ILLINOIS POLLUTION CONTROL BOARD
April 7, 2022

MARATHON PETROLEUM COMPANY, LP	)	
Petitioner,	)	
v.	)	PCB 18-49 (Thermal Demonstration)
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent.	)	

OPINION AND ORDER OF THE BOARD (by B. F. Currie):

Marathon Petroleum Company, LP (Marathon) filed a petition (Pet.) requesting that the Board grant an alternative thermal effluent limitation (ATEL) for discharges from its Crawford County petroleum refinery into Robinson Creek through Outfall 001. Marathon requests that its proposed alternative limitations apply instead of those included in its National Pollutant Discharge Elimination System (NPDES) permit, which are based on the Board's water quality standards for temperature. Marathon is also requesting relief from the mixing zone regulations in 35 III. Adm. Code 302.102(b)(8) so they can use 100% of Robinson Creek for mixing with no zone of passage.

The Illinois Environmental Protection Agency (IEPA) recommends that the Board grant the request, with a minor change regarding the location of the compliance point. Agency Rec. at 4. The Illinois Department of Natural Resources (IDNR) recommends Marathon apply for an incidental take of a state protected species, due to the presence of a threatened species in Robinson Creek. IDNR Resp. to IEPA Rec. at 4-5.

Based on the record before it, the Board grants Marathon's alternative thermal effluent limitations with certain conditions as described in its order below.

GUIDE TO THE BOARD'S OPINION

The Board summarizes the procedural background at pages 2-6 and the factual background, including Marathon's National Pollutant Discharge Elimination System (NPDES) permit, at pages 6-11. The Board presents Marathon's requested alternative standard at pages 11-12 and addresses the legal background, including statutory and regulatory authorities and Marathon's burden of proof, at pages 13-17.

The opinion discusses Marathon's Biotic Category Analysis at pages 18-28, the Temperature Regime in Robinson Creek at pages 28-35, Marathon's Type II Demonstration including Representative Important Species (RIS) and Predictive Demonstration at 35-47, and

IDNR's concerns at pages 47-64. The Board addresses Marathon's Master Rationale at pages 64-67 before making its overall determination. In these sections, the Board's discussion applies draft guidance prepared by the United States Environmental Protection Agency (USEPA) entitled Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Section of Nuclear Facilities Environmental Impact Statements (DRAFT) dated May 1, 1977 (USEPA Manual). Marathon requests relief under authorities including Section 316(a) of the Clean Water Act (CWA), and the Board considers the USEPA Manual as a useful and instructive guide to analyzing the petition. *See* 35 Ill. Adm. Code 106.1120(e).

The Board reaches its conclusion and issues its order at pages 69-70.

PROCEDURAL BACKGROUND

Procedure Before Filing Petition with the Board

Early Screening Information

Before filing a petition for alternative thermal standards, a petitioner must submit specified early screening information to IEPA. 35 Ill. Adm. Code 105.1115(a). Within 30 days after submitting that information, the petitioner must consult with IEPA on that information. 35 Ill. Adm. Code 106.1115(b).

Marathon retained Midwest Biodiversity Institute (MBI) and Tetra Tech, Inc. (TTI) to conduct studies and collect data. Pet. at 13. Marathon submitted the required Early Screening Information to IEPA on March 11, 2016. *Id*. at 10. Marathon received approval from IEPA for the Early Screening Information on March 24, 2016.

Detailed Plan of Study

After submitting early screening information to IEPA, a petitioner must submit a detailed plan of study to support its request. 35 Ill. Adm. Code 106.1120(a). Marathon submitted a plan to IEPA on April 18, 2016. Pet. at 10.

IEPA Response

Within 90 days after receiving a detailed plan of study, IEPA must respond in writing by approving it or "recommending necessary revisions." 35 Ill. Adm. Code 106.1120(f). By letter dated May 17, 2016, IEPA approved Marathon's plan. Pet. at 10, citing Exh. 5d.

Completing Plan

After receiving IEPA's response, Marathon implemented its detailed plan of study. 35 Ill. Adm. Code 106.1120(g). MBI performed a Type II predictive demonstration, which Marathon argues is necessary because the biota in Robinson Creek are impaired by multiple non-thermal stressors. Pet. at 13. MBI conducted field study and analysis from June 2016 to October 2016. Pet. at 15-16. The completed study and analysis are compiled in the Biological and Water

Quality Assessment of Robinson and Sugar Creeks Tributaries 2016, which is attached as Exhibit 7 of Marathon's Petition.

Petition to the Board

On December 15, 2017, Marathon filed its petition accompanied by seven exhibits, including five subparts to Marathon's Exhibit 5:

Exhibit 1: NPDES permit No. IL0004073 (modified Sept. 19, 2013) (NPDES Permit);

Exhibit 2: Marathon Robinson Refinery Fact Sheet;

Exhibit 3 Discharge Temperature Data from 2002 – 2016;

Exhibit 4 Midwest Biodiversity Institute, Technical Support Documentation for Alternative Thermal Effluent Limitations under Section 316(a) of the Clean Water Act and 35 Ill. Adm. Code 304.141(c) for the Marathon Petroleum Company LP Refinery located in Robinson, Illinois (Dec. 15, 2017);

Exhibit 5(a) Early Screening Information submitted to Illinois EPA on 3/11/2016;

Exhibit 5(b) Illinois EPA Approval Letter for Early Screening Information dated 3/24/2016;

Exhibit 5(c) Detailed Plan of Study submitted to Illinois EPA on 4/18/2016;

Exhibit 5(d) Illinois EPA Approval Letter for Detailed Plan of Study dated 5/17/2016;

Exhibit 5(e) Illinois Department of Natural Resources (IDNR) "No Objection" Letter for Detailed Plan of Study dated 6/2/2016;

Exhibit 6 Tetra Tech, Inc., Final Hydrodynamic and Temperature Modeling Report for Robinson Creek, Illinois (May 9, 2017); and

Exhibit 7 Midwest Biodiversity Institute, Biological and Water Quality Assessment of Robinson and Sugar Creeks and Tributaries 2016 (Dec. 15, 2017).

Notice and Opportunity to Request Hearing

Marathon served a copy of the petition on IEPA and IDNR. *See* 35 Ill. Adm. Code 106.1125. On December 28, 2017, Marathon filed a certificate of publication stating that the *Robinson Daily News*[1] published notice on December 21, 2017. *See* 35 Ill. Adm. Code 106.1135(a), 106.1140. The notice announced that any person may within 21 days after the date of publication request that the Board hold a public hearing. *See* 35 Ill. Adm. Code

[1] The certificate of publication states that the *Robinson Daily News* is published in Crawford County and is a newspaper of general circulation in the county in which the refinery is located.

106.1135(b)(7). Accordingly, such a request was to be received by the Board on or before Thursday, January 11, 2018. The Board did not receive a request to hold a public hearing and did not hold one.

