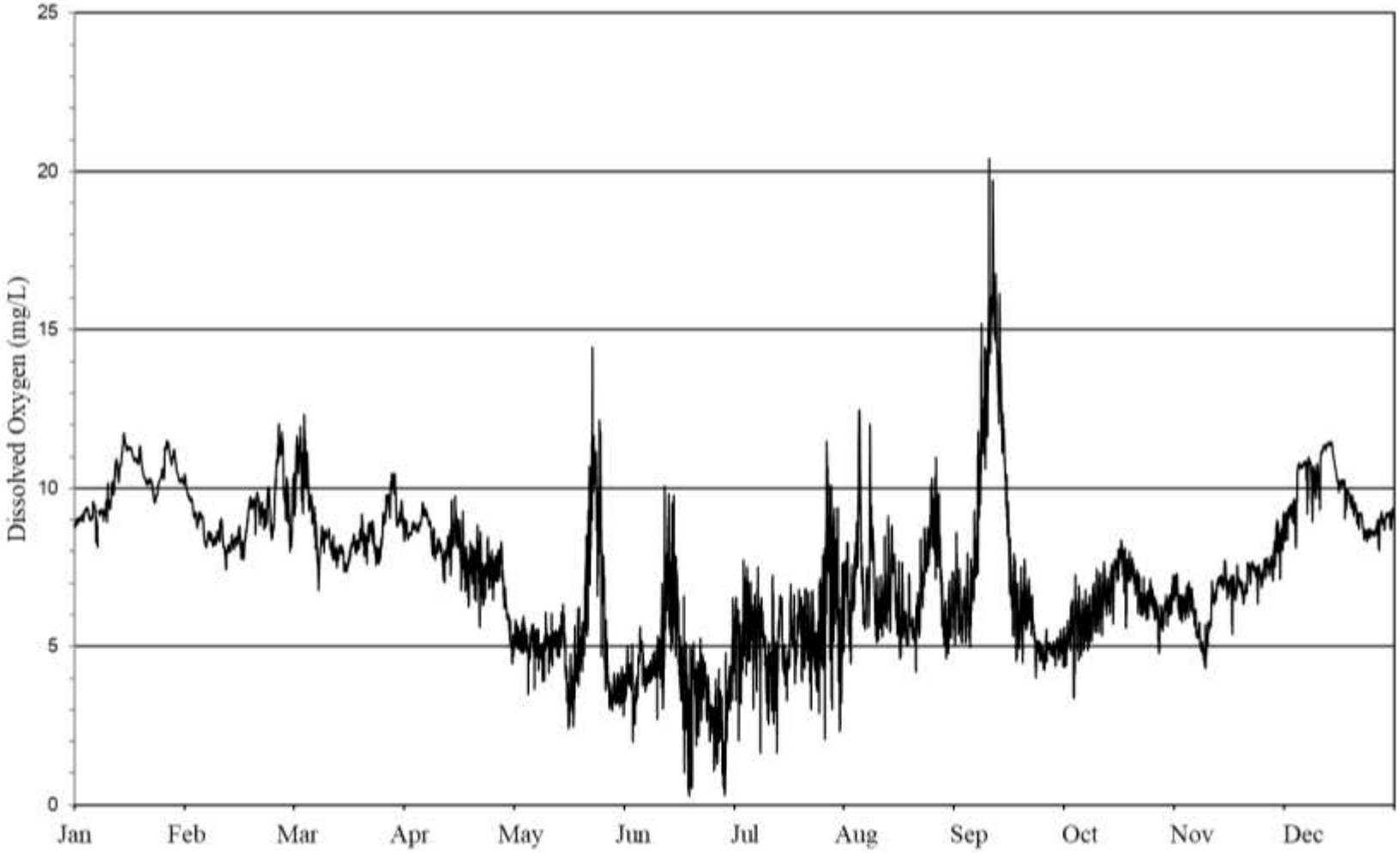


FIGURE 18: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT DEVON AVENUE ON THE DES PLAINES RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

