BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
WATER QUALITY STANDARDS AND	)	R08-9
EFFLUENT LIMITATIONS FOR THE	)	(Rulemaking - Water)
CHICAGO AREA WATERWAY SYSTEM	)	
AND THE LOWER DES PLAINES RIVER:	)	Subdocket C
PROPOSED AMENDMENTS TO 35 Ill.	)	
Adm. Code Parts 301, 302, 303 and 304	)	

NOTICE OF FILING

To: ALL COUNSEL OF RECORD
(Service List Attached)

PLEASE TAKE NOTICE that on the 2nd day of February, 2011, I electronically filed with the Office of the Clerk of the Illinois Pollution Control Board, the **Pre-Filed Testimony of Adrienne D. Nemura – Wet Weather Limited Use for Aquatic Life in the Chicago Area Waterway System.**

Dated: February 2, 2011.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

By: */s/ Fredric P. Andes*
One of Its Attorneys

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PROOF OF SERVICE

The undersigned attorney certifies, under penalties of perjury pursuant to 735 ILCS 5/1-109, that I caused a copy of the foregoing, **Notice of Filing** and **Pre-Filed Testimony of Adrienne D. Nemura – Wet Weather Limited Use for Aquatic Life in the Chicago Area Waterway System**, to be served via First Class Mail, postage prepaid, from One North Wacker Drive, Chicago, Illinois, on the 3rd day of February, 2011, upon the attorneys of record on the attached Service List.

/s/ David T. Ballard
David T. Ballard

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

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EFFLUENT LIMITATIONS FOR THE	)	R08-9
CHICAGO AREA WATERWAY SYSTEM	)	(Rulemaking - Water)
AND THE LOWER DES PLAINES RIVER:	)	
PROPOSED AMENDMENTS TO 35 Ill.	)	
Adm. Code Parts 301, 302, 303 and 304	)	

PRE-FILED TESTIMONY OF ADRIENNE D. NEMURA

WET WEATHER LIMITED USE FOR AQUATIC LIFE IN THE CHICAGO AREA WATERWAY SYSTEM

My name is Adrienne D. Nemura and I am presenting testimony in the matter of: "Water Quality Standards and Effluent Limitations for the Chicago Area Waterways System and Lower Des Plaines River: Proposed Amendment to 35 ILL. Adm. Code Parts 301, 302, 303 and 304 (RO8-9)." I am a consulting environmental engineer and an owner of LimnoTech, where I hold the title of Vice President. I am a registered Professional Engineer in the State of Michigan and a Board-Certified Environmental Engineer by the American Academy of Environmental Engineers. I have 26 years of experience evaluating impacts of pollutant sources on watersheds and waterways. This experience includes work while employed by the Virginia Water Control Board, the Metropolitan Washington Council of Governments, and LimnoTech.

For the last 13 years, I have worked on evaluating the impacts of sewer overflows on water quality and development of appropriate control measures to meet water quality standards. I have worked for numerous municipalities on combined sewer overflow (CSO) long-term control plans (LTCPs) and have supported the United States Environmental Protection Agency (US EPA) in developing guidance documents, training materials, and Reports to Congress on these issues. This work has included assessment of CSO impacts, evaluation of CSO control

alternatives, preparation of LTCPs, and review and revision of water quality standards, including use attainability analyses (UAAs).

I have worked for the Metropolitan Water Reclamation District of Greater Chicago (District) on dissolved oxygen and related water quality issues in the Chicago Area Waterways (CAWS) since 2004. This work has included evaluating the impact of CSOs and urban runoff on dissolved oxygen levels in the CAWS, reviewing the habitat study, and reviewing cost estimates for addressing dissolved oxygen issues in the CAWS.

Attachment 1 describes the District's proposed wet weather limited use (WWLU) provision for the CAWS. The WWLU would apply to waters receiving or otherwise affected by CSOs or other wet weather flows, and would remain in effect during and after a wet weather event. My opinions address the need for and appropriateness of a wet weather provision based on this determination and describe how the WWLU could be implemented for the CAWS.

Overview

It is my professional opinion that a wet weather provision needs to be included in the water quality standards for protection of aquatic life uses in the CAWS. This is because wet weather sources of pollution can significantly reduce dissolved oxygen (zero to three milligrams per liter) for days to weeks as a result of precipitation events. (Nemura 2008; Dennison 2008; Melching 2008; and Alp & Melching 2009). Wet weather sources of pollution to the CAWS include discharges from gravity CSOs, pump stations, municipal separate storm sewer system (MS4) outfalls, highway runoff, and runoff in tributary watersheds.

The impacts of these sources on water quality in the CAWS tend to vary from event to event and location to location, which makes it difficult and costly to implement any corrective actions (Zenz 2008 and 2011). Because it is not possible to eliminate or fully treat these wet weather sources in the foreseeable future, the impact of these events on dissolved oxygen levels

in the CAWS needs to be considered when establishing the highest attainable designated uses for these waterways. In my testimony, I describe the following:

1. Why the concept of a WWLU is appropriate;
2. How the WWLU could be generally applied to the CAWS;
3. A suggested approach using current monitoring for compliance reporting; and
4. An example of how the WWLU would be applied using data from 2001 to 2008.