IDNR January 26, and March 29, 2018 Consultation Letters

On January 26, 2018, IDNR sent IEPA a letter reopening its consultation with IEPA on Marathon's ATEL petition, pursuant to the Illinois Endangered Species Act, the Illinois Natural Areas Preservation Act, and Title 17 Illinois Administrative Code Part 1075. IEPA Mot. 6/12/18, Att. A. IDNR's letter concerns the presence of a particular fish, the Bigeye Chub, in Robinson Creek near Marathon's discharge. *Id*. The Bigeye Chub at the time was an Illinois endangered species[2], and Marathon had not included it as a concern in their petition and supporting documents. *Id*. As a result of prior discussions with IEPA and IDNR, on February 27, 2018, Marathon filed a motion for leave to file an addendum to Exhibit 4, which included evidence of the occurrence of the Bigeye Chub in Robinson Creek. The motion was granted by hearing officer order on March 14, 2018.

In a letter dated March 29, 2018, IDNR said it did not believe Marathon's petition, or supporting documents, demonstrated that the proposed alternative thermal limit would protect endangered species present in the receiving waters. IDNR's letter also contained four recommendations: 1) the need for a bioassay of the upper thermal tolerance limits of the Bigeye Chub, 2) the need for a bioassay on representative fish species to identify the character and likely causes of the DELTs (Deformities, Eroded fins, Lesions, and Tumors) observed by MBI to see if increased thermal limits would increase the incidence and/or severity of the DELTs, 3) that the ATEL should be monitored at Outfall 001, or as near as feasible, rather than 1.7 miles away from the outfall, and 4) the need for Marathon to seek and apply for an Incidental Take Authorization for the Bigeye Chub.

Board Order Accepting Petition

On October 4, 2018, the Board found that Marathon had provided timely and sufficient notice of filing the petition and noted that it had not received a request to hold a hearing. The Board accepted the petition and indicated that the Board "may submit questions to Marathon through a Board or hearing officer order."

IEPA Recommendation

On September 7, 2018, IEPA filed its recommendation (Rec.) that the Board grant the relief requested by Marathon. Rec. at 4, citing 35 Ill. Adm. Code 106.1145. Attachments to IEPA's recommendation included:

Attachment A	Letter to Scott Twait, Illinois EPA, from Keith Shank, IDNR, RE: Alternative Thermal Effluent Limitations, Section 316(a) of the Clean Water Act. (March 29, 2018)

[2] On May 28, 2020, the status of the Bigeye Chub was changed from endangered to threatened. *See infra at 8.*

Attachment B	Marathon Petroleum Company LP's Response to the Illinois Department of Natural Resources' Consultation Letter, Dated March 29, 2018 (August 14, 2018)
Attachment C	EcoCAT Natural Resource Review Results, IDNR Project Number 1608667 (March 17, 2016)
Attachment D	Email from Scott Twait, Illinois EPA, to Nathan Grider, IDNR, Subject: FW: Marathon Petroleum IAC 106.1120 Detailed Plan of Study (May 10, 2016)
Attachment E	Letter from Keith Shank, IDNR, to Scott Twait, Illinois EPA (January 26, 2018)

However, IEPA noted that it was not specifically rendering an opinion on either the IDNR recommendations for the protection of Bigeye Chub (*See* Attachment A) or Marathon's Response (*See* Attachment B) to IDNR's letter and recommendations. Rec. at 4.

Based on the predictive analysis performed by Marathon for the 316(a) demonstration, IEPA agrees that the proposed alternative thermal effluent limitations do not adversely affect the balanced, indigenous population of fish, shellfish, and wildlife currently inhabiting the receiving water. *Id.* Further, IEPA says that while Marathon has asked for a mixing zone greater than that allowed by Section 302.102(b)(8) and the relief is larger than what could be typically granted by the Agency, the stream biota indigenous to this small watershed possess thermal tolerance thresholds greater than that of the proposed alternative thermal effluent limitations. *Id.* at 6 citing Exh. 4. Thus, any short-term exceedances of the proposed maximum effluent limitations within the 1.7-mile mixing zone would be offset with stress recovery periods (cooler temperatures) of longer durations. *Id.*

IDNR's Response to IEPA's Recommendation and Related Filings

On December 28, 2018, IDNR filed a response to IEPA's recommendation, in part recommending the Board deny Marathon's petition. IDNR Resp. 12/28/18 at 7-8. IDNR recommended denial because it did not think Marathon met its burden concerning protection and propagation of a species under 35 Ill. Adm. Code 1160, or the protection of threatened and endangered species under 35 Ill. Adm. Code 106.1130(e)(4). *Id*.

IDNR's response included a copy of the bioassay completed by Dr. Suski and Qihong Dai on December 14, 2018, entitled "Suski Lab Technical Report Review No. 2018-003 – Interim Report Thermal Tolerance Limits of Bigeye Chub" (UIUC Bioassay Report). IDNR Resp. 12/28/18 at 2, Att. A. IDNR asserted that the preliminary results of the University of Illinois at Urbana-Champaign (UIUC) study show the proposed ATEL is not protective of the Bigeye Chub. IDNR also expressed concern regarding the requested relief from the mixing zone and zone of passage. It is IDNR's position that the requested 100% mixing zone is not allowable under the Board's subpart K regulations and is not sufficiently protective of the balanced

indigenous community. *Id.* at 6-7. IDNR also noted the mere presence of the Bigeye Chub or other wildlife in Robinson Creek does not indicate their protection and/or propagation.

Marathon's Response to IDNR

On March 15, 2019, Marathon filed a reply to IDNR's recommendation. Marathon disagreed with IDNR's claim that Marathon had not met its burden and urged the Board to grant its petition. Marathon Reply 3/15/19 at 15-16. Regarding the UIUC study, Marathon argued that the researchers did not use appropriate research methods to measure the thermal critical points they calculated. 3/15/19 Marathon Resp. at 4-5. Marathon submitted a report prepared by MBI to support its assertions. Marathon also contends that the UIUC study results do not affect the results of their demonstration. Marathon declined to submit an Incidental Take Authorization and stated that they are not requesting relief to increase the temperature of its discharge.

IEPA's Response

On April 12, 2019, after reviewing the UIUC study, IEPA filed a reply to IDNR's response again recommending that the Board grant Marathon's petition. IEPA Reply 4/12/19 at 4. IEPA says that "the response temperatures for the Bigeye Chub were in line with the thermal response temperatures of other cyprinids that were already represented in the Fish Temperature Modeling System (FTMS) used by the Petitioner. *See* Pet. Exh. 4 at 63, Table 13. "Inclusion of the Bigeye Chub critical thermal maximum temperature (96.8º F) into the FTMS has not modified the model outputs that were developed for protection of all RIS." 4/12/19 IEPA Rep at 3. IEPA also submitted spawning information for the Bigeye Chub provided by Marathon to evaluate whether they would be able to propagate in Robinson Creek under the requested ATEL. IEPA argues that the data Marathon sent shows that most spawning occurs in the late spring/early summer. *Id*., *citing* Att. A. Therefore, IEPA contends that the proposed ATEL protects the spawning temperature range for the Bigeye Chub. *Id*.