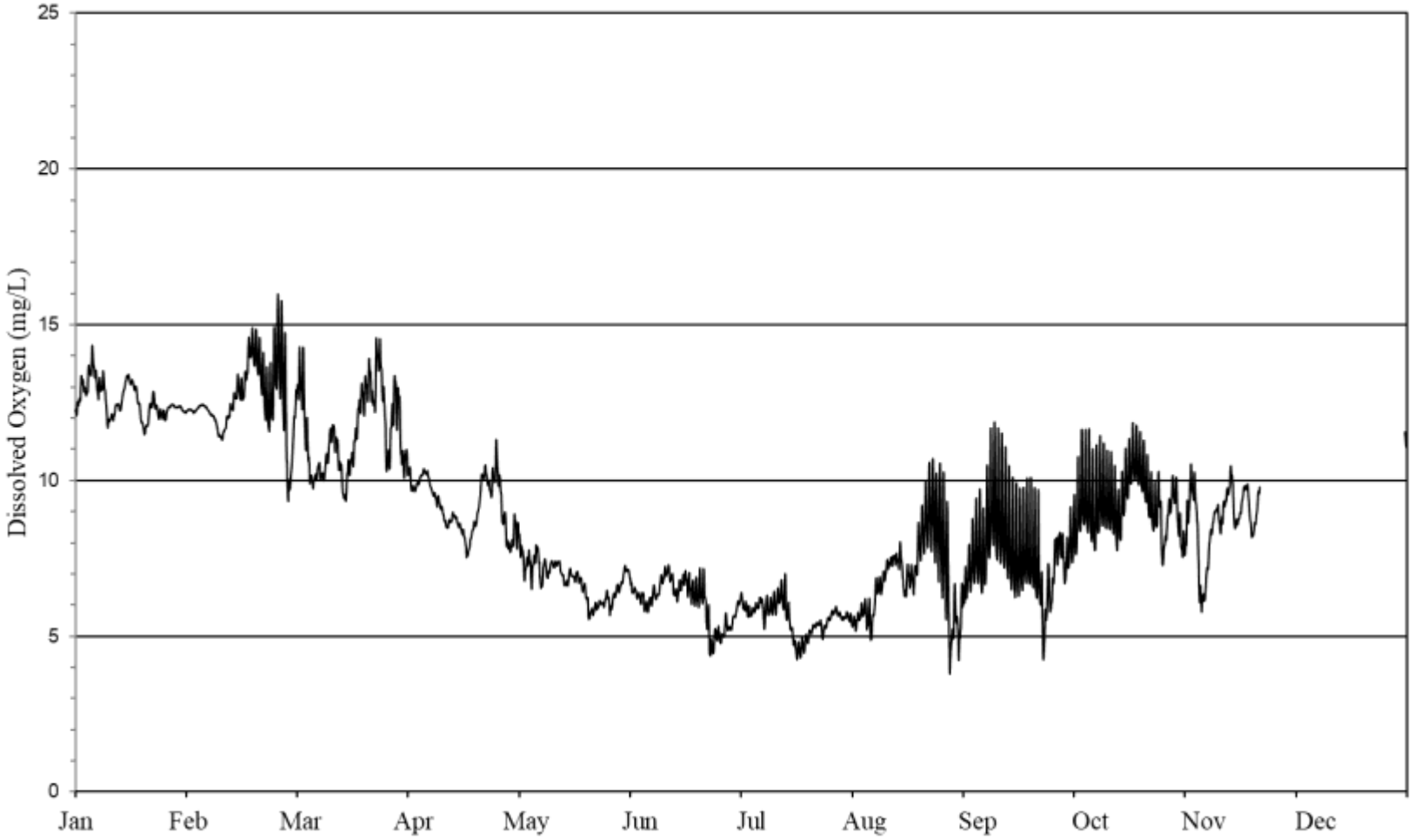


FIGURE 19: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT IRVING PARK ROAD ON THE DES PLAINES RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

