ILLINOIS POLLUTION CONTROL BOARD
November 7, 2019

MIDWEST GENERATION, LLC,	)	
	)	
Petitioner,	)	
	)	
v.	)	PCB 18-58
	)	(Thermal Demonstration)
ILLINOIS ENVIRONMENTAL	)	
PROTECTION AGENCY,	)	
	)	
Respondent.	)	

OPINION AND ORDER OF THE BOARD (by A. Palivos):

This case concerns the discharge of heated wastewater to the Chicago Sanitary and Ship Canal (CSSC) from a coal-fired electric generating facility. The facility, Will County Electric Generating Station (WCGS), is owned by Midwest Generation, LLC (MWG) and located at river mile 295.6 on the western bank of the CSSC's Lower Lockport Pool in Romeoville, Will County. WCGS withdraws water from the CSSC to cool and condense steam from its generating units before discharging the heated wastewater back to the CSSC.

MWG petitioned the Board for relief from thermal effluent limitations that are based on the Board's temperature water quality standards (35 Ill. Adm. Code 302.408(c)–(f) and (h)). MWG also seeks relief from the Board's zone-of-passage requirements for mixing zones (35 Ill. Adm. Code 302.102(b)(8)). MWG asks that the Board grant "alternative thermal effluent limitations," including an alternative zone of passage, as allowed under the federal Clean Water Act (CWA) (33 U.S.C. § 1326(a)) and the Board's regulations (35 Ill. Adm. Code 304.141(c); 35 Ill. Adm. Code 106.Subpart K). The Illinois Environmental Protection Agency (IEPA) recommends that the Board grant MWG's request. The Illinois Department of Natural Resources (IDNR) concurs with IEPA's recommendation.

Based on this record, the Board finds that MWG's demonstrations satisfy the legal standards for receiving the requested relief. First, the proposed alternative thermal effluent limitations will assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in and on the CSSC near WCGS. Second, for the WCGS discharge, the applicable thermal effluent limitations are more stringent than necessary to assure the protection and propagation of that community. Therefore, the Board grants MWG alternative thermal effluent limitations, including an alternative zone of passage. The Board directs IEPA to include these alternative thermal effluent limitations in WCGS' National Pollutant Discharge Elimination System (NPDES) permit.

GUIDE TO THE OPINION

The Board's opinion begins with procedural history, both pre- and post-petition (pp. 3–6), followed by the case's factual background (pp. 6–13). Next, the Board addresses the legal background relevant to MWG's request, including statutory and regulatory authorities (pp. 13–14). The Board then presents the temperature water quality standards and zone-of-passage requirements (pp. 14–16), MWG's requested alternative thermal effluent limitations (p. 16–19), and the burden of proof (pp. 19–20).

After that, the opinion turns to the Board's discussion, which is divided between this case's two primary issues. First, the opinion addresses whether MWG has demonstrated that its proposed alternative thermal effluent limitations will assure the protection and propagation of balanced, indigenous communities (pp. 20–69). In this first part of the discussion, the Board:

- Summarizes MWG's "Master Rationale" (pp. 21–24);
- Reviews MWG's biotic category identification (pp. 24–35);
- Reviews MWG's retrospective demonstration (pp. 35–37);
- Reviews MWG's predictive demonstration (pp. 37–54);
- Analyzes the biotic category criteria (pp. 55–66); and
- Analyzes MWG's Master Rationale (pp. 66–70).

In these sections, the Board's analysis is based on draft guidance for demonstrations under Section 316(a) of the CWA (33 U.S.C. § 1326(a)). This guidance, prepared by the United States Environmental Protection Agency (USEPA), is entitled <u>Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Section of Nuclear Facilities Environmental Impact Statements (DRAFT)</u>, May 1, 1977 (USEPA 316(a) Manual). MWG requests relief under authorities including Section 316(a) of the CWA, and the Board considers the USEPA 316(a) Manual a useful and instructive guide for its analysis of the petition. *See* 35 Ill. Adm. Code 106.1120(e).

In the second part of the discussion, the Board addresses whether MWG has demonstrated that the effluent limitations based on the applicable thermal water quality standards are more stringent than necessary (pp. 70–73). This discussion includes the Board's analysis of:

- Numeric temperature water quality standards under Section 302.408(h) (pp. 70);
- "Excursion" hours under Section 302.408(f) (pp. 70–71);
- The minimum zone of passage left by the thermal mixing zone under Section 302.102(b)(8) (pp. 71–72); and
- Temperature fluctuations under the "narrative" temperature water quality standards of Sections 302.408(c), (d), and (e) (pp. 72–73).

After these analyses, the Board states its conclusion and issues its order (pp. 73–75).

Abbreviations and Acronyms Used in the Opinion	
ACRCC	Asian Carp Regional Coordinating Committee
ALU B	Chicago Area Waterway System and Brandon Pool Aquatic Life Use B
CAWS	Chicago Area Waterway System
cfs	cubic feet per second
Corps	United States Army Corp of Engineers
CSOs	combined sewer overflows
CSSC	Chicago Sanitary and Ship Canal
CWA	Clean Water Act
EA Engineering	EA Engineering Science and Technology, Inc.
Electric Barrier	Aquatic Nuisance Species Dispersal Barrier
HMS	Hanson Material Service
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
INHS	Illinois Natural History Survey
IWBmod	Modified Index of Well-Being
Mg/L	milligrams per liter
MW	megawatt
MWG	Midwest Generation LLC
MWRDCG	Metropolitan Water Reclamation District of Greater Chicago
NPDES	National Pollutant Discharge Elimination System
NPDES Permit	National Pollutant Discharge Elimination System permit No. IL 0002208
POTW	publicly owned treatment works
QHEI	Qualitative Habitat Evaluation Index
USEPA	United States Environmental Protection Agency
WCGS	Will County Electric Generating Station

PROCEDURAL BACKGROUND

Pre-Petition Communications

Early Screening Information and Detailed Study Plan

Before filing a petition for alternative thermal limitations, a petitioner must submit early screening information to IEPA. 35 Ill. Adm. Code 106.1115(a). Within 30 days after submitting the information, the petitioner must consult with IEPA on that information. 35 Ill. Adm. Code 106.1115(b). Then, the petitioner must submit a detailed plan of study to support its request. 35 Ill. Adm. Code 106.1120(a).

MWG states that within six months after the Board adopted the thermal water quality standards for the CSSC, MWG satisfied the requirements for both the early screening and the detailed plan of study. Petition (Pet.) at 2–3. MWG submitted a proposal for its "Detailed Study Plan" in support of the WCGS "316(a) Demonstration" to both IEPA and IDNR on December 5, 2015. *Id*. at 11. IEPA approved the Detailed Study Plan by correspondence dated March 3,

2016. *Id*., Exhibit (Exh.) 1 at 1. IDNR provided two substantive comments on the Detailed Study Plan. MWG addressed those comments to IDNR's satisfaction. *Id*., Exh. 2 at 1. To expedite completion of the Detailed Study Plan, MWG consulted IEPA and USEPA in November 2016 concerning sources of habitat and fisheries data. Pet. at 3, 11. With approval from IEPA and USEPA, MWG revised the Detailed Study Plan and resubmitted it to IEPA on December 5, 2016. IEPA approved the modified Detailed Study Plan on December 12, 2016. *Id*.; Exh. 3.

Completed Demonstration

After receiving IEPA's approval, MWG implemented its Detailed Study Plan. *See* 35 Ill. Adm. Code 106.1120(g). After completing the 316(a) Demonstration report, MWG submitted it to IEPA for comment. To address IEPA's comments, MWG revised the 316(a) Demonstration report before filing it with the Board on January 26, 2018, as part of its petition. Pet. at 3. MWG also submitted a copy of the 316(a) Demonstration report to USEPA on January 10, 2018, but USEPA did not provide any comments. *Id*.

In its recommendation (IEPA Rec.) on the petition, IEPA states that IDNR and USEPA were informed that MWG filed its petition with the Board. IEPA Rec. at 9. On January 30, 2018, IDNR and USEPA were provided with a link to the Board's website and informed of the March 12, 2018 deadline for IEPA to file its recommendation. *Id*.

Petition to the Board

On January 26, 2018, MWG filed its petition requesting alternative thermal effluent limitations—including an alternative zone of passage—for WCGS' heated discharge. *See* 35 Ill. Adm. Code 106.1125, 106.1130. MWG's petition attached six exhibits:

- Exhibit 1: Letter dated March 3, 2016, from IEPA (Exh. 1);
- Exhibit 2: Email correspondence (and attachments) ending with June 9, 2016 email from IDNR (Exh. 2);
- Exhibit 3: Revised Demonstration Study Plan dated December 5, 2016 (Exh. 3);
- Exhibit 4: Will County Station 316(a) Demonstration (Exh. 4);
- Exhibit 5: Will County Generating Station NPDES Permit (Exh. 5); and
- Exhibit 6: List of Planned and Emergency Shutdowns from Previous Five Years (Exh. 6).

MWG's Exhibit 4, the 316(a) Demonstration report, provides a narrative summary of its eight supporting appendices:

- Appendix A – Description of the CSSC (Exh. 4, App. A);
- Appendix B – Biothermal Prospective Assessment (Exh. 4, App. B);
- Appendix C – Retrospective Assessment (Exh. 4, App. C);
- Appendix D – Station Operations and Hydrothermal Analysis (Exh. 4, App. D);
- Appendix E – Data Collection Programs (Exh. 4, App. E);
- Appendix F – 2016 Upper Illinois Waterway Fisheries Investigation (Exh. 4, App. F);

- Appendix G – 2015 Upper Illinois Waterway Fisheries Investigation (Exh. 4, App. G); and
- Appendix H – 2011 WCGS Thermal Plume Surveys (Exh. 4, App. H).

Notice and Hearing

MWG served a copy of its petition on IEPA and IDNR. *See* 35 Ill. Adm. Code 106.1125. MWG timely filed a certification of publication on February 6, 2018, indicating that notice of the petition was published on January 31, 2018, in the *Herald-News*. *See* 35 Ill. Adm. Code 106.1140. By order of March 22, 2018, the Board found that MWG's petition notice satisfied the timing and content requirements of the Board's rules. *See* 35 Ill. Adm. Code 106.1135(a), (b). Any request for a public hearing was due by February 21, 2018, which was the 21st day after the publication date. 35 Ill. Adm. Code 106.1150 (any person may request a public hearing). The Board did not receive a request to hold a public hearing and did not hold one.

IEPA Recommendation

IEPA timely filed its recommendation with the Board on March 12, 2018. *See* 35 Ill. Adm. Code 106.1145(a), (b). IEPA recommends granting MWG's requested relief. IEPA Rec. at 3. IEPA agrees that the proposed alternative thermal effluent limitations are more stringent than the formerly applicable "Secondary Contact and Indigenous Aquatic Life Use" temperature water quality standards. *Id*. at 4-6. IEPA states that MWG's 316(a) Demonstration shows there is no evidence of appreciable harm to the balanced indigenous community over the past 20 years, despite the former, less-stringent water quality standards applying and WCGS operating more units. *Id*. at 4. It is therefore logical, according to IEPA, that the proposed, more-stringent alternative thermal effluent limitations also should not result in appreciable harm. *Id*. at 6. IEPA also states that it is comfortable with the proposed alternative zone of passage. *Id*. MWG timely filed its response on March 26, 2018 (MWG Resp.1), concurring with IEPA's recommendation (*id*. at 2). *See* 35 Ill. Adm. Code 106.1145(c). No one else responded to IEPA's recommendation. *Id*. (Board rules allow any interested person to file a response).

Board Questions to MWG

The Board's March 22, 2018 order stated that the Board "may submit questions to MWG through a Board or hearing officer order." Midwest Generation LLC v. IEPA, PCB 18-58, slip op. at 1 (Mar. 22, 2018). On November 21, 2018, the Board's hearing officer issued an order with questions for MWG regarding the petition and its exhibits. The order directed MWG to file responses by December 21, 2018. After receiving an extension, MWG timely filed its responses (MWG Resp.2) on January 11, 2019.

On April 5, 2019, the Board's hearing officer issued a second order with additional questions for MWG, directing MWG to file its responses by April 19, 2019. MWG timely filed its responses to the second set of questions on April 15, 2019.

IDNR Response and Additional Board Questions

IDNR filed a response to IEPA's recommendation (IDNR Resp.1) on April 2, 2018, concurring with IEPA on the protection of threatened and endangered species. IDNR Resp.1 at 3. However, IDNR stated that it was unable to confirm any conclusions on the merits of IEPA's recommendation concerning MWG's *modified* Detailed Study Plan for assessing the maintenance of a balanced, indigenous community of shellfish, fish, and wildlife. *Id.* IDNR explained that it was not informed of MWG's December 2016 request for IEPA to approve modifications to the Detailed Study Plan—the one IDNR had approved in June 2016. *Id.* at 2–3.

A May 9, 2018 hearing officer order directed IDNR to respond to Board questions seeking clarification of IDNR's position. On May 14, 2018, IDNR clarified its position (IDNR Resp.2). Specifically, after review of the record and discussions with IEPA and MWG, IDNR concurred with the conclusions in IEPA's recommendation. IDNR Resp.2 at 3. IDNR agreed that the modifications to the Detailed Study Plan—regarding the use of fisheries and habitat data—are justified. *Id.*

FACTUAL BACKGROUND

Description of Station and Cooling System

Station, Generating Capacity, Fuel, Load Factor, Estimated Retirement, and Shutdowns

WCGS is a coal-fired electric generating facility located at river mile 295.6 on the CSSC in Romeoville, Will County. Pet. at 5; Exh. 4, App. A, Figure A-1. At its peak, WCGS consisted of four generating units with a total generating capacity of 1,163 megawatts (MW). Pet. at 5. As of the petition's filing, only one of the four units remained active. Units 1 and 2 (167 MW each), which started operations in 1955, were retired in late 2010. *Id.* at 5–6. Unit 3 (278 MW), which began operation in 1957, was deactivated in early 2015, though it could resume operations. *Id.* Only Unit 4 (551 MW), which began operation in 1963, is currently active. *Id.* at 6. WCGS is estimated to retire in 2034. *Id.* at 8.

MWG listed the "load factors"[1] experienced over the five years before the petition's filing, as well as the load factors projected for the five years following the petition's filing:

Year	**2013**	**2014**	**2015**	**2016**	**2017****
Load Factor	58.1%	61.1%	54.7%	47.2%	9.6%
Number of Units Operating	2	2	1–2*	1	1
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Load Factor	40.0%	45.2%	38.8%	28.5%	28.6%

[1] For background, "load factor" refers to "[t]he ratio of the average load to peak load during a specified time interval." U.S. Energy Information Administration, Glossary at https://www.eia.gov/tools/glossary/index.php?id=L (last visited Oct. 15, 2019).

* Unit 4 operated throughout 2015, but Unit 3 ceased operation in April 2015.
** Unit 4 experienced an extended outage in 2017 that was projected to last from April 2017 to February 2018, which accounts for the significantly lower load factor in 2017.

Pet. at 7.

From 2013 through 2017, Units 3 and 4 were shut down for a combined outage of 604 days, not including "the days that Unit 3 has been deactivated"—from April 29, 2015, to the petition's filing. Pet. at 8. Through 2022, Unit 4 was planned to be shut down from January 26, 2018 to February 28, 2018 (33 days) and from April 27, 2019 to May 6, 2019 (9 days). *Id.*

Cooling System and Heat Dissipation

Since it began operations in 1955, WCGS has operated with a "once-through" circulating water system for condenser cooling. Pet. at 8. Under its current single-unit operation, Unit 4 draws water from an intake structure in the Lower Lockport Pool of the CSSC at river mile 295.6. *Id.* When in operation, Unit 3 draws water from a separate, but immediately adjacent, intake structure. *Id.* Both intakes are flush with the canal shoreline and are designed to withdraw water from the entire water column. *Id.* The CSSC is the WCGS' only source of cooling water. *Id.*

Once drawn, this water passes through WCGS' heat exchangers to cool and condense steam from the coal-fired electric generating process. Pet. at 8–9. The cooling water is designed to pass through the system at a rate of 395,842 gallons per minute. *Id.* The design temperature rise of the Unit 4 cooling-water discharge is 11.1°F and is similar for Unit 3. *Id.* WCGS maintains its condenser tubes through dehumidification, which involves isolating and drying individual intake water boxes with residual heat. *Id.* No chemicals are used in this process. *Id.* MWG states that this practice is "more environmentally benign" than using chlorination. *Id.*

The circulated cooling water is discharged as heated effluent directly back into the CSSC through an approximately 250-foot discharge canal. Pet. at 9; Exh. 4 at 2-5.[2] This discharge canal from Units 3 and 4 (and previously Units 1 and 2 as well) is located at the downstream end of the WCGS property and oriented in a downstream position adjacent to the CSSC wall. *Id*. There are no flow-controlling structures or gates for the discharge canal. *Id*.

The discharge's thermal plume into the CSSC is surficial in nature, as demonstrated by the cross-section vertical profiles south of the outfall. Exh. 2 at 7; Exh. 4, App. D at D-32. MWG explains:

> The WCGS discharge canal is relatively short, narrow, and approximately half the depth (or less) of the main canal channel. All of these characteristics serve to increase the overall exit velocity of the thermal discharge, as well as maintain its

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[2] "Effluent" means "any wastewater discharged, directly or indirectly, to the waters of the State or to any storm sewer . . . ." 35 Ill. Adm. Code 301.275.

> surficial character . . . . [B]ecause the mixing occurs primarily in the upper water column, a zone of passage is maintained for aquatic life in lower depths. The high velocity of the discharge helps to ensure that the surface plume is distributed across the surface of the waterway. MWG Resp.2 at 2.

The exit velocity is at least 1.5 times greater than the average velocity of the CSSC. *Id.* Additionally, barge traffic and erratic changes in CSSC flow promote surficial mixing. *Id.* MWG continues:

> Maintaining the thermal plume near the surface is more beneficial in terms of providing a zone of passage . . . . A buoyant plume provides cooler temperatures at greater depth than occur at the surface, allowing fish to move under and/or around critical water temperatures that may be outside of their preferred range. *Id.* at 3.

WCGS has no supplemental cooling mechanisms. Pet. at 6–7. The property lacks enough space to install helper towers that would significantly reduce discharge temperature. *Id*. MWG indicates that it would require significant capital investments to provide closed-cycle cooling, approximately $257 million in 2011 dollars. *Id*. Additionally, MWG notes that installing any type of diffuser structure—to further enhance thermal mixing or otherwise dissipate heat more quickly—would not be feasible. *Id*. Because the CSSC is used for navigation, no diffuser structure that extends into the CSSC would be allowed. *Id*. MWG adds that a diffuser would not better protect the balanced, indigenous community because distributing the thermal load more evenly across the water column would reduce the zone of passage. MWG Resp.2 at 3–4.

NPDES Permit and Thermal Compliance History

WCGS discharges heated wastewater under NPDES Permit No. IL0002208 (NPDES Permit), issued by IEPA on May 15, 2014, as modified April 24, 2017. Exh. 5. The discharge is subject to the thermal limitations in Special Condition 4 of the NPDES Permit. *Id*. at 8. Special Condition 4.A provides that at the edge of the allowed 26-acre mixing zone, "temperatures shall not exceed 93°F (34°C) more than 5% of the time, or 100°F (37.8°C) at any time." *Id*.[3]

MWG states that, for 2013 through 2017, WCGS has complied with the existing thermal discharge limitations and conditions in the NPDES Permit. Pet. at 11. MWG uses the "Near-

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[3] "Mixing Zone" means "a portion of the waters of the State identified as a region within which mixing is allowed pursuant to Section 302.102(d) of this Part." 35 Ill. Adm. Code 302.100 (definitions). Section 302.102(d) provides in part that "[u]pon proof by the applicant that a proposed mixing zone conforms with the requirements of Section 39 of the Act, this section and any additional limitations as may be imposed by the [CWA], the Act or Board regulations, [IEPA] shall, pursuant to Section 39(b) of the Act, include within the NPDES permit a condition defining the mixing zone." 35 Ill. Adm. Code 302.102(d). Generally, water quality standards must be met "at every point outside of the area and volume of the receiving water within which mixing is allowed." 35 Ill. Adm. Code 302.102(c).

Field Thermal Compliance Model" to determine the water temperature in the CSSC at the edge of the 26-acre mixing zone, as provided for by Special Condition 4.D.1 of the NPDES Permit. *Id*. at 10. MWG explains:

> The Near-Field Thermal Model utilizes real-time station operating data and 24-hour antecedent flow to calculate fully mixed temperatures in the main body of the waterway . . . . The results produced by the Near-Field Thermal Model have been demonstrated to be equivalent to the approximate edge of the allowed 26-acre mixing zone for WCGS. *Id*.

Additionally, the Near-Field Thermal Compliance Model is "designed to allow for the accounting and reporting of excursion hour use." Exh. 4, App. D. "The Excel-based Near-Field Thermal Compliance Matrix can be used by station personnel on an as-needed basis to ensure that compliance with the Secondary Contact [and Indigenous Aquatic Life] thermal standards is maintained under current receiving stream conditions." *Id*., Exh. D at 2.

Although not included in this requested relief, WCGS' thermal discharge is also subject to Special Conditions 4.B and 4.C of the NPDES Permit, which provide alternate temperature limitations that apply in the main channel of the Lower Des Plaines River at the I-55 Bridge, downstream of the CSSC. Pet. at 10. These alternate thermal standards were requested by ComEd, the previous owner of WCGS, and granted by the Board as an adjusted standard under 35 Ill. Adm. Code 304.141(c) and CWA Section 316(a). *Id*., *citing* Petition of Commonwealth Edison Company for Adjusted Standard from 35 Ill. Adm. Code 302.211(d) and (e), AS 96-10 (Oct. 3, 1996) (amended Mar. 16, 2000, to substitute MWG). Special Conditions 4.B and 4.C applied to the operations of four additional MWG generating stations: Joliet #9; Joliet #29; Crawford; and Fisk. Pet. at 10. The Joliet stations and WCGS, however, are the only stations still operating. *Id*. Also, Joliet #9 and #29 were converted from coal-fueled to natural gas in 2016 and are now operated as "peaking facilities", *i.e.*, only during peak system electrical demand. *Id*. Accordingly, Crawford, Fisk, Joliet #9, and Joliet #29 no longer contribute to the thermal loading in the CSSC and Des Plaines River.

WCGS explains that demonstration studies to evaluate the new operating mode of the Joliet stations commenced in 2017 and are still in progress. Pet. at 10–11. It is necessary to study the thermal discharges from both WCGS and the Joliet stations to determine whether the I-55 Bridge alternate thermal effluent limitations are still needed. *Id*. at 11. MWG intends to evaluate that issue as part of the Section 316(a) demonstration studies for the Joliet stations, and did not request in this petition any modification to Special Conditions 4.B and 4.C. *Id*.

Ecological Setting

Hydrology

WCGS is located adjacent to, and discharges heated effluent to, the CSSC. The CSSC is part of the Chicago Area Waterway System (CAWS), defined in 35 Ill. Adm. Code 302.Subpart D. The CAWS consists of 78 miles of canals that "serve the Chicago area for drainage of urban stormwater runoff, treatment of municipal wastewater effluent, and support of commercial navigation." Exh. 4, App. A at A-1. About 75% of the length of the CAWS consists of constructed canals where no water existed previously, including the CSSC. *Id.*

The CSSC is a segment of the Illinois Waterway, which is a continuous navigation route—constructed to be at least 9 feet deep and 300 feet wide—from Lake Michigan to the Mississippi River. Exh. 4, App. A at A-2. This channel runs through the Chicago River, the CSSC, the Des Plaines River, and the Illinois River. *Id.* The Illinois Waterway has seven major locks and dams, including the Lockport Lock and Dam, which is near WCGS, approximately five miles downstream at river mile 291.1. *Id.* The Chicago River and the Cal-Sag Channel, which is another constructed waterway, are the only major tributaries to the CSSC. *Id.* The confluence of the Cal-Sag Channel and the CSSC is approximately eight miles upstream of WCGS at river mile 303.5. *Id.* This succession of constructed pools, coupled with frequent flow and level fluctuations controlled by the locks and dams (to manage commercial use of the waterway and prevent flooding), "creates a dynamic which largely dictates the type of aquatic life that can inhabit the [CAWS and Upper Illinois Waterway]." *Id.*

The mean annual flow in the CSSC is 2,480 cubic feet per second (cfs). Exh. 4, App. A at A-2 (measured 2006–2015). The 7-day, 10-year (7Q10) low flow for this portion of the CAWS is 1,315 cfs. *Id.*[4] Three large publicly-owned treatment works (POTWs) discharge into the CAWS, "which essentially dictates the base flow of the system." *Id.* But, abrupt and frequent fluctuations, on the order of three to five feet or more, are "most common during or immediately preceding predicted rainfall events." *Id.* Lowering canal level provides additional capacity to handle stormwater flows from runoff and combined sewer overflows (CSOs). *Id.*[5]

<u>Water Quality</u>

MWG states:

> There are a wide variety of both historical and present-day sources of pollutants found in Lockport Pool as a consequence of historical and current use for industrial and commercial navigation purposes, as well as conveyance of [POTW] effluents, [CSOs], and stormwater run-off. As a result, the water has been contaminated by these sources along the canal . . . . Exh. 4, App. A at A-12 (citation omitted).