Marathon's Supplemental Response

On June 4, 2019, Marathon filed a motion to supplement its March 15, 2019 reply to IDNR, which the hearing officer granted. Marathon stated that counsel for IDNR conveyed that Marathon and IEPA's reply briefs addressed IDNR's concerns and that IDNR would no longer seek a denial of Marathon's petition. Marathon Mot. at 3. The Board's record shows IDNR never withdrew its recommendation to deny the petition.

Board Questions and Party Responses

On March 10, 2020, the Board's hearing officer issued an order, attached to which were six questions addressed to IDNR, five questions for IEPA, and seven questions for Marathon. The order directed the parties to file written responses to the questions on or before April 9, 2020 (Board Questions). These questions were based on the Board's finding "that additional information is warranted in determining, among other things, whether the requested mixing zone, absent any zone of passage, would assure the protection and propagation of the Bigeye Chub, and if the requested thermal limits protect the biotic life in Robinson Creek. 3/5/20 Board Order.

On April 8, 2020, the hearing officer granted the parties joint motion to extend the response deadline to July 9, 2020.

On July 7, 2020, IDNR filed its responses to the Board's questions (IDNR Resps.). On July 9, 2020, IEPA and Marathon each filed their responses to the Board's questions (IEPA Resps. & Marathon Resps. respectively).

In its responses, among other things, IDNR says that additional information provided by Marathon on March 15, 2019, or IEPA on April 12, 2019, did not change IDNR's position. IDNR Resps. at 2.

FACTUAL BACKGROUND

Marathon's Petroleum Refinery

Site

Marathon runs an integrated petroleum refinery at 100 Marathon Avenue, Robinson, Crawford County. The Robinson Refinery (Refinery) was built in 1906. Exh. 2. In 1924, Marathon (then The Ohio Oil Company) purchased the Refinery. *Id*. The facility operates 24 hours per day, 365 days per year producing gasoline, distillates, propane, anode-grade coke, aromatics, fuel-grade coke and slurry. Pet. at 6. The Refinery is the largest refinery in the Midwest, and the third largest in the U.S. Exh. 2. The Refinery processes approximately 1.8 million barrels of crude oil per day, with a capacity to process 2.31 million barrels per day. *Id*.

The Refinery uses nine outfalls to Robinson Creek, Marathon Creek, and an unnamed creek, drainage tile and ditches. Pet. at 1.

Generating Capacity

Section 106.1130(a)(1) requests information regarding the petitioner's electrical generating capacity. Because the Refinery does not generate electricity there is no information for this requirement.

Fuel

Although the Refinery is not a power generating facility, Marathon says that it uses crude oil as its primary raw material. Pet. at 7; *see* 35 Ill. Adm. Code 106.1130(a)(2). The Refinery first heats the crude oil and separates it into its various natural petroleum fraction or products. Pet. at 7. After the initial separation some products are ready for market, while others require further processing. *Id*.

Further Marathon says that the Refinery's various process units are "fueled" by either natural gas or refinery fuel gas. Pet. at 7. Additional energy is provided by steam generated by the Refinery, as well as electricity purchased off the grid. *Id*.

Load Factors

Marathon says that this petition involves a refinery, rather than a power generating station, and therefore "load factors" does not apply. Pet. at 8; *see* 35 Ill. Adm. Code 106.1130(a)(4).

Estimated Retirements

Marathon says that it "does not have any plans to permanently shut down any process units at the Refinery, nor does [it] have any plans for additional units." Pet. at 8; *see* 35 Ill. Adm. Code 106.1130(a)(6).

Shutdowns

Marathon says that the Refinery has not shut down entirely in the last five years, and does not have any planned temporary shutdowns. Pet. at 8.

Robinson Creek

The depth of Robinson Creek ranges from 2 inches in riffle areas to 20 inches in pools of some areas of the stream. Marathon Resp. Bd. Ques. at 5. The width of the stream ranges from 23 to 31 feet. *Id*. The Route 1 Highway bridge crosses the stream 1.7 miles downstream of Outfall 001. IEPA Rec. at 6.

The City of Robinson Publicly Owned Treatment Works (POTW) also discharges into the Robinson Creek. Exh. 6 at 1. The Robinson POTW discharges a maximum permitted discharge of 6.25 million gallons per day (MGD) to Robinson Creek approximately 1.5 miles upstream of the Robinson Refinery. *Id*.

IEPA reports that Robinson Creek is classified as a General Use Water. Rec. at 2. The typical depth of the creek is reported to be between one and two feet according to Marathon. Exh. 6 at 4.

Threatened or Endangered Species

Marathon's Technical Support Document says that "[t]here are no rare, threatened, or endangered fish species in Robinson or any other area streams. . ." Exh. 4 at 17. However, on January 26, 2018, IDNR sent IEPA a letter stating that IDNR would re-open its consultation process, which it closed on June 2, 2016, because an Illinois state-listed endangered species of fish was discovered near the outfall. Mot. for Add. to Exh. 4 at 2, *see also* Pet. at 10. IDNR discovered the presence of the Bigeye Chub, an Illinois state-listed endangered species, while reviewing Marathon's petition. Mot. for Add. to Exh. 4, att. 1, at 2.

Marathon argues that when the original list of RIS was developed for Robinson Creek, there were no records of Bigeye Chub. Add. to Exh. 4 at 4. However, 2016 fish sampling results identified eight individual Bigeye Chub at three sites in Robinson Creek, and one site in Lamotte

Creek. *Id*. at 1 and 4. Lamotte Creek is a tributary of Robinson Creek, but is outside the area of thermal influence of Outfall 001. *Id*. Total length data showed that most of the individuals were very likely sexually mature and capable of reproducing. *Id*. at 1. Marathon also argued that of the eight individuals collected there were no occurrences of deformities, erosions, lesions, or tumors. *Id*. After the 2016 discovery Marathon added the Bigeye Chub to its list of RIS. *Id*. at 4.

Marathon further argues that the Bigeye Chub is a peripheral species in Illinois, because Illinois is at the northwest edge of the Bigeye Chub's natural range. Marathon Resp. to Bd. Ques. at 3. Marathon explains that a species may be particularly sensitive, when in fact the sensitivity may be due to natural factors such as geology, winter or summer temperature extremes, etc., which naturally control the distribution of a species. *Id*.

Effective May 28, 2020, the Bigeye Chub was moved from the endangered species list to the threatened species list.[3] The Endangered Species Protection Board consists of nine persons appointed by the governor who serve on a volunteer basis. 520 ILCS 10/6. The Endangered Species Protection Board reviews and revises the list as needed but meets at least once every five years. *Id*.