1. The concept of a Wet Weather Limited Use (WWLU) designation is consistent with District findings and EPA Policy.

The proposed WWLU designation is consistent with the District's findings that applicable Illinois Pollution Control Board (IPCB) dissolved oxygen criteria for the CAWS cannot be met exclusively by advanced wastewater treatment at its three major (Calumet, North Side, and Stickney) regional water reclamation plants (WRPs) or by the capture and treatment of CSOs (MWRD 2009). The WWLU designation is consistent with information from other studies and prior testimony to the IPCB that shows that violations of the dissolved oxygen criteria proposed by the Illinois EPA will occasionally occur as a result of wet weather events, even with additional supplemental aeration, flow augmentation, or hypothetical elimination of gravity CSOs (Nemura 2008; Dennison 2008; Melching 2008; and Alp & Melching 2009).

The existing biotic community appears to tolerate periodic low dissolved oxygen levels in the CAWS that are caused by wet weather events. This is evidenced by the fact that there have been no fish kills except during extremely rare occurrences, such as the August 2006 fish kill event in the North Branch Chicago River where there was a prolonged antecedent dry period followed by a high intensity rain event after three days of high temperatures near 100 degrees F (Exhibit 47).

For the foreseeable future, CSOs and other wet weather sources will continue to impact dissolved oxygen levels in the CAWS. Testimony by the District's witnesses (Bell 2011, Mackey 2011, and Wasik 2011) indicate that the resident fish populations are able to tolerate current dissolved oxygen levels and that increasing dissolved oxygen would not result in appreciable improvements due to the habitat limitations within the CAWS. Establishing a WWLU, which recognizes that there will be periods when the dissolved oxygen criteria cannot be met, will not result in degraded water quality.

Analysis of the District's Continuous Dissolved Oxygen Monitoring (CDOM) Program data indicates that low dissolved oxygen occasionally occurs in the CAWS particularly during wet weather conditions, despite continued progress in mechanically improving dissolved oxygen conditions during dry weather and reducing CSO impacts on the CAWS. Model simulations where gravity CSOs were hypothetically eliminated showed that wet weather conditions would continue to adversely impact dissolved oxygen conditions (Nemura 2008). Therefore it is appropriate to establish a WWLU based on the existing system. This is supported by analyses of CDOM data and modeling data by the District (Dennison 2008; Attachment 1); Marquette University (Melching 2008; Alp & Melching 2009); AECOM (Zenz 2008 and 2011); LimnoTech (Bell 2011; Nemura 2008); and Mackey (2008 and 2011).

The evaluation of current fish populations and habitat limitations (Dennison 2008; Bell 2011; and Mackey 2008 and 2011) have revealed that improving dissolved oxygen conditions (in general) will not result in appreciable improvements in the resident fish population. The proposed WWLU can be re-evaluated periodically as new data become available or as additional CSO and other wet weather source controls are established for this system (Lanyon 2008).

2. Application of the WWLU designation to the CAWS

The WWLU designation would apply to waterway segments receiving or otherwise affected by CSOs or other wet weather flows and would remain in effect during, and up to a predefined maximum amount of time after a wet weather event. The amount of time would depend on the amount of rainfall falling near a segment on a particular day. The WWLU designation would apply on a segment-by-segment, event-by-event basis.

The District is proposing that a "trigger" be established to define the onset of a wet weather event during which the WWLU designation, if necessary, would be applied. The District is also proposing that the maximum duration (number of days following the start of an event) that the WWLU designation could be applied would also be established. The proposed trigger and maximum duration are shown in Table 1. (The basis for these proposals is provided in Attachment 1.) Based on an analysis of rainfall data from 2001 to 2008, there will be instances where a wet weather event will have multiple consecutive trigger days. In these instances, the maximum duration would be extended by the maximum duration following the last trigger day.

Table 1. Proposed Wet Weather Trigger and Maximum Duration for Application of the Wet Weather Limited Use Designation for the CAWS

Rainfall Trigger (Inches in a Day)	Maximum Duration After "Trigger Day" to Apply WWLU Designation
0.25 to 0.49	2 Days
0.5 to 1.0	4 Days
> 1.0	6 Days

The waterways would still need to comply with dissolved oxygen criteria if the levels are not affected by wet weather events or when the duration of wet weather impacts exceed the maximum duration specified in Table 1. The WWLU would not be applied during a wet weather event when dissolved oxygen levels were greater than or equal to the dissolved oxygen criterion.

Finally, the WWLU designation would not apply at a location for a wet weather event if the dissolved oxygen immediately preceding the start of the wet weather event was less than the criterion.