The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) has had a long-term monitoring program in the CSSC, collecting data describing the presence, spatial distribution, and temporal variability of dissolved oxygen; concentrations of both naturally-

[4] "The 7Q10 is the lowest 7-day average flow that occurs (on average) once every 10 years." USEPA, Environmental Modeling Community of Practice, Definition and Characteristics of Low Flows, https://www.epa.gov/ceam/definition-and-characteristics-low-flows#1Q10 (last visited Oct. 15, 2019).

[5] "Combined Sewer" means "a sewer designed and constructed to receive both wastewater and land runoff." 35 Ill. Adm. Code 301.255.

occurring and anthropomorphic nutrients; organics; heavy metals; and water transparency. Exh. 4, App. A at A-17 (citing MWRD.org); Exh. 4, App. A, Table A-1. MWG also monitors pH, total residual chlorine, organics, and heavy metals in its discharge under the terms of the NPDES Permit. Exh. 4, App. A at A-22; Exh. 5 at 10 (Special Condition 11).

Temperature. The dry-weather flow in the CSSC is dominated by the discharge from MWRDGC's Stickney wastewater treatment plant. MWG Resp.2 at 30. Accordingly, the ambient temperature profile in the CSSC reflects the temperature of the treated wastewater from the Stickney POTW, which is cooler in the summer and warmer in the winter than a natural waterway. *Id*. MWG explains that "[t]he addition of heat from the operation of WCGS does not constitute a large change in the overall temperature regime, especially outside of the allowed mixing zone." *Id*. Annual mean water temperatures measured five miles upstream of WCGS (2005–2015) ranged from a high of 63.3°F in 2007 to a low of 57.9°F in 2013. Exh. 4, App. A, Table A-1. Temperatures 3.5 miles downstream of WCGS ranged from a high of 67.6°F in 2007 to a low of 60.4°F in 2014. *Id*. Over the ten-year period, both upstream and downstream temperatures have shown a generally decreasing trend with decreasing thermal loadings. Upstream, the Crawford and Fisk electrical generating stations became inactive in 2012; downstream, WCGS operations transitioned from four units (2000–2010) to two units (2011–2014), and then to one unit (2015–2016). *Id*.; Pet. at 23; Exh. 4 at 6-12, 6-13.

Dissolved Oxygen. The concentration and presence or absence of dissolved oxygen has "a dramatic impact on the distribution and abundance of fish and other aquatic life." Exh. 4, App. A at A-16. Under the Board's water quality standards for the CSSC adjacent to WCGS, dissolved oxygen must never be less than 3.5 milligrams per liter (mg/L) and must meet a 4.0 mg/L daily minimum averaged over seven days. *Id*. at A-17.

MWRDGC has sampling locations located 4.5 river miles upstream of WCGS and 4.9 river miles downstream of WCGS—at Stephen Street and Lockport Powerhouse, respectively. Exh. 4, App. A at A-17. Annual mean dissolved oxygen concentrations at the Stephen Street monitoring station (2005–2015) ranged from 5.4 to 7.0 mg/L. *Id.* For the same period, the Lockport Powerhouse location had annual mean dissolved oxygen concentrations ranging from 5.5 to 6.3 mg/L. *Id.*

Nutrients. The urban, industrial, and commercial nature of the constructed CSSC "leads to elevated levels of many nutrients by means of surface run-off." Exh. 4, App. A at A-19. In addition, located upstream of WCGS and contributing to higher nutrient concentrations in the CSSC are also several large POTWs, including the world's largest water reclamation plant (MWRDGC's Stickney POTW), as well as hundreds of CSOs. *Id.* Data for the nutrient parameters monitored by the MWRDGC are described below.

Nitrogen in surface water may be present in organic and inorganic forms. Exh. 4, App. A at A-19. Runoff from areas with "intensive cultivation or large livestock densities is an important source of nitrogen to waterways primarily in more rural areas." *Id.* In addition, industrial discharges and municipal wastewater effluents may contain "high concentrations of inorganic nitrogen, especially ammonia or nitrate nitrogen." *Id.* Over 2005–2015, data collected from MWRDGC water monitoring stations, upstream and downstream of WCGS, reported annual mean concentrations of total Kjeldahl nitrogen ranging from 1.33 mg/L to 1.76 mg/L upstream and from 1.29 mg/L to 1.67 mg/L downstream. *Id.* at Table A-1.

Phosphorus is "an essential plant nutrient within freshwater systems and a major element affecting eutrophication." Exh. 4, App. A at A-20. Excess phosphorus can cause "too much aquatic plant growth and algae blooms, sometimes choking off waterways and causing toxic or oxygen-poor conditions that can lead to fish kills and affect other aquatic life." *Id.* In general, wastewater treatment plant discharges, along with urban and agricultural nonpoint sources, are "major contributors of phosphorus." Exh. 4, App. A at A-20. Based on data from the MWRDGC's water quality monitoring program (2005 to 2015), total phosphorous annual mean concentrations in the CSSC ranged from 0.764 to 1.350 mg/L upstream of WCGS and from 0.827 to 1.263 mg/L downstream. Exh. 4, App. A, Table A-1.

MWG also discussed general trends in total suspended solids, organics, and heavy metals in the CSSC. Exh. 4, App. A at A-21 toA-24.

Aquatic Habitat

MWG states:

> Aquatic habitat is inherently limited in the CAWS by the system's form and function. Habitat in the CAWS is significantly limited by the design of the CAWS, most of which is manmade. The manmade reaches of the CAWS were built to support wastewater effluent conveyance and commercial navigation. The reaches that were once natural streams have been heavily modified to serve these purposes and the changes are unlikely to be reversed as long as the CAWS needs to serve these functions. The form and uses of the CAWS impose severe limitations on physical habitat in the system. Exh. 4, App. A at A-34 (citation omitted).

The CSSC around WCGS is "entirely vertical rock walled and uniform in character, without shallows, side-channels, or backwaters." Exh. 4, App. A at A-3. The CSSC's depth ranges from 14 to 27 feet, maintained by the downstream lock and dam at Lockport. *Id.* The immediate area around WCGS has almost no in-stream cover or rooted aquatic vegetation. *Id.* Hardpan substrates and silt covered bedrock characterize most of the area. *Id.* But, some limited areas of cobble and gravel exist, including the WCGS discharge canal, which is "more lotic in nature and consists of a short, constructed channel cut into the vertical canal wall which is scoured by the swift discharge current." *Id*.

The types of habitat that would contribute to "the diversity and quality of overall aquatic habitat" are not present in the Lockport Pool or are spatially limited. Exh. 4, App. A at A-33. Shallow littoral zone habitat is important to many aquatic species but it is "virtually non-existent" at the shoreline around WCGS. *Id*. at A-34. The closest littoral habitat is more than two miles downstream of the WCGS discharge, near the Route 7 Bridge and just downstream of the Lockport Controlling Works. *Id*.; Exh. 4, App. C, Figure C-1.

Generally, habitat in the Lockport Pool around WCGS is poor for six reasons:

> 1) the lack of riffle/run habitat; 2) sparse amounts of clean, hard substrates (i.e., gravel and cobble); 3) excessive siltation, particularly in the scarce, shallow littoral zone areas; 4) channelization; 5) poor riparian and floodplain quality; and 6) a general lack of instream cover, except for macrophytes in the limited shallow littoral zone areas. Exh. 4, App. A at A-33 (citation omitted); *see also* Exh. 4, App. C, Fig. C-1 and C-2.

LEGAL BACKGROUND

It is unlawful for any person to discharge a pollutant from a point source into waters of the United States without a permit under the CWA. 33 U.S.C. § 1311(a). Because heat is a pollutant (33 U.S.C. § 1362(6)), heated discharges require a permit. In general, discharge limitations in a permit are technology-based or water-quality based. 33 U.S.C. § 1311(b). Technology-based effluent limits generally are developed for an industry and reflect the "best available technology economically achievable." 33 U.S.C. § 1311(b)(2)(A); *see*, *e.g.*, 40 C.F.R. Parts 405–471.

Water quality-based effluent limits ensure that water quality standards are met regardless of technology or economics considered in establishing technology-based limits. Water quality-based effluent limits are defined as "any more stringent limitation, including those necessary to meet water quality standards, treatment standards, or schedules of compliance, established pursuant to any State law or regulations . . . or any other Federal law or regulation, or required to implement any applicable water quality standard." 33 U.S.C. § 1311(b)(1)(C).

Thus, if a discharge from a point source interferes with attainment or maintenance of a water quality standard, an effluent limitation is established for that discharge, regardless of any other technology-based standard. 33 U.S.C. §§ 1311(b)(1)(C), 1312(a); *see also* 35 Ill. Adm. Code 304.105 (Violation of Water Quality Standards). Water quality standards are set under authority provided in Section 303 of the CWA (33 U.S.C. § 1313). Illinois law authorizes the Board to adopt water quality standards, including thermal standards. 415 ILCS 5/13 (2018). The Board has done so, and the Board's water quality temperature standards for the CAWS are found at 35 Ill. Adm. Code 302.408.

Since adoption of the CWA in 1972, Section 316(a) has allowed a point source with a thermal discharge to obtain relief from otherwise applicable thermal effluent limitations. Specifically, CWA Section 316(a) provides:

> With respect to any point source otherwise subject to the provisions of section 1311 of this title or section 1316 of this title, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any discharge from such source will require effluent limitations more stringent than necessary to assure the pro[t]ection and propagation of a balanced, indigenous population of

> shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator (or, if appropriate, the State) may impose an effluent limitation under such sections for such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water. 33 U.S.C. § 1326 (Thermal Discharges).

Accordingly, Section 304.141(c)[6] of the Board's rules provides:

> The standards of this Chapter shall apply to thermal discharges unless, after public notice and opportunity for public hearing, in accordance with section 316 of the CWA, and applicable federal regulations, and procedures in 35 Ill. Adm. Code 106.Subpart K, the Board has determined that different standards shall apply to a particular thermal discharge. 35 Ill. Adm. Code 304.141(c).

Therefore, under Section 316(a) of the CWA and 35 Ill. Adm. Code 304.141(c), the Board may establish "alternative thermal effluent limitations" based on a demonstration that the alternate limits will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the receiving water. Part 106, Subpart K of the Board's rules provides for review of a petition for an alternative thermal effluent limitation. 35 Ill. Adm. Code 106.1100–106.1180. The establishment of alternative thermal effluent limitations is not a change in the water quality standard.

In 1977, USEPA issued a draft manual on demonstrations under CWA Section 316(a). This "USEPA 316(a) Manual" provides that it "is intended to be used as a general guidance and as a starting point for discussions," and that delegated state agencies "are not rigidly bound by the contents of this document." USEPA 316(a) Manual at 8–9. This USEPA guidance remains a draft. Nevertheless, the Board has found that the "decision criteria" in the USEPA 316(a) Manual are a useful guide for the Board's analysis, and the Board has followed guidance's decision-making outline. Exelon Generation LLC v. IEPA, PCB 14-123, slip op. at 2 (Sept. 18, 2014). Further, Section 106.1120 of the Board's rules requires a petitioner seeking alternative thermal effluent relief to consider guidance published by USEPA in making its demonstration. *See* 35 Ill. Adm. Code 106.1120(e). In 1979, USEPA promulgated rules implementing CWA Section 316(a) which are codified at 40 C.F.R. 125.Subpart H.

TEMPERATURE WATER QUALITY STANDARDS AND ZONE-OF-PASSAGE REQUIREMENTS

The CSSC was formerly designated as "Secondary Contact and Indigenous Aquatic Life" waters. *See* Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304, R08-9(A), slip op. at 22 (Aug. 18, 2011) (repealed 35 Ill. Adm. Code 303.441).

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[6] The Board originally codified the rule on August 29, 1974, as Rule 410(c) of Chapter 3 of its water pollution regulations.

The CSSC is now designated as "Chicago Area Waterway System and Brandon Pool Aquatic Life Use B" (ALU B) waters. 35 Ill. Adm. Code 303.240(c)(1).

MWG's NPDES Permit Special Condition 4.A (Exh. 5 at 8) reflects the now-replaced Secondary Contact and Indigenous Aquatic Life temperature standards for the CSSC: "Temperature (STORET number (º F) 00011 and (º C) 00010) shall not exceed 34º C (93º F) more than 5% of the time, or 37.8º C (100º F) at any time." Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304, R08-9(D), slip op. at 57 (June 18, 2015) (former 35 Ill. Adm. Code 302.408). These same temperature standards continued to apply to ALU B waters, including the CSSC, for three years, from July 1, 2015 until July 1, 2018:

> The temperature standards in subsections (c) through (i) will become applicable beginning July 1, 2018. Starting July 1, 2015, the waters designated at 35 Ill. Adm. Code 303 as Chicago Area Waterway System Aquatic Life Use A, Chicago Area Waterway System and Brandon Pool Aquatic Life Use B, and Upper Dresden Island Pool Aquatic Life Use will not exceed temperature (STORET number (º-F) 00011 and (º-C) 00010) of 34º C (93º F) more than 5% of the time, or 37.8º C (100º F) at any time. 35 Ill. Adm. Code 302.408(b).

MWG seeks relief from effluent limits based on the ALU B temperature standards at subsections (c)–(f) and (h) of Section 302.408:

> (c) There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.
>
> (d) The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.
>
> (e) The maximum temperature rise above natural temperatures shall not exceed 2.8° C (5° F).
>
> (f) Water temperature at representative locations in the main river shall not exceed the maximum limits in the applicable table in subsections (g), (h) and (i), during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature exceed the maximum limits in the applicable table that follows by more than 1.7° C (3.0° F)[.]
>
> ***
>
> (h) Water temperature in the Chicago Area Waterway System and Brandon Pool Aquatic Life Use B waters listed in 35 Ill. Adm. Code 303.240, shall not exceed the limits in the following table in accordance with subsection (f):

Months	Daily Maximum (°F)
January	60
February	60
March	60
April	90
May	90
June	90
July	90
August	90
September	90
October	90
November	90
December	60

35 Ill. Adm. Code 302.408(c)–(f), (h).

These current ALU B temperature standards therefore include not only numeric limits with excursion hours (subsections (f) and (h)), but also narrative limits (subsections (c), (d), and (e)).

MWG also requests relief from effluent limits based on the zone-of-passage requirements in the Board's mixing zone regulations at subsection (b)(8) of Section 302.102:

b) The portion, volume and area of any receiving waters within which mixing is allowed pursuant to subsection (a) shall be limited by the following:

***

8) The area and volume in which mixing occurs, alone or in combination with other areas and volumes of mixing must not contain more than 25% of the cross-sectional area or volume of flow of a stream . . . . 35 Ill. Adm. Code 302.102(b)(8).

MIDWEST GENERATION'S PROPOSED ALTERNATIVE THERMAL EFFLUENT LIMITATIONS

MWG's petition proposed the following alternative thermal effluent limitations:

(1) Water temperature at the representative locations in the Chicago Sanitary and Ship Canal shall not exceed the maximum limits listed below for more than 5% of the time in a calendar year. Moreover, at no time shall water temperature exceed the daily maximum limit by more than 1.7°C (3°F).

(2) A zone of passage for aquatic life in which the proposed thermal alternative effluent limits are met shall be maintained at 50% or greater at all times.

(3) Proposed Numeric Thermal Alternative Effluent Limits for Will County Generating Station:

Month	Daily Maximum (°F)
January	70
February	70
March	75
April	80
May	85
June	93
July	93
August	93
September	93
October	90
November	85
December	75

Pet. at 25.

MWG states that these proposed alternative thermal effluent limits would be effective at the edge of the 26-acre mixing zone. Pet. at 26. Further, they would "effectively replace the function of" ALU B's narrative criteria for the CSSC near WCGS. *Id*.

The following tables compare the prior and current temperature limits under the Board's regulations with those proposed by MWG, as well as the Board's zone-of passage requirements with the alternative proposed by MWG:

Numeric Temperature Limits			
Month	**Secondary Contact & Indigenous Aquatic Life (pre-7/1/15) & "Interim" ALU B (7/1/15–6/30/18)**[7]	**ALU B (post-6/30/18)**[8]	**MWG's Proposal**[9]
	Daily Maximum	Daily Maximum	Daily Maximum
	(°F)	(°F)	(°F)
Jan.	93	60	70

[7] Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304, R08-9(D), slip op. at 57–58 (June 18, 2015).

[8] 35 Ill. Adm. Code 302.408(f), (h).

[9] Pet. at 25.

Feb.	93	60	70
Mar.	93	60	75
Apr.	93	90	80
May	93	90	85
June	93	90	93
July	93	90	93
Aug.	93	90	93
Sept.	93	90	93
Oct.	93	90	90
Nov.	93	90	85
Dec.	93	60	75
Excursion Hours	Must not exceed numeric limit more than 5% of the time or 100º F ever.	Must not exceed numeric limits more than 1% of the hours in the 12-month period ending with any month. And, must never exceed any numeric limit by more than 3.0°F.[10]	Must not exceed numeric limits more than 5% of the time in a calendar year. And, must never exceed any numeric limit by more than 3°F.

Narrative Temperature Limits		
Secondary Contact & Indigenous Aquatic Life (pre-7/1/15) & ALU B (7/1/15–6/30/18)	**ALU B (post-6/30/18)**[11]	**MWG's Proposal**[12]
None	There must be no abnormal temperature changes that may adversely affect aquatic life unless	None

[10] Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304, R08-9(D), slip op. at 78 (Mar. 19, 2015) (for ALU B waters, the Board intended to adopt "3°F" from the General Use temperature standards at 35 Ill. Adm. Code 302.211(e)).

[11] 35 Ill. Adm. Code 302.408(c)–(e).

[12] Pet. at 18, 25–26.

	caused by natural conditions. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes must be maintained. The maximum temperature rise above natural temperatures must not exceed 5°F.	

Zone-of-Passage	
Section 302.102(b)(8)[13]	**MWG's Proposal**[14]
At least 75%, but if the dilution ratio[15] is less than 3:1, at least 50%	At least 50%

BURDEN OF PROOF

The burden of proof is on MWG. 35 Ill. Adm. Code 106.1160(a). MWG must demonstrate that the otherwise applicable thermal effluent limitations based on temperature water quality standards (35 Ill. Adm. Code 302.408(c)–(e), (h)) and zone-of-passage requirements (35 Ill. Adm. Code 302.102(b)(8)) are "more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made." 35 Ill. Adm. Code 106.1160(b); *see also* 40 C.F.R. § 125.73(a). MWG must also demonstrate that the requested alternative thermal effluent limitations, "considering the cumulative impact of its thermal

[13] 35 Ill. Adm. Code 302.102(b)(8).

[14] Pet. at 25.

[15] "Dilution Ratio" means "the ratio of the seven-day once in ten year low flow of the receiving stream or the lowest flow of the receiving stream when effluent discharge is expected to occur, whichever is greater, to the average flow of the treatment works for the design year." 35 Ill. Adm. Code 301.270.

discharge, together with all other significant impacts on the species affected, will assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made." 35 Ill. Adm. Code 106.1160(c); *see also* 40 C.F.R. § 125.73(a).

An *existing* discharger may base its demonstration on the absence of prior appreciable harm instead of using "predictive" studies. 35 Ill. Adm. Code 106.1160(d). This "retrospective" demonstration must show either:

> A) That no appreciable harm has resulted from the normal component of the discharge, taking into account the interaction of such thermal component with other pollutants and the additive effect of other thermal sources to a balanced, indigenous community . . . ; or
>
> B) That despite the occurrence of such previous harm, the desired alternative thermal effluent limitation (or appropriate modifications thereof) will nevertheless assure the protection and propagation of a balanced, indigenous community . . . . 35 Ill. Adm. Code 106.1160(d)(1)(A), (B); *see also* 40 C.F.R. § 125.73(c).

In determining whether prior appreciable harm has occurred, the Board considers "the length of time during which the petitioner has been discharging and the nature of the discharge." 35 Ill. Adm. Code 106.1160(d)(2).

MWG's consultant, EA Engineering, Science, and Technology, Inc., PBC (EA Engineering), prepared the 316(a) Demonstration based on both predictive and retrospective studies.

BOARD DISCUSSION

MWG seeks alternative thermal effluent limitations to increase the daily maximum numeric temperature limits and excursion hours in its NPDES Permit as measured at the edge of its 26-acre permitted mixing zone. MWG also seeks to decrease the required zone of passage from 75% to 50%. Additionally, MWG requests that the proposed alternative thermal effluent limitations apply in lieu of the narrative temperature criteria.

MWG must demonstrate that thermal effluent limitations applicable to the heated effluent from WCGS are more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the Lower Lockport Pool of the CSSC. The demonstration must also show that the proposed alternative thermal effluent limitations will assure the protection and propagation of this balanced, indigenous population. *See* 33 U.S.C. § 1326(a); 35 Ill. Adm. Code 106.1160; 40 C.F.R. § 125.73.

The USEPA 316(a) Manual provides the components for this demonstration. A petitioner must provide a master rationale supported by a biotic category rationale, which demonstrates that decision criteria specific to each of the six biotic categories are satisfied. The first step in the biotic category rationale is an early screening process that identifies the biotic community in the impacted area of the discharge. Based on this early screening process, petitioner selects any one or combination of four types of demonstrations to support its biotic category rationale: "Type I" (Retrospective/Absence of Prior Appreciable Harm); "Type II" (Predictive/Representative Important Species); "Type III" (Low Potential Impact); and "Other Type III" (Biological, Engineering, and Other Data). These demonstrations are synthesized into a master rationale for the proposed alternative thermal effluent limitations to support the conclusion that each biotic category's criteria are satisfied.

Below, the Board first decides whether MWG has shown that the proposed alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous community. 35 Ill. Adm. Code 106.1160(c); *see also* 33 U.S.C. § 1326(a). This involves reviewing whether MWG's 316(a) demonstration identifies the balanced, indigenous community and shows that the proposed alternatives will assure the protection and propagation of that community.

Then, the Board decides whether effluent limits based on its numeric temperature limits, excursion hour limits, and narrative temperature limits (Section 302.408(c)–(f) and (h)) and its zone-of-passage requirements (Section 302.102(b)(8)) are more stringent than necessary to assure the protection and propagation of the balanced, indigenous community in the CSSC near WCGS. 35 Ill. Adm. Code 106.1160(b); *see also* 33 U.S.C. § 1326(a).

Assure the Protection and Propagation of the Balanced, Indigenous Community

The Board first summarizes the conclusions and supporting materials of MWG's Master Rationale. Then, the Board reviews MWG's 316(a) Demonstration, starting with the biotic categories assessed. After that, the Board reviews MWG's "Type I Retrospective/Absence of Prior Appreciable Harm Demonstration" and "Type II Predictive/Representative Important Species Demonstration." The Board then assesses whether MWG's 316(a) Demonstration shows the biotic category criteria are satisfied, and whether the conclusions in MWG's Master Rationale are supported.

Master Rationale

The master rationale should form a convincing argument that the balanced, indigenous community will be protected. USEPA 316(a) Manual at 52. In doing so, the master rationale must concisely summarize the demonstration's key findings, including the following: an overall picture of the ecosystem identified in the biotic category analysis; the resource zones impacted; and why the demonstration and its supporting documents suggest that the balanced, indigenous community will be protected. *Id.*

MWG's Master Rationale draws four general conclusions:

1. There has been no prior appreciable harm to the balanced, indigenous community associated with the long history of WCGS operations,

including its operation under the thermal effluent limits of the existing NPDES Permit;

2. The existing aquatic community near the WCGS thermal discharge is like that observed in other parts of the CSSC outside of the influence of the WCGS thermal plume and downstream of the Asian carp electrical barrier, which is a strong indication that the WCGS thermal discharge is not adversely impacting the balanced, indigenous community;

3. The balanced, indigenous community is characterized by typical diversity, a capacity to sustain itself through seasonal cycles, and a dynamic food chain, including an appropriate mix of key trophic level species; and

4. The proposed [alternative thermal effluent limitations] will not preclude overall improvements to the composition of the balanced, indigenous community in response to possible future improvements in water quality and habitat conditions. Exh. 4 at 4-13.

MWG performed the early screening to identify the biotic communities near WCGS. MWG's Master Rationale explains that despite the constraints of the CSSC as a man-made, artificially controlled waterway, the CSSC around the WCGS maintains "a diverse biological assemblage which is predominately influenced by the limited aquatic habitat inherent to the canal system." Exh. 4 at 4-1.

After identifying the balanced, indigenous community in each biotic category, MWG's Master Rationale explains that its 316(a) Demonstration integrates both retrospective studies and predictive analyses (Type I and Type II) to show that a balanced, indigenous community of shellfish, fish, and wildlife has been and will be maintained in and on the receiving waterbody of the WCGS thermal discharge.