Heat Dissipation

Type of System

Marathon says, "[t]he Refinery operates a wet surface air cooler ("WSAC") to cool the crude desalter effluent stream, which is the warmest wastewater stream, before it feeds into the Refinery's wastewater treatment plant (WWTP). Pet. at 9. The desalter effluent leaves the 2nd stage desalter through the 2nd stage desalter level control valve and then to a series of cooling water rundown coolers. It is then sent to two air coolers in series and thereafter leaves the Crude Unit boundary limits and sent to the WWTP. The WSAC is operated year-round except during maintenance. The flow is either routed directly to the Main Lift station or diverted to WWTP front end tanks. Marathon installed and began operating the WSAC in April 2016 as part of the Crude Unit Light Crude Upgrade Project. The WSAC is designed to remove approximately 5.6 mmBTU/hr. The crude desalter effluent stream constitutes approximately seventeen percent of the wastewater treated by the WWTP." Pet. at 9.

"The Refinery also operates three cooling towers to cool various process streams via closed loops. The three cooling towers have average duties of 246 mmBtu/hr, 465 mmBTU/hr, and 128 mmBTU/hr, respectively, for a total of 839 mmBTU/hr. The cooling towers have a combined blow down of approximately 300 gallons per minute to the WWTP, which constitutes approximately fourteen percent of the flow to the WWTP." Pet. at 9.

Discharges

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3 https://www2.illinois.gov/dnr/ESPB/Documents/ET%20List%20Review%20and%20Revision/IllinoisEndangeredandThreatenedSpecies.pdf

As part of the refining process the Refinery generates wastewater and stormwater. Pet. at 1. Of the nine outfalls, Marathon discharges wastewater to Robinson Creek from Outfall 001. *Id*. at 2. The Refinery discharges treatment plant bypass wastewater and east impoundment basin wastewater to Marathon Creek via Outfalls 002 and 003, respectively. *Id*. Stormwater is also discharged to Robinson Creek, Marathon Creek, an unnamed creek, an unnamed creek drainage tile, and unnamed ditches via Outfalls 005, 006, 007, 008, 009, and 010.

IEPA says, "[t]he Refinery discharges to Robinson Creek at a point where 1.4 cubic feet per second [cfs] of flow exists upstream of the outfall during critical 7Q10 low-flow conditions." Rec. at 2. "The 7Q10 flow (the lowest 7-day average flow that occurs on average once every 10 years) is 0 cfs in Robinson Creek upstream of the Robinson POTW." Exh. 6 at 36. According to IEPA, "[t]he Refinery has an average flow of 2.666 million gallons per day" to Robinson Creek. Rec. at 2. "Robinson Creek also receives water from ephemeral stream channels and ditches from the agricultural lands." Exh. 6 at 1.

NPDES Permit

IEPA issued NPDES Permit No. IL0004073 to Marathon on September 30, 2009, with an effective date of October 1, 2009. Exh. 1 at 2. The permit was modified three times, including on: December 9, 2010, May 11, 2012, and lastly on September 19, 2013. *Id*.

The permit authorizes ten discharges including Outfall 001 to Robinson Creek. *Id*. Relevant to this matter, the permitted discharge from Outfall 001 includes a temperature standard at Special Condition 8. Special Condition 8 provides:

> For outfall 001, discharge of wastewater from this facility must not alone or in combination with other sources cause the receiving stream to violate the following thermal limitations at the edge of the mixing zone which is defined by Section 302.211, Illinois Administrative Code, Title 35, Chapter 1, Subtitle C, as amended:
>
> A. Maximum temperature rise above natural temperature must not exceed 5°F (2.8°C).
>
> B. Water temperature at representative locations in the main river shall not exceed the maximum limits in the following table during more than one (1) percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 3°F (1.7°C). (Main river temperatures are temperatures of those portions of the river essentially similar to and following the same thermal regime as the temperatures of the main flow of the river.)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
°F	60	60	60	90	90	90	90	90	90	90	90	60
°C	16	16	16	32	32	32	32	32	32	32	32	16

Thermal Compliance History

Marathon reports that within the last five years, Marathon exceeded applicable temperature limitations seven times, and temperature increase limitations four times. Pet. at 10.

Monitoring and Data Collection

University of Illinois at Urbana-Champaign Study

In response to concerns regarding the presence of Bigeye Chub in Robinson Creek, IDNR contracted with Dr. Cory Suski at the UIUC to study the thermal tolerance of Bigeye Chub. 12/28/18 IDNR Rep. at 3. UIUC issued its study findings on December 14, 2018 as "Suski Lab Technical Report Review No. 2018-003 -Interim Report Thermal Tolerance Limits of Bigeye Chub." *Id.* The findings of the UIUC Report were peer reviewed and published in *Aquatic Biology* in October 2019 as "Effects of acclimation temperature on critical thermal limits and swimming performance of the state-endangered Bigeye Chub *Hybopsis amblops*". 7/7/20 IDNR Rep. at 6. This order will refer to the Aquatic Biology publication as the "UIUC Study".

MARATHON'S PROPOSED ALTERNATIVE THERMAL EFFLUENT LIMITATION

Marathon is seeking an ATEL that: exempts its discharge from the maximum temperature rise limitations under Section 302.211(d); specifies alternative monthly temperature limitations instead of those in Section 302.211(e); adds an average water temperature limitation in Robinson Creek downstream of Outfall 001; prescribes mixing zone in lieu of Section 302.102(b); and proposes alternative sampling locations. Marathon's request for an ATEL is for its existing thermal discharge and not for an increase in the temperature of its thermal effluent. Rec. Att. B; Marathon's Resp. to IDNR 3/29/18 letter, EA Engineering August 13, 2018 document at 3. The following table compares the thermal limitations in Marathon's current NPDES Permit and the proposed alternative thermal effluent limitations.

Comparison of Marathon's Current NPDES Permit with Proposed Alternative Thermal Effluent Limitations

	Current NPDES Permit	**Proposed Alternative Thermal Effluent Limitations (PCB 18-49)**
Maximum temperature rise	Maximum temperature rise above natural temperature must not exceed 5°F. (based on General Use 35 IAC 302.211(d))	35 IAC 302.211(d) shall not apply.
Maximum Temperature Limitations	(°F) based on General Use 35 IAC 302.211(e)	(°F)
January	60	65

February	60	65
March	60	74
April	90	82
May	90	88
June	90	90
July	90	90
August	90	90
September	90	90
October	90	85
November	90	85
December	60	74
Average	*(Not included in current permit or 35 IAC 302.211.)*	The average water temperature in Robinson Creek downstream from the Marathon 001 Outfall at a point instream in the vicinity of the IL Route 1 bridge for the period June 16 – September 15 shall not exceed 87°F.
Excursion Hours	Shall not exceed the maximum limits during more than 1% of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature exceed the maximum limits by more than 3°F.	Shall not exceed the maximum limits during more than 1% of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature exceed the maximum limits by more than 3°F.
Mixing Zone	The NPDES Permit allows for a mixing zone by mentioning that the thermal limitations apply "at the edge of the mixing zone". Exh. 1. (*The NPDES Permit does not include a formal definition of the area and volume of mixing zone pursuant to 35 IAC 302.102(d), so the mixing zone provisions of 35 Ill. Adm. Code 302.102 apply by default.)*	In lieu of 35 IAC 302.102(b), the following shall apply: the area and volume of mixing shall extend from the Marathon 001 Outfall to a point instream in the vicinity of the IL Route 1 bridge.
Monitoring Points	Temperature monitoring is to be performed with manual grab samples 2 times per week at Outfall 001. In the event temperatures at Outfall 001 exceed the limitations, Marathon must monitor upstream of Outfall 001 and near the Route 1 Highway	The instream sampling location for monitoring the alternative thermal effluent limitations, i.e. the point of compliance, is located at a point instream in the vicinity of the IL Route 1 bridge.