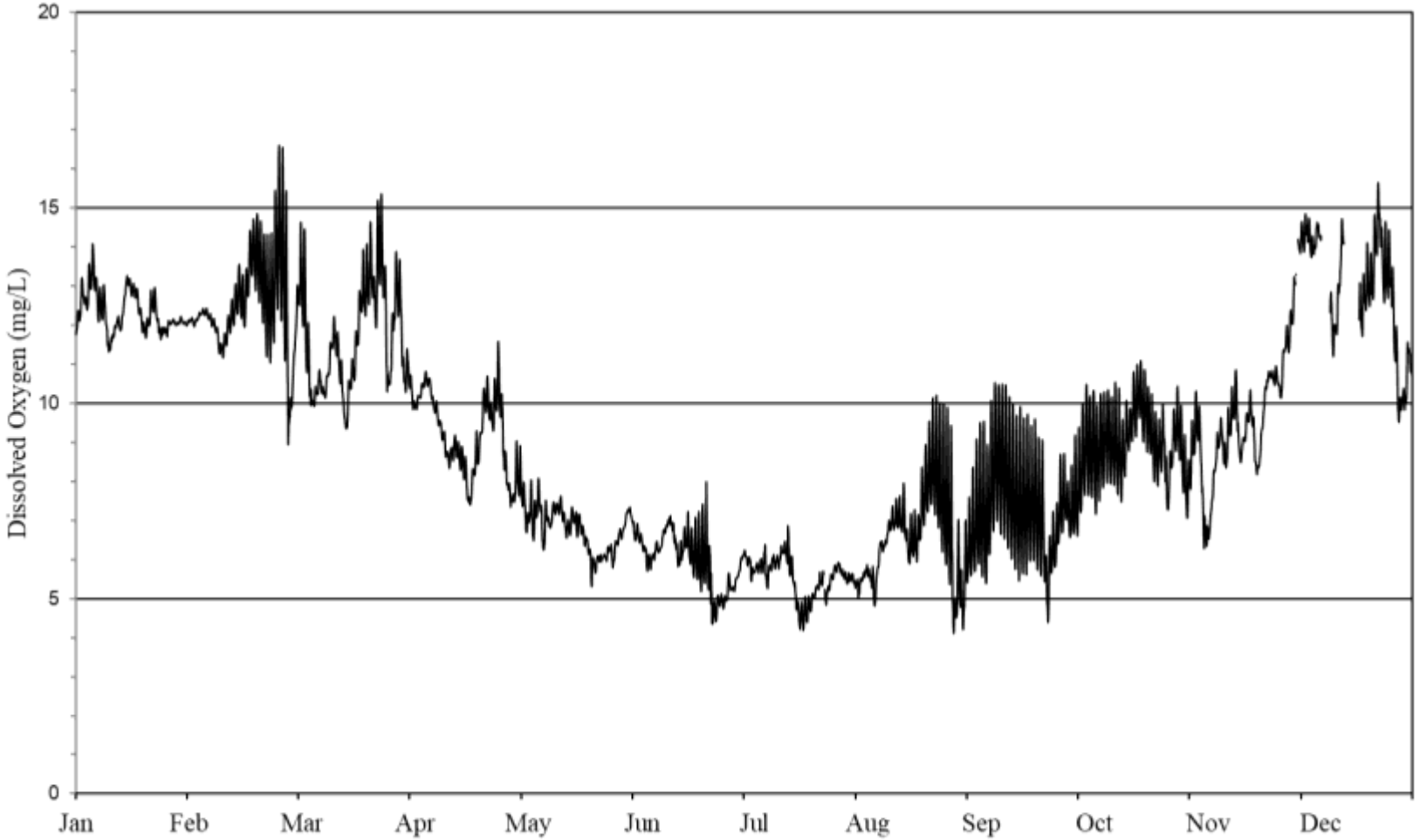


FIGURE 20: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT OGDEN AVENUE ON THE DES PLAINES RIVER FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024