The Master Rationale explains the retrospective approach uses historical data to demonstrate that compliance with NPDES Permit limitations—which are based on the previous Secondary Contact and Indigenous Aquatic Life Use water quality standards, as well as AS 96-10[16]—has resulted in no "prior appreciable harm" to the balanced, indigenous community. MWG's Master Rationale states:

> Over two decades of biological studies performed by WCGS, covering its current operating configuration, as well as under multiple unit operation, indicate that the aquatic community in the vicinity of the WCGS discharge is similar to that in adjacent areas of the CSSC upstream of the WCGS discharge, as well as areas downstream in the lower Lockport Pool, with differences that are reflective only

[16] Petition of Commonwealth Edison Company for Adjusted Standard from 35 Ill. Adm. Code 302.211(d) and (e), AS 96-10 (Oct. 3, 1996) (AS 96-10).

> of the presence or absence of areas of more suitable habitat and not related to the influence of the WCGS thermal plume. Exh. 4 at 4-1–4-2.

MWG also performed a predictive demonstration, which was "undertaken to complement the retrospective analysis, by assessing the potential effects of the WCGS thermal discharge on the [balanced, indigenous community] of the CSSC under both the current and the proposed alternate thermal limits." Exh. 4 at 4-2. MWG's predictive approach couples hydrothermal modeling with biothermal response data for "representative important species" of fish to demonstrate that the proposed alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous community. *Id*. The Master Rationale concludes:

> The modeled "worst-case" summer and winter scenarios further indicate that the proposed seasonal [alternative thermal effluent limitations] would result in temperature conditions adequate to support and protect the [balanced, indigenous community] near the WCGS thermal discharge. Survival, reproduction, development, and growth would not be appreciably reduced due to operation under the proposed [alternative thermal effluent limitations]. The potential for mortality associated with high discharge temperatures is negligible under the "worst case" conditions modeled for WCGS, and would be even less so under typical seasonal weather and flow conditions. Similarly, the WCGS thermal plume is not expected to block or inhibit access to any potential spawning habitat, spawning activities, or the development and growth of eggs, larvae, and early juveniles of [representative important species] and the [balanced, indigenous community]. Consequently, the WCGS thermal discharge is not expected to reduce normal annual growth and performance of [representative important species] and the [balanced, indigenous community] in the CSSC. *Id*. at 4-6.

Based on the retrospective and predictive demonstrations, the Master Rationale argues that the biotic category criteria are satisfied. According to the Master Rationale, the retrospective and predictive demonstrations show there has been and—under the alternative thermal effluent limitations—will be:

- No substantial increase in abundance or distribution of any nuisance species or heat tolerant community;
- No substantial decreases of formerly abundant indigenous species or community structure to resemble a simpler successional stage than is natural for the locality and season, other than nuisance species;
- No unaesthetic appearance, odor, or taste of the water;
- No elimination of an established or potential economic or recreational use of the waters;
- No reduction in the successful completion of life cycles of indigenous species;
- No substantial reduction of community heterogeneity or trophic structure;
- No adverse impact on threatened or endangered species;
- No destruction of unique or rare habitat; and

- No detrimental interaction with other pollutants, discharges, or water-use activities. Exh. 4 at 4-9.

The Master Rationale concludes that it demonstrates (1) the WCGS thermal discharge has not caused prior appreciable harm to the balanced, indigenous community and (2) the proposed alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous community in the CSSC around WCGS. 35 Ill. Adm. Code 106.1160(c), (d). The Board reviews the supporting material for the Master Rationale, beginning with biotic category identification.

Biotic Category Identification

The starting point in a CWA Section 316(a) demonstration is the early screening process to identify the balanced, indigenous population of aquatic life in the receiving water. USEPA 316(a) Manual at 33. The CWA uses the phrase "balanced, indigenous population" and the federal regulations define the phrase "balanced, indigenous community." These phrases have come to be synonymous and mean:

> a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species, and by a lack of domination by pollution tolerant species. Such a community may include historically non-native species introduced in connection with a program of wildlife management and species whose presence or abundance results from substantial, irreversible environmental modifications. Normally, however, such a community will not include species whose presence or abundance is attributable to the introduction of pollutants that will be eliminated by compliance by all sources with section 301(b)(2) of the CWA; and may not include species whose presence or abundance is attributable to alternative thermal effluent limitations imposed pursuant to this Subpart or through regulatory relief from otherwise applicable thermal limitations under Chapter I of Subtitle C or standards granted by the Board. 35 Ill. Adm. Code 106.1110; *see also* 40 C.F.R. § 125.71(c).

As biotic communities may contain numerous species, USEPA suggests assessing thermal impacts on a community-by-community basis. The USEPA 316(a) Manual identifies six categories of biotic communities: (1) habitat formers; (2) phytoplankton; (3) zooplankton; (4) macroinvertebrates and shellfish; (5) fish; and (6) other vertebrate wildlife. USEPA 316(a) Manual at 18–32.

After completing the early screening process and the preliminary assessment of the amount of additional work needed in each of the six biotic categories, petitioner chooses the most appropriate type of demonstration for the site. USEPA 316(a) Manual at 33–34. A demonstration describes the impact of the thermal discharge on each biotic category. *Id*. at 16. A successful demonstration must show that each biotic category meets either the decision criteria for a site that is a low potential impact area or the decision criteria for a site that is not a low potential impact area. *Id*. at 18–32.

MWG prepared a Detailed Study Plan (Exh. 3), outlining its early screening. MWG also prepared a summary of the early screening process titled "Description of Chicago Sanitary and Ship Canal" (Exh. 4. App. A). Below, the Board reviews the six biotic categories assessed by MWG.

Habitat Formers (Aquatic Vegetation). Habitat formers are the plants providing cover, foraging, spawning, or nursery habitat for fish and shellfish. USEPA 316(a) Manual at 76–77. The USEPA 316(a) Manual states that habitat formers play a role "unquestionably unique and essential to the propagation and well-being of fish, shellfish, and wildlife." *Id*. at 57. These organisms may be vulnerable to the temperature, velocity, or turbidity of a heated discharge and may also be damaged by biocides present in the discharge. *Id*.

In its Detailed Study Plan, MWG explained that it intended to rely on historical survey data for aquatic vegetation in the Lockport Pool, and would not perform additional surveys of the aquatic vegetation around the WCGS. Exh. 3 at 16. Assessing the local habitat in the CSSC, EA Engineering reviewed studies from 1992–1995 on mesohabitat classification, Qualitative Habitat Evaluation Index (QHEI) assessments from 1993–1994 and 2016, and system-wide habitat evaluations conducted by MWRDGC in 2008. Exh. 4, App. E at E-5.

Submerged and emergent aquatic vegetation were part of these studies. Exh. 4, App. A at A-36–A-37. Submerged aquatic vegetation includes plants that grow below the water surface and are "usually anchored to the bottom by roots." *Id*. at A-36. Emergent aquatic vegetation consists of plants that have roots anchored under water but with "much of the plant extending above the water surface." *Id*. at A-37. Thirty-four distinct taxa have been identified in the Upper Illinois Waterway. *Id.* at A-36. Most of these taxa were found to be "common and relatively pollution tolerant." *Id.*

EA Engineering reports that aquatic vegetation growth near the WCGS is "very limited" because of the habitat limitations, sedimentation, and other variables in the CSSC. Exh. 4, App. A at A-36. The studies show that submerged aquatic vegetation accounts for almost all the aquatic vegetation observed around WCGS. *Id.* The area near WCGS is dominated by main channel habitat with vertical retaining walls, a deep draft channel, and artificial embayment areas, all of which support sparse beds of submerged aquatic vegetation. *Id.* The studies consulted by EA Engineering identified American elodea (*Elodea canadensis*) and flat stem pondweed (*Potamogeton zosteriformis*), with the latter dominating the Lockport Pool. *Id.* In addition, the vertical walls of the CSSC mean that the immediate area has no littoral zones to support emergent aquatic vegetation generally found in the Upper Illinois Waterway. *Id.* at A-37.

Habitat in the Lockport Pool near WCGS was classified as "poor" to "fair" by QHEI studies done in 1993–1994 and 2016, which were compared to evaluate changes in habitat that might have occurred over the years. Exh. 4, App. A at A-33, App. C at C-10, C-20, App. E at E-10. The QHEI studies were designed to measure habitat corresponding to physical factors that affect fish communities and are generally important to other aquatic life, such as invertebrates. Exh. 4, App. C at C-9. The QHEI considers six factors: substrate; in-stream cover; channel morphology; riparian and bank condition; pool and riffle quality; and gradient. *Id*.

Low QHEI scores resulted from many factors, including excessive siltation, channelization, poor floodplain areas, no in-stream cover, and lack of riffle/run habitat. Exh. 4, App. F at 1-2. The physical conditions of the CSSC in WCGS's immediate vicinity are characterized by vertical rock walls with no side channels or backwaters beyond a few isolated barge slips. Exh. 4, App. A at A-3, A-33. The canal is relatively deep, with depths varying from 14 to 27 feet as controlled by the downstream Lockport Lock and Dam. *Id*. The canal bed is composed of silt and the occasional cobble that can also be found along the scoured bottom of the WCGS discharge canal. *Id*. at A-3. And, the record demonstrates less habitat diversity upstream of WCGS than downstream. Exh. 4, App. C at C-10. The result is almost no in-stream cover or rooted emergent aquatic vegetation, and limited diversity of submerged aquatic vegetation along the canal bed. The QHEI studies determined that habitat limits the aquatic biota in the Upper Illinois Waterways. *Id*.

One exception is an area that EA Engineering defined as "atypical": a shallow littoral zone with dense aquatic vegetation identified in the Lower Lockport Pool. Exh. 4 at 4-8; MWG Resp.2 at 36–37. In this area, EA Engineering observed the Illinois-listed threatened Banded Killifish (*Fundulus diaphanous*) and noted an increasing number of these fish. Exh. 4 at 4-8. As further discussed below under the fish biotic category, EA Engineering noted that the expanding population of Banded Killifish, even under the former, less-stringent temperature water quality standards for Secondary Contact and Indigenous Aquatic Life Use waters, suggests that WCGS' thermal plume is not impacting them. Exh. 4 at 4-8; Exh. 4, App. A at A-46. IDNR agreed with MWG's findings and IEPA's assessment that adverse impact is unlikely and no further study was required. Exh. 4 at 4-8; Exh. 4, App. A at A-6; IEPA Rec. at 9; IDNR Resp.2 at 3.

EA Engineering states:

> [T]he reduction in habitat complexity (particularly near the WCGS discharge), is the primary basis for biota limitations, and is not related to the operation of WCGS or its thermal discharge. *** The distribution and abundance of habitat formers and habitat quality in this artificially constructed and anthropogenically-influenced impounded waterway are dictated primarily by dominance of limited and/or poor quality channel habitat and the subsequent lack of appropriate conditions for the development of greater diversity of habitat former types. The habitat former community would be essentially the same regardless of the operation of the WCGS cooling water discharge with the proposed [alternative thermal effluent limitations]. Exh. 4 at 6-4.

<u>Phytoplankton.</u> Phytoplankton are microscopic plants, such as algae, transported by river current. USEPA 316(a) Manual at 78. Phytoplankton are a food source for zooplankton and fish. *Id*. at 55.

Assessing phytoplankton in the CSSC, EA Engineering consulted studies from 1991 and 1993 done for ComEd, as well as studies from 2004–2016 done by MWRDGC as part of its annual phytoplankton productivity (chlorophyll *a*) monitoring throughout the Upper Illinois

Waterway. Exh. 4, App. A at A-37. EA Engineering explained in its Detailed Study Plan that additional phytoplankton studies were unnecessary. Exh. 3 at 15.

The phytoplankton surveys near WCGS evaluated the species assemblages and chlorophyll *a* concentrations. Both the ComEd study and MWRDGC monitoring program sampled upstream and downstream of WCGS. Exh. 4, App. A at A-37.

MWRDGC's annual monitoring of phytoplankton productivity showed a "progressive increase in downstream concentrations." Exh. 4, App. A at A-37–A-38. The ComEd study, which sampled at the WCGS intake and discharge sites, measured phytoplankton densities using the Shannon Weaver diversity index and Pielou evenness index. *Id.* at A-37. The phytoplankton community had low diversity and evenness values (less than 2.0 and 0.6, respectively). *Id.* The diversity and evenness were both slightly higher in the discharge sample than in the intake sample. *Id.* The community upstream of WCGS was closely related to that of the discharge, which was attributed to "the dominance and density of the colonial green algae species *Dactylosphaerium jurisii*, both upstream and downstream of the WCGS." *Id.*

Zooplankton and Meroplankton. Zooplankton are "[a]nimal microorganisms living unattached in water." USEPA 316(a) Manual at 79. Zooplankton refer to small crustacea such as daphnia and cyclops, and single-celled animals such as protozoa, as well as the planktonic life stage of many important species of fish and wildlife. *Id.* at 56, 79. Some species are planktonic throughout their life, while others termed "meroplankton" are planktonic only during a portion of their life cycles. *Id.* at 56. Zooplankton are the primary food source for larval fish and shellfish. *Id.*; Exh. 4, App. E at E-11–E-13. "If a heated discharge kills or prevents development of the meroplankton, fewer adult fish and shellfish will be produced each year." *Id.*

EA Engineering explained in its Detailed Study Plan that additional zooplankton studies were unnecessary. Exh. 3 at 16. To examine the impact of the thermal discharge on zooplankton and meroplankton, EA Engineering considered MWRDGC studies from 1978 and 1979 in the CSSC near WCGS, EA Engineering entrainment surveys from 2005 and 2016 for the WCGS intake structure, and an MWRDGC survey of zooplankton from 2010–2013 in the CSSC near WCGS. Exh. 4, App. E at E-6–E-7, E-12. EA Engineering also consulted studies from the 1970s and 1980s of general power plant thermal discharges, along with the Asian Carp Regional Coordinating Committee (ACRCC) plankton and zooplankton monthly sampling from 2009–2014 throughout the Upper Illinois Waterway. *Id.* at E-6–E-7. Additionally, EA Engineering reviewed ichthyoplankton studies on the early-life stages of fish in the Upper Illinois Waterway from a 1994 ComEd survey and from continuous studies beginning in 2010 by the Illinois Natural History Survey (INHS) on behalf of ACRCC. *Id.* at E-11–E-13; Exh. 4, App. C at C-12.

EA Engineering explains that historical studies of the Upper Illinois Waterway "have not considered zooplankton due to their low numbers and disproportionate biomass." Exh. 4 at 6-5. When they did consider zooplankton, they "classified the zooplankton community broadly throughout the system as Protozoa and Rotatoria." *Id.*

A 2010–2013 survey sponsored by MWRDGC observed that zooplankton communities were dominated by rotifers. Exh. 4 at 6-5; Exh. 4, App. A at A-38. Other taxa of cladocerans and copepods were also found, but in lower concentrations. Exh. 4, App. A at A-38. The diversity and population were similar upstream and downstream. *Id.*

Macroinvertebrates and Shellfish. Macroinvertebrates, including shellfish,[17] are an important part of "aquatic food webs" and provide a source of bait for sport and commercial fishing. USEPA 316(a) Manual at 58. Thermal discharges may have numerous effects on macroinvertebrates, including reproduction and survival. *Id*. at 59.

To identify the biotic category of macroinvertebrates, MWG reviewed studies that used ponar and Hester-Dendy artificial substrate sampling methods: a ComEd study from 1993–1994 of the Upper Illinois Waterway, including the CSSC; a MWRDGC studies from 2001–2010 conducted by in the CSSC as part of the Upper Illinois Waterway ambient water quality program; and EA Engineering studies from 2005, 2006, and 2010 performed for MWRDGC upstream and downstream of WCGS in the CSSC. Exh. 4, App. E at E-7–E-8; Exh. 4, App. C at C-12–C-13.

The benthic macroinvertebrate community throughout the canal system near WCGS is "dominated by pollution tolerant taxa." Exh. 4 at 6-7–6-8. The 1993-1994 Upper Illinois Waterway study included two sampling locations near WCGS, and a third in the lower portion of Lockport Pool. Exh. 4, App. A at A-38. At two of the three sampling locations, Oligochaeta (aquatic worms) were the dominant group of organisms collected. *Id.* At the sampling site downstream of WCGS, *Caecidotea spp.* (isopods) composed nearly 58% of the organisms collected, followed by Oligochaeta. *Id.* These densities and populations were corroborated by MWRDGC's studies conducted between 2001 and 2010. Exh. 4, App. A at A-38–A-39; Exh. 4, App. E at E-8.

For mussels, EA Engineering consulted four studies: a 1999 Environmental Assessment by the Federal Energy Regulatory Commission; a 2009–2011 study by INHS in the Des Plaines River two miles upstream of the confluence with the CSSC; a 2010 study by EA Engineering using ponar samples in the CSSC near shore and mid-channel; and a 2010 benthic study by MWRDGC of the Chicago River. Exh. 4, App. E at E-9–E-10.

INHS sought freshwater mussels in the Lake Michigan and Des Plaines River tributaries. Exh. 4, App. A at A-39. At INHS Site 10 in the upper Des Plaines River—approximately two miles upstream of the confluence of the Des Plaines River and the CSSC, where mussel habitat is superior to that found in the CSSC—"only dead and relic shells of three common mussel species were collected" (Giant Floater *Pyganodon grandis,* Paper Pondshell *Utterbackia imbecillis*, and Fat Mucket *Lampsilis siliquoidea*). *Id.* at A-39–A-40.

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[17] "Macroinvertebrates" may be considered synonymous with "aquatic macroinvertebrates," which are "those invertebrates that are large enough to be retained by a U.S. Standard No. 30 sieve (0.595-mm openings) and generally can be seen by the unaided eye." USEPA 316(a) Manual at 73, 77. "Shellfish" are "[a]ll mollusks and crustaceans (such as oysters, clams, shrimp, crayfish, and crabs) which, in the course of their life cycle, constitute important components of the benthic, planktonic, or nektonic fauna in fresh and salt water." *Id*. at 79.

When EA Engineering identified macroinvertebrates for MWRDGC and IEPA in 2000, only three bivalve species were encountered: *Corbicula fluminea*; *Musculium transversum*; and *Dreissena polymorpha*. Exh. 4, App. A at A-41. Comparing these data with the 2010 data from MWRDGC shows a continued sparsity of bivalves in the system. *Id*.

The MWRDGC 2010 study sampled at two locations in proximity to WCGS. At a sampling location 3.5 miles downstream of WCGS, *Corbicula fluminea* was the only bivalve species found in both the petite ponar and Hester-Dendy samples. Exh. 4, App. A at A-40. At the second sampling site five miles upstream of WCGS, *Corbicula fluminea*, *Dreissena bugensis,* and *Pisidium* sp.—all either non-indigenous/invasive or common species—were the only bivalve species found. *Id.*

MWRDGC also studied 11 benthic stations on the southern portion of the Chicago River System (including the Chicago River, South Branch of the Chicago River, Bubbly Creek, and the CSSC). Exh. 4, App. A at A-40. The study found primarily non-native and invasive species. The non-indigenous mottled fingernail clam (*Eupera cubensis*) was found in the CSSC. *Id*. Also found at the Lockport location in the CSSC was the *E. cubensis*, which is native to the southern United States coastal plain. *Id*.

The studies consistently showed that the indigenous macroinvertebrate community in the CSSC near WCGS is "dominated by pollution tolerant taxa which is capable of utilizing the sparse benthic habitat available in this man-made waterway." Exh. 4 at 6-7. Some differences in the benthic macroinvertebrate community were observed between upstream and downstream locations; those differences were attributed not to the thermal discharge, but rather to the presence of some depositional material along the canal bed downstream that is not present in the scoured limestone bed upstream. *Id*. EA Engineering states, "[g]iven that no live mussels were found in the upper Des Plaines River, they would not be expected to be present in the CSSC near WCGS where habitat is significantly poorer." *Id*. at 6-8.

One mussel species, sheepnose (*Plethobasus cyphyus*), which is federal-listed as endangered, has been reported in Will County. Exh. 4 at 4-8. IDNR requested a brailing survey for mussels in the study area to support EA Engineering's conclusion that mussel populations are not present. Exh. 2 at 2–3. However, IEPA agreed with EA Engineering that additional sampling of mussels would be "impractical" and "not expected to yield representative information." *Id*. 2 at 10. Responding to a Board order, IDNR later stated that it concurred with IEPA's recommendation. IDNR Resp.2 at 3.

In its questions to MWG, the Board noted that the 7Q10 flow of the CSSC is 1315 cfs, and the design flow of the WCGS facility is 882 cfs, which is greater than 30% of the 7Q10 flow. *See* Exh. 4, App. D at D-13, D-30. Under Section 3.3.4 of the USEPA 316(a) Manual, a discharge equal to 30% or more of the 7Q10 flow would cause concern—unless the demonstration shows that invertebrates do not serve as a major forage for fish, food is not a limiting factor, and drifting invertebrates are not harmed by passing through the thermal plume. USEPA 316(a) Manual at 24–25; Exh. 4 at 6-6. MWG responded that historical data from 1993 to 2010 (Exh. 4 at 6-6) show that the benthic macroinvertebrate communities have been improving compared to those upstream. MWG Resp.2 at 38. New fish studies show fish are growing at normal rates and are in average or better-than-average condition. *Id*. at 39. The fish relative weight (Wr) shows no relationship to WCGS operations with either four units (2000–2010), two units (2011–2014), or one unit (2015–2016). *Id*. The body condition of fish show that no problems have been observed with health or food availability in the CSSC near WCGS, indicating lower trophic levels, such as the macroinvertebrates, have not been negatively impacted by the WCGS discharge and the drifting invertebrates are not harmed by passage through the thermal plume. *Id*. at 38–39; Exh. 4 at 6-12–6-13.

Fish. "The discharge of waste heat can affect fish populations in many ways." USEPA 316(a) Manual at 60. The applicant for alternative thermal effluent limitations must characterize the indigenous fish community to identify habitat use and provide baseline information on the fish community. *Id*.

EA Engineering consulted several studies to help identify the fish community in the CSSC around WCGS. EA Engineering's review included results from its long-term fish community monitoring in the Lower Lockport Pool. EA Engineering monitored from 2005–2016 to document fish community changes in response to WCGS operational changes. The results from 2015 and 2016 are part of MWG's demonstration (Exh. 4, App. G and App. F, respectively). EA Engineering also consulted a study conducted by ComEd in 1993–1994 along the entire CSSC, which used electrofishing, gillnetting, and seining. The ComEd study assessed fish age, growth, condition, movement, reproductive success, and food habits, as well as diseases and anomalies. In addition, EA Engineering reviewed a 2001–2007 LimnoTech study of adult fish in the CAWS to identify physical habitat factors and potential for improvement. EA Engineering also consulted fishery studies from 2010, 2012, and 2014 by the United States Fish and Wildlife Service (Carterville Fish and Wildlife Conservation Office) on behalf of ACRCC.

Long-Term Monitoring Studies. EA Engineering's electrofishing and seining surveys from 2005 to 2016 captured 47 fish species and two hybrids. Exh. 4, App. A at A-42. Ninety-five percent of the fish captured consisted of twelve species, including Gizzard Shad, Common Carp, Emerald Shiner, Bluntnose Minnow, Green Sunfish, Bluegill, and Largemouth Bass. *Id.* Of these seven species, approximately 75% of the total catch over that 12-year period were tolerant species: Gizzard Shad, Bluntnose Minnow, and Green Sunfish. *Id.* In 11 out of the past 12 annual surveys, Gizzard Shad was the most captured native species. *Id.* EA Engineering warns, however, that although native species such as Gizzard Shad have dominated the catch, "species richness in the lower Lockport Pool has historically been low." *Id.*[18]

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[18] EA Engineering's long-term fisheries monitoring program classified the Lower Lockport Pool using the Modified Index of Well-Being (IWBmod), which was developed by the Ohio Environmental Protection Agency (*see* Ohio Administrative Code 3745-1-07). Exh. 4, App. A at A-42. IWBmod is a scoring system used as an indicator of fish community well-being. *Id*. at A-49. It is based on abundance, weight, and diversity; higher IWBmod scores represent greater well-being. *Id*. Using the IWBmod, each year of the long-term fisheries monitoring program (2005–2016) classified the fish community in Lower Lockport Pool as very poor. *Id*. at A-42. As of 2017 reporting, IWBmod ratings from locations there were consistently poor or very poor. *Id*.

Impingement Studies. EA Engineering consulted a 52-week impingement study (July 2004 to June 2005) in which a total of 4,572 organisms weighing approximately 38 kilograms (kg) were collected. Exh. 4, App. A at A-42. Twenty-five native shellfish and fish species, along with ten introduced or invasive fish species, were impinged during the study. *Id.* Ten fish species accounted for 95% of the total impingement and 89% of the biomass. *Id.*

The 2005 study collected native sportfish species, including Yellow Bullhead, Channel Catfish, Yellow Bass, Bluegill, Largemouth Bass, and Yellow Perch, "but most were not common or numerous." Exh. 4, App. A at A-42. The exception was the Yellow Bass, which ranked in the top three species based on both numbers and biomass impinged. *Id.* The study also captured the introduced and invasive species of Alewife, Threespine Stickleback, White Perch, and Round Goby. *Id.* These species have invaded Lake Michigan and entered the CAWS and CSSC. *Id.* The samples included only two "shellfish" taxa, Northern crayfish and an unidentified crayfish. *Id.*

Thirty-two of the 41 taxa collected were represented by 52 or fewer specimens (*i.e.*, less than one specimen per event), and 20 taxa were represented by less than ten specimens. Exh. 4, App. A at A-42– A-43. Two invasive species—Round Goby and White Perch—ranked third and fourth among the most numerous captured. *Id.* at A-42. Four species—Gizzard Shad, Yellow Bass, Round Goby, and White Perch—accounted for 74% of the total biomass, while 32 fish taxa individually accounted for less than 0.5 kg of the estimated 38 kg of biomass collected during the 52-week study. *Id.* at A-43. And, ten of the introduced and invasive fish species collected during the study "accounted for 18% of the total number of fish collected and 27% of the biomass, largely reflecting the substantial contribution of White Perch and Round Goby to the study totals." *Id.* Of the remaining 39 taxa, 51% were of the minnow and sunfish families. *Id.* at A-42.