	bridge downstream of Outfall 001. Exh. 1.	*(No monitoring would be required at Outfall 001.)*

The Board also notes that IEPA recommended the Board change the language "in the vicinity of the IL Route 1 bridge" in Marathon's requested relief to "at the IL Route 1 bridge." IEPA Rec. at 4. Due to potential difficulties regarding construction of the instream temperature monitor, Marathon and IEPA agree to change the language in the requested relief except for one area:

Also, Marathon proposes that the instream sampling location for monitoring the alternative thermal effluent limitations, i.e. the point of compliance, be located at a point instream ~~in the vicinity~~at or upstream of the IL Route 1 bridge. *See* Marathon Resp. to IEPA Rec. at 6.

LEGAL BACKGROUND

Statutory and Regulatory Background

It is unlawful for any person to discharge a pollutant from a point source into waters of the United States without a permit. 33 U.S.C. § 1311(a). Heat is a pollutant (33 U.S.C. § 1362(6)), and 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).

Accordingly, 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 notwithstanding any other technology-based standard. 33 U.S.C. §§ 1311(b)(1)(C), 1312(a); *see* 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 (2014). The Board's water quality temperature standards for general use waters are found at 35 Ill. Adm. Code 302.211.

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

> [w]ith 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 projection (sic) 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(a) (Thermal Discharges); *see* Pet. at 3-4.

The Board's regulations define "balanced, indigenous community" or "BIC" as synonymous with the term "balanced, indigenous population" in the CWA and as:

> a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species, and 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 under this Subpart or to regulatory relief, granted by the Board, from otherwise applicable thermal limitations or standards under 35 Ill. Adm. Code 301 through 312. 35 Ill. Adm. Code 106.1110; *see* 40 C.F.R. § 125.71(c); *see* Pet. at 4.

> Accordingly, Section 304.141(c)[4] of the Board's rules provides that:

> [t]he 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, applicable federal regulations, and procedures in 35 Ill. Adm. Code

[4] The Board originally adopted 35 Ill. Adm. Code 304.141(c) on August 29, 1974, as Rule 410(c) of Chapter 3 of the Board's Water Pollution Regulations, which provided that

> [t]he standards of Chapter 3 shall apply to thermal discharges unless, after public notice and opportunity for public hearing, in accordance with Section 316 of the [Federal Water Pollution Control Act] and applicable federal regulations, the Administrator and the Board have determined that different standards shall apply to a particular thermal discharge.

> 106.Subpart K, the Board has determined that different standards shall apply to a particular thermal discharge. 35 Ill. Adm. Code 304.141(c); *see* Pet. at 3.

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

In 1977, USEPA issued a draft manual on demonstrations under CWA Section 316(a). The draft 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 Manual at 8-9; *see* Pet. at 6. This guidance has not been finalized and remains a draft. Nevertheless, the Board has found that its decision criteria are a useful guide for its analysis and followed its decision-making outline. *See* Exelon Generation LLC v. IEPA, PCB 15-204, slip op. at 2 (Mar. 3, 2016); Exelon Generation LLC v. IEPA, PCB 14-123, slip op. at 2 (Sept. 18, 2014). Also, a petitioner seeking alternative thermal effluent limitations must consider guidance published by USEPA in making its demonstration. 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.

Mixing Zones

Under Section 316(a) of the CWA, the USEPA allows the use of mixing zones as a mechanism to deal with thermal discharges in setting alternative thermal effluent limitations, provided that the mixing zone assures the protection and propagation of the biological indigenous community.

The Board's mixing zone rules are found at 35 Ill. Adm. Code 302.102(b), and provide in pertinent part:

> Section 302.102 Allowed Mixing, Mixing Zones and ZIDs
>
> …
>
> (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:
>
> …
>
> 4) Mixing is not allowed in waters containing mussel beds, endangered species habitat, fish spawning areas, areas of important aquatic life habitat, or any other natural features vital to the well-being of aquatic life in such a manner that the maintenance of aquatic life in the body of water as a whole would be adversely affected.
>
> …

6) Mixing must allow for a zone of passage for aquatic life in which water quality standards are met. 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.

…

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 except for those streams for which the dilution ratio is less than 3:1. In streams where the dilution ratio is less than 3:1, the volume in which mixing occurs, alone or in combination with other volumes of mixing, must not contain more than 50% of the volume flow unless an applicant for an NPDES permit demonstrates, pursuant to subsection (d), that an adequate zone of passage is provided for pursuant to subsection (b)(6).

…

10) No body of water may be used totally for mixing of single outfall or combination of outfalls, except as provided in subsection (b)(6).

…

d) Pursuant to the procedures of Section 39 of the Act and 35 Ill. Adm. Code 309, a person may apply to the Agency to include as a condition in an NPDES permit formal definition of the area and volume of the waters of the State within which mixing is allowed for the NPDES discharge in question. The defined area and volume of allowed mixing shall constitute a "mixing zone" for the purposes of 35 Ill. Adm. Code: Subtitle C. Upon 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 Clean Water Act (CWA) (33 USC 1251 et seq.), the Act or Board regulations, the Agency shall, pursuant to Section 39(b) of the Act, include within the NPDES permit a condition defining the mixing zone.

Additionally, the definitions under 35 Ill. Adm. Code 301.270 provide:

"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.

Threatened or Endangered Species

Under the Illinois Endangered Species Act, IDNR along with the Illinois Endangered Species Protection Board (ESP Board), is authorized to approve the listing, delisting, or change of listed status of plant or animal species as endangered or threatened, and to authorize regulations for such listings. 17 Ill. Adm. Code 1010 and 1050.

The Illinois Endangered Species list automatically includes those species or subspecies of animal or plants that are designated as endangered or threatened by the U.S. Secretary of the

Interior pursuant to the federal Endangered Species Act. P.L. 93-205. Additionally, the ESP Board may list species that are in the State of Illinois and have scientific evidence qualifying them as endangered or threatened. 520 ILCS 10/7. The dual list recognizes state by state and ecological differences of endangered or threatened species.

Endangered species means a species which "is in danger of extinction in the wild in Illinois due to one or more causes including but not limited to, the destruction, diminution or disturbance of habitat, overexploitation, predation, pollution, disease, or other natural or manmade factors affecting its prospects of survival." 520 ILCS 10/2.

A threatened species includes those "the [ESP] Board may list as likely to become endangered in the wild in Illinois within the foreseeable future." 520 ILCS 10/2.