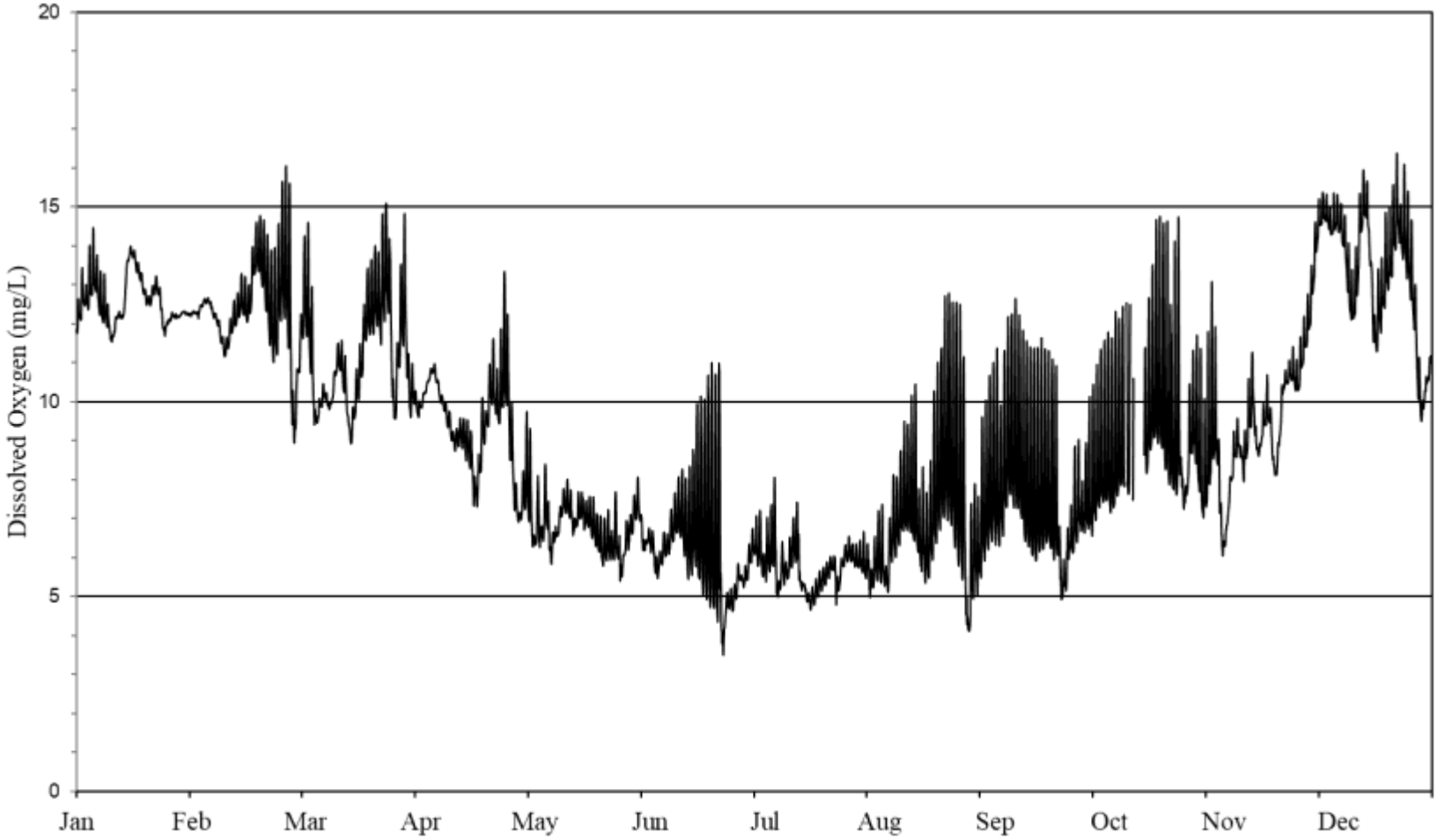