The study did not collect any shellfish or fish species listed as endangered or threatened by the State of Illinois or the U.S. Fish and Wildlife Service. Exh. 4, App. at A-43.

Ichthyoplankton Studies of Spawning and Nursery Areas. EA Engineering consulted three investigations that studied the fish community's use of the Upper Illinois Waterway and CSSC for spawning and nurseries.

First, EA Engineering consulted an ichthyoplankton study of the Upper Illinois Waterway performed for ComEd in the spring and summer of 1994. Exh. 4, App. A at A-43. The study sought to determine if the fish community in the Illinois River drainage was using the Upper Illinois Waterway as a spawning or nursery area, as well as when and where use occurs. *Id.*; Exh. 4, App. E. The study took samples upstream (river mile 292.4) and downstream of the WCGS discharge (river mile 295.4). Exh. 4, App. A at A-43.

The study collected larval and young-of-the-year fish, representing at least 48 species and 14 reproductive guilds. Exh. 4, App. A at A-43. In many cases, egg and larval stages are not adequately described to identify them to species level. *Id.* But, approximately half of the identified fish eggs collected were Common Carp; also collected were smaller numbers of Common Carp/Goldfish and Freshwater Drum eggs. *Id*. The most commonly collected taxa were these six: Common Carp; *Pimephales* spp.; *Alosa* spp.; Common Carp/Goldfish; *Clupeidae* spp.; and Fathead Minnow. *Id.* In all, these species/taxa made up more than 87% of all larvae or juveniles collected. *Id.*

The second study consulted is an entrainment characterization from 2005 conducted for MWG during the spawning season (April through August). Exh. 4, App. A at A-43. This study collected 5,835 specimens, representing five life stages: egg; yolk-sac; post yolk-sac; larvae; and juveniles. *Id*. These specimens consisted of 14 distinct taxa, including Gizzard Shad, Common Carp, four cyprinid types, Yellow Bullhead, Freshwater Drum, and Round Goby. *Id.* In all, only 2.6% of the specimens collected represented sportfish—Yellow Bullhead, Freshwater Drum, *Morone, Lepomis*, and *Pomoxis* spp. *Id.* Of the total ichthyoplankton collected "within the influence of the WCGS intakes," 85% was identified as post yolk-sac Gizzard Shad. *Id*. The next most common was yolk-sac larvae of Common Carp, 7% of the total number collected. *Id*.

The third study was EA Engineering's 2016 update of the 2005 entrainment study. Exh. 4, App. A at A-44. The 2016 study collected 2,322 specimens, representing the same five life stages. *Id*. Thirteen distinct taxa were collected, including Gizzard Shad, Common Carp, four cyprinid types, Freshwater Drum, and Round Goby. *Id.* Post yolk-sac Gizzard Shad, Common Carp yolk-sac larvae, and *Clupeidae* spp. post yolk-sac larvae and larvae accounted for 93% of the specimens collected—the post yolk-sac Gizzard Shad made up 40% of the total ichthyoplankton collected. *Id.* Sportfish—Freshwater Drum, Yellow Perch, Channel Catfish, *Morone* and *Lepomis* spp.—made up only 2.2% of the ichthyoplankton specimens collected. *Id.*

The physical characteristics of the CSSC limit suitable habitat for spawning and nursing around WCGS. Exh. 4 at 4-7–4-8; IEPA Rec. at 6. After heavy rainfall events, the CSSC experiences abrupt and substantial drawdowns, controlled by MWRDGC and the U.S. Army Corps of Engineers (Corps) to prevent localized flooding. Exh. 4, App. A at A-41–A-42. These drops in CSSC water levels disrupt spawning and desiccate early-life stages of fish by exposing the littoral zones, but these effects are unrelated to the WCGS discharge. *Id*. at A-42. Further, the eggs of representative important species are "demersal, adhesive, or deposited in shallow areas protected by the adults and thus have limited vulnerability to entrainment," as well as "minimal exposure to the WCGS thermal plume." Exh. 4, App. B at B-19.

<u>Sport and Commercial Species.</u> Both the long-term monitoring studies and impingement studies collected sportfish, including Bluegill and Largemouth Bass. Exh. 4, App. A at A-41–A-42. Though the sportfish were not statistically numerous, Yellow Bass were among the highest in number and biomass in the impingement studies. *Id*. at A-42. The diversity of sport species is limited, but the research shows they are present and, in the case of Yellow Bass, more than marginally so. *Id*.

<u>Migration.</u> For migration, EA Engineering explained that the "most significant influence on aquatic life" in the CSSC near WCGS is the Corps' Aquatic Nuisance Species Dispersal Barrier system (Electric Barrier), which is less than one mile upstream of WCGS. Exh. 4, App. A at A-29. The Electric Barrier's primary function is to "impede the spread" of the invasive Asian carp from the Mississippi drainage to the Great Lakes. *Id*. It consists of three electrical barriers, the first of which began operation in 2002, the second in 2009, and the third in 2011.

Id. Construction of another barrier intended to be permanent began in 2013. *Id*. Although the Electric Barrier is intended to "block" the movement of Asian carp, it also prevents "the normal upstream and downstream movement" of other fish. *Id*. Sampling has shown that upstream migrating fish tend to accumulate immediately downstream of the Electric Barrier and around the WCGS cooling water intake structure. *Id*. at A-29–A-30. EA Engineering therefore identifies the Electrical Barrier, not the WCGS thermal discharge, as the most significant influence on fish migratory patterns. *Id*. at A-30.

Threatened or Endangered Species. Based on 15 years of fish sampling data (between 1994 to 2015), no federal-listed threatened or endangered fish species were collected in the CSSC study area near WCGS. Exh. 3 at 5. However, as noted by IDNR, the Banded Killifish, an Illinois-listed threatened species of fish, has been caught around WCGS. IEPA Rec. at 9. The first documented catch in the downstream Lower Lockport Pool was during the adult fisheries monitoring program in 2012, followed by increased catches from 2013 to 2016 when 199 were collected. Exh. 4 at 4-8. The Banded Killifish were caught in an area of atypical habitat for the Lockport Pool—a shallow littoral zone with dense aquatic vegetation. *Id*.; MWG Resp.2 at 36–37. Banded Killifish "normally inhabit areas such as clear, glacial lakes with abundant aquatic vegetation." Exh. 4 at 4-8. This is unlike the habitat near WCGS. *Id*. With the Banded Killifish population apparently expanding, even under the former, less-stringent temperature water quality standards for Secondary Contact and Indigenous Aquatic Life Use waters, EA Engineering suggests that WCGS' thermal plume is not adversely impacting these fish. *Id*.

Other Vertebrate Wildlife. "Other vertebrate wildlife" includes birds (such as ducks and geese), mammals, and reptiles, but not fish. USEPA 316(a) Manual at 32, 77.

EA Engineering reports that observed wildlife in the canal system adjacent to WCGS consists of "occasional, short-term foraging visits by small numbers of gull and common waterfowl species," which can descend directly on the water. Exh. 4, App. A at A-44. Any "long-term occupancy" by waterfowl is precluded by frequent barge traffic in this narrow waterway. *Id.* "There has been no observed use of the canal in the WCGS study area for nesting, nursery, and wintering grounds." *Id.*

EA Engineering reports that, in Will County near WCGS, many bird species have been observed, including "migratory species such as Mallard (*Anas platyrhynchos*), Canada Geese (*Branta canadensis*) and Sandhill Crane (*Grus Canadensis*). Other commonly sighted species are Black-Capped Chickadee (*Poecile atricapilla*), European Starling (*Sturnus vulgaris*), and Black Duck (*Anas rubripes*)." Exh. 4, App. A at A-44 (citation omitted). Bald Eagles (*Haliaeetus leucocephalus*) have been observed "during routine fisheries monitoring studies around the WCGS and along the CAWS." *Id*. Bald eagles overwinter along the Illinois River and have been seen nesting in northeast Illinois in Cook, Kane, and Will counties. *Id.* (citation omitted). Additionally, several Illinois-listed protected species of waterfowl and songbirds have been found in the areas surrounding WCGS, including the Upland Sandpiper (*Bartramia longicauda*), Barn Owl (*Tyto alba*), and Northern Harrier (*Circus cyaneus*). *Id.*

In addition to the Illinois-listed threatened Banded Killifish, IDNR noted that an INHS survey identified the Illinois-listed endangered Blanding's turtle (*Emydoidea blandingii*) near WCGS. Exh. 2 at 2. IDNR recommended that MWG review the INHS survey report and "evaluate potential impacts to this species in [the] study plan." *Id.* IDNR further recommended that MWG conduct field surveys as necessary to support its findings. *Id.* MWG responded initially by noting that it was involved in "turtle habitat assessment efforts" for the Des Plaines River Valley from 2006-2012 and no Blanding's turtles had ever been observed on the WCGS property. *Id*. at 6. EA Engineering also reviewed the INHS (2015) survey report. Exh. 4, App. C at C-23. EA Engineering explained why there should be no interaction between the WCGS thermal discharge, which is confined to the CSSC, and Blanding's turtle:

> Based on the Blanding's habitat preference and life history, there is no evidence or reason to believe that the turtle would utilize the CSSC in any way. Near the station, the canal is lined with vertical limestone walls that extend anywhere from 6-12' (or more) above the water's surface, depending upon flow and flood control operations. There is little to no natural shoreline development or vegetation that would be considered even remotely marginal habitat for the Blanding's turtle, nor any of the other state-listed turtle species. Exh. 4, App. A at A-46; *see also* Exh. 4, App. C at C-23.

MWG added that IDNR later "agreed that no additional turtle surveys are required for the Will County 316(a) Study Plan." Exh. 2 at 7.

EA Engineering acknowledged that historic and current data show Blanding's turtles inhabit portions of the Lower Des Plaines River Valley. Exh. 4, App. A at A-46. INHS performed its turtle survey (2015) on Hanson Material Service (HMS) property to the south of WCGS. *Id.* That survey included both visual encounters and trapping Blanding's turtle. *Id.* The study documented "the presence of both Blanding's habitat and individuals on the HMS ComEd, River North and Middle Parcels." *Id.*

EA Engineering cited a 2013 environmental assessment by the Corps, which characterized the area around WCGS as having very little vegetation, high levels of human use, and steep canal walls. Exh. 4, App. A at A-46–A-47; *see also* Exh. 4 at 6-13 (water level is normally six feet or more below the top of the canal wall; "no natural or constructed ingress/egress points for wildlife along almost the entire expanse of the Lockport Pool, within which the WCGS is located."). These physical features deter use by mammals, including white tailed deer, striped skunks, raccoon, Virginia opossum, muskrat, beaver, and mink. Exh. 4, App. A at A-47. "None of these species would be expected to be impacted by the WCGS thermal discharge." *Id.*; *see also* Exh. 4 at 6-13 (in addition to resident mammals, these physical features also deter song birds (*e.g.*, black-capped chickadee, tufted titmice), reptiles (*e.g.*, northern water snake, red-eared slider), and amphibians (*e.g.*, northern leopard frog, American bullfrog)).

Although migrating waterfowl were found to occasionally use the CSSC for feeding and resting, the WCGS thermal discharge does not attract large numbers of birds during spring and fall migration or encourage overwintering. Exh. 4 at 6-13–6-14; Exh. 4, App. C at C-23. Frequent barge traffic in the narrow CSSC waterway "precludes any long-term occupancy by water birds." Exh. 4 at 6-13–6-14. EA Engineering therefore found that the thermal plume was not disrupting the normal migratory patterns. Exh. 4 at 6-14.

CWA 316(a) Demonstration

MWG must demonstrate that its requested alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous population in and on the CSSC near the WCGS mixing zone. MWG's 316(a) Demonstration has two components:

- A Type I Retrospective/Absence of Prior Appreciable Harm Demonstration; and
- A Type II Predictive/Representative Important Species Demonstration.

First, the retrospective demonstration used the historical database of monitoring data. According to MWG, the retrospective demonstration shows that the temperature limits—under the previous Secondary Contact and Indigenous Aquatic Life Use water quality standards and the current AS 96-10—have resulted in no "prior appreciable harm." 35 Ill. Adm. Code 106.1160(d). Because these temperature limits are less stringent than MWG's proposed alternative thermal effluent limitations, MWG concludes that its proposal will assure the protection and propagation of the balanced, indigenous community. Second, MWG's predictive demonstration coupled hydrothermal modeling with biothermal response data for representative important species to develop and evaluate the potential effects of the proposed alternative thermal effluent limitations. MWG concludes that the predictive demonstration supports the conclusion that the proposal will assure the protection and propagation of the balanced, indigenous community.

Before finding whether MWG has demonstrated that the 316(a) Guidance Manual's biotic category criteria are satisfied, the Board reviews the retrospective (Type I) and predictive (Type II) demonstrations in turn.

Type I Demonstration (Retrospective/Absence of Prior Appreciable Harm). MWG's Type I Retrospective Demonstration relied on monitoring data from the past 23 years, when the former, less-stringent temperature water quality standards applied under Secondary Contact and Indigenous Aquatic Life Use. Pet. at 19, 23; Exh. 4 at 6-2; Exh. 4, App. C at C-3. During much of that time, the CSSC was also subject to significantly more thermal loading. Specifically, WCGS operated four generating units, but only one is operating today. WCGS began operations with Units 1 and 2 in 1955, added Unit 3 in 1957, and added Unit 4 in 1963; all used the once-through cooling water system. Exh. 4, App. D at D-4. Units 1 and 2 were retired in 2010, and Unit 3 was deactivated in 2015, although it could be reactivated. Unit 4 is currently the only operating unit. Pet. at 5-6; Exh. 4, App. C at C-2. In addition to thermal loading from the other three WCGS units, the CSSC upstream also experienced thermal loading from the former Crawford and Fisk electrical generating stations, both of which were shut down in 2012. Pet. at 19, 23; Exh. 4, App. C at C-6.

The WCGS Detailed Study Plan for the retrospective demonstration proposed concentrating on the local fish community and summarizing available data on all biotic categories: phytoplankton; habitat formers; zooplankton; mussels and macroinvertebrates; fish; and other vertebrate wildlife. Pet. at 19. The retrospective demonstration was carried out in two parts. First, EA Engineering analyzed the condition of each biotic category by comparing the observed abundance and species composition to what would be expected in the CSSC near WCGS, given the existing habitat, flow, and chemical characteristics. Second, with over 20 years of data, EA Engineering analyzed long-term trends in population abundance for each of the biotic categories to determine whether changes occurred that could be attributed to WCGS. *Id.*

EA Engineering found no substantial changes in the abundance of nuisance species or fish communities in the CSSC near WCGS over the past 23 years. Pet. at 23. The Corps' Electric Barrier is "the primary factor influencing the distribution and spread of aquatic nuisance species." Exh. 4, App. C at C-24. Fish communities continue to be "dominated by tolerant and highly tolerant species, such as Gizzard Shad, Bluntnose Minnow, and Green Sunfish." Exh. 4, App. C at C-25; *see also* Exh. 4, App. B at B-8. The studies demonstrate that the aquatic community near WCGS is like those both upstream and downstream in the Lockport Pool. Exh. 4 at 4-1–4-2. EA Engineering concluded that the differences are attributable to the presence of more suitable habitat rather than the influence of the thermal plume. *Id.* at 4-2.

To test this conclusion, EA Engineering evaluated changes in the CSSC since 2005. From 2005 to 2015, the CSSC experienced higher-than-current thermal loadings—from Crawford and Fisk (2005–2012), four WCGS units (2005–2010), and two WCGS units (2010–2015). Pet. at 23. Since 2015, only the one unit at WCGS has been in operation. *Id.* Regardless of how many generating units were in operation, EA Engineering found no substantial changes in the abundance of nuisance species or fish communities in the CSSC. Exh. 4 at 6-12; Exh. 4, App. C at C-21, C-25. Based on the IWBmod, EA Engineering found few statistical changes in the aquatic community. Exh. 4 at 6-12; Pet. at 20. Data from 2005 to2016 resulted in IWBmod scores in the Lockport Pool that ranked consistently "Very Poor," averaging 3.2[19] during WCGS' four-unit operations, 3.3 during its two-unit operations, and 3.0 during its one-unit operations. Exh. 4 at 6-12; Exh. 4, App. C. at C-21; Pet. at 20. Native species richness was also similar during WCGS' three different periods of unit operations. Exh. 4, App. C at C-19. The similarity of scores over time, despite different unit-operating configurations, suggests that WCGS has little effect on the well-being of the fish community. Rather, the primary factors affecting the fishery are navigation, CSOs, and physical conditions of the Lockport Pool and the CSSC. *Id.* at C-21.

Based on the long-term trends, EA Engineering found that WCGS' thermal discharge has not had an adverse impact on the survival, growth, or reproduction of the fish community. Exh. 4, App. C at C-24–C-25. With the proposed alternative thermal effluent limits being more stringent than the temperature water quality standards that have applied, no appreciable harm is expected under MWG's proposal. Exh. 4 at 5; Exh. 4, App. at C-24–C-25. Additionally, statistically consistent scores over time for fish well-being and native species richness

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[19] Ohio Environmental Protection Agency (1987, 1989, updated 2006) "uses IWBmod scores to assign streams or stream segments to the following classifications: Exceptional = ≥9.6; Very Good = 9.1–9.5; Good = 8.5–9.0; Marginally Good = 8.0–8.4; Fair = 6.4–7.9; Poor = 5.0–6.3; and Very Poor = <5.0." Exh. 4, App. C at C-21.

demonstrate that, even if WCGS resumed two-unit operations, the proposal would be protective of the aquatic community. Pet. at 20.

Type II Demonstration (Predictive/Representative Important Species). EA Engineering also used the Type II Predictive Demonstration to further support its conclusion—that the requested alternative thermal effluent limitations are sufficiently protective to assure the protection and propagation of the balanced, indigenous community of the CSSC near WCGS. EA Engineering reviewed the scientific literature on how representative important species respond physiologically and behaviorally to predicted water temperatures. Exh. 3 at 3. EA Engineering also conducted hydrothermal modeling and evaluated biothermal metrics. *Id*.

The hydrothermal model first examined the thermal plume under typical and worst-case scenarios for varying canal flows, temperatures, meteorological conditions, and WCGS operating conditions. Exh. 4, App. B at B-2, B-18. Then, the biothermal assessment compared the temperatures predicted in the modeled thermal plume to the range of response temperatures of aquatic organisms identified in scientific literature. *Id.* The comparison allowed EA Engineering to assess the potential for mortality, blockage of migration, exclusion from large areas of habitat, effects on spawning and early development, and effects on performance and growth. Pet. at 21–22; Exh. 3 at 3; *see also* USEPA 316(a) Manual at 28–29.

The Board first reviews MWG's representative important species selection, hydrothermal model, and biothermal assessment. The Board then reviews MWG's methodology for developing its proposed alternative thermal effluent limitations and showing that they will assure the protection and propagation of representative important species.

Representative Important Species Selection. A CWA Section 316(a) Type II Predictive Demonstration must identify the representative important species for further study. "Representative important species" are defined as "species that are representative, in terms of their biological needs, of a balanced, indigenous community of shellfish, fish, and wildlife in the body of water into which a discharge of heat is made." 35 Ill. Adm. Code 106.1110; *see also* 40 C.F.R. § 125.71(b). Because it is not economically feasible to study each species in detail, a few species are selected as representative important species for more detailed study.

Representative important species are selected from any combination of these three biotic categories: shellfish; fish; and habitat formers. USEPA 316(a) Manual at 36. The USEPA 316(a) Manual lists these seven considerations for selecting representative important species:

1. Species mentioned in state water quality standards;
2. Species identified in consultation with other governmental agencies;
3. Threatened or endangered species;
4. Thermally sensitive species;
5. Commercially or recreationally valuable species;
6. Far-field and indirect effects on entire water body; and
7. Critical to structure and function of ecological system.

Id. at 37–38.

The USEPA 316(a) Manual elaborated on the most thermally sensitive species:

> The most thermally sensitive species (and species group) in the local area should be identified and their importance should be given special consideration, since such species (or species groups) might be most readily eliminated from the community if effluent limitations allowed existing water temperatures to be altered. Consideration of the most sensitive species will best involve a total aquatic community viewpoint. *Id.* at 37.

In preparing a CWA Section 316(a) demonstration and underlying studies, federal and state agencies must be consulted to ensure that studies address appropriate wildlife. To this end, the Board's rules require that a petitioner serve a copy of its petition on both IEPA and IDNR, as well as inform IEPA of its proposed representative important species list and supporting data and information. *See* 35 Ill. Adm. Code 106.1115(a)(4), 106.1120(b)(5), 106.1125. In addition, the USEPA 316(a) Manual advises that the permitting authority:

> [C]heck[] with the Regional Director of the [U.S. Fish and Wildlife Service] and representatives of the [National Marine Fisheries Service] and States to make sure the study plan includes appropriate consideration of threatened or endangered species as well as other fish and wildlife resources. USEPA 316(a) Manual at 15.

The applicant must collect thermal effects data for each representative important species, including: (1) high temperature survival for juveniles and adults; (2) thermal shock tolerance; (3) optimum temperature for growth; (4) minimum and maximum temperatures for early development; (5) normal spawning dates and temperatures; and (6) any special temperature requirements for reproduction. USEPA 316(a) Manual at 43–45. A Type II Predictive Demonstration must show that representative important species "will not suffer appreciable harm from the heated discharge." *Id.* at 35.

EA Engineering selected representative important species based on a wholistic review of fish sampling data collected over a 22-year period (1994–2016). The data were collected near WCGS from the Lower Lockport Pool, between Romeo Road and the Lockport Lock and Dam. Consistent with the 316(a) USEPA 316(a) Manual, EA Engineering used these data to identify representative important species for the fish community in the Lower Lockport Pool, *i.e.*, representative of (1) numerically dominant species, (2) various trophic levels, (3) targets for recreational or commercial fisheries, (4) potential nuisance species, (5) thermally sensitive species, and (6) Illinois-listed threatened or endangered species. EA Engineering selected representative important species that were representative of the balanced, indigenous community that currently exists near WCGS and could exist if improvements in water quality occur. Exh. 4 at 4-4. EA Engineering found one Illinois-listed threatened species of fish but no federal-listed threatened or endangered species in the Lower Lockport Pool. Exh. 4, App. B at B-7. The seven representative important species selected for evaluation under the Type II Predictive Demonstration were:

- Gizzard Shad (Abundant, Forage)
- Bluntnose Minnow (Abundant, Forage)

- Banded Killifish (State Threatened)
- Common Carp (Abundant, Nuisance)
- Channel Catfish (Recreational)
- Green Sunfish (Abundant, Recreational, Predator)
- Largemouth Bass (Abundant, Recreational, Predator)

Id. at B-8.

Hydrothermal Model (Appendix D). To predict water temperatures and profiles of the thermal plume under differing canal flows and temperatures, weather, and WCGS operating conditions, EA Engineering developed the hydrothermal model of the receiving water in the CSSC. Exh. 3 at 3. EA Engineering tailored the hydrothermal model to the WCGS site by surveying the CSSC bathymetry and developing depth contours. Exh. 4, App. B at B-2; Exh. 4, App. D at D-24, Fig. D-5a–D-5c, D-6. Additionally, to fit the model to the site, EA Engineering surveyed the WCGS thermal plume in the summer (2011 and 2016) and winter (2017). Exh. 4, App. B at B-2; Exh. 4, App. D, D-6, D-8a–D-8c. The bathymetric and thermal plume survey results were used to develop and calibrate a site-specific, three-dimensional hydrodynamic model, called "MIKE3." Pet. at 21-22; Exh. 4, App. B at B-2; Exh. 4, App. D at D-9, D-13, D-42, Fig. D-10–D-23. The model was validated using a thermal plume survey from July 2011. Exh. 4 at D-42; Exh. 4, App. D, Fig. D-27–D-36. For the 316(a) predictive demonstration, EA Engineering used the model to predict water temperatures and profiles at fifteen locations—referred to as "transects"—along the CSSC, beginning at 3,380 feet upstream to 19,000 feet downstream of the WCGS discharge canal. Exh. 4, App. D, Fig. D-3, D-4.

The Board first describes the engineering and hydrological data used. Then, the Board describes the hydrothermal analysis.