The District proposed Category 1 and Category 2 waters (Wasik 2011) would be eligible for the WWLU designation under specific conditions. These conditions include continued rainfall and ambient monitoring and reporting and operational requirements set forth in applicable permits for wet weather sources such as CSOs. The WWLU would not apply to Category 3 waters (North Branch Canal, Bubbly Creek, Grand Calumet River, and unspecified side channels and boat slips) because the narrative criteria proposed for Category 3 waters would protect the aquatic life uses for those waterways, regardless of impacts of wet weather discharges. Table 2 lists the proposed Category 1 and 2 waters and the associated minimum dissolved oxygen criteria.

Table 2. District Proposed Minimum Dissolved Oxygen Criteria for CAWS Segments

CAWS Segment	Aquatic Life Use Category	Dissolved Oxygen (mg/L)
North Shore Channel	1	4.0
Upper North Branch Chicago River	1	4.0
Lower North Branch Chicago River	2	3.5
Chicago River	2	3.5
South Branch Chicago River	2	3.5
Chicago Sanitary and Ship Canal	2	3.5
Little Calumet River	1	4.0
Calumet-Sag Channel	2	3.5

The appropriateness of the "trigger" and the maximum duration for applying a WWLU designation could be re-examined periodically. For example, the designation could be re-evaluated after major changes to the operation of the CAWS (e.g., construction of additional supplemental aeration or flow augmentation facilities or full implementation of the Tunnel and Reservoir Plan).

3. A suggested approach for compliance monitoring and reporting using existing rainfall and dissolved oxygen monitoring programs

The District would continue to operate its rainfall monitoring and CDOM Programs. The CDOM Program is reviewed on an annual basis to ensure that the District can appropriately characterize the impacts of its water reclamation plant (WRP) and CSO discharges under the NPDES permits for the North Side, Stickney, and Calumet WRPs. The rainfall monitoring and CDOM Programs are depicted in Figure 1.

The District would notify Illinois EPA in advance of any proposed changes to the current CDOM Program. The District would submit annual documentation of water quality data, including the rainfall and CDOM data, no later than March 31 of the following year. This documentation would report the events where the WWLU was exercised and any non-compliance issues associated with wet weather events (for example, wet weather events where the antecedent dissolved oxygen was less than the criteria or where an event lasted longer than the maximum duration in Table 1).

The sections below describe how the data would be collected and compared to the WWLU designation. The first section describes the rainfall and CDOM monitoring locations and data retrieval. The second section describes how the data would be compared to the proposed criteria.


CHICAGO AREA WATERWAY SYSTEM
CAWS CDOM Stations and MWRDGC Precipitation Gages
CDOM stations
For compliance
Other station
MWRDGC precipitation gages
Used for study
Other gage
Control works
Water reclamation plant
Pumping station
0 1 2 3 mi
LimnoTech
Glenview
Wilmette Pumping Station
Wilmette (4)
North Side WRP (2)
North Side Water Reclamation Plant
North Shore Channel
Lake Michigan
North Branch Pumping Station
North Branch Pumping Station (3)
North Branch Dam
Upper N Br Chicago R
Springfield (6)
MWRDGC Main Office Building (8)
Chicago
Chicago River
Chicago River Lock & Controlling Works
West Side (5)
Stickney Water Reclamation Plant
Chicago Sanitary and Ship Canal
Racine Ave. Pumping Station
Racine Ave Pumping Station (7)
87th and Western (10)
Melvina Ditch (9)
95th Street Pumping Station
95th Street Pumping Station (11)
Calumet WRP (12)
Calumet Water Reclamation Plant
Lake Calumet
Calumet-Sag Channel
Lemont Water Reclamation Plant
125th Street Pumping Station
Little Calumet R North
O'Brien Lock & Controlling Works
Lockport Controlling Works
Lockport Powerhouse & Lock
DUPAGE
COOK
WILL
ILLINOIS
INDIANA
RSW 31 Jan 2011 s:\caws\gis\maps\sampling\caws cdom and precip gages4.mxd

Monitoring Locations and Data Retrieval

Table 3 lists the rainfall gages that the District currently operates for a number of different programs. Data from the gages, which record rainfall continuously, can be retrieved for comparison to the CDOM data. The District periodically reviews the representativeness of these gages in the context of current and historical conditions, so the number and location may change over time.

Daily rainfall at these gages would be used to assess if a WWLU trigger has occurred for a CAWS segment. For example, the total daily rainfall recorded at rain gages #2 and #4 would be evaluated to estimate the rainfall contributing to wet weather discharges to the North Shore Channel.