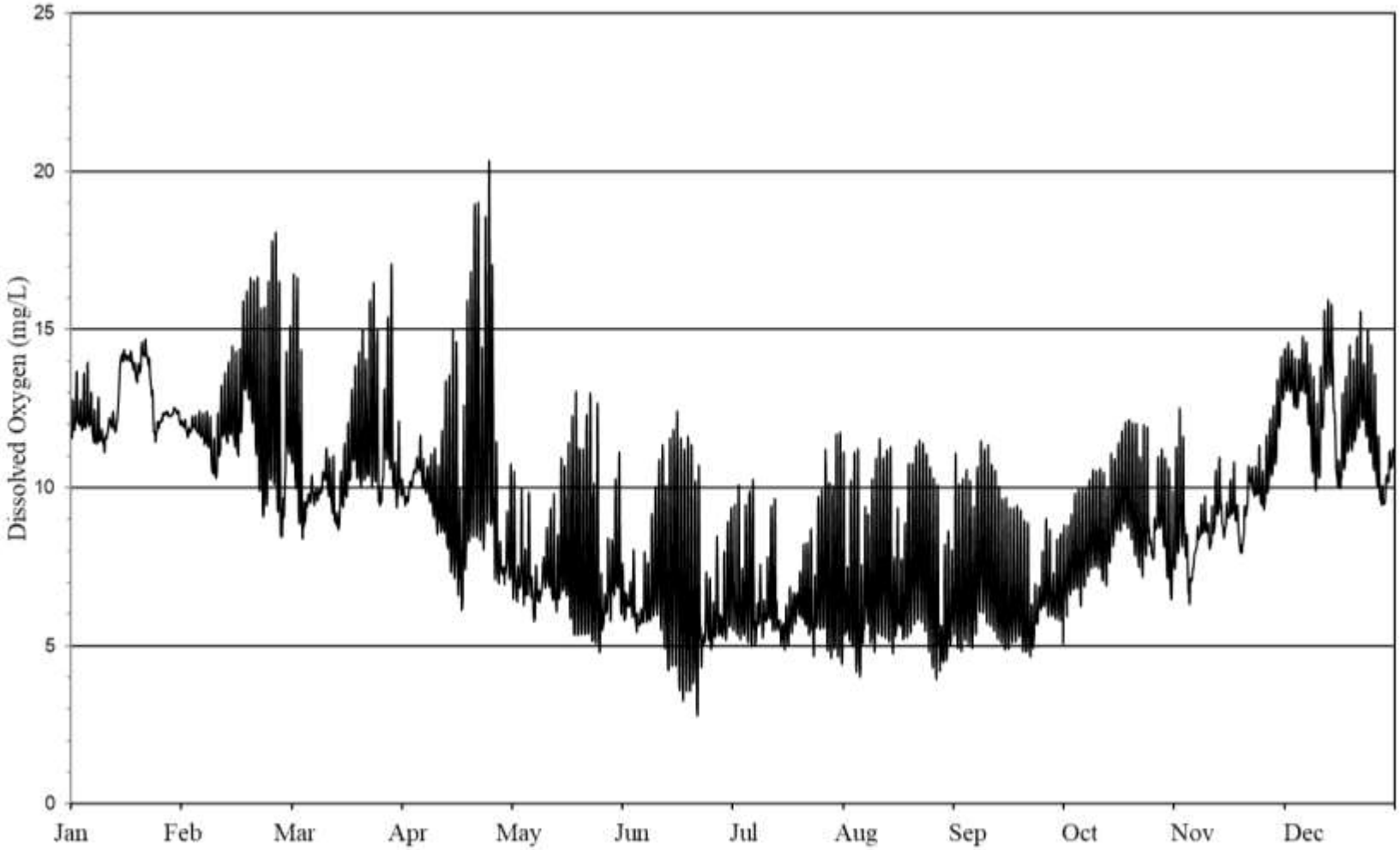