Engineering and Hydrological Data. The USEPA 316(a) Manual calls for the engineering and hydrological data to be supplied as part of the Type II Predictive Demonstration. USEPA 316 (a) Manual at 46. Engineering and hydrological data provide a baseline for parameters to be used in predictive models. *Id.* This information includes plant operating data (*e.g.*, cooling water flow, time-temperature profiles, chlorine use, dissolved oxygen levels, contaminants other than MWG's heat), hydrologic information (*e.g.*, canal flow, depth contours), meteorological data, outfall configuration, plume data, and the results of hydrologic models. *Id.* at 46–52. It also considers the interaction between the thermal component of the discharge and other pollutants in the water. *Id.*

The hydrothermal model recognizes that WCGS uses a once-through circulating water system for condenser cooling. Pet. at 8. Under four-unit operation, cooling water and service water is withdrawn from the Lockport Pool at a "total design intake flow rate" of approximately 1,296 million gallons per day. Exh. 4, App. D at D-1. Under the current single-unit operation, the flow rate was reduced 56% to approximately 570 million gallons per day. *Id.* After passing through the heat exchangers, the water is discharged back into the CSSC with no supplemental cooling mechanisms. Pet. at 6; Exh. 4, App. D at D-2. The outfall configuration is a 250-foot long, constructed channel cut into the vertical canal wall with no flow control structures. Pet. at 6-9; Exh. 4, App. A at A-3.

Canal flow parameters used by the MIKE3 model came from the United States Geological Survey's Lemont station. Exh. 4, App. D, Fig. D-2a–D-2h, Tables D-4a–D-4b; Exh. 4, App. D at D-30. The MIKE3 model used meteorological parameters (including air temperature, relative humidity, cloud cover, and wind speed and direction) obtained from Lewis University/Airport in Romeoville, Illinois, approximately six miles from WCGS. Exh. 4, App. D at D-25; Exh. 4, App. D, Fig. D-7a–D-7c. WCGS operating parameters included intake temperature, discharge temperature, circulating water flow, and power production. Exh. 4, App. D, Tables D-5a–D-5c.

EA Engineering's hydrothermal modeling did not include chlorine use, dissolved oxygen levels, or contaminants other than MWG's thermal discharge, but EA Engineering addressed them in the demonstration.

MWG's 316(a) demonstration confirms that WCGS does not add chlorine or other chemicals to the circulating water, which is used to cool and condense the steam from the generating units and then is discharged back into the CSSC. Exh. 4, App. D at D-2. Because MWG does not chlorinate its condenser cooling water before discharging it, EA Engineering concludes there would be "no detrimental impacts to aquatic life, including zooplankton, related to [WCGS thermal discharges]." Exh. 4, App. C at C-12.

Its NPDES Permit requires MWG to monitor dissolved oxygen at WCGS' intake and its discharge within thirty minutes of each other. Exh. 4, App. A at A-17. Monitoring results from 2005 to 2015 indicate that low dissolved oxygen levels were associated with CSOs into the CSSC and not with WCGS operations. Exh. 4, App. A at A-18, Table A-2. IEPA added that the CSSC is not subject to enhanced dissolved oxygen standards. IEPA Rec. at 2.

As to the potential interaction between the thermal component of WCGS's discharge and other contaminants, EA Engineering considered dissolved organic carbon, total phosphorus, total nitrogen, biocides, heavy metals, and other thermal discharges located upstream. Exh. 4, App. C at C3–C7. EA Engineering found no evidence of harmful interactions between other pollutants and the thermal component of the WCGS discharge, whether historic or predicted under the proposed alternative thermal effluent limitation. Exh. 4, App. C at C-3.

Hydrothermal Analysis. EA Engineering ran the hydrothermal model under conditions reflecting both worst-case and typical scenarios for summer and winter. Pet. at 21–22; Exh. 4 at 4-2; Exh. 4, App. D at D-9–D-12. The worst-case scenarios were based on actual worst-case conditions in recent history, using WCGS operating data, CSSC flow, and weather data. For summer, the worst-case scenario used actual weather, canal flow, and Unit 4 load conditions from July 2012, when Chicago had a widespread heat wave and drought. Exh. 4, App. D at D-30–D-33. The typical summer scenarios used the 75th percentile of the same WCGS operating data and weather data—except for CSSC flows, which were evaluated at the median flow and 10th percentile low flow for July 2011–2016. Exh. 4, App. D at D-33–D-36, Tables D-10, D-14.

For winter, the worst-case scenario was drawn from the higher unit load demand and low flows that occurred during the unseasonably warm winter months of 2011–2016, including March 2012, when air temperatures were the highest in Chicago's 145-year record. Exh. 4, App.

D at D-36–D-41, Table D-24. The typical winter scenarios used the 75th percentile of the same WCGS operating data and weather data for December and March 2011–2016, along with CSSC flows, which were evaluated at the median flow and 10th percentile low flow. Exh. 4, App. D at D-33–D-36, Table D-28.

Using the input parameters for the typical and worst-case scenarios, the hydrothermal model produced thermal profiles of the CSSC for the horizontal and vertical extent of the predicted thermal plume. Exh. 4, App. D, Fig. D-24a–D-26f, D-37a–D-39f.

For the summer-modeling scenarios, the maximum recorded temperature of the WCGS area for July 1-7, 2012, was 99°F. Cooling water intake temperatures were as high as 87°F and the maximum discharge temperature to the discharge canal was 103°F. Exh. 4 at 4-2–4-3. For the worst-case summer scenario at the 180-foot transect, a 53.5% zone of passage was provided by the 96°F isotherm. At the 7,000-foot transect at the edge of the mixing zone, a 96.4% zone of passage was provided by the 93°F isotherm. Exh. 4, App. D at D-21–D-33.

For the winter-modeling scenarios, cooling water intake temperatures were as high as 74.8°F, with median winter values ranging from 42.3°F to 48.0°F. The maximum measured winter discharge temperature for 2011–2016 was 78°F. Exh. 4 at 4-2–4-3. For the worst-case winter scenario at the 180-foot transect, a 14% zone of passage was provided by the 70°F isotherm and a 66% zone of passage was provided by the 75°F isotherm. At the 7,000-foot transect at the edge of the mixing zone, a 0% zone of passage was provided by the 70°F isotherm and a 100% zone of passage was provided by the 75°F isotherm. Exh. 4, App. D at D-39.

EA Engineering concludes the model results show WCGS would be unable to consistently meet the thermal limits under the Board's new "CAWS and Brandon Pool Aquatic Life Use B" or "ALU B" standards during times of adverse weather and low-canal flows—which occurred in the past and are expected in the future. Exh. 4, App. D at D-42. EA Engineering explains, however, that "even under these extreme conditions":

> [T]here are no temperatures within the range of thermal influence of the WCGS plume that would be considered adverse to the [balanced, indigenous community] of the CSSC, which is already acclimated to higher water temperatures than would be found in a natural system, due to the predominance of POTW flow during the winter period. Exh. 4, App. D at D-38–D-39.

<u>Biothermal Assessment (Appendix B).</u> To estimate the extent of the effect on representative important species' life cycle functions, including spawning, growth, and survival, EA Engineering compared temperatures estimated by the hydrothermal model with biothermal metrics for fish. Exh. 4, App B at B-2. The model provided cross-section and bottom water temperatures to estimate the habitat that would be excluded or not considered optimum for representative important species. *Id.* Thermal diagrams were constructed for each representative important species —except the Banded Killifish because EA Engineering lacked thermal endpoint data. The thermal diagrams illustrate the biothermal response metrics of temperature thresholds for thermal tolerance, heat shock, cold shock, acute mortality, chronic mortality, avoidance, no growth, optimum growth, and spawning. *Id.* at B-16, Fig. B-1–B-6. The Board reviews the biothermal assessment on representative important species' life cycle functions, starting with spawning, followed by growth, avoidance, and thermal mortality.

Spawning. Most of the representative important species spawn from late spring through early summer (May to June). Because the eggs are demersal, adhesive, or deposited in nests in shallow adult-protected areas, they have minimal exposure to the surficial WCGS thermal plume. Exh. 4, App. B at B-19. For other fish that spawn in the shallower littoral zones, abrupt water-level changes in the CSSC—due to heavy rainfall events and water drawdowns—expose the littoral zones, disrupting spawning and desiccating early-life stages of fish, unrelated to the WCGS discharge. Exh. 4, App. A at A-41–A-42.

Growth. Typical of temperate zone fishes, the representative important species all exhibit growth patterns that are based on seasons. Exh. 4, App. B at B-39. In the summer, if peak temperatures rise above a critical level, growth might decline or stop temporarily. *Id.* In the winter when temperatures fall below a critical temperature, the representative important species may show zero growth; however, zero winter growth is unlikely in the CSSC because ambient temperatures are higher (from the POTW flow) than in natural systems. *Id.* Therefore, the elevated winter temperatures may stimulate growth earlier and later in the year. *Id.* Additionally, there are no species present that require a "chilling period" during the winter to complete their life cycle. Exh. 4 at 3-8. The maximum proposed winter alternative thermal effluent limitations are all within the temperature change tolerance for warm water aquatic life. *Id.* EA Engineering found it "unlikely that temperatures in the WCGS thermal plume outside the immediate discharge area would adversely affect growth or cause a cessation of growth for these [representative important species]." *Id*. at 4-6; *see also id*. at B-31 ("immediate discharge area" extends from WCGS discharge point to 180 feet downstream).

Avoidance. The modeled typical summer scenarios show the discharge temperatures do not exceed the avoidance temperatures for the six representative important species. Exh. 4 at 4-5; Exh. 4, App. B, Fig. B-1–B-6. In contrast, the worst-case summer scenario avoidance data indicate the representative important species would only avoid the thermal plume in the immediate discharge area. Exh. 4 at 4-5. And, the modeled worst-case winter scenarios show the temperatures would not induce avoidance by the CSSC aquatic community. *Id.* During the winter and transition months, the proposed alternative thermal effluent limitations are not expected to affect the representative important species because temperatures will remain lower than avoidance temperatures and preferred temperatures. Exh. 4, App. B at B-19. Because avoidance is predicted to be minimal and of short duration, EA Engineering found that local representative important species' movement along with diel and seasonal migrations are not likely to be inhibited. *Id*. at B-38.

Thermal mortality. Under the modeled typical summer scenarios, the discharge temperatures did not exceed the chronic or acute thermal mortality threshold for the representative important species. Exh. 4 at 4-5; Exh. 4, App. B, Fig. B-1–B-6. These two scenarios are typical of what EA Engineering expects are past and future conditions at WCGS; EA Engineering concludes that, under these conditions, no appreciable harm is predicted under the proposed alternative thermal effluent limitations. Under the modeled worst-case winter scenarios, EA Engineering determined that the temperatures would not cause mortality in the

CSSC aquatic community. Exh. 4 at 4-5. MWG states that "there has never been, under any set of actual conditions, an observed winter fish kill near WCGS under both historical four-unit operation, or current single-unit operation." MWG Resp.2 at 23.

Under the worst-case summer scenario, temperatures exist in the WCGS thermal plume that have the potential to cause mortality if those conditions result in extended chronic exposure; however, the demonstration shows these conditions are rare and of short duration. Exh. 4, App. B at B-38. The potential for mortality associated with the proposed alternative thermal effluent limitations is "negligible" and would be even less so under the typical scenarios. Exh. 4 at 4-6. Fish can avoid high temperatures and find thermal refuge upstream of the WCGS discharge and further downstream outside the immediate influence of the discharge. Exh. 4, App. B at B-38.

Development of Values for Proposed Alternative Thermal Effluent Limitations. The currently applicable temperature water quality standards for the CSSC, as an ALU B water, provide for a two-period, monthly approach. This approach allows for a daily maximum of 90°F and 60°F for April through November and December through March, respectively, with excursions allowed up to 3.0°F for as much as 1% of the time. 35 Ill. Adm. Code 302.408(f), (h). The previously applicable thermal water quality standards—Secondary Contact and Indigenous Aquatic Life Use—provided for a single, year-round daily maximum of 93°F, with excursions limited to no more than 5% of the time or 100°F any time. Pet. at 18.

MWG seeks alternative thermal effluent limitations for its heated effluent, which is discharged from WCGS to the Lower Lockport Pool in the CSSC. The alternative thermal effluent limitations would:

- Increase the daily maximum limits and excursion hours in its NPDES Permit, which are based on the former Secondary Contact and Indigenous Aquatic Life Use standards; and

- Decrease the minimum zone of passage required by35 Ill. Adm. Code 302.102(b)(8).

These alternative thermal effluent limitations would be measured at the edge of MWG's permitted mixing zone. MWG also requests that the proposed alternative thermal effluent limitations apply in lieu of the narrative thermal limitations at 35 Ill. Adm. Code 302.408(c), (d), and (e). EA Engineering used its hydrothermal modeling and biothermal assessment of the representative important species to develop MWG's proposed alternative thermal effluent limitations. The Board reviews how EA Engineering used the predictive demonstration to develop MWG's proposed temperature limitations, excursion hours, zone of passage, and method for demonstrating compliance.

Temperature Limitations. MWG requests an increase in the daily thermal discharge temperature limits over those under the ALU B standards of 35 Ill. Adm. Code 302.408(h). EA Engineering used different approaches depending on the season. For summer and winter months, it determined temperature limits by integrating the hydrothermal model and predictive analysis with the representative important species temperature tolerances and life history requirements documented in the biothermal assessment. Pet. at 21–22. For setting spring and fall temperature limits, EA Engineering used a "stair-step" approach, providing a gradual transition between seasons. Exh. 4, App. D at D-12, D-43–D-44. The result is a table of alternative thermal effluent limitations by month, distinguishing eight time periods and seven temperature limits. Pet. at 25–26. The Board reviews MWG's demonstration for each season below.

Summer. The proposed summer thermal limits are based on the typical and worst-case scenarios under the hydrothermal modeling, coupled with the representative important species biothermal assessment. Exh. 4, App. D at D-42. MWG proposes limits designed not only to protect the balanced, indigenous community in the CSSC, but also to accommodate WCGS' continued operations under adverse weather and flow conditions, which tend to occur when power demand is greatest. *Id.*

Under the worst-case summer scenario, the maximum modeled surface temperature near the edge of the permitted mixing zone at the 7,000-foot transect was 96°F with a zone of passage of 100%. Exh. 4, App. D at D-32–D-33. MWG proposes a daily maximum of 93°F with a 3°F allowable excursion, resulting in a maximum compliance temperature of 96°F for June through September at the edge of the mixing zone. Exh. 4, App. B at B-35. EA Engineering notes that most of the representative important species can tolerate water temperatures above 95°F for extended periods of time (48–96 hours) at acclimation temperatures above 85°F. *Id.* at B-30. These temperatures have the potential to cause mortality if exposure is chronic, but EA Engineering concludes chronic exposure is not expected here because those conditions in the CSSC are rare and of short duration. *Id.* Further, under the proposed alternative thermal effluent limitations, thermal refuge will continue to be available outside the immediate discharge zone. *Id.*

Past compliance at the edge of the mixing zone—with the prior, long-standing thermal limits under the Secondary Contact and Indigenous Aquatic Life Use standards—was not found to have a detrimental impact on the balanced, indigenous community (as detailed in the retrospective demonstration). Exh. 4, App. B at B-35. EA Engineering therefore found that, for MWG's thermal discharge, "the proposed summer daily maximum based on the previous daily maximum is appropriate." *Id.*

Winter. EA Engineering developed the proposed winter standards to ensure adequate protection of aquatic life in the CSSC not only under varying WCGS operating conditions, but also under infrequent periods of warm weather and low canal flows documented in the past. Exh. 4, App. B at B-35.

Under the winter-modeling worst-case scenario, the WCGS discharge temperature at the 75th percentile winter load was as high as 80.5°F, with a mean of 77.8°F. Exh. 4, App. B at B-16. For the typical winter-median and low-flow scenarios, ambient water temperatures did not exceed 51.0°F and discharge temperatures did not exceed 66°F. *Id.* Surface temperatures tend to be higher than at lower depths in the canal. *Id.* at B-25; Exh. 4, App. D at D-38–D-39. However, the modeled temperature over the entire water column at the edge of the permitted mixing zone at the 7,000-foot transect was 75°F with a zone of passage of 100% and 70°F with a zone of passage of 0%. Exh. 4, App. D at D-38–D-39. MWG proposes a daily maximum of 70°F with a 3°F allowable excursion, resulting in a maximum compliance temperature of 73°F for January through February at the edge of the mixing zone while excursion hours are available. Pet. at 25–26. The worst-case winter model predicted a 0% zone of passage at the 70°F isotherm 7,000 to 11,000 feet downstream from the discharge. Exh. 4, App. D at D-38–D-39. MWG explained, however, that WCGS personnel would be alerted by the Near-Field Compliance Model to implement control measures that would always ensure a minimum 50% zone of passage. MWG Resp.2 at 21.

The proposed winter alternative thermal effluent limitations fall within the preference or tolerance zones for the representative important species having thermal tolerance data. Exh. 4 at 3-7–3-8, App. B, Fig. B-1–B-6. No species are present that require a "chilling period" during the winter to complete their life cycle. Exh. 4 at 3-8.

EA Engineering compared winter temperatures (based on the 2011–2016 WCGS discharge and the results of the hydrothermal modeling under typical and worst-case scenarios) to the thermal tolerances of the representative important species. Exh. 4, App. B and B-35. EA Engineering found "no actual or modeled station discharge temperatures that would put the CSSC balanced, indigenous community at risk, nor preclude upstream or downstream movements." *Id.* Actual temperatures at the CSSC near WCGS are warmer than a natural waterway during the winter and average 51.6°F due to the flow from the POTW, which accounts for 70–100% of the flow in the CSSC at WCGS. Exh. 4, App. D at D-43. Because of this perennial source, the balanced, indigenous community in the Lower Lockport Pool is already acclimated to warmer winter water temperatures than are typical of a natural stream. Exh. 4, App. B at B-39. Based on these observed and modeled temperatures and the representative important species thermal tolerance and life histories, EA Engineering found that "there should be no negative impacts from the operation of WCGS under the proposed winter thermal [alternative effluent limitations]." Exh. 4, App. at D-43.

Spring and Fall. EA Engineering relied on the hydrothermal model to develop alternative thermal effluent limitations for the summer and winter scenarios. However, it relied on a different method for the transitional months of April/ May and October/November. Exh. 4, App. D at D-12. MWG proposes a "stair-step" approach that would "provide a more seasonally-based and gradual transition between the summer and winter months . . . which is more in line with the existing thermal regime of the CSSC." *Id.*

According to EA Engineering, for the transitional months between the extremes of winter and summer, the stair-step approach—with eight different time periods and seven different temperatures—better reflects the seasonal variation in ambient water temperatures than the two-temperature/two-time period standards under either the former Secondary Contact and Indigenous Aquatic Life Use or the current ALU B. Exh. 4, App. D at D-43–D-44. EA Engineering stated:

> The proposed transitional month thermal [alternative effluent limitations] are also more stringent than the corresponding [ALU] B numeric limitations. This seasonally variable approach will ensure continued protection of the [balanced, indigenous community], and will effectively supersede, yet still fulfill the intent

of the "5°F above natural temperature" narrative criteria as applied to the CSSC near WCGS. Exh. 4, App. B at B-36.

IEPA acknowledges that MWG's proposed numeric limits for the "transition months (April, May, and November) are more stringent than the corresponding limits under ALU B and closer to seasonal temperature expected in the [CSSC]." IEPA Rec. at 5. IEPA observes that the ALU B temperature standards provide for "abrupt standards changes from March to April (60°F to 90°F) and from November to December (90°F to 60°F)." *Id*. Further, IEPA agrees that MWG's proposed numeric limits "will protect the [balanced, indigenous community] in lieu of other narrative criteria." *Id*. at 4–5.

Increase in Excursion Hours. MWG requests an increase in excursion hours from 87.6 to 438. Section 302.408(f) allows 87.6 excursion hours (1% of the 8,760 hours in 12 months). The previous Secondary Contact and Indigenous Aquatic Life Use standards, like MWG's proposal, allowed 438 excursion hours (5% of the 8,760 hours in 12 months). IEPA Rec. at 5; MWG Resp.2 at 26. Under MWG's proposal, WCGS would use excursion hours when the temperature at the edge of the mixing zone exceeds the numeric limit up to 3°F. Pet. at 18. EA Engineering states that the 1% limit "would be entirely insufficient to support WCGS operations during both the summer and winter months, especially if unseasonal weather patterns and/or low flow conditions persisted during a given year." Exh. 4, App. D at D-12; Pet. at 16.

Except with the July 1, 2018 applicability of the 1% excursion-hour limitation under Section 302.408(f), "[s]ince regulation of heat discharges began in the 1970s, the CSSC has never had an excursion-hour limitation of less than 5%." MWG Resp.2 at 26. MWG therefore asserts that its "proposed maintenance of a 5% standard will not 'increase' the amount of heat encountered by the [balanced, indigenous community]." *Id.*[20] IEPA and MWG agree the 316(a) demonstration shows that WCGS operations under those prior standards have not caused appreciable harm to the balanced, indigenous community in the CSSC. IEPA Rec. at 5; MWG Resp.2 at 26. Additionally, MWG states that the proposed alternative thermal effluent limitations are a "significant tightening" of the prior standards, which will "preserve the decreased thermal loading that the waterway has experienced after the shutdowns of the Fisk and Crawford Generating Stations and WCGS's reduced unit operations." MWG Resp.2 at 26.

According to MWG, with the proposed numeric limitations more stringent than the previous 93°F year-round standard, the 438 excursion hours are "now more essential" because of the potential for exceedances in the winter months and, though less likely, transitional months. MWG Resp.2 at 26. MWG does not expect to use all 438 hours "except under the most extreme circumstances," but states that the excursion hours are necessary because provisional variances

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[20] Based on MWG's pending petition for time-limited water quality standards, application of the current standards is stayed as to WCGS. MWG Resp.2 at 26, n. 12; *see also* docket PCB 16-19, Midwest Generation, LLC v. IEPA.

(35 Ill. Adm. Code 104.Subpart C) are "no longer an available regulatory option for infrequent and unpredictable thermal compliance challenges." *Id*. at 17–18, 26.[21]

The hydrothermal analysis documents the number of hours and months (2011–2016) with discharge temperatures above the proposed limits. Exh. 4, App. D, Tables D-3a–D-3c. During this period, discharge temperatures approaching those modeled under the worst-case scenario are expected in July and September up to 5% of the time. Exh. 4, App. B at B-35; Exh. 4, App. D, Table D-1. Discharge temperatures exceeding 93ºF are expected in June through August up to 20% of the time, and if no mixing is allowed, WCGS might need to use excursion hours 20% of the time. MWG Resp.2 at 27. MWG lacks data on the number of excursion hours that would have been used if the proposed alternative thermal effluent limits had applied during 2011-2016. MWG Resp.2 at 27. The available biological data, however, show that "temperatures in the excursion-hour range have not had any adverse effects on the indigenous aquatic community under the prior Secondary Contact thermal standards and are not expected to do so in the future under the proposed [alternative thermal effluent limitations]." *Id*.

According to MWG, its 316(a) Demonstration "shows that, because the species inhabiting the CSSC are generally tolerant and have the ability to sense and avoid areas of water temperatures outside of their preferred range, these temporary instances of increased thermal discharge temperatures will not fundamentally change the inhabitability of the CSSC." Pet. at 23–24. EA Engineering notes that most of the representative important species can tolerate water temperatures above 95°F for extended periods of time (48–96 hours) at acclimation temperatures above 85°F. Exh. 4, App. B at B-30. MWG states that the likelihood is low for excursion hours to occur consecutively in periods exceeding 96 hours. MWG Resp.2 at 27. Based on thermal data for the most recent extreme weather period (July 2012), 20 hours was the longest duration of discharge temperatures exceeding 95ºF. *Id*. at 27–28. The average was nine hours. MWG therefore asserts that even during critical weather and flow conditions, the proposed 438 excursion hours would provide a recovery period for thermal refugia. *Id*. Additionally, WCGS will maintain at least a 50% zone of passage. *Id*. at 28.