Table 3. Assignment of Current Rain Gages for Characterizing Wet Weather Discharges to the CAWS

Rain Gage (Number)	North Side WRP (2)	North Branch Pump Station (3)	Wilmette (4)	West Side (Stickney) (5)	Racine Avenue Pump Station (7)	Main Office Bldg (8)	Melvina Ditch (9)	95th St. Pump Station (11)	Calumet WRP (12)
Rain Gage Location / CAWS Segment	3500 Howard Street, Skokie	4840 N. Francisco Avenue, Chicago	613 Sheridan Road, Wilmette	6001 W. Pershing Road, Cicero	3838 S. Racine, Chicago	100 E. Erie Street, Chicago	8644 S. Natchez Ave., Burbank	9535 S. Baltimore Ave., Chicago	400 E. 130th Street, Chicago
North Shore Channel	**2**		**4**						
Upper North Branch Chicago River	**2**	**3**				**8**			
Lower North Branch Chicago River	**2**	**3**				**8**			
Chicago River		**3**			**7**	**8**			
South Branch Chicago River				**5**	**7**	**8**			
Chicago Sanitary and Ship Canal				**5**	**7**	**8**			
Little Calumet River								**11**	**12**
Calumet-Sag Channel							**9**		**12**

Note: If a rain gage was not operational, nearby gages could be used to estimate whether wet weather discharges were affecting dissolved oxygen in a CAWS segment.

Table 4 lists the current CDOM stations that are relevant to the WWLU designation. Hourly data would be used to assess compliance with the dissolved oxygen criteria, including periods when the WWLU may apply. The monitors at the stations record dissolved oxygen levels hourly when operational (there may be periods when CDOM monitors are not operational due to ice conditions or other issues). The District periodically reviews the representativeness of these monitoring locations in the context of current and historical conditions, so the number and location of the monitors may change over time.

Table 4. Continuous Dissolved Oxygen Monitoring (CDOM) Stations for Characterizing Impact of Wet Weather Events on the CAWS

Segment	CDOM ID	CDOM Name	Latitude	Longitude	Northing	Easting
North Shore Channel	57	Foster Avenue	41.9761	-87.70476667	1934507.794	1155166.717
Upper North Branch Chicago River	6	Addison Street	41.94651017	-87.69612769	1923742.503	1157595.978
Lower North Branch Chicago River	9	Kinzie Street	41.88937675	-87.63948525	1903042.644	1173173.557
South Branch Chicago River	12	Loomis Street	41.84578333	-87.66103333	1887110.577	1167430.743
Chicago Sanitary and Ship Canal	14	Cicero Avenue	41.81948333	-87.7436	1877361.681	1144999.604
	15	B&O RR Bridge	41.78316667	-87.82566667	1863985.301	1122707.946
	19	Lockport Powerhouse	41.57128333	-88.07851667	1786472.719	1053975.403
Little Calumet River	34	C&W Indiana Harbor Belt RR	41.65043333	-87.61158333	1816036.128	1181501.503
	35	Halsted Street	41.65718333	-87.64083333	1818430.156	1173487.785
Calumet-Sag Channel	20	Route 83	41.69655216	-87.93664198	1832264.828	1092586.624

Note: If a CDOM monitor was not operational for a period of time, those hours would not be included in the wet weather limited use analysis.

Data retrieval procedures for the rainfall monitoring and CDOM Program are included in the annual reports that are provided to Illinois EPA (see for example MWRD 2009). Based on the quality assurance/quality control procedures, readings may be rejected or adjusted for drift. It can take several weeks to conduct the appropriate quality control and quality assurance checks and to align the data with the rainfall data for interpretation. Further, wet weather events can

span calendar months. This therefore makes annual (versus monthly) reporting of the WWLU designation appropriate.

Comparison of CDOM Data to Proposed Criteria

During preparation of the annual water quality report, the daily rainfall from the representative rain gages would be reviewed and compared with the CDOM data. The first step in conducting this comparison would be to assign a day as a "dry" day or a "wet" day based on total daily rainfall. Since 0.25 inches of rain in a day is the proposed minimum threshold for applying the WWLU, any days with rainfall greater than or equal to 0.25 inches would be labeled as a "wet" day. Days following the start of a rainfall that fell within the maximum duration shown in Table 1 (which is dependent on the preceding days' rainfall) would also be labeled as "wet" days. If there were overlapping "wet" events, the trigger would be reset within the "wet" period. For example, if it rained 0.3 inches on January 15, 0 inches on January 16, and 0.75 inches on January 17, each day for the period January 15 through January 21 (inclusive) would be considered a "wet" day.

The total number of times (hours) that dissolved oxygen was equal to or greater than the criteria would then be calculated for each CDOM location. Each hour would be placed in one of three bins:

- **Bin 1, Dry Weather Day:** The day was not a candidate for a WWLU designation and was considered a "dry weather" day. That is, rainfall on that day was less than 0.25 inches and the day did not fall within the maximum duration for a wet weather event (up to two, four or six days following a trigger day).
- **Bin 2, Wet Weather Day- WWLU Candidate:** The day was a candidate for a WWLU designation and the dissolved oxygen preceding the wet weather event

was greater than or equal to the criterion. Candidate days include trigger days or days that fall within the maximum duration for a wet weather event (up to two, four or six days following a trigger day).

- **Bin 3, Wet Weather Day- WWLU Excluded:** Hours associated with "wet" days could be placed in this bin if the day was a candidate for a WWLU designation but failed because the dissolved oxygen immediately preceding the wet weather event was less than the criterion.