FIGURE 21: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT WOLF ROAD ON SALT CREEK FROM JANUARY 1, 2024, THROUGH DECEMBER 31, 2024



REFERENCES

Metropolitan Water Reclamation District of Greater Chicago, "Description of the Chicago Waterway System for the Use Attainability Analysis," Research and Development Department, Report Number 08-15-R, March 2008.

Pescitelli, S. and T. Widloe, "Current Status of Fish Assemblages and the Sport Fishery in the Des Plaines River Watershed – Changes Over 44 years of Basin Surveys." Illinois Department of Natural Resources, Division of Fisheries Streams Program, Plano, IL, 2018.

APPENDIX AI

SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

TABLE AI-1: SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
North Shore Channel									
Church Street									
05/09/2024	4.6	8.1	2.5	9	8.46	8.93	8.65	0.20	2.33
08/15/2024	4.0	6.4	3.6	8	6.18	7.96	7.87	0.06	0.75
10/04/2024	3.1	6.2	5.3	8	7.13	7.45	7.27	0.10	1.41
Foster Avenue									
05/09/2024	3.2	8.0	3.2	8	7.96	8.50	8.12	0.23	2.86
08/15/2024	7.9	8.6	5.4	10	6.67	6.97	6.74	0.10	1.53
10/04/2024	2.3	9.7	3.9	8	5.98	6.03	6.01	0.02	0.25
North Branch Chicago River									
Addison Street									
05/08/2024	9.2	9.3	6.0	11	7.57	7.68	7.62	0.03	0.39
08/30/2024	8.6	8.9	4.6	11	7.15	7.19	7.18	0.01	0.20
10/23/2024	8.5	9.8	5.1	11	4.90	4.95	4.92	0.02	0.36

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
North Branch Chicago River (Continued)									
Division Street									
05/08/2024	13.8	16.5	11.9	12	5.78	6.05	5.84	0.08	1.31
08/30/2024	14.9	15.9	12.2	12	7.29	7.46	7.38	0.07	0.89
10/23/2024	14.9	16.8	12.3	12	8.23	8.34	8.28	0.03	0.41
Chicago River									
Michigan Avenue									
05/16/2024	13.6	22.9	20.3	12	10.11	10.23	10.19	0.04	0.41
08/07/2024	14.4	23.3	21.3	12	7.29	7.43	7.35	0.05	0.64
10/02/2024	19.0	23.4	21.0	12	7.48	7.53	7.51	0.02	0.24
South Branch Chicago River									
Loomis Street									
05/16/2024	21.0	20.3	14.4	12	6.91	7.14	7.07	0.07	0.94
08/07/2024	15.5	21.7	15.3	12	5.46	5.76	5.58	0.10	1.79
10/02/2024	21.0	22.5	15.5	12	5.76	5.93	5.84	0.06	0.97

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
Bubbly Creek									
36th Street									
05/16/2024	3.7	5.3	5.3	8	13.49	19.51	15.63	1.90	12.16
08/07/2024	4.5	5.2	4.1	9	5.85	8.47	6.70	0.82	12.17
10/02/2024	5.9	5.9	5.9	9	8.73	11.17	10.02	0.92	9.22
Interstate Highway 55									
05/16/2024	4.9	11.8	10.3	11	10.34	13.39	11.60	0.88	7.60
08/07/2024	4.5	10.4	10.1	11	5.55	6.74	6.42	0.33	5.15
10/02/2024	4.6	11.6	10.2	11	5.13	5.38	5.26	0.08	1.48
Chicago Sanitary and Ship Canal									
Cicero Avenue									
05/23/2024	10.0	19.9	15.2	12	7.79	8.15	8.01	0.11	1.34
08/14/2024	15.0	17.6	10.8	12	9.11	10.20	9.41	0.30	3.24
10/09/2024	15.1	17.3	7.1	11	7.06	7.23	7.14	0.04	0.54