It is illegal to "take" any animal species which occurs on the Illinois Endangered Species List, unless otherwise authorized by law. 520 ILCS 10/3. The definition of "take" includes to harm, wound, kill, harass, or to attempt to engage in such conduct. 520 ILCS 10/2.

Under regulations stemming from the Federal Endangered Species Act (Federal Act) (16 USC 35 Section 1531 et seq) at 50 CFR 17.3, "harass" and "harm" are defined:

> Harass in the definition of "take" in the Federal Act means an intentional or negligent act or omission which creates the ***likelihood of injury to wildlife*** by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering…
>
> Harm in the definition of "take" in the Federal Act means an act which ***actually kills or injures wildlife***. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.
>
> 50 CFR 17.3, emphasis added.

Incidental Take

IDNR may authorize an "incidental take" under prescribed terms and conditions when the take is incidental to, and not the purpose of, carrying out an otherwise lawful activity. 520 ILCS 10/5.5(a). To receive an incidental take, an applicant must submit a conservation plan to IDNR. *Id*. Once IDNR reviews the application, it can decide to grant the incidental take if it finds in a written decision that the taking will meet certain statutory requirements. *See* 520 ILCS 10/5.5(c).

Burden of Proof

Marathon bears the burden of proof. 35 Ill. Adm. Code 106.1160(a); *see* Pet. at 5. Marathon must demonstrate that an otherwise applicable thermal effluent limitation is "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 made." 35 Ill. Adm. Code 106.1160(b); 33 U.S.C. § 1326(a). Marathon must also demonstrate that the requested alternative thermal effluent limitation, "considering the cumulative impact of its thermal 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). This demonstration may be referred to as a predictive demonstration.

BOARD DISCUSSION

As explained above, Marathon must demonstrate that the current standard is more stringent than necessary to assure, and the requested alternative limit will assure, the protection and propagation of a balanced and indigenous population of shellfish, fish, and wildlife in the receiving water. *See* 33 U.S.C. § 1326(a). The USEPA Manual sets forth the main components for such demonstrations, beginning with a biotic category identification and early screening process to determine which type or types of demonstrations are appropriate for the site: 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). Then the applicant synthesizes information from the demonstrations into a master rationale for the proposed alternate thermal effluent limitations.

After completing the Biotic Category Identification, Marathon selected to produce a Type II Predictive/Representative Important Species Demonstration. Marathon relies on biological field studies of the receiving stream, comparisons to thermal tolerance information for RIS with measured and modeled temperature regimes developed by its consultants, MBI and TTI, to support the demonstration. Marathon says, "MBI determined that a [Type II] predictive demonstration was appropriate for this Section 316(a) Demonstration because the biota in Robinson Creek are currently impaired by multiple non-thermal stressors both upstream and downstream of the Refinery's Outfall 001." Pet. at 19. Other stressors include chemical and physical alterations to flow and habitat. Exh. 4 at 7. MBI explained that this "precludes the showing of a lack of prior appreciable harm [Type I Retrospective / Absence of Prior Appreciable Harm Demonstration] due to the thermal effluent." Exh. 5a at 3.

In the following sections of the opinion, the Board summarizes the record on these elements of the demonstration and makes its findings on whether the Type II Predictive Demonstration shows that the current limitations are more stringent than necessary and that the requested alternative limitations meet the Biotic Category Criteria to assure the protection and propagation of the balanced, indigenous community.

Biotic Category Identification

A CWA Section 316(a) demonstration begins with the early screening process to identify the balanced, indigenous population of aquatic life in the receiving water. USEPA 316(a) Manual at 18, 34.

Because 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 additional work needed in each of the six biotic categories, the petitioner chooses the most appropriate type of demonstration for the site. USEPA 316(a) Manual at 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. If a site is a low potential impact area for each biotic category, the applicant may conduct a relatively streamlined demonstration. USEPA 316(a) Manual at 6, 14, 33; *see id*. at 63 (§ 3.6: Type III Low Potential Impact Demonstrations). If a site is not a low potential impact area for each biotic category, the applicant must conduct a more comprehensive analysis. *Id.* at 15, 33; *see id*. at 34-61, 72 (§ 3.9: Type I Demonstration (Retrospective/Absence of Prior Appreciable Harm); § 3.5: Type II Demonstration (Predictive/Representative Important Species); § 3.7: Other Type III Demonstration (Biological, Engineering, and Other Data)).

Marathon's consultant, MBI conducted the early screening assessment of the biotic communities identified in the USEPA Manual. See Exh. 4 and 5. Based on this assessment, MBI recommended that Robinson Creek be classified as a low potential impact area for four of the six biotic communities listed in the USEPA Manual. Exh. 5a at 4. These include habitat formers, phytoplankton, zooplankton and meroplankton, and other vertebrate wildlife. Thus, MBI concluded that the principal assemblages for inclusion in the detailed field study for further evaluation would be fish, macroinvertebrates, and shellfish (mussels). Exh 5a at 6. These assemblages were classified as high impact for Robinson Creek. IEPA approved MBI's recommendations concerning the assessment of biotic communities as part of the early screening approval. See Exh. 5b.

MBI conducted biological assessment field study from June through October 2016 (2016 study) in compliance with the detailed study plan approved by IEPA. Exh. 5c and 7. The 2016 study was conducted to determine the existing status of the selected biological assemblages and their relationship to chemical, physical, and biological stressors in Sugar Creek, Robinson Creek and its tributaries, and Lamotte Creek. Exh. 7 at 2. In compliance with 35 Ill. Adm. Code 106.1130(e), IEPA says that the 2016 study meets requirements of the detailed plan of study submitted under Section 106.1120. Rec. at 8. Below, the Board reviews the six biotic categories assessed by MBI starting with the four low impact assemblages followed by a discussion of macroinvertebrates/shellfish and fish.

Low Impact Assemblages

Habitat Formers (Aquatic Vegetation). Habitat formers are the assemblage of plants and animals that stabilize sediments and provide cover areas, food sources, spawning sites, and nursery areas. USEPA Manual at 76-77. Their role is "unquestionably unique and essential to the propagation and well-being of fish, shellfish, and wildlife." *Id*. at 57. Habitat formers may be vulnerable to the temperature, velocity, or turbidity of a heated discharge and may also be damaged by biocides in the discharge. *Id*.

Sites may lack habitat formers as a result of "low levels of nutrients, inadequate light penetration, sedimentation, scouring stream velocities, substrate character, or toxic materials." USEPA Manual at 22. These conditions may lead to designation as a low impact area. *Id*. If these limiting factors may be overcome and habitat formers established in the area, then "the applicant will be required to demonstrate that the heated discharge would not restrict re-establishment." *Id*. A site will not be considered low impact for habitat formers if "there is a possibility that the power plant will impact a threatened or endangered species through adverse impacts on habitat formers." *Id*.