Bins 1 and 3 would further be sub-divided into two bins each - compliance and non-compliance - based on a comparison of the hourly dissolved oxygen level to the criteria in Table 2. For example, hours in Bin 1 (dry weather) could either be greater than or equal to the dissolved oxygen criterion (resulting in compliance) or less than the criterion (resulting in non-compliance). Non-compliance would consist of dissolved oxygen levels during hours that occurred during dry weather periods or during wet weather periods when the WWLU could not be applied (for example, due to low levels of dissolved oxygen that immediately preceded a wet weather event). For accounting purposes, the actual number of hours Bin 2 days were less than the dry weather standard would also be noted.

Percent compliance with the dissolved oxygen criteria would then be calculated for each of these six categories based on the total number of hours in the bin divided by the total number of hours that the CDOM probe was operational and producing valid data at a station. This would result in five different compliance statistics as shown in the right-hand column of Table 5.

Table 5.Compliance Statistics for Proposed Reporting of the Wet Weather Limited Use Designation for the CAWS

Hour is in Bin #	Dissolved Oxygen Levels are	Compliance Statistic As Percent (%) of Time
Hours in Compliance		
1 (Dry Weather Day)	Greater than or equal to the criterion	Dry Hours Above the Water Quality Criteria
2 (WWLU Candidate)	Greater than or equal to the criterion	Wet Hours Above the Water Quality Criteria
3 (WWLU Excluded)	Greater than or equal to the criterion	
Hours where Wet Weather Limited (WWLU) Use is Needed		
2 (WWLU Candidate)	Less than the criterion	Wet Hours Below the Water Quality Criteria (WWLU Needed)
Hours in Non-Compliance		
3 (WWLU Excluded)	Less than the criterion	Wet Hours Below the Water Quality Criteria (WWLU Excluded)
1 (Dry Weather Day)	Less than the criterion	Dry Hours Below the Water Quality Criteria

4. An example application to data collected between 2001 and 2008 shows that the WWLU designation would be applied infrequently and therefore should not adversely affect the resident community of aquatic life.

The procedures described above were applied to the CDOM and rainfall data for 2001 to 2008. Table 6 shows that the WWLU designation would have, in general, been exercised less than 10 percent of the time at any given station (with the exception of Main Street on the North Shore Channel). Under the District's proposal, this location will receive additional treatment which could improve dissolved oxygen conditions during dry and wet weather (Zenz 2011). Further, the District's evaluation of the results of the CDOM Program found that CSOs do not impact all of the CAWS at the same time or in the same manner following rain events, which may explain why fish are able to avoid the low dissolved oxygen pockets (Alp and Melching 2009, Dennison 2008).

Table 6. Percent of Hours when Proposed Wet Weather Limited Use would have been Exercised from Calendar Years 2001 to 2008

CAWS Segment	CDOM Location	Minimum	Maximum
North Shore Channel	Main Street	1.4%	18.9%
	Foster Avenue	0.0%	0.1%
Upper North Branch Chicago River	Addison Street	0.1%	0.5%
Lower North Branch Chicago River	Fullerton Avenue	0.2%	1.9%
	Kinzie Street	0.4%	1.5%
Chicago River	Clark Street	0.0%	0.7%
South Branch Chicago River	Loomis Street	0.0%	1.6%
Chicago Sanitary and Ship Canal	Cicero Avenue	1.7%	10.8%
	B&O RR Bridge	0.0%	1.7%
	Route 83	1.1%	8.2%
	Lockport Powerhouse	1.9%	7.4%
Little Calumet River	C&W Indiana Harbor Belt RR	0.0%	2.5%
	Halsted Street	0.0%	1.5%
Calumet-Sag Channel	Cicero Avenue	0.1%	2.3%
	104th Avenue	0.0%	7.0%
	Route 83	0.4%	3.7%