MWG proposes that its excursions hours be capped at 5% of the time in a calendar year instead of a "12-month period ending with any month," as required by Section 302.408(f). Pet. at 25. MWG explains that a calendar-year approach for excursion hours is preferred because "extreme ambient conditions that can require their use generally cluster in summer and winter

[21] Applying the "arbitrary or unreasonable hardship" standard under the Environmental Protection Act (Act) (415 ILCS 5 (2018)), the Board may grant a "variance" and IEPA may grant a "provisional variance." 415 ILCS 5/35-38 (2018). However, the CWA and USEPA regulations "only allow variances from a water quality standard if, among other things, the state demonstrates that the designated use for the water body at issue is not attainable for at least one of the [40 C.F.R. § 131.10(g)] factors." IEPA proposal (filed Aug. 9, 2017) at 5 in docket R18-18, Regulatory Relief Mechanisms: Proposed New 35 Ill. Adm. Code Part 104, Subpart E. "Before the Act was amended in 2017 [by Public Act 99-937, effective Feb. 24, 2017, adding authority for time-limited water quality standards], it did not provide any other mechanism consistent with federal law to grant [water quality standard] variances." *Id*.

months." MWG Resp.2 at 16. Based on this clustering of extreme conditions, MWG argues against the Section 302.408(f) "rolling" 12-month cap on excursion hours:

> Thus, any system of rationing excursion hours over the course of a rolling 12-month period risks a scenario where one set of adverse weather and flow conditions is followed 11 months later by a second set of adverse conditions. And if the first period was severe enough to use the majority of available excursion hours (which is a realistic possibility), this could force WCGS to derate during the second period, even though the balanced, indigenous community would not require such a reduction in the thermal discharge as the result of a period of excursion hours used 11 months earlier. The required deratings to meet the rolling accounting requirement in this case would be arbitrary and would provide no ecological benefit. This scenario exists in the calendar-year approach, but it can only occur if there are several severe periods occurring within a single calendar year, which is possible, but does not occur frequently. *Id*.[22]

The Board asked MWG—applying the Secondary Contact and Indigenous Aquatic Life Use temperature standards—to identify all instances over the past five years when the 5% excursion-hours cap would have been exceeded under a 12-month rolling calculation but not exceeded under a calendar-year calculation. MWG explained that in the CSSC, the excursion-hours cap "becomes critical only during times that see extreme weather and/or chronically low flow conditions." MWG Resp.2 at 17. Because the IEPA-approved quantitative methodology for the accounting of near-field excursion hours was not implemented until January 2015, MWG had no data on calculated excursion hours preceding 2015, even though the prior thermal standards had an excursion-hours requirement. *Id*. MWG reviewed data for 2015–2018 but the CSSC had, in that timeframe, experienced no extreme weather conditions, which resulted in the number of excursion hours "used between 93°F and 100°F" being "very limited": 0 hours in 2015; 4 hours in 2016; 0 hours in 2017 (WCGS did not run March–December); and 0 hours in 2018. *Id*.

MWG cautioned, however, that these low excursion-hour totals were "misleading" because no data were available for excursion hours used during "the 2012 heat wave/drought." MWG Resp.2 at 17. Discharge temperature and flow data from the 2012 summer indicate that "there may well have been a large number of excursion hours consumed during this critical period." *Id*. In addition, MWG emphasized that "more excursion hours would be used under the proposed [alternative thermal effluent limitations], which has significantly lower temperature limits in most months than was the case under the former Secondary Contact standards." *Id*. MWG explains that it requests the 5% excursion-hours cap and calendar-year calculation "to help preserve ongoing thermal compliance under extreme circumstances like those seen in 2012, when power demand is likely to be high." *Id*. MWG asserts that these limits are "shown by past experience to be protective of the [balanced, indigenous community]." *Id*. at 18.

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[22] For background, "derating" refers to "[a] decrease in the available capacity of an electric generating unit . . . ." U.S. Energy Information Administration, Glossary at https://www.eia.gov/tools/glossary/index.php?id=D (last visited Oct. 15, 2019).

The Board also asked MWG—applying the current ALU B numeric temperature standards—to identify all instances over the past five years when the 1% excursion-hours cap would have been exceeded under a 12-month rolling calculation but not exceeded under a calendar-year calculation. For 2015–2018, MWG reviewed near-field excursion-hour accumulation based on "theoretical compliance" with ALU B numeric temperature water quality standards (60°F December–March; 90°F April–November). MWG Resp.2 at 18. MWG found that WCGS would have used 169 excursion hours in 2015; 415 excursion hours in 2016; 14 excursion hours in 2017; and 0 excursion hours in 2018. *Id*. Again, however, WCGS did not run for nine months in 2017 (March–December) and the 2015–2018 period did not capture the 2012 heat wave and drought. *Id*. at 17–18.

In 2016, 257 excursion hours would have been used in March and another 138 excursion hours would have been used over the two months of August and September. MWG Resp.2 at 18. Under the 12-month rolling calculation:

> [T]he 257 hours used in March 2016 would not again become available for use until March 2017, leaving only 181 excursion hours remaining for use during the summer months of 2016. *** While this might not present an issue during most years, if the summer, fall or early winter of 2016 had been more extreme, there would have been an insufficient number of remaining excursion hours available for use, which would have then required WCGS to implement unit derating during critical power demand conditions . . . ." *Id*.

In contrast, under the calendar-year calculation, though there could be adverse spring and summer weather in a single year that requires using many excursion hours, "there would be excursion hours remaining for use through the end of the year" and "[t]he full complement of allowed excursion hours would again be available on January 1st of the following year, rather than gradually accruing them back over time . . . ." *Id*. at 19.

Zone of Passage. EA Engineering states that reducing the minimum required zone of passage from 75% to 50% is "unlikely to result in adverse harm." Exh. 4 at 5-2.

IEPA points out that the current rules (35 Ill. Adm. Code 302.102(b)(8)) already allow a 50% zone of passage in streams where the dilution ratio is less than 3:1. IEPA Rec. at 6. IEPA addressed WCGS and the CSSC waters into which it discharges:

> Based on the design flow of the facility (570 [million gallons per day] (882 cfs)) and the 7Q10 flow of the receiving stream (1315.0 cfs), the dilution ratio is less than 3:1. The discharge is located directly below the electric barrier, which does not allow the passage of fish. [IEPA] is comfortable with recognizing that WCGS can utilize up to 50% of the stream flow for mixing. *Id*.

MWG states, "[i]n general, a CSSC flow of less than 2,646 cfs would represent a less than 3:1 dilution ratio, but compliance would also depend upon station operations and ambient canal temperatures at any given time, as well as how long that flow rate continued." MWG Resp.2 at 4–5. MWG addressed when dilution ratio is greater than 3:1:

> [T]he zone of passage is much larger when the dilution-flow ratio is at or greater than 3:1. (In most cases, 75% or greater.) *** [T]he proposed 50% zone of passage would be relevant for WCGS thermal compliance only in situations when upstream flows remain low for these longer periods of time ["for more than just a few hours"], and the station is running at higher load with all circulating water pumps on.
>
> The proposed 50% zone of passage is designed to cover a "worst case" situation when the factors affecting thermal compliance may potentially combine to create adverse conditions. *Id*. at 4.

To demonstrate compliance with the proposed 50% zone of passage, MWG would continue using the WCGS Near-Field Thermal Compliance Model approved in the NPDES Permit. MWG Resp.2 at 4. EA Engineering states that the model accounts for changing WSGS operations, weather, and canal flow. *Id*. at 4–5.

Based on CSSC flows during 2011–2016, MWG noted that flows providing less than the 3:1 ratio occurred only in January, February, October, November, and December, although it could occur at any time of the year. Daily average CSSC flows less than the 7Q10 value of 1,315 cfs occurred only during the non-summer months; the biological information collected during this period did not indicate any appreciable harm. MWG Resp.2 at 5; Exh. 4 at 4-13. During the summer months, CSSC flows tend to be higher when WCGS is expected to operate with higher discharge temperatures. MWG Resp.2 at 5. These higher summer flows are attributed to Lake Michigan diversions to the CSSC, rainfall, runoff, and increased summer effluents flows from POTWs. *Id*. MWG states that adverse thermal effects on the indigenous aquatic community have not been found. *Id*.

In 2014, the Board granted alternative thermal effluent limitations for Quad Cities Nuclear Generating Station that included relief from the zone-of-passage requirements. The size of the zone of passage was conditioned on the quantity of flow in the receiving stream. *See* Exelon Generation LLC v. IEPA, PCB 14-123, slip op. at 54–55 (Sept. 18, 2014). Specifically, the relief required a zone of passage of at least 66% only when the flow in the receiving stream was less than 16,400 cfs, requiring at least a 75% zone of passage when the river flow was at 16,400 cfs or more. *Id*. The Board asked MWG whether any zone-of-passage relief here should be similarly conditioned. MWG argued that such a "bifurcated" flow-rate trigger in this case would provide no ecological benefit here and prove infeasible "to design, and even harder to implement." MWG Resp.2 at 24. Unlike the natural flow of the Mississippi River considered for Quad Cities Nuclear Generating Station, the frequent large-scale flow fluctuations in the CSSC are not seasonal or otherwise predictable. *Id*. at 24–25.

As part of MWG's Type II Predictive Demonstration, EA Engineering used the hydrothermal model to predict the available zone of passage under typical and worst-case scenarios of ambient temperature and flow. Exh. 4, App. B at B-1. The hydrothermal modeling predicts the percent cross-sectional area of the CSSC as a function of temperature. *Id.* at B-21. The zone of passage is part of the cross-sectional area of the thermal plume in the CSSC that is available where temperatures are less than the avoidance temperature for representative important species. *Id*.

Based on the hydrothermal model, EA Engineering found that a 75% or greater zone of passage would be expected most of the time under the proposed alternative thermal effluent limitations in the CSSC near WCGS. Pet. at 24, citing Exh. 4, App. D. MWG explained that because of the frequent erratic flow fluctuations in the CSSC, determining a zone-of-passage standard tied to the dilution ratio (stream flow to discharge flow) at any given time would be nearly impossible. *Id*. Therefore, MWG proposes a zone of passage of 50% of the cross-section area or greater, regardless of the dilution ratio. *Id*. The predictive demonstration, MWG continues, shows that this will not impair the ability of fish to move upstream or downstream of the WCGS thermal plume area. *Id*.

Based on the worst-case scenarios under the hydrothermal model, MWG states that its proposal would provide "sufficient limits on heated effluent such that the CSSC will maintain a zone of passage even under worst-case scenarios." Pet. at 21. EA Engineering elaborates:

> Only under the worst-case condition, at the 7,000 ft downstream of the WCGS discharge location, was the zone of passage for the 90°F isotherm less than 75% of the water column. Although a zone of passage of less than 75% may affect some species in a limited fashion, the instances where the zone of passage downstream of the WCGS thermal discharge is less than 75% (but not less than 50%) are expected to be rare and limited in duration. Under these limited conditions, there would be only temporary and infrequent avoidance of the plume. Exh. 4 at 5-2.

EA Engineering concludes that temporarily reducing the zone of passage is "unlikely to result in adverse harm," given the nature of the balanced, indigenous community in the CSSC. *Id.*

Under the worst-case summer scenario, the hydrothermal model predicts a 53.5% zone of passage for the 96°F isotherm at the 180-foot transect, and a 96.4% zone of passage for the 93°F isotherm at the 7,000-foot transect (edge of the allowed 26-acre mixing zone). Exh. 4, App. D at D-21–D-33.

Under the worst-case winter scenario for the 70ºF isotherm (proposed limitation for January and February), the zone of passage reached 14% at the 180-foot transect, and 0% at the 7,000-foot transect and 11,000-foot transect. Exh. 4, App. D at D-39–D-40. For the 75ºF isotherm, the zone of passage reached 66% at the 180-foot transect. *Id.* The worst-case winter scenario was modeled when temperatures were unseasonably warm, and flow was near 7Q10 of 1315 cfs. *Id.* at D-30. Under the typical winter scenario with median flow or 10th percentile low flow, however, the zone of passage was 100% across the 7,000-foot transect and 70°F proposed limitation. *Id.* at D-39–D-40.

The Board asked MWG to elaborate on the worst-case winter scenario and the predicted 0% zone of passage, citing Section 302.102(b)(6), which generally provides that "[m]ixing must allow for a zone of passage for aquatic life in which water quality standards are met." 35 Ill.

Adm. Code 302.102(b)(6).[23] MWG explained the worst-case modeling is not representative of "'real world conditions'" because it does not account for operational changes that would be implemented: "WCGS personnel would be following established protocols for adjusting station operations based on the results of the Near-Field Thermal Compliance Model to ensure that the extreme results predicted by the worst-case scenario would not materialize." MWG Resp.2 at 22. Inherent in the Near-Field Compliance Model is the calculation based on a minimum required zone of passage. *Id*. at 21. That calculation would be modified from a 75% to a 50% zone of passage. *Id*. at 21, n. 9. The Near-Field Compliance Model enables WCGS to constantly determine the temperature at the edge of the mixing zone. *Id*. at 21. When the model shows that temperatures at the edge of the mixing zone are in danger of exceeding the thermal limits, MWG requires that station personnel act, "up to and including derating," to maintain compliance. *Id*. MWG states that WCGS personnel would take these actions before the zone of passage could go below 50%. *Id*.

MWG explains that the worst-case winter scenario is most likely expected to occur during the warmest of the winter months—December and March—when the 75°F alternative limitation would apply. MWG Resp.2 at 21. At the 75°F isotherm, the zone of passage reached 66% at the 180-foot transect and 100% at the 7,000-foot transect. Exh. 4, App. D at D-39–D-40. A 50% zone of passage would be achieved at the 180-foot transect at 74°F. MWG Resp.2 at 22. The modeled conditions showing zones of passage below 50% would be seen "only in a worst-case scenario occurring in January or February" with the proposed limitation of 70°F, but the "concurrent combination of unusually high air ambient temperatures and unusually low flow are relatively unlikely to occur in those months." *Id*. MWG adds that "there has never been, under any set of actual conditions, an observed winter fish kill near WCGS under both historical four-unit operation, or current single-unit operation." *Id*. at 23.

NPDES Permit Compliance. MWG proposes that the compliance point for the alternative thermal effluent limitations be at the edge of WCGS' permitted mixing zone, rather than at the point of discharge. Pet. at 26. This approach accounts for times when canal flow is low for extended periods, which limits dilution and reduces the available heat dissipation. Exh. 4, App. B at B-35.

To determine compliance at the edge of the mixing zone, MWG proposes to continue using the WCGS Near-Field Thermal Compliance Model under the terms of the NPDES Permit. Pet. at 26; Exh. 4 at 3-9. The Near-Field Thermal Compliance Model enables MWG to demonstrate compliance with limits on temperature, zone of passage, and excursion hours. *Id*.; Exh. 4, App. D, Exh. D at 1. The model (Exh. 4, App. D, Exh. D) was approved by IEPA in December 2014. MWG Resp.2 at 17. MWG explains that using this model, as opposed to in-stream monitoring, is necessary due to the turbulent CSSC environment and the constantly changing shape and extent of the zone of passage. MWG Resp.2 at 13. In-stream monitors would be impractical due to damage from barge traffic, vandalism, and inability to anchor at a fixed location. Exh. 4, App. D at D-8.

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[23] "However, a zone of passage is not required in receiving streams that have zero flow for at least seven consecutive days recurring on average in nine years out of 10." 35 Ill. Adm. Code 302.102(b)(6).

The Near-Field Thermal Compliance Model is an Excel-based model that uses "real-time station operating data and 24-hour antecedent flow to calculate fully mixed temperatures in the main body of the waterway that has been demonstrated to be equivalent to the approximate edge of the allowed 26-acre mixing zone." Exh. 4, App. D at D-8. The model predicts and documents compliance:

> [It] takes into account upstream flow characteristics and temperature in the receiving stream, effluent flow and other associated factors to both predict and document on-going compliance with the near field thermal limitations applicable to the station's thermal discharge at the edge of the allowed 26-acre mixing zone. Exh. 4, App. D, Exh. D at 1.

WCGS personnel use the Near-Field Thermal Compliance Model on an "as-needed" basis to ensure compliance with the thermal standards under the current receiving stream conditions. *Id*. at 2. "The model updates the compliance temperature every 15 minutes based on real-time data input." MWG Resp.2 at 9. The model is also designed to allow for the accounting and reporting of excursion hour use. Exh. 4, App. D, Exh. D at 1. WCGS personnel use "the dynamic model itself," rather than a series of static tables, to monitor compliance. MWG Resp.2 at 9.

The Near-Field Thermal Compliance Model recognizes that when the available upstream flow in the CSSC is equal to or less than the WCGS circulating water flow, no dilution is available. MWG Resp.2 at 9. In this case, no mixing zone would be allowed, consistent with current mixing zone requirements under 35 Ill. Adm. Code 302.102(b)(10). *Id*. When this occurs, the model shows the temperature limits that must be met in the discharge itself. *Id*. During prolonged low-flow conditions, WCGS personnel closely monitor the temperatures to determine if proactive measures, such as derating, should be implemented to maintain compliance. *Id*. at 10. MWG states that "[a]larms are built in at set compliance temperature points to alert WCGS personnel when excursion hours are in use, and also when the temperature begins to approach the maximum limit, in order to allow for the implementation of timely control measures." *Id*.

MWG explains that the Near-Field Thermal Compliance Model is configured to avert triggering rapid changes in station operations "in response to brief drops in flow." MWG Resp.2 at 9–10. The CSSC experiences "constantly changing, erratic flow conditions," and a brief drop in flow will be typically followed by a significant increase in flow "before any significant changes in waterway temperature will occur." *Id*. at 9. The Near-Field Thermal Compliance Model therefore uses a "rolling 24-hour average antecedent canal flow." *Id*. This saves WCGS' proactive measures for sustained changes in the waterway when temperature effects are more tangible. *Id*. at 10.

With the requested relief from the zone-of-passage requirements—from a minimum of 75% to a minimum of 50%—MWG explains that the Near-Field Thermal Compliance Model would be adjusted accordingly. MWG Resp.2 at 10. MWG calculates the upstream flow available for mixing by subtracting the flow of its effluent (the circulating water flow) from the upstream flow in the CSSC and multiplying it by the percent available to ensure a zone of passage. *Id*. For a 75% zone of passage, the multiplier is 25% to quantify the remaining flow available for mixing; and for a 50% zone of passage, the multiplier is 50%. *Id*. This multiplier is the only parameter in the underlying equation that would adjusted for the requested limitations. *Id*. at 11. To demonstrate the effect that changing the percentage has on the calculations, MWG provided sample tables produced by the Near-Field Thermal Compliance Model using both the 50% and 75% calculations under hypothetical conditions. *Id*. at 12. MWG stresses that WCGS uses the model itself "on a real-time basis," rather than such tables, to monitor compliance and track excursion hours used. *Id*.

Changing the underlying calculation to accommodate a 50% zone of passage would result in "lower overall calculated in-stream temperatures" at the edge of the mixing zone. MWG Resp.2 at 11. MWG anticipates that this would generally result in using fewer potential excursion hours. *Id*. MWG expects a zone of passage less than 75% would only occur during "atypical" prolonged periods of low flow and high ambient temperatures, when WCGS "may be operating at higher megawatt loads." *Id*. at 13. During these prolonged periods of low-flow conditions when the 24-hour average available flow is equal to or less than the effluent flow, compliance with thermal limits would be required in the discharge itself. *Id*. at 11. MWG states that, in this situation, "it is highly likely that a large number of excursion hours would be used in a short time while the WCGS simultaneously implements measures to cut back station load to avoid potential thermal noncompliance." *Id*. MWG adds that even with the reduced zone of passage, "there remain inherent limitations on the WCGS thermal discharges under the proposed [alternative thermal effluent limitations] that will continue to assure the protection and propagation of the waterbody's balanced, indigenous community." *Id*.

MWG believes that the NPDES Permit—with the Near-Field Thermal Compliance Model updated for the alternative limitations—is an appropriate mechanism for demonstrating compliance with the proposed numeric temperature limits at the edge of the mixing zone and the proposed 50% zone of passage. MWG Resp.2 at 12.

BOARD FINDINGS

The Board must determine whether MWG has demonstrated that WCGS effluent limits based on the Board's temperature water quality standards for ALU B waters and zone-of-passage requirements are more stringent than necessary to assure, and that the requested alternative thermal effluent limitations will assure, the protection and propagation of a balanced and indigenous population of shellfish, fish, and wildlife in and on the receiving water. *See* 33 U.S.C. § 1326(a).

The Board first determines whether the biotic category criteria have been met under the Type I Retrospective/Absence of Prior Appreciable Harm Demonstration and Type II Predictive/Representative Important Species Demonstration. Next, the Board determines whether MWG has justified the maximum temperature limits and excursions for the proposed alternative thermal effluent limitations. The Board then considers the Master Rationale and determines whether MWG's demonstration shows that the current standards are more stringent than necessary and that the proposed alternative limitations will assure protection and propagation of the balanced, indigenous community living in and on the CSSC.

Board Findings on Biotic Category Criteria that Assure the Protection and Propagation of a Balanced, Indigenous Community

A CWA Section 316(a) demonstration describes the impact of the thermal discharge on each of six biotic categories: (1) habitat formers; (2) phytoplankton; (3) zooplankton and meroplankton; (4) macroinvertebrates and shellfish; (5) fish; and (6) other vertebrate wildlife. A successful CWA Section 316(a) demonstration shows that each biotic category meets specified decision criteria. USEPA 316(a) Manual at 18-32.

MWG's demonstration consists of information gathered for the Biotic Category Identification, the Type I Retrospective/Absence of Prior Appreciable Harm Demonstration, and the Type II Predictive/Representative Important Species Demonstration. MWG's demonstration addresses the USEPA 316(a) Manual's decision criteria applicable to a site that is not classified as a "low potential impact area" for five of the six biotic categories: habitat formers; phytoplankton; zooplankton and meroplankton; macroinvertebrates and shellfish; and fish. MWG's demonstration addresses the decision criteria applicable to a site that is classified as a low potential impact area for the remaining biotic category: other vertebrate wildlife. The demonstration for a low potential impact area entails a less comprehensive assessment than one for a site that is not classified as a low potential impact area. USEPA 316(a) Manual at 6, 14–15, 33. The Board determines below whether MWG's Demonstration satisfied these decision criteria.

MWG argues its 316(a) Demonstration shows that decision criteria for all the biotic categories are satisfied, there is no prior appreciable harm from the thermal plume to the biotic communities, and the proposed alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous community.

As discussed below, the Board finds that MWG's proposed alternative thermal effluent limitations meet the decision criteria for each of the biotic categories. The Board finds that the balanced and indigenous community of aquatic life that currently exists in the CSSC is limited not by the WCGS thermal plume but instead by the physical factors of the CSSC, which restrict habitat diversity and availability. The Board also observes that even under the formerly applicable, less-stringent Secondary Contact and Indigenous Aquatic Life Use temperature water quality standards, there is no evidence of nuisance algal blooms, abnormal phytoplankton blooms, or fish kills attributable to WCGS thermal discharges.

Habitat Formers (Aquatic Vegetation)

MWG's n 316(a) Demonstration did not attempt to show that the site is a low potential impact area for habitat formers. At a site that is not classified as a low potential impact area, a successful CWA Section 316(a) demonstration for habitat formers must show that the heated discharge:

1. Will not "result in any deterioration of the habitat formers community or that no appreciable harm to the balanced indigenous community will result from such deteriorations"; and

2. Will not have "an adverse impact on threatened or endangered species as a result of impact upon habitat formers." USEPA 316(a) Manual at 22.

No "unique" or "rare" aquatic habitat was detected in the CSSC near the WCGS, nor does the Lockport Pool provide unique or "critical" habitat for the survival or growth of any wildlife species. Exh. 4 at 4-8, 6-14; MWG Resp.2 at 36–37. Habitat was also evaluated for the potential use by threatened and endangered species; specifically, the federal-listed endangered mussel species sheepnose (*Plethobasus cyphyus*), the Illinois-listed threatened mussel species black sandshell (*Ligumia recta*) and purple wartyback (*Cyclonaias turerbulate*), the Illinois-listed threatened Banded Killifish (*Fundulus diaphanus*), and the Illinois-listed endangered Blanding's turtle (*Emydoidea blandingii*). Exh. 4 at 4-8; Exh. 2 at 2, 6, 10; Exh. 4, App. A at A-46; Exh. 4, App. C at C-23.

The federal-listed endangered sheepnose has been reported in Will County, but the Lower Lockport Pool near the WCGS is "not conducive to this mussel species, which occurs in larger rivers and streams where it is usually found in shallow areas with moderate to swift currents that flow over coarse sand and gravel substrates." Exh. 4 at 4-8.

IDNR stated that there is some evidence of freshwater mussel recovery in the Lower Des Plaines River, citing a 2014 survey conducted by EA Engineering. Exh. 2 at 2. During its survey, EA Engineering collected two Illinois-listed threatened species, black sandshell and purple wartyback. *Id.* IDNR requested a brailing survey for mussels in the study area to support the conclusion that mussel populations are not present. *Id.* at 2–3. EA Engineering responded that, because the thermal plume is surficial, a zone of passage is maintained for aquatic life. Therefore, no benthic (bottom dwelling) organisms (like mussels and macroinvertebrates) are expected to be negatively impacted, "whether or not any mussel species may be present." *Id.* at 7. EA Engineering explained:

> Consistent with [the USEPA 316(a)] Manual, these empirical data show that the CSSC mussel community is extremely limited due to the physical characteristics of this man-made waterway and its lack of suitable habitat, and is not related to the thermal discharge from WCGS. The WCGS thermal discharge has not and is not expected to result in a reduction in the diversity of the CSSC freshwater mussel community. Operation of the WCGS under the proposed [alternative thermal effluent limitations] is not expected to interfere with maintenance or critical, seasonal, life history cycles (e.g., spawning and recruitment) of the freshwater mussel community in the vicinity of WCGS. Exh. 4 at 6-7–6-9.