If an applicant can show that a site is a low impact area for habitat formers, then that section of the demonstration "will be judged successful." USEPA Manual at 22. For all other sites, the decision criteria for this section require an applicant to demonstrate that:

1. The heated discharge will not result in any deterioration of the habitat formers community or that no appreciable harm to the balanced indigenous population will result from such deteriorations.

2. The heated discharge will not have an adverse impact on threatened or endangered species as a result of impact upon habitat formers. *Id*.

For sites that are not low impact for habitat formers, the USEPA Manual lists information that an applicant should provide. USEPA Manual at 22-23, 57-58.

A request may be denied if there is "[a]ny probable thermal elimination of habitat formers" or "if important fish, shellfish, or wildlife are thermally excluded from the use of the habitat." *Id*. at 22.

MBI addressed the habitat formers in its early screening report to IEPA. Exh. 5 a. In that report, MBI notes that the habitat formers in freshwater streams and rivers "most commonly includes submergent and emergent aquatic macrophytes. Exh. 5a at 4. While they can be of significant concern in soft bottom low gradient streams and rivers with soft substrates, the concern is much less so in moderate and high gradient streams. Further, MBI asserts that habitat formers are not usually used to assess warmwater streams. If they are present, habitat formers will be included in the habitat assessment under the proposed field studies because "vast majority of the habitat in Midwestern U.S. streams is comprised of physical and other features such as pools, riffles, runs, undercut banks, overhanging terrestrial vegetation, and woody debris". *Id.* Therefore, MBI recommended classifying Robinson Creek as low potential impact for habitat

formers. *Id.* IEPA approved this recommendation along with the rest of Marathon's "Early Screening Information" on March 24, 2016. Exh. 5b.

Phytoplankton. Phytoplankton are "[p]lant microorganisms such as certain algae, living unattached in the water." USEPA Manual at 78. Phytoplankton are "a principal food source for most zooplankton and for some fish species." *Id*. at 55.

In the USEPA Manual, systems where the food chain base is detrital material rather than phytoplankton, such as most rivers and streams, are areas of low potential impact for this category. USEPA Manual at 18-19; *see id*. at 55. An area is not considered low impact for phytoplankton if:

1. The phytoplankton contribute a substantial amount of the primary photosynthetic activity supporting the community;

2. A shift towards nuisance species[5] may be encouraged; or

3. Operation of the discharge may alter the community from a detrital to a phytoplankton based system. *Id*. at 19.

If an applicant can show that a site is a low impact area for phytoplankton, then that section of the demonstration "will be judged successful." USEPA Manual at 18. For other sites, the decision criteria for this section require an applicant to demonstrate that:

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

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. *Id*.; *see* Exh. B. at 4-1.

For sites that are not low impact, the USEPA Manual lists information that an applicant should provide. USEPA Manual at 19-20, 55-56.

MBI concluded Robinson Creek is a low impact area for phytoplankton. Exh. 5a at 4. Phytoplankton was classified as part of the Algal Assemblage grouping which is regarded as being low potential in rivers and streams via the Interagency Technical Guidance (U.S. EPA

[5] The USEPA Manual states that "[a]ny microbial, plant or animal species which indicates a hazard to ecological balance or human health and welfare that is not naturally a dominant feature of the indigenous community may be considered a nuisance species. Nuisance species of the phytoplankton include those algae taxa which in high concentration are known to produce toxic, foul tasting, or odiferous compounds to a degree that the quality of water is impaired." USEPA Manual at 77.

1977). *Id*. Also, they generally are less thermally sensitive than fish and freshwater mussels. *Id*. The main concern with phytoplankton in rivers and streams is the effects of nutrient enrichment. However, the proposed field studies will include other parameters and indicators to evaluate the adverse effects of nutrient enrichment. *Id*. IEPA approved MBI's conclusion that Robinson Creek is low impact for phytoplankton. Exh. 5 c.

Zooplankton/Meroplankton. Zooplankton are "[a]nimal microorganisms living unattached in water. They include small crustacea such as daphnia and cyclops, and single-celled animals such as protozoa, etc." USEPA Manual at 79. Zooplankton provide "a primary food source for larval fish and shellfish and also makes up a portion of the diets of some adult species." *Id*. at 56. Many fish species have a planktonic life stage termed meroplankton, which distinguishes those species from organisms that remain planktonic for their entire life cycle. USEPA Manual at 56, 77. "If a heated discharge kills or prevents development of the meroplankton, fewer adult fish and shellfish will be produced each year." *Id*. at 56.

If an applicant can show that a site is a low impact area for zooplankton, then that section of the demonstration "will be judged successful" and no further studies are necessary. USEPA Manual at 20, 21. "Areas of low potential impact for zooplankton and meroplankton are defined as those characterized by low concentrations of commercially important species, rare and endangered species, and/or those forms that are important components of the food web or where the thermal discharge will affect a relatively small proportion of the receiving water body." *Id*. at 20-21. For other sites, this section requires an applicant to demonstrate that:

1. Changes in the zooplankton and meroplankton community in the primary study area 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 in the far field study area from those values typical of the receiving water body segment prior to plant operation.

3. The thermal plume does not constitute a lethal barrier to the free movement (drift) of zooplankton and meroplankton. *Id*. at 20; *see* Exh. B at 4-3.

For sites that are not low impact for zooplankton and meroplankton, the USEPA Manual lists information that an applicant should provide. USEPA Manual at 21, 56-57; *see* Exh. B at 4-3.

MBI notes that according to the Interagency Technical Guidance (U.S. EPA 1977) neither zooplankton and meroplankton are considered numerous or of concern in small stream/river systems and thus considered low impact within the study area. Exh. 5a at 4. Again, MBI's recommendation concerning zooplankton and meroplankton was approved by IEPA. Exh. 5 c.

Other Vertebrate Wildlife. "Other vertebrate wildlife" includes species such as ducks and geese, but not fish. USEPA Manual at 32, 77. If an applicant can show that a site is a low

impact area for other vertebrates, then that section of the demonstration "will be judged successful." *Id*. at 32. Most U.S. sites will be considered low potential impact for other vertebrate wildlife because the projected thermal plume "will not impact large or unique populations of wildlife." *Id*. Exceptions include the "few sites" where important, threatened, or endangered wildlife may be affected by the discharge. *Id*. Exceptions may also include sites in the northern U.S. that attract species such as ducks and geese and encourage them to stay through the winter. *Id*. These sites may be considered low impact if there is a demonstration that a wildlife protection plan or other method would protect those species from specified harms. *Id*.

For sites that are not considered low impact for other vertebrate wildlife, the decision criteria for this section require an applicant to demonstrate "that other wildlife community components will not suffer appreciable harm or will actually benefit from the heated discharge." USEPA Manual at 32. For these sites, the USEPA Manual lists study requirements that an applicant should meet. *Id*. at 33, 61.