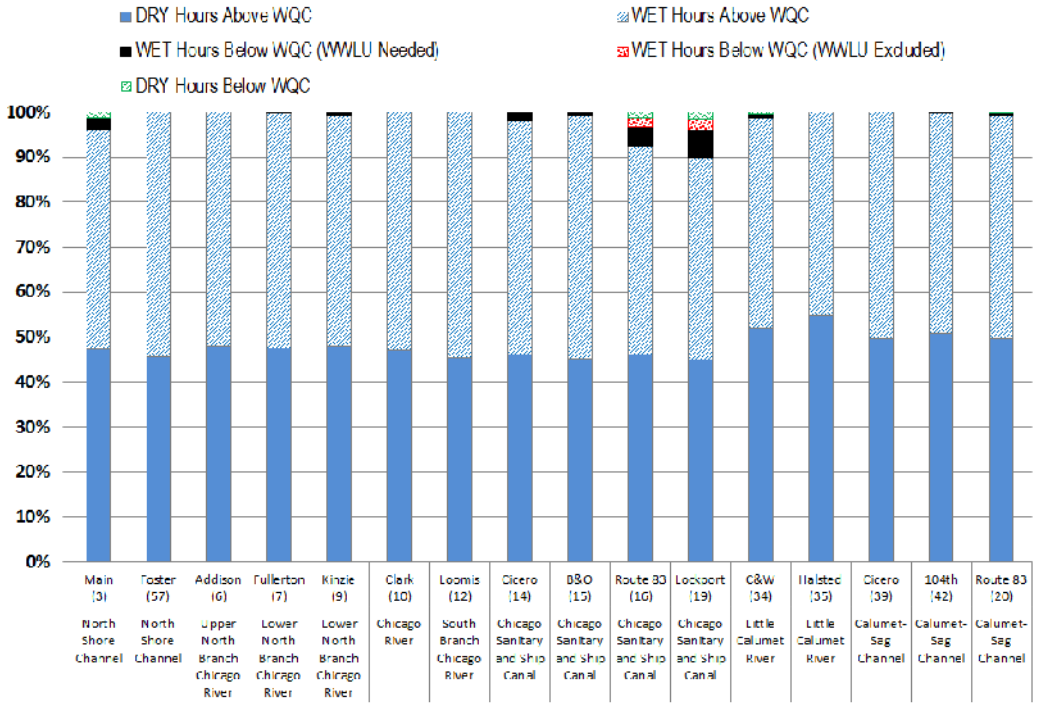
The years 2001 to 2008 included a wide variety of rainfall conditions. An analysis of rainfall data from 1997 to 2007 indicated that 2001 was a relatively "wet" year and 2003 was a relatively "dry" year (Melching 2008). The year 2006 was chosen to illustrate the calculation of the proposed compliance statistics described in the previous section; 2006 rainfall conditions were somewhere in between the representative wet and dry years that were modeled by Dr. Melching in his analysis.

Table 7 presents the results of the a comparison of the rainfall and CDOM data for calendar year 2006 to the proposed water quality standards, including the WWLU described above. The table provides each CDOM location that was operational, and the total number of "dry" and "wet" hours. The percentage of the total hours for each compliance statistic in Table 5 is then presented. This information is depicted graphically in Figure 2.

Table 7. Comparison of CDOM Data for 2006 to Proposed Criteria for the CAWS

CDOM Name	Count of Hours			Compliance Statistic as Percent of Time				
	Dry Hours	Wet Hours	Total Hours	Dry Hours Above the WQC	Wet Hours Above the WQC	Wet Hours Below the WQC (WWLU Needed)	Wet Hours Below the WQC (WWLU Excluded)	Dry Hours Below the WQC
Main Street	3,945	4,188	8,133	47.2%	48.8%	**2.7%**	0.0%	1.3%
Foster Avenue	3,830	4,594	8,424	45.5%	54.5%	**0.0%**	0.0%	0.0%
Addison Street	4,116	4,479	8,595	47.9%	52.0%	**0.1%**	0.0%	0.0%
Fullerton Avenue	3,997	4,425	8,422	47.4%	52.3%	**0.3%**	0.0%	0.0%
Kinzie Street	4,199	4,559	8,758	47.8%	51.4%	**0.6%**	0.0%	0.1%
Clark Street	3,950	4,449	8,399	47.0%	53.0%	**0.0%**	0.0%	0.0%
Loomis Street	3,959	4,799	8,758	45.2%	54.6%	**0.2%**	0.0%	0.0%
Cicero Avenue	3,960	4,631	8,591	45.9%	52.2%	**1.7%**	0.0%	0.2%
B&O RR Bridge	3,958	4,798	8,756	45.2%	54.1%	**0.7%**	0.0%	0.0%
Route 83	3,262	3,637	6,899	45.9%	46.6%	**4.0%**	2.1%	1.4%
Lockport Powerhouse	3,936	4,480	8,416	44.9%	44.8%	**6.0%**	2.4%	1.8%
C&W RR	4,508	4,077	8,585	51.8%	46.6%	**0.9%**	0.0%	0.7%
Halsted Street	4,606	3,811	8,417	54.7%	45.2%	**0.1%**	0.0%	0.0%
Cicero Avenue	4,248	4,339	8,587	49.4%	50.4%	**0.1%**	0.0%	0.0%
104th Avenue	3,648	3,537	7,185	50.7%	48.8%	**0.4%**	0.0%	0.0%
Route 83	4,367	4,389	8,756	49.5%	49.7%	**0.4%**	0.0%	0.4%

Figure 2. Dissolved Oxygen Compliance Statistics for CDOM Stations in 2006 with Proposed Water Quality Standards



As shown in Table 7 and Figure 2, the need for the WWLU will vary location to location. Also, there may be instances when the dissolved oxygen levels that are less than the proposed criteria in wet weather were candidates for the WWLU but were excluded because the dissolved oxygen levels were less than the criteria prior to the start of the event. Likewise, there may be "dry" weather measurements that followed a wet weather event but were outside of the maximum duration specified in Table 1. Therefore, it will be important to note these instances in the proposed annual reports for review with the Illinois EPA to distinguish between wet and dry weather compliance issues.

Summary

I therefore find the concept of a WWLU, as described above and in Attachment 1, necessary and appropriate for protection of the resident fish community in the CAWS.