IEPA agreed that additional sampling of mussels would be impractical and not expected to yield representative information. Exh. 2 at 10. IDNR later stated that it "concurs with the conclusions in the IEPA's Recommendation on the [balanced, indigenous community] assessment . . . ." IDNR Resp.2 at 3.

Illinois-listed threatened Banded Killifish were collected at two sampling locations farthest downstream from WCGS in the Lower Lockport Pool. Exh. 4 at 4-8. They were caught in shallow littoral zone areas with dense aquatic vegetation, which EA Engineering generally characterized as "unique habitat for a main channel border in the lower Lockport Pool." *Id*. Although Banded Killifish normally inhabit clear glacial lakes with abundant vegetation, the area near WCGS and most of the Lower Lockport Pool do not provide this type of habitat. *Id*. Even so, the area has seen an increasing number of these fish, which, EA Engineering observed, suggests "the operation of the WCGS, including its thermal discharge, is having no adverse impact on this species" or its habitat. Exh. 4, App. A at A-46.

MWG clarified that the habitat where the Banded Killifish were found is "atypical" for the Lower Lockport Pool, but would not be considered "unique" or "rare" habitat as those terms are used in the USEPA 316(a) Manual. MWG Resp.2 at 36. MWG also clarified that no portion of the CSSC is designated as "essential habitat" for the Banded Killifish, as that term is defined in the Illinois Endangered Species Protection Act (520 ILCS 10/2). *Id*. at 37; *id*., n. 17.

INHS identified the Illinois-listed endangered Blanding's turtle near WCGS, and IDNR expressed concern regarding possible threats from WCGS operations. Exh. 2 at 10; Exh. 4, App. A at A-46; Exh. 4, App. C at C-23. IDNR commented that field surveys should be conducted as necessary to address the presence of Blanding's turtle near WCGS. Exh. 2 at 2. IDNR requested that MWG's study plan evaluate potential impacts to this species. *Id*. MWG responded that it was already involved in turtle habitat assessment efforts. *Id*. at 6. Turtles inhabit portions of the lower Des Plaines River Valley, but no Blanding's turtles had ever been observed on the WCGS property. *Id*. EA Engineering explained why Blanding's turtles would not be expected to use the CSSC:

> Based on the Blanding's habitat preference and life history, there is no evidence or reason to believe that the turtle would utilize the CSSC in any way. In the vicinity of the station, the canal is lined with vertical limestone walls that extend anywhere from 6-12' (or more) above the water's surface, depending upon flow and flood control operations. There is little to no natural shoreline development or vegetation that would be considered even remotely marginal habitat for the Blanding's turtle, nor any of the other state-listed turtle species. Exh. 4, App. A at A-46; Exh. 4, App. C at C-23.

MWG later reported "IDNR has agreed that no additional turtle surveys are required for the Will County 316(a) Study Plan." Exh. 2 at 7.

The Board finds that MWG's 316(a) Demonstration meets the decision criteria for habitat formers at sites that are not low potential impact areas. *See* USEPA 316(a) Manual at 22. MWG's demonstration shows the poor to fair habitat quality in the Lockport Pool of the CSSC is the result of many factors, including excessive siltation, channelization, poor floodplain areas, no in-stream cover, and lack of riffle/run habitat. The habitat former community will continue to be essentially the same regardless of WCGS' operation under the proposed alternative thermal effluent limitations. The habitat is the primary basis for the limited biotic community, unrelated to WCGS' thermal discharge. MWG's demonstration shows that the proposed thermal discharge: (1) will not result in deterioration of habitat formers so as to cause appreciable harm to the balanced, indigenous community of fish or mussels; and (2) will not adversely impact threatened or endangered species due to impact on habitat formers.

Phytoplankton

MWG's 316(a) Demonstration did not attempt to show that the site is a low potential impact area for phytoplankton. At a site that is not classified as a low potential impact area, a successful CWA Section 316(a) demonstration for phytoplankton must show that:

1. A "shift towards nuisance species of phytoplankton is not likely";

2. There is "little likelihood that the discharge will alter the indigenous community from a detrital to a phytoplankton based system"; and

3. "Appreciable harm to the balanced indigenous population is not likely to occur as a result of phytoplankton community changes caused by the heated discharge." USEPA 316(a) Manual at 18.

In assessing phytoplankton in the CSSC, EA Engineering consulted studies done for ComEd (1991, 1993), as well as studies done by MWRDGC (2004–2016) as part of its annual phytoplankton productivity (chlorophyll *a*) monitoring. Exh. 4, App. E at E-6. MWG demonstrated that the proposed thermal discharge is not likely to encourage a shift toward nuisance species. EA Engineering noted a single instance of a phytoplankton bloom in the CSSC near WCGS, occurring in 2012. Exh. 4 at 6-2. The bloom occurred under conditions of drought and low flow that were interrupted by heavy storm events and CSOs; however, EA Engineering found no indication that the bloom was dominated by the nuisance blue-green algae. *Id*. The proposed thermal discharge is unlikely to encourage nuisance species of phytoplankton. *Id*. at 6-3.

MWG demonstrated that the proposed thermal discharge is not likely to alter the community from a detrital-based to phytoplankton-based system. EA Engineering assessed the phytoplankton populations that appear in the CSSC upstream and downstream of the WCGS station. Based on Morisita's Index of Similarity and chlorophyll *a* concentrations, EA Engineering found that phytoplankton community upstream and downstream of WCGS were closely related, indicating no adverse impact from the WCGS discharge. Exh. 4, App. C at C-8, C-9. EA Engineering pointed out that the proposed alternative thermal effluent limitations are more stringent than the limits that were in place for more than 40 years under the Secondary Contact and Indigenous Aquatic Life Use water quality standards, and therefore, no appreciable harm is expected to come to the phytoplankton community or the balanced, indigenous community. Exh. 4 at 6-2.

The Board finds that MWG's 316(a) Demonstration meets the decision criteria for phytoplankton at sites that are not low potential impact areas. *See* USEPA 316(a) Manual at 18. It shows: (1) a shift toward nuisance species of phytoplankton is not likely to result from the proposed thermal discharge; (2) the proposed thermal discharge is not likely to alter the indigenous community from a detrital-based to phytoplankton-based system; and (3) appreciable harm to the balanced indigenous population is not likely to result from phytoplankton community changes caused by the proposed thermal discharge.

Zooplankton and Meroplankton

MWG's 316(a) Demonstration did not attempt to show that the site is a low potential impact area for zooplankton and meroplankton. At a site that is not classified as a low potential impact area, a successful CWA Section 316(a) demonstration for zooplankton and meroplankton must show that:

1. "Changes in the zooplankton and meroplankton community . . . that may be caused by the heated discharge will not result in appreciable harm to the balanced indigenous fish and shellfish population";

2. "The heated discharge is not likely to alter the standing crop, relative abundance, with respect to natural population fluctuations . . . from those values typical of the receiving water body segment prior to plant operation"; and

3. "The thermal plume does not constitute a lethal barrier to the free movement (drift) of zooplankton and meroplankton." USEPA 316(a) Manual at 20.

In examining the impact of the proposed thermal discharge on zooplankton and meroplankton, EA Engineering reviewed MWRDGC studies (1978, 1979) in the CSSC near WCGS, EA Engineering entrainment surveys (2005, 2016) for the WCGS intake structure, and a MWRDGC survey of zooplankton (2010–2013) in the CSSC near WCGS. Exh. 4, App. E at E-6–E-7, E-12. EA Engineering also consulted studies from the 1970s and 1980s of general power plant thermal discharges, along with ACRCC plankton and zooplankton monthly sampling from 2009–2014. *Id*. at E-6–E-7. Additionally, EA Engineering reviewed ichthyoplankton studies on the early-life stages of fish from a 1994 ComEd survey, as well as from continuous studies beginning in 2010 by INHS on behalf of ACRCC. *Id*. at E-11–E-13; Exh. 4, App. C at C-12.

Studies both upstream and downstream of WCGS in the CSSC since 2009 indicate that the thermal discharges from WCGS have not impacted zooplankton and meroplankton populations. EA Engineering determined that "the CSSC zooplankton assemblage is primarily determined by the dominance of main channel habitat, lack of backwater sources, the short residence time within the CSSC, and the physical-chemical limitations of the CSSC." Exh. 4, App. C at C-12. The community of zooplankton in the CSSC around WCGS is limited in diversity, consisting mostly of rotifers and low concentrations of copepods and cladocerans. Exh. 4 at 6-5; Exh. 4, App. A at A-38. The assemblages are similar upstream and downstream, indicating WCGS has had no measurable impact on the zooplankton and meroplankton communities. Exh. 4 at 6-5; Exh. 4, App. A at A-38; Exh. 4, App. C at C-12. Further, EA Engineering states, "[g]iven that station operating conditions have remained essentially unchanged and community structure of higher trophic levels have remained similar or improved over time, it can be concluded that WCGS has no measurable effect on the zooplankton assemblage." Exh. 4 at 6-5.

EA Engineering found that available thermal tolerance data did not predict any mortality for ichthyoplankton with early-life stages that comprise drift through the area of the WCGS thermal plume during summer. Exh. 4 at 5-5.

The Board finds that MWG's 316(a) Demonstration shows: (1) changes in zooplankton and meroplankton will not result in appreciable harm to the balanced, indigenous community of fish and shellfish; (2) the heated discharge is not likely to alter the standing crop or relative abundance of zooplankton and meroplankton; and (3) the thermal plume is not a lethal barrier to free movement (drift) of zooplankton and meroplankton.

Macroinvertebrates and Shellfish

MWG's 316(a) Demonstration did not attempt to show that the site is a low potential impact area for macroinvertebrates and shellfish. At a site that is not classified as a low potential impact area, a successful CWA Section 316(a) demonstration for macroinvertebrates and shellfish must show that:

1. Any measurable reduction of standing crop of shellfish and macroinvertebrates "caused no appreciable harm to balanced indigenous populations";

2. "[C]ritical functions . . . of the macroinvertebrate fauna are being maintained . . . as they existed prior to the introduction of heat";

3. Where the discharge of cooling water comprises 30% or more of 7Q10 low flow, "[i]nvertebrates do not serve as a major forage for the fisheries," "[f]ood is not a factor limiting fish production," and "[d]rifting invertebrate fauna is not harmed by passage through the thermal plume"; and

4. The discharge area does not include "spawning and nursery sites for important shellfish and/or macroinvertebrate fauna." USEPA 316(a) Manual at 23–25.

The studies cited by EA Engineering and the information provided by IEPA and IDNR show that—due to the CSSC's physical characteristics and poor habitat quality—significant mussel populations do not exist and the macroinvertebrate community is dominated by pollution-tolerant taxa. Exh. 2 at 1, 7–10; Exh. 4 at 6-6–6-8. An increase in the richness of pollution-sensitive *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), *and Tricoptera* (caddisflies) taxa downstream of the WCGS discharge was attributed to "somewhat more depositional material, rather than hard-pan and scoured limestone characteristic of most of the canal system." Exh. 4 at 6-7. Additionally, fish studies indicate no problems with health or food availability near WCGS, suggesting lower trophic levels have not been negatively impacted by WCGS' discharge. Exh. 4 at 6-12–6-13; MWG Resp.2 at 38–39. And, the historical data show "most of the benthic communities in WCGS's portion of the CSSC have been improving relative to upstream communities," indicating that "the drifting invertebrate fauna is not harmed by passage through the thermal plume." MWG Resp.2 at 38.

Thus, the habitat rather than the thermal discharge has resulted in the lack of a diverse benthic macroinvertebrate and mussel community near WCGS. WCGS' operation under the proposed alternative thermal effluent limitations is not expected to interfere with maintenance or critical, seasonal, life cycle (*e.g.*, spawning and recruitment) of mussels or benthic macroinvertebrates. Exh. 4 at 6-6–6-8. The Board finds that MWG's 316(a) Demonstration meets the four criteria above from the USEPA 316(a) Manual.

Fish

MWG's 316(a) Demonstration did not attempt to show that the site is a low potential impact area for fish. At a site that is not classified as a low potential impact area, a successful CWA Section 316(a) demonstration for fish must show that fish communities "will not suffer appreciable harm" from:

1. "Direct or indirect mortality from cold shocks";

2. "Direct or indirect mortality from excess heat";

3. "Reduced reproductive success or growth as a result of plant discharges";

4. "Exclusion from unacceptably large areas"; or

5. "Blockage of migration." USEPA 316(a) Manual at 28–29.

To address the fish biotic category for a site that is not classified as a low potential impact area, MWG provided a Type I Retrospective Demonstration and Type II Predictive Demonstration. MWG asserts that these demonstrations show that there has been no appreciable harm to the fish community under WCGS' existing operations and the alternative thermal effluent limitations will assure the continued protection and propagation of the fish community near WCGS.

In the retrospective demonstration, EA Engineering used fishery studies from several different sources. ComEd conducted studies in 1993–1994 along the entire CSSC using electrofishing, gillnetting, and seining to assess fish age, growth, condition, movement, reproductive success, food habits, and disease or anomalies. Exh. 4, App. E at E-10. In 2001–2007, LimnoTech studied adult fish in the CAWS for MWRDGC to identify physical habitat factors and potential for improvement. *Id*. at E-10–E-11. From 2005–2016, MWG conducted its own fish-community monitoring in the Lower Lockport Pool, documenting fish community changes in response to WCGS operational changes. *Id*. at E-11. Additional fishery studies consulted included those done in 2010, 2012, and 2014 for ACRCC by the Carterville Fish and Wildlife Conservation Office of the U.S. Fish and Wildlife Service. *Id*.

In the predictive demonstration, EA Engineering analyzed the predicted effect of the proposed alternative thermal effluent limitations on the balanced, indigenous community. MWG selected seven species as representative important species: Gizzard Shad; Bluntnose Minnow; Banded Killifish; Common Carp; Channel Catfish; Green Sunfish; and Largemouth Bass. Exh. 4, App. B at B-8. Thermal diagrams were constructed for each representative important species, except the Banded Killifish which lacked thermal endpoint data. These diagrams illustrate the biothermal metrics of temperature thresholds for thermal tolerance, heat shock, cold shock, acute mortality, chronic mortality, avoidance, no growth, optimum growth, and spawning. *Id*. at B-16, Fig. B-1–B-6. As described in more detail above, EA Engineering analyzed the impact of the proposed limitations—for winter, summer, spring, and fall—on these biothermal metrics. EA Engineering concluded that there would be no adverse impact on the six representative important species for which thermal data exist during any time of the year. *Id*. at B-39. For the seventh representative important species, the Illinois-listed threatened Banded Killifish, EA Engineering concluded that—because the alternative limits would be more stringent than the previous temperature water quality standards—adverse effects on any Illinois-listed or federal-listed fish species would be unlikely. Exh. 4 at 4-8.

EA Engineering observed that water flow and temperatures in the CSSC are historically dominated by POTW flow. Exh. 4, App. B at B-39; Exh. 4, App. D at D-43. That flow accounts for 70–100% of the flow in the CSSC at WCGS and maintains winter temperatures at an average of 51.6°F. Exh. 4, App. D at D-43. Therefore, the balanced, indigenous community in the Lower Lockport Pool is already acclimated to warmer winter water temperatures than would be found in natural streams. Exh. 4, App. B at B-39.

Below, the Board considers whether MWG's 316(a) Demonstration shows that the biotic category criteria for fish are satisfied.

Threatened and Endangered Species. No federal-listed threatened or endangered fish species were collected in the CSSC study area near WCGS. Exh. 3 at 5. However, the 2012 catch of an Illinois-listed threatened species of fish, the Banded Killifish, in the Lower Lockport Pool was followed by increased catches (199) from 2013 to 2016. Exh. 4 at 4-8. The Banded Killifish were caught in an area of atypical habitat for the Lockport Pool, with a shallow littoral zone and dense aquatic vegetation, unlike the habitat near WCGS. *Id.* MWG suggested that the Banded Killifish population seems to be expanding, even under the less-stringent thermal standards for Secondary Contact and Indigenous Aquatic Life Use. MWG Resp.2 at 37. MWG asserted that because the proposed alternative thermal effluent limits are more stringent than the previous temperature water quality standards, adverse effects on the Banded Killifish would be unlikely. *Id.* at 38.

Criteria (1) and (2): Cold Shock and Excess Heat. Thermal shock can result from a sudden change in temperature compared to the temperature at which aquatic organisms are acclimated. Exh. 4 at 5-4. An organism would experience a sudden change in temperature if it were swiftly entrained in a thermal plume or if the thermal plume stopped and the surrounding water temperatures decreased rapidly. *Id.* The magnitude of temperature change, the length of acclimation time, and the final temperature are all factors in considering the potential for thermal shock. *Id.* at 5-4–5-5.

As for cold shock, MWG explains that even if WCGS were to suddenly shut down and stop discharging heated effluent into the CSSC, water temperatures are not expected to fall below the point at which cold shock and adverse impacts on aquatic life might occur. Exh. 4 at 5-5. If there's a shutdown, residual heat in the system continues to be discharged as the circulating water pumps operate to cool the equipment. *Id.* The ambient water temperature therefore declines gradually over the course of hours, not minutes. *Id.* Also, as water in the CSSC is dominated by effluent from MWRDGC's Stickney water reclamation plant, the winter water temperatures are normally near 50°F. Exh. 4, App. at D-43. EA Engineering explains that adverse impacts on aquatic life tend to occur when ambient water temperatures fall below 45°F. Exh. 4, App. B at B-39; Exh. 4 at 5-5. EA Engineering elaborates:

> Since the ambient winter canal water temperatures are artificially elevated by the dominant contribution of POTW effluent, there is little likelihood of cold shock mortality should the WCGS experience an unplanned unit trip, as the maximum proposed winter [alternative thermal effluent limitations] are all within the temperature change tolerance for warm water aquatic life. Exh. 4 at 3-8.

As for exposure to excess heat, aquatic life at greatest risk would be early-life stages of fish and invertebrates "whose distribution and transport are dominated by water currents." Exh. 4 at 5-5. These early-life stages could become entrained in the thermal plume and exposed to rapid temperature increases. *Id*. During the summer is typically when most of the early-life stages of species that comprise this drift move through the area of the WCGS thermal plume. *Id*. Based on available thermal tolerance data, no mortality is predicted for ichthyoplankton with early-life stages during the summer. *Id*. EA Engineering stated that "[e]arly life stages often have a higher thermal tolerance than adults." *Id*. For example, EA Engineering explained that for two of the representative important species —Common Carp and Channel Catfish—eggs and larvae, when acclimated to temperatures of 50–91.4ºF, can tolerate acute exposure of 87.8–105.8ºF and chronic exposure up to 101.8ºF. *Id*. For representative important species' juvenile- and adult-life stages, fish can "detect and avoid potentially lethal temperatures." *Id*. at 4-13. EA Engineering stated that, during the limited times of extremely warm weather, potentially lethal temperatures are "confined to a small portion of the plume." *Id*.

Criterion (3): Reproductive Success or Growth. As to ichthyoplankton reproductive success, EA Engineering observed that the CSSC's physical characteristics limit the availability of suitable habitat for spawning and nursery areas around WCGS. Exh. 4 at 4-7–4-8. The CSSC experiences abrupt changes in water levels in response to heavy rainfall events and water drawdowns. Exh. 4, App. A at A-41. EA Engineering explained that these drops in water levels, which are unrelated to WCGS operation, expose the shallow littoral zones, "likely disrupting spawning and desiccating early life stages of fish." *Id*. at A-42. However, EA Engineering found that because representative important species' eggs are demersal, adhesive, or deposited in shallow adult-protected areas, they have limited vulnerability to entrainment and minimal exposure to the surficial WCGS thermal plume. Exh. 4, App. B at B-19.

As to growth, based on field surveys from 1991–2016, EA Engineering found "relatively good growth" for the representative important species in the CSSC, indicating that ambient temperatures upstream of the WCGS discharge and downstream in the thermal plume "support normal growth patterns under typical summer temperature conditions in the waterway." Exh. 4 at 5-4. MWG's demonstration shows that predicted temperatures within most of the WCGS thermal plume are "within the maximum range for optimum growth and well below the upper zero growth temperature" of the representative important species. *Id*. EA Engineering explained:

> Under the worst-case modeled summer temperature condition, ambient temperatures were generally near the upper zero growth temperature and exceed the upper optimum temperature for growth for the less thermally tolerant of the [representative important species], but only for a limited period. The worst-case modeled summer temperature condition was not near the upper zero growth temperature nor did it exceed the upper optimum temperature for the more thermally tolerant Channel Catfish, Common Carp, and Largemouth Bass. *Id*.

Criterion (4): Exclusion from Unacceptably Large Areas. EA Engineering reviewed thermal tolerance data for the representative important species. Exh. 4 at 5-3. EA Engineering found that during typical temperature scenarios, aquatic life can inhabit more than 75% of the cross-section at the WCGS thermal discharge "for extended periods of time with little likelihood of thermal-related mortality." *Id*.

EA Engineering also evaluated the increased excursion hours and the decreased zone of passage. The increased excursion hours from 1% to 5% of the time would allow an increase from 87.6 to 438 hours over 12 months. Exh. 4, App. B at B-35. EA Engineering explained that even though the proposal represents a five-fold increase in excursion hours, these excursions are expected to be rare and of short duration. Accordingly, the anticipated effect on representative important species' mortality and diel or seasonal migrations would be negligible and not preclude upstream or downstream movements. *Id.* at B-38. EA Engineering noted that most of the representative important species can tolerate water temperatures above 95°F for extended periods of time (48–96 hours) at acclimation temperatures above 85°F. *Id.* at B-30. Additionally, thermal refuge would still exist under the decreased zone of passage. *Id.* at B-38.

The predicted decrease in the zone of passage from 75% to 50% was determined using hydrothermal modeling at the proposed alternative thermal effluent limitations. Both EA Engineering and IEPA recognized, however, that normal upstream and downstream movement of fish is prevented by other factors: the canal's physical configuration and the Corps' Electric Barrier, which also largely limit habitat and species in the CSSC. Exh. 4 at 4-7–4-8; IEPA Rec. at 6. Given that WCGS' thermal discharge is located directly below the Electric Barrier, IEPA "is comfortable with recognizing that WCGS can utilize up to 50% of the stream flow for mixing." IEPA Rec. at 6.

As discussed above, the worst-case modeled winter scenario predicted a 0% zone of passage at the 70°F isotherm 7,000 to 11,000 feet downstream from the discharge. Exh. 4, App. D at D-39. MWG explained, however, that this modeled scenario does not represent real-world conditions. MWG Resp.2 at 20, 21. Even under such worst-case conditions, the Near-Field

Compliance Model would alert station personnel to implement control measures, ensuring there would always be a minimum 50% zone of passage. MWG Resp.2 at 10, 21.

Criterion (5): Blockage of Migration. MWG explained that under the current ALU B temperature water quality standards—if low-flow conditions in the CSSC are exacerbated by warm weather—the WCGS thermal discharge would not comply with the Board's 75% zone-of-passage requirement. Pet. at 17. MWG requests a reduced zone-of-passage requirement of 50%, which the Board's rules allow only in streams where the dilution ratio is less than 3:1. *See* 35 Ill. Adm. Code 302.102(b)(8).

EA Engineering observed that fish migration is most significantly impacted by the Corps' Electric Barrier. Exh. 4 at 4-7–4-8; *see also* IEPA Rec. at 6. Although that barrier is intended to block the movement of Asian carp, it also blocks the normal upstream and downstream movement of other fish and disrupts the patterns of migratory fish. Exh. 4, App. A at A-29–A-30. The Electric Barrier is located less than one mile upstream from WCGS. *Id*. Exh. 4, App. A at A-29.

Despite this physical barrier to fish migration upstream, MWG demonstrated that the thermal discharge would not impact fish migration under the proposed alternative thermal effluent limitations. EA Engineering performed hydrothermal modeling to predict thermal gradients and zone-of-passage availability under different weather and river-flow conditions. Exh. 4, App. D. Based on the modeling results of the worst-case summer scenario with elevated temperatures and low flow, 93°F provided the following zones of passage: a 47.2% zone of passage at 180 feet downstream of WCGS within the mixing zone; and a 96.4% zone of passage at 7,000 feet downstream at the edge of the mixing zone. Exh. 4 at 5-1; Exh. 4, App. D at D-33. EA Engineering observed:

> Although a zone of passage of less than 75% may affect some species in a limited fashion, the instances where the zone of passage downstream of the WCGS thermal discharge is less than 75% (but not less than 50%) are expected to be rare and limited in duration. Under these limited conditions, there would be only temporary and infrequent avoidance of the plume. Given the nature of the [balanced, indigenous community] in the CSSC, a temporary reduction in the extent of the zone of passage is unlikely to result in adverse harm. *** During the seasonal periods when adults or juveniles of the Channel Catfish may migrate through the CSSC near WCGS, the proposed [alternative thermal effluent limitations] will still provide an area for adequate passage by the [representative important species], including the Channel Catfish. Therefore, the thermal plume associated with both typical and atypical high temperature conditions during WCGS operation is not predicted to interfere with migratory functions . . . associated with spawning of resident [representative important species]. Exh. 4 at 5-1.