MBI notes that "other vertebrate wildlife" include birds, mammals, amphibians, and reptiles that are not included in the other five biotic categories. Exh. 5a at 6. MBI asserts that while "species of all four groups occur in Robinson Creek and other area stream drainages none are compelling enough to warrant inclusion as having a high potential for adverse impacts from thermal enrichment." *Id.* Thus, MBI recommends listing "other vertebrate wildlife" as low potential impact. As noted above, IEPA agrees with MBI's recommendation. Exh. 5b.

Macroinvertebrates and Shellfish

Macroinvertebrates[6] including shellfish are an important part of aquatic food webs and provide a source of bait for sport and commercial fishing. USEPA Manual at 58. Thermal discharges may have a number of effects on macroinvertebrates, including reproduction and survival. *Id*. at 59.

An area with low potential impact for macroinvertebrates and shellfish is defined as one that can meet five requirements:

1. Shellfish/macroinvertebrate species of existing or potential commercial value do not occur at the site. This requirement can be met if the applicant can show that the occurrence of such species is marginal.

2. Shellfish/macroinvertebrates do not serve as important components of the aquatic community at the site.

3. Threatened or endangered species of shellfish/macroinvertebrates do not occur at the site.

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[6] "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 Manual at 73, 77.

4. The standing crop of shellfish/macroinvertebrates at the time of maximum abundance is less than one-gram ash-free dry weight per square meter.

5. The site does not serve as a spawning or nursery area for the species in 1, 2, or 3 above. USEPA Manual at 25.

A shellfish/macroinvertebrate section of the demonstration is successful "if the applicant can demonstrate that no appreciable harm to the balanced indigenous population will occur as a result of macroinvertebrate changes caused by the heated discharge." USEPA Manual at 23. The USEPA Manual provides decision criteria. First, a reduction in the standing crop of macroinvertebrates may be a cause for denial, "unless the applicant can show that such reductions cause no appreciable harm to balanced indigenous populations within the water body segment." USEPA Manual at 23. Second, reduced diversity may be a cause for denial unless the applicant can show that critical macroinvertebrate functions "are being maintained in the water body segment as they existed prior to the introduction of heat." *Id*. at 24. The third criterion addresses drift in a river or stream. *Id*. Fourth, "[a]reas which serve as spawning and nursery sites for important shellfish and/or macroinvertebrate fauna are considered as zero allowable impact areas and will be excluded from the discharge of waste heat." *Id*. at 24-25.

For sites that are not low impact, the USEPA Manual lists information that an applicant should provide. USEPA Manual at 25-28, 58-60.

Although macroinvertebrates are generally more thermally tolerant than fish, MBI says that IEPA uses macroinvertebrates to determine the status of general aquatic life, and therefore recommends listing macroinvertebrates as high potential impact. Exh. 5a at 5. MBI further asserts that macroinvertebrates are useful in assessing non-thermal causes of impairment. *Id*.

MBI reviewed the Illinois Natural History Survey database of mussel assemblage for various sites in nearby streams, including Sugar Creek, Big Creek, and Hutson Creek. Exh. 5a at 5-6. Although results did not show a large assemblage of mussels, because of their sensitivity to thermal enrichment and other pollutants, MBI recommends classifying shellfish as a high potential for impact for Robinson Creek and other area streams. Exh. 5a at 5-6. Based on this classification, MBI conducted detailed field studies to develop additional information on macroinvertebrates and shellfish. See generally Exh. 7.

Macroinvertebrates.

Sampling Methods. MBI followed the IEPA's multi-habitat methods to sample macroinvertebrates at 17 instream sites. Exh. 7 at 19 citing Table 4. The sampling reaches were selected based on flow conditions similar to base summer flows, absence of influential tributary streams, the presence of one rifle/pool sequence or analog, and if present a length of at least 300 feet. *Id.* Samples were collected by using a dip net in all bank-zone and bottom-zone within a habitat site when water conditions allowed samplers to apply the 11 transect habitat method or estimate with visual or tactile cues the amount of each bank-zone and bottom-zone habitat types. *Id.* Multi-habitat samples were preserved in 10% formalin and treated with 70% ethyl alcohol

upon reaching the MBI lab. *Id.* Macroinvertebrates taxa were identified using the IEPA (2011e) methodology. *Id.*

Macroinvertebrates Distribution. In the 17 stream sites assessed for macroinvertebrates within the study area, the total taxa ranged from 32 in Lamotte Creek to 17 in Robinson Creek at river mile (RM) 2.0 (RC08). Exh. 7 at 58 citing Table 16. The number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) taxa ranged from 1 at RM 4.9 (RC05) located immediately downstream of the Marathon 001 discharge to 7 at the most downstream sites at Sugar Creek (SC03) and Lamotte Creek (LC01). *Id.* The percentage of EPT taxa ranged from a high of 42.8% at RC07 and a low of 0.7% at RC04. *Id.* at 58-60. Mayfly taxa ranged from 0 found at sites in Robinson Creek at RC01, RC02, RC03, RC04, and RC05 to 5 found in Sugar Creek (SC01B) and Lamotte Creek (LC01). *Id.*

MBI notes that in contrast to historical fish studies there is not enough data to determine macroinvertebrate trends across time. Exh. 7 at 60. However, MBI asserts that macroinvertebrates like fish assemblages experienced an improvement since 1990s in the study area. *Id.* Further, MBI notes that toxic response signatures for macroinvertebrates include midges of the genus *Cricotopus* >5%, macroinvertebrate Index of Biotic Integrity (mIBI) scores in the poor range, and EPT taxa <4. *Id.* Only one site immediately downstream of the Marathon 001 discharge (RC05) came close to meeting these criteria with 4.9% of *Cricotopus sp*, a poor mIBI score, and 1 EPT taxa. *Id.* However, MBI maintains that none of the other sites met the toxic signature criteria with *Cricotopus sp*. rates at 0 or less than 1%. *Id.*

Shellfish (mussels).

Mussels sampling methods. Freshwater mussels were collected at the 17 instream sites and two discharge plumes within the study area using IDNR methods. Exh. 7 at 19. Live mussels and shells were collected at each sample site by hand grubbing, raking, and visual detection of trails, siphons, and exposed shells using an observation bucket. *Id.* MBI notes that all available habitat types including riffles, pools, slack water, and areas of differing substrates were sampled, live mussels were held instream until they were processed and then released. *Id.*

The mussel sampling results indicated presence of only two species in the 2016 study area: three live specimens of *Anodontoides ferussacianus* was found in Lamotte Creek (LC01); and relict specimens of *Uniomerus tetralasmus* were collected in Robinson Creek at RC04, RC05 and RC06. *Id.* at 53. Based on Szafoni (2001), MBI classified all four sites in the 2016 study area as Restricted. *Id.* citing Table 15.

Fish

"The discharge of waste heat can affect fish populations in many ways." USEPA Manual at 60. If an applicant can show that a site is a low impact area for fish, then that section of the demonstration "will be judged successful." *Id*. at 28. A discharge may be determined to be in an area of low potential impact for fishes if it meets the following conditions:

1. The occurrence of sport and commercial species of fish is marginal;

2. The discharge site is not a spawning or nursery area;

3. The thermal plume