Respectfully submitted,

By: Adrienne D. Nemura
LimnoTech

Testimony Attachments

Attachment 1. WET WEATHER LIMITED USE DESIGNATION: Determination of Wet Weather Limited Use Application

REFERENCES

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Lanyon, R. 2008. Pre-Filed Testimony of Richard Lanyon. [Exhibit 60]

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
WATER QUALITY STANDARDS AND	)	
EFFLUENT LIMITATIONS FOR THE	)	R08-9
CHICAGO AREA WATERWAY SYSTEM	)	(Rulemaking - Water)
AND THE LOWER DES PLAINES RIVER:	)	
PROPOSED AMENDMENTS TO 35 Ill.	)	
Adm. Code Parts 301, 302, 303 and 304	)	

ATTACHMENT 1 TO

PRE-FILED TESTIMONY OF ADRIENNE D. NEMURA

WET WEATHER LIMITED USE DESIGNATION
Determination of Wet Weather Limited Use Application

To determine wet weather limited use (WWLU) hours for a segment using available information, historical dissolved oxygen (DO) data from the District's Continuous Dissolved Oxygen Monitoring (CDOM) program along with combined sewer overflow (CSO) records and rainfall data from the District's rain gages were analyzed. The purpose of the analysis was to: 1) identify a simple, consistent "trigger" to indicate when application of WWLU designation would begin; 2) identify a time period in which the WWLU designation would apply following a "trigger" as the wet weather period; and 3) compute the hours when DO was below the proposed standards during the wet weather periods determined in steps 1 and 2 on a yearly basis.

DO data collected from 2001 to 2008 from eight monitoring locations throughout the Chicago Area Waterways (CAWS), one for each waterway segment, were used in the analysis. These data were combined with daily rainfall, local/gravity CSO and pump station CSO data. The rainfall and CSO data were associated to a specific monitoring location. The rainfall measured at any gage in the area of the particular location was used in the evaluation. For a CSO

occurrence to be associated with one of the locations, it had to occur upstream of the location. Pump station CSO data were available for all years. Local/gravity CSO data were available for 2002 to 2008. Table 1 contains a list of the monitoring locations used and the rainfall gages that were associated with them.

Upon review of the data, it was apparent that DO concentrations in the waterways are affected following rainfall and CSO events. Steps were taken to identify a consistent trigger that could be used to indicate when application of the WWLU designation could begin. These steps included evaluating a number of trigger scenarios. The trigger scenarios that were evaluated are listed in Table 2 along with comments on why they did or did not make an ideal trigger. The scenario that was most appropriate and could be applied the most consistently was rainfall greater than or equal to 0.25 inch.

Once the trigger of 0.25 inch of rainfall was determined to be appropriate, the time period that the WWLU designation would apply following the trigger had to be determined. Two options were evaluated. One option, determining the number of hours to compliance following non-compliance, proved to be difficult to track because of adjacent rain events. The option of using the numbers of days following a trigger proved effective. Further analyses were then performed using the 2001 through 2008 DO and rainfall data along with the 0.25 inch trigger to determine specific and relevant days the WWLU designation period would have applied.

TABLE 1 MONITORING LOCATIONS USED IN ANALYSIS ALONG WITH RAIN GAGES ASSOCIATED WITH EACH LOCATION

Monitoring Location	Rainfall Gage ID*
Main Street (North Shore Channel)	4 (Wilmette) 2 (North Side WRP)
Addison Street (Upper North Branch Chicago River)	2 (North Side WRP) 3 (North Branch PS) 8 (100 E. Erie)
Fullerton Ave. (Lower North Branch Chicago River)	2 (North Side WRP) 3 (North Branch PS) 8 (100 E. Erie)
Clark Ave. (Chicago River)	3 (North Branch PS) 8 (100 E. Erie) 7 (Racine PS)
Loomis (South Branch Chicago River)	8 (100 E. Erie) 7 (Racine PS) 5 (Stickney WRP)
Cicero Ave. (Chicago Sanitary and Ship Canal)	8 (100 E. Erie) 7 (Racine PS) 5 (Stickney WRP)
C&W RR (Little Calumet River North)	11 (95^{th} St. PS) 12 (Calumet WRP)
RT 83 (Calumet-Sag Channel)	12 (Calumet WRP) 9 (Melvina)

Note: WRP = water reclamation plant; PS = pump station.