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
Chicago Sanitary and Ship Canal (Continued)									
B&O Railroad									
05/23/2024	15.3	20.4	6.2	11	6.21	6.64	6.38	0.13	1.97
08/14/2024	14.5	19.9	10.9	12	8.21	9.16	8.60	0.35	4.04
10/09/2024	14.3	17.3	11.4	12	4.12	4.53	4.33	0.13	3.03
Lockport Powerhouse									
05/15/2024	26.2	28.4	30.1	12	5.40	5.95	5.56	0.15	2.62
08/28/2024	30.6	30.0	26.6	12	6.48	6.86	6.69	0.10	1.57
10/21/2024	25.5	26.9	31.1	12	4.14	4.52	4.34	0.14	3.21
Little Calumet River									
C&W Indiana Railroad									
05/09/2024	9.8	14.8	9.9	12	5.78	7.84	6.78	0.53	7.79
08/20/2024	9.6	15.2	9.7	12	7.72	8.46	7.97	0.27	3.37
10/22/2024	9.4	15.4	10.9	12	10.37	10.62	10.50	0.08	0.76

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
Little Calumet River (Continued)									
Halsted Street									
05/29/2024	13.6	13.4	6.9	11	5.25	6.50	6.11	0.44	7.25
08/20/2024	7.5	13.1	7.9	10	7.11	7.85	7.42	0.28	3.77
10/22/2024	6.2	15.5	9.4	11	7.19	8.23	8.00	0.31	3.85
Ashland Avenue									
05/15/2024	2.3	3.1	2.9	6	6.24	6.37	6.32	0.06	0.99
09/04/2024	2.9	3.8	3.0	6	9.79	11.11	10.44	0.47	4.51
10/25/2024	3.5	3.5	2.4	6	6.78	6.95	6.98	0.07	1.02
Calumet-Sag Channel									
Cicero Avenue									
05/29/2024	5.5	14.3	9.5	11	5.40	5.57	5.47	0.06	1.07
08/20/2024	10.0	13.0	9.3	12	6.56	6.83	6.66	0.09	1.37
10/22/2024	9.4	13.6	9.2	12	7.93	8.18	8.09	0.08	0.98

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
Calumet-Sag Channel (Continued)									
Route 83									
05/23/2024	16.4	14.4	10.1	12	11.69	13.72	12.53	0.60	4.76
08/14/2024	15.0	13.5	8.5	12	6.55	8.12	7.08	0.49	6.97
10/09/2024	16.8	13.8	8.5	12	6.45	7.15	6.70	0.22	3.24
Des Plaines River									
Devon Avenue									
05/09/2024	4.2	5.0	4.6	9	6.85	6.99	6.89	0.04	0.64
08/15/2024	1.3	2.7	2.1	4	6.82	6.92	6.85	0.05	0.67
10/04/2024	1.1	1.5	0.9	3	9.10	7.54	9.34	0.13	1.44
Irving Park Road									
05/09/2024	4.2	5.4	4.6	9	7.07	7.13	7.09	0.02	0.30
08/15/2024	1.9	2.7	2.1	5	6.46	6.49	6.47	0.01	0.19
10/04/2024	0.9	1.8	1.6	3	7.86	8.06	7.94	0.10	1.31

TABLE AI-1 (Continued): SUMMARY STATISTICS FOR DISSOLVED OXYGEN MEASURED DURING CROSS-SECTIONAL SURVEYS IN 2024

Station and Date	Water Depth[1] (ft) Left	Center	Right	N[2]	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)
Des Plaines River (Continued)									
Ogden Avenue									
05/09/2024	2.8	3.4	3.0	6	6.64	6.71	6.69	0.03	0.46
08/15/2024	1.1	2.2	2.1	5	6.02	6.26	6.19	0.10	1.61
10/04/2024	1.2	1.6	1.6	3	10.17	10.52	10.31	0.19	1.82
Salt Creek									
Wolf Road									
05/13/2024	1.6	1.5	1.7	3	7.57	7.68	7.61	0.06	0.80
08/15/2024	2.0	2.5	2.2	5	5.20	5.44	5.32	0.11	2.14
10/04/2024	1.5	1.5	1.3	3	8.39	8.41	8.40	0.01	0.14

[1]Water depth at the time of cross-sectional survey. Exact measurement location may differ slightly during each event.
[2]Number of dissolved oxygen measurements across transects.