Board Finding on Fish Biotic Category Criteria. Based on the information discussed above, the Board finds that MWG's requested alternative thermal effluent limitations will protect the balanced, indigenous community in the CSSC. Being dominated by relatively consistent temperature flow from the Stickney water reclamation plant, cold shock in the CSSC is not expected. Additionally, exposure to potentially lethal temperatures from excess heat is confined to a small portion of WCGS' thermal plume, which fish can avoid. As for reproductive success and growth, the worst-case modeled summer scenario exceeded the upper optimum temperatures of the more thermally sensitive representative important species for only a limited period, while growth patterns were normal under the typical scenario. Based on the hydrothermal modeling and thermal tolerance data for the representative important species, temporarily reducing the zone of passage is not expected to interfere with migratory functions or exclude aquatic life from unacceptably large areas.

Accordingly, the Board finds that MWG's 316(a) Demonstration meets the criteria for a site that is not a low potential impact area for fish. MWG has demonstrated that (1) there will be no direct or indirect mortality from cold shock; (ii) there will be no direct or indirect mortality from excess heat; (iii) there will be no reduced reproductive success or growth due to the heated discharge; (iv) there will not be exclusion from unacceptably large areas; and (v) there will not be blockage of migration due to the thermal discharge.

Other Vertebrate Wildlife

MWG's 316(a) Demonstration attempted to show that the site is a low potential impact area for other vertebrate wildlife. The USEPA 316(a) Manual states that "most sites in the United States" will be considered to have low potential impact for other vertebrate wildlife "simply because the projected thermal plume will not impact large or unique populations of wildlife." USEPA 316(a) Manual at 32. The "main exceptions" are (1) sites where important, threatened, or endangered wildlife may be adversely affected by the discharge and (2) sites in cold areas where the thermal plume is predicted to attract geese and ducks and encourage them to stay through the winter. *Id*.

The Board finds that the CSSC around WCGS' mixing zone is a low potential impact area for other vertebrate wildlife. MWG's demonstration meets the decision criteria for low potential impact areas by showing that the thermal plume should not harm any important, threatened, or endangered populations of vertebrate wildlife or encourage geese and ducks to stay through the winter. The area around WCGS has (1) very little vegetation, (2) high levels of human use, and (3) canal walls with steep drop offs that deter use by resident mammals. In addition, frequent barge traffic in the narrow CSSC waterway precludes any long-term occupancy by water birds.

Board Findings on MWG's Master Rationale

The Board finds that MWG's 316(a) Demonstration successfully addresses each of the elements of the Master Rationale outlined in the USEPA 316(a) Manual. *See* USEPA 316(a) Manual at 70–71. Specifically, for the alternative thermal effluent limitations in the order below, the Board finds that MWG's demonstration shows the following: (1) due consideration of the requisite steps in the USEPA 316(a) Manual's "decision train"; (2) there will be no appreciable harm to the balanced, indigenous community; (3) receiving water temperatures will not be in excess of the upper temperature limits for the life cycles of the representative important species;

(4) the absence of the proposed thermal discharge would not result in excessive growth of nuisance organisms; (5) a zone of passage provides for the normal movement of representative important species; (6) there will be no adverse impact on threatened or endangered species; (7) there will be no destruction of unique or rare habitat, and (8) there will be no use of biocides and therefore biocides will not result in appreciable harm to the balanced, indigenous community.

Decision Train

The decision train in the USEPA 316(a) Manual provides steps to ensure that the demonstration is complete; required data has been submitted; the studies justify the conclusions for each of the biotic category criteria; the information shows the representative important species will not suffer appreciable harm; the engineering and hydrological data justify the conclusions for the Master Rationale; technical experts were consulted that include other government agencies; and the information is not negated by outside evidence. USEPA 316(a) Manual at 16–17, 70.

Through its Type I Retrospective/Absence of Prior Appreciable Harm and Type II Predictive/Representative Important Species Demonstrations, MWG addressed each of the biotic category criteria for a demonstration to be judged successful. MWG's 316(a) Demonstration followed the elements of the USEPA 316(a) Manual. Exh. 4 at 4-9–4-12. MWG consulted with IEPA, IDNR, INHS, and USEPA to develop a Detailed Study Plan. Pet. at 2–3; Exh.1, 2, 3. Then, to review available information and determine the need for further study, MWG assessed each of the six biotic categories: habitat formers; phytoplankton; zooplankton and meroplankton; shellfish and macroinvertebrates; fish; and other vertebrate wildlife. Exh. 4, App. C, E, F, G. After that, MWG used both a Type I Retrospective Demonstration and a Type II Predictive Demonstration. Exh. 4, App. B, C, D. MWG selected and assessed representative important species of the balanced, indigenous community that exist around WCGS or could exist with water quality improvements that might result from implementing the current ALU B water quality standards. Exh. 4 at 4-4; Exh. 4, App. B.

No Appreciable Harm to the Balanced, Indigenous Community

MWG requests thermal relief for an existing discharge. MWG's Type I Retrospective Demonstration reviewed 23 years of monitoring data in the CSSC near WCGS, both upstream and downstream. That period captured a range of conditions. Not only did the less-stringent water quality standards apply under Secondary Contact and Indigenous Aquatic Life Use, but the CSSC was subject to greater thermal loading from all four WCGS units, as well as from the Fisk and Crawford generating units. Now, WCGS operates one unit and Fisk and Crawford have been shut down. Despite the significant changes in thermal loading over the years, the demonstration shows that the aquatic community has not displayed statistically significant changes in abundance, richness, or diversity in fish species or nuisance species. The key factors limiting the aquatic community throughout this period have been navigation, CSOs, and physical conditions of the Lockport Pool and CSSC.

MWG also used a Type II Predictive Demonstration to show that the proposed alternative thermal effluent limitations will assure the protection and propagation of the balanced, indigenous community. To evaluate the potential effects of MWG's proposal, EA Engineering used hydrothermal modeling and a biothermal assessment for representative important species. Specifically, EA Engineering evaluated seven representative important species in the CSSC under both summer and winter worst-case scenarios. MWG maintains that even under the worst-case scenarios, a minimum 50% zone of passage in which water quality standards are met would always be available. To assure compliance, MWG would continue using its Near-Field Compliance Model, which alerts station personnel when temperatures approach maximum limits. This allows them to implement control measures.

Together, the Type I Retrospective and Type II Predictive Demonstrations make two showings. First, WCGS' heated effluent has not caused appreciable harm to the balanced, indigenous population in the Lower Lockport Pool under the previous thermal water quality standards. Second, WCGS' heated effluent is not expected to cause appreciable harm to the balanced, indigenous population in the Lower Lockport Pool under the proposed alternative thermal effluent limitations. Exh. 4 at 4-12–4-13; Exh. 4, App. B, C, D.

Upper Temperature Limits

Additionally, EA Engineering's biothermal assessment documented that, by complying with the proposed thermal effluent limitations at the edge of WCGS' permitted mixing zone, receiving water temperatures outside the mixing zone (1) will not exceed the thermal tolerances for survival, growth, and reproduction for the seven representative important species evaluated, and (2) are not expected to adversely affect the Illinois-listed threatened Banded Killifish, one of the representative important species. Exh. 4 at 4-8; Exh. 4, App. A at A-6; Exh. 4, App. B at B-16, Fig. B-1–B-6.

Nuisance Organisms

An algal bloom was documented in 2012. However, records show no dominant contribution by nuisance species. Further, the demonstration shows that nuisance species are not likely to be encouraged by the proposed alternative thermal effluent limitations. Exh. 4 at 4-7, 6-2.

Zone of Passage

Based on the hydrothermal modeling of the WCGS thermal plume and biothermal assessment of the representative important species, reducing the required minimum zone of passage from 75% to 50% is not expected to impede fish movement upstream or downstream of WCGS. Pet. at 21, 24; Exh. 4 at 4-6, 5-2; Exh. 4, App. B at B-30, B-35, B-38–B-39; IEPA Rec. at 5. Both MWG and IEPA point out that Board rules (35 Ill. Adm. Code 302.102(b)(8)) allow a 50% zone of passage in streams where the dilution ratio is less than 3:1, as can occur in the CSSC at any time of year. IEPA Rec. at 6; MWG Resp.2 at 5.

Even under the worst-case summer scenarios, the proposed thermal effluent limitations will maintain a zone of passage; and under the worst-case winter scenario, the temperatures will be within the thermal tolerances of the representative important species evaluated. Pet. at 21;

Exh. 4, App. B at B-39; Exh. 4, App. D-43. Although modeling for the worst-case winter scenario predicted a zone of passage less than 50%, MWG stated that the modeled worst-case conditions have never been observed in the CSSC. MWG Resp.2 at 21. Even so, MWG explained that the Near-Field Thermal Compliance Model would be set to ensure a minimum 50% zone of passage, alerting WCGS personnel when temperatures at the edge of the mixing zone risk exceeding the thermal limits. *Id.* at 22. In that event, MWG will require WGS personnel to act, "up to and including derating," before the zone of passage could go below 50%. *Id.* at 23.

Threatened or Endangered Species

During 15 years of study between 1994 and 2015, no federal-listed threatened or endangered fish species were collected in the CSSC near WCGS. Exh. 3 at 5. However, the federal-listed endangered sheepnose mussel was reported in Will County; and the Illinois-listed endangered Blanding's Turtle and the Illinois-listed threatened Banded Killifish were reported near WCGS. IEPA Rec. at 9; Exh. 2 at 2–3; Exh. 4, App. A at A-45–A-46; Exh. 4, App. C at C-23.

For the federal-listed endangered sheepnose mussel, the Lower Lockport Pool of the CSSC near WCGS "is not conducive to this mussel species." Exh. 4 at 4-8. Regarding the Illinois-listed endangered Blanding's Turtle, based on their "habitat preference and life history, there is no evidence or reason to believe that the turtle would utilize the CSSC in any way." Exh. 4, App. A at A-46; Exh. 4, App. C at C-23. And, the increasing number of the Illinois-listed threatened Banded Killifish—even with the less-stringent temperature limits for Secondary Contact and Indigenous Aquatic Life Use waters—indicates that WCGS' thermal plume is not adversely impacting them. Exh. 4 at 4-8; Exh. 4, App. A at A-45–A-46.

IDNR agreed with EA Engineering's findings and IEPA's assessment that adverse impact on federal-listed or Illinois-listed species is unlikely and no further study was required. Exh. 2 at 1, 7, 10; Exh. 4 at 4-8; Exh. 4, App. A at A-45–A-46; IEPA Rec. at 9; IDNR Resp.2 at 3.

Unique or Rare Habitat

No unique or rare habitat was identified as needing special protection and no destruction of habitat in the Lockport Pool of the CSSC is expected under the alternative thermal effluent limitations. Exh. 4 at 4-8, 6-14. MWG identified the habitat where the Banded Killifish were found as "atypical" for the Lower Lockport Pool; it would not be considered "unique" or "rare" habitat as those terms are used in the USEPA 316(a) Manual. MWG Resp. 2 at 36. MWG also stated that this area of the CSSC has not been designated as "essential habitat" for the Banded Killifish as that term is defined in the Illinois Endangered Species Protection Act. *Id.* at 37.

Biocides

As to the last element of the Master Rationale, EA Engineering confirmed that WCGS does not add chlorine or other chemicals to the circulating cooling water that is discharged back into the CSSC. Therefore, there are no detrimental impacts to aquatic life from using biocides. Exh. 4, App. D at D-2; Exh. 4, App. C at C-12.

Board Finding that Applicable Effluent Limits Are More Stringent Than Necessary

MWG requests alternative thermal effluent limitations from those that are based on these Board standards: (1) ALU B numeric temperature water quality standards; (2) excursion hours; (3) minimum zone of passage left by the mixing zone; and (4) temperature fluctuations under the narrative temperature water quality standards. *See* 35 Ill. Adm. Code 302.408(c)–(f), (h), and 302.102(b)(8). MWG must demonstrate that, for WCGS' thermal discharge, the otherwise applicable effluent limits are more stringent than necessary to assure the protection and propagation of the balanced, indigenous population in and on the Lower Lockport Pool of the CSSC. *See* 33 U.S.C. § 1326; 35 Ill. Adm. Code 106.1160(b). For the reasons below, the Board finds that MWG has made this demonstration.

ALU B Numeric Temperature Water Quality Standards

Section 302.408(h) limits daily maximum water temperatures to 60°F (December–March) and 90°F (April–November). 35 Ill. Adm. Code 302.408(h). MWG's Type I Retrospective/Absence of Prior Appreciable Harm Demonstration shows the previous 93°F year-round temperature standards did not cause appreciable harm to the balanced, indigenous community. Further, MWG's Type II Predictive /Representative Important Species Demonstration, with hydrothermal modeling and biothermal assessment, shows that the proposed numeric effluent limitations (less stringent than if based on ALU B standards for December–March and June–September) would be within the thermal tolerances of the representative important species. Under these circumstances, for the WCGS thermal discharge, the Board finds MWG has demonstrated that effluent limitations based on the ALU B numeric temperature water quality standards of Section 302.408(h) are more stringent than necessary to assure the protection and propagation of a balanced, indigenous population in and on the Lower Lockport Pool of the CSSC.

Excursion Hours

Section 302.408(f) limits excursion hours to 87.6 hours in each 12-month period ending with any month (1% of the 8,760 hours in 12 months). 35 Ill. Adm. Code 302.408(f). For the reasons detailed above, increasing excursion hours for WCGS to 438 hours in a calendar year (5% of the 8,760 hours in 12 months) is sufficiently protective of aquatic life in and on the Lower Lockport Pool of the CSSC. Excursions of the proposed limits are expected to be rare and of short duration, having only negligible effect on representative important species and without precluding upstream or downstream movements. Exh. 4 at 4-6; Exh. 4, App. B at B-35, B-38. Additionally, thermal refuge would exist despite the decreased zone of passage. Exh. 4, App. B at B-30, B-38. The Board agrees with MWG that the available data "support the position that a provision allowing up to 438 excursion-hours in a calendar year will continue to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the CSSC." MWG Resp.2 at 26.

Under the prior Secondary Contact and Indigenous Aquatic Life Use standards, "with *higher* temperature limits than requested here and with the *same* number of allowed excursion hours," there was no appreciable harm to the balanced, indigenous community. MWG Resp.2 at 26 (emphasis added); *see also* Exh. 4 at 6-9; Exh. 4, App. B at B-21; Exh. 4, App. C at C-16. IEPA agrees, noting that MWG's proposed 5% excursion-hour cap in a calendar year mimics the prior standards. IEPA Rec. at 5. IEPA concludes MWG's 316(a) Demonstration "shows that there is no evidence that operation of the facility in accordance with the former Secondary Contact Waters thermal limits have caused appreciable harm to a [balanced, indigenous community] in the [CSSC]." *Id.* And, the NPDES Permit requires MWG to report "the cumulative number of hours used in a 12 month *calendar* period in which temperatures exceed the [Secondary Contact and Indigenous Aquatic Life Use] standards (the 'excursion hours')." Exh. 5 at 8 (Special Condition 4.E.1.b.) (emphasis added). Further, for excursion-hour accounting in a thermal demonstration case, the Board has previously allowed a calendar-year basis to replace the rule's 12-month rolling basis. *See* Exelon Generation (Quad Cities Station) v. IEPA, PCB 14-123, slip op. at 48, 54 (Sept. 18, 2014).

Under these circumstances, for the WCGS thermal discharge, the Board finds MWG has demonstrated that effluent limits based on the excursion-hour requirements of Section 302.408(f) are more stringent than necessary to assure the protection and propagation of the balanced, indigenous population in and on the CSSC near WCGS.

Minimum Zone of Passage Left by Mixing Zone

With "allowed mixing," a discharger meeting specified requirements may "use a limited portion of the receiving body of water to effect mixing of the effluent with the receiving water. Within this limited portion of the receiving body of water, the discharger is excused from compliance" with the prohibition against the effluent, alone or in combination with other sources, causing a violation of the applicable water quality standard. Marathon Oil Co. v. IEPA, PCB 92-166, slip op. at 4 (Mar. 31, 1994) (quoting Amendments to Title 35, Subtitle C (Toxics Control), R88-21(A) (Jan. 25, 1990)); *see also* 40 C.F.R. § 131.13. A mixing zone is "an area for allowed mixing which is formally defined by [IEPA] in the NPDES permitting process and, if granted, is included as a condition in the permittee's NPDES permit." Granite City Division of National Steel Co. v. IPCB, 155 Ill. 2d 149, 160 (1993).

Section 302.102(b)(8) requires that a mixing zone always provide at least a 75% zone of passage in which water quality standards are met (*i.e.*, the mixing zone must not contain more than 25% of the cross-sectional area or volume of flow of a stream). 35 Ill. Adm. Code 302.102(b)(8). If the stream's dilution ratio is less that 3:1, however, the mixing zone must always provide at least a 50% zone of passage in which water quality standards are met. *Id.*

Most of the year, the zone of passage in the CSSC near WCGS is expected to meet the 75% requirement. Even under worst-case conditions, a 50% zone of passage is expected to be maintained. But, because of the frequent and erratic changes in CSSC flow, it is infeasible to set a zone-of-passage standard to the canal's dilution ratio at any given time. MWG's demonstration shows that a 50% zone of passage, regardless of the dilution ratio, will not impair the ability of fish to move upstream or downstream of the WCGS thermal plume area. Based on the Type I Retrospective Demonstration's long-term fish monitoring, as well as the Type II Predictive Demonstration's hydrothermal modeling and biothermal assessment, there is no evidence that reducing the size of the zone of passage from 75% to 50% will cause appreciable harm to the representative important species or balanced, indigenous community of aquatic life.

The Board finds MWG has demonstrated that a 50% zone of passage will assure the protection and propagation of the balanced, indigenous population. Under these circumstances, for the WCGS thermal discharge, the 75% zone-of-passage requirement of Section 302.102(b)(8) is more stringent than necessary to assure the protection and propagation of the balanced, indigenous population in and on the CSSC near WCGS.

Temperature Fluctuations under Narrative Temperature Water Quality Standards

Subsections (c), (d), and (e) of Section 302.408 are narrative temperature standards. These standards, which apply in addition to the numeric temperature standards, concern:

- Prohibiting adverse "abnormal temperature changes" unless caused by "natural conditions" (Section 302.408(c));

- Maintaining "normal daily and seasonal temperature fluctuations" that existed before adding heat from other than natural causes (Section 302.408(d)); and

- Limiting the temperature rise to 2.8°C (5°F) above "natural temperatures" (Section 302.408(e)). 35 Ill. Adm. Code 302.408(c), (d), (e).

On subsection (c), MWG states that the temperature of the man-made CSSC is "almost exclusively influenced by 'non-natural conditions,' such as POTW effluent discharges, CSOs, operation of the locks and dams, and commercial navigational traffic." MWG Resp.2 at 30. More importantly, MWG continues, its 316 (a) Demonstration shows that:

> [E]ven during abnormal weather and flow conditions, the water temperature in the CSSC will remain at levels that do not adversely affect aquatic life. The proposed numeric criteria are sufficient to protect aquatic life from abnormal thermal conditions whether caused by "natural conditions" or "unnatural conditions" or both.
>
> ***
>
> [A]mbient winter temperatures in the CSSC are not low enough to produce "cold shock," even when sudden drops in temperature occur, such as when WCGS might shut down during winter operation. *Id*. at 30, 35.

On subsection (d), MWG maintains that the CSSC's "daily" temperature fluctuations are "far removed from what would be found in a natural system" because the "primary water source is treated wastewater from POTWs" and the canal system is managed for navigation and flood control. MWG Resp.2 at 30–31. These "non-natural influences" do not follow "predictable patterns" and, in any event, the WCGS thermal discharge does not "disrupt or negate" any daily thermal fluctuations. *Id*. at 31, 34. MWG also states that "seasonal" temperature fluctuations would be maintained by its proposed monthly numeric limitations, including those "tailored" for the "transitional" months in the spring and fall. *Id*. at 31, 35; *see also* Exh. 4 at 4-5–4-6 ("This seasonally variable approach will ensure continued protection of the [balanced, indigenous community], and will effectively supersede, yet still fulfill, the intent of the narrative criteria as applied to the CSSC near WCGS.").

As for subsection (e), MWG states that its proposed numeric limitations, supported by the biothermal analysis and long-term monitoring results discussed above, are "sufficient to preclude large swings in temperature that may be harmful." MWG Resp.2 at 32. EA Engineering states that the proposed stair-step approach to daily maximum temperature limits—rising and falling with the months of the year—between the summer high of 93°F and the winter low of 70°F "will ensure continued protection of the [balanced, indigenous community] and will effectively fulfill the intent of the '5°F above natural temperature' narrative criteria." Exh. 4, App. D at D-43–D-44. Referencing its retrospective demonstration, MWG adds that the balanced, indigenous population "was adequately protected despite the fact that the then-applicable Secondary Contact standards did not have a 5°F delta T provision" and WCGS operated four units. MWG Resp.2 at 32.

Under these circumstances, for the WCGS thermal discharge, the Board finds that the narrative temperature standards of subsections (c), (d), and (e) of Section 302.408 are more stringent than necessary to assure the protection and propagation of the balanced, indigenous population in and on the Lower Lockport Pool of the CSSC.

CONCLUSION

Based on the record, the Board finds that MWG had justified the grant of alternative thermal effluent limitations for WCGS in compliance with 33 U.S.C. § 1326(a), 35 Ill. Adm. Code 304.141(c), and 35 Ill. Adm. Code 106.Subpart K.

The Board finds MWG has demonstrated that, for the WCGS discharge, thermal effluent limitations based on Sections 302.102(b)(8) and 302.408(c), (d), (e), (f), and (h) of the Board's water pollution regulations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the Lower Lockport Pool of the CSSC near WCGS. MWG's Type I Retrospective/Absence of Prior Appreciable Harm Demonstration shows that no appreciable harm to the balanced, indigenous community has resulted from the WCGS heated discharge, despite more generating units having operated for years under less stringent thermal standards. The Board also finds MWG's Type II Predictive/Representative Important Species Demonstration shows that the stair-step, seasonal numeric thermal effluent limitations in the order below, along with the increased excursion hours and decreased zone of passage, will assure the protection and propagation of a balanced, indigenous community in and on the CSSC near WCGS. Accordingly, the Board grants MWG's requested relief, effective today.

ORDER

Under 35 Ill. Adm. Code 106.Subpart K and 35 Ill. Adm. Code 304.141(c), the Board orders that the following alternative thermal effluent limitations apply to the discharge to the Chicago Sanitary and Ship Canal from Midwest Generation, LLC's Will County Generating Station.

1. Temperature

a. Instead of thermal effluent limitations based on the Chicago Area Waterway System and Brandon Pool Aquatic Life Use B (ALU B) temperature water quality standards in 35 Ill. Adm. Code 302.408(h), the following daily maximum temperature effluent limitations apply:

Month	Daily Maximum (°F)
January	70
February	70
March	75
April	80
May	85
June	93
July	93
August	93
September	93
October	90
November	85
December	75

b. Instead of the water temperature requirements of 35 Ill. Adm. Code 302.408(c), (d), (e), and (f), effluent temperatures must not exceed the daily maximum temperature limitations in paragraph (1)(a) during more than 5% of the hours (438 hours) in a calendar year. Moreover, the water temperature must never exceed the daily maximum temperature limitations in paragraph (1)(a) by more than 3°F.

c. The alternative thermal effluent limitations in paragraphs (1)(a) and (1)(b) apply at the edge of the 26-acre mixing zone allowed in Will County Generating Station's National Pollutant Discharge Elimination System (NPDES) permit.

2. Zone of Passage. Instead of 35 Ill. Adm. Code 302.102(b)(8), the mixing zone identified in paragraph (1)(c) must allow for a zone of passage that includes at least 50% of the cross-sectional area and volume of flow of the Chicago Sanitary and Ship Canal.

3. Compliance. Midwest Generation, LLC must demonstrate compliance with paragraphs (1) and (2) by modeling that is approved by the Illinois Environmental Protection Agency (IEPA) as a condition of Will County Generating Station's NPDES permit.

4. NPDES Permit. IEPA must expeditiously modify Midwest Generation, LLC's NPDES permit for Will County Generating Station to make the permit consistent with this opinion and order.

IT IS SO ORDERED.

Board Member B.K. Carter abstained.

Section 41(a) of the Act provides that final Board orders may be appealed directly to the Illinois Appellate Court within 35 days after the Board serves the order. 415 ILCS 5/41(a) (2018); *see also* 35 Ill. Adm. Code 101.300(d)(2), 101.906, 102.706. Illinois Supreme Court Rule 335 establishes filing requirements that apply when the Illinois Appellate Court, by statute, directly reviews administrative orders. 172 Ill. 2d R. 335. The Board's procedural rules provide that motions for the Board to reconsider or modify its final orders may be filed with the Board within 35 days after the order is received. 35 Ill. Adm. Code 101.520; *see also* 35 Ill. Adm. Code 101.902, 102.700, 102.702.

<table>
<tr><th colspan="2">Names and Addresses for Receiving Service of
Any Petition for Review Filed with the Appellate Court</th></tr>
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I, Don A. Brown, Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above opinion and order on November 7, 2019, by a vote of 3-0.

Don A. Brown, Clerk
Illinois Pollution Control Board