TABLE 2 SCENARIOS EVALUATED FOR SELECTING A TRIGGER

Scenario No.	Trigger	Comments
1	Rainfall ≥ 0.05 inch	Rainfall of slightly above 0.05 inch hardly results in a significant increase in flow to a WRP. DO data generally showed that decreases in DO at rainfall around 0.05 inch were rare.
2	Rainfall ≥ 0.1 inch	Rainfall approximately 0.1 inch results in noticeable increase in flow to a WRP, indicating runoff to a combined sewer system. But, practical maximum flow at the WRP typically lasts no more than a few hours if rainfall is slightly above 0.1 inch. DO data generally showed that decreases in DO could happen, but were not common at rainfall of approximately 0.1 inch, if no prior rainfall or CSO occurred around the same time.
3	Rainfall ≥ 0.25 inch	Rainfall greater than or equal to 0.25 inch generally results in practical maximum flow at the WRPs from a few hours to more than a day depending on the duration of the rainfall. Local/gravity CSOs start to take place at rainfall of approximately 0.25 inch. Data generally showed DO decreases in the waterway were common at rainfall equal to or greater than 0.25 inch.
4	Plant Flow (in area of waterway) ≥ Practical Maximum Flow	Stickney and Calumet WRPs receive Tunnel and Reservoir Plan (TARP) pump back, so high flows may be observed on days during dry periods. Also, depending on what time of day rainfall commences, the daily average flow may be less than maximum practical flow while still resulting in the need to apply the WWLU designation.
5	Pump Station CSO	While this may appear to be an ideal trigger, local/gravity CSOs occur more often than pump station CSOs, particularly at lower rainfall amounts (< 0.5 inch). Using only pump station CSOs would ignore the impact from local/gravity CSOs.
6	Pump Station CSO and Local/Gravity CSO	Some local/gravity CSOs are not monitored, while the accuracy of other local/gravity CSOs could be questionable because of the telemetry signals, which makes the information less reliable.

To determine the period of days, first the total number of triggers were determined for a given location and year. Three locations were chosen, one in each of the north, south, and west areas of the system, so that the results could be applied system wide for the CAWS. Next, each trigger was evaluated closely and the following noted: (1) the amount of rainfall resulting in a trigger, (2) whether the trigger resulted in non-compliant DO concentrations, (3) if so, how many days the non-compliance lasted, (4) whether there were local/gravity CSO events, and (5) whether there were pump station CSO events. During this analysis in which the period of days for applying WWLU was determined, only those triggers resulting in DO below the criterion due to wet weather that could be attributed to that specific trigger were used. For example, if three triggers occurred within three or four consecutive days and it was unclear which trigger resulted in DO below the criterion, the triggers were omitted from the analysis.

Once the data were summarized, they were sorted by increasing rainfall amounts. Three groupings were created based on observed similarities. The first group included rainfall amounts from 0.25 to 0.49 inches. These rainfall amounts resulted in CSO discharges of relatively low duration. For rainfall amounts of 0.25 to 0.49 inches, roughly 21 percent resulted in pump station CSO and 16 percent resulted in local/gravity CSO. This range of rainfall amounts also resulted in a smaller number of days after the trigger in which DO concentrations below the criterion occurred, ranging between 0 and 9 days with a 70^{th} percentile of 2 days. Rainfall amounts between 0.5 and 0.99 inches, resulted in roughly 59 percent pump station CSOs and 76 percent in local/gravity CSOs. For the 0.5 and 0.99 inches range, the number of days following the day after the trigger in which DO concentrations fell below criterion was longer, ranging between 0 and 12 days with a 70^{th} percentile of 4 days. The last group included rainfall greater than 1.0 inch. CSO occurrences were very common, with 80 percent of the triggers resulting in

pump station CSOs and 81 percent in local/gravity CSOs. This group also had the longest number of days following the day after the trigger in which DO concentrations fell below criterion ranging between 1 and 14 with a 70th percentile of 6 days. Plots showing the frequency of occurrence of the days in which DO concentrations fell below criterion following a trigger (2, 4, and 6 days) for the three groupings increased sharply after the 70th percentile, indicating that the days above this percentile where less likely to occur. The 70th percentiles were then set as a maximum allowable time period that the WWLU designation could apply (during the trigger day and up to 2, 4, and 6 days after the trigger day). As a check, the period criteria were evaluated for other locations throughout the system. The criteria fit well with the other data.

Based on the wet weather criteria from the previous analyses, as summarized in Table 3, the WWLU hours were determined by summing the hours in which DO concentrations were below the corresponding District proposed DO standards during the wet weather periods for each year in 2001 through 2008. Only a small percent of the proposed wet weather "triggers" (between 0 and 20 percent) resulted in the application of WWLU designation at most of the locations and for most of the years analyzed. In the last 8 years, more than 20 percent of the total number of the proposed wet weather triggers in a year occurred a few times in the North Shore Channel, likely due to its stagnant nature, and a few times in the Chicago Sanitary & Ship Canal, likely due to wet weather discharges upstream.

TABLE 3 CRITERIA FOR APPLYING WET WEATHER LIMITED USE DESIGNATION

Trigger (Rainfall in Inches)	Days After a Trigger WWLU Designation May Apply
0.25 - 0.49	2 Days
0.50 to 0.99	4 Days
> 1.0	6 Days

In summary, wet weather impact on the water quality of the CAWS is inevitable due to CSOs and other wet weather sources in the Chicago metropolitan area. However, this impact varies event by event and location by location because of many factors like rainfall amounts, characteristics of wet weather flows, and of the travel time for these flows in the waterway. The criteria for the application of the WWLU designation, however, provide a clear and consistent method for applying the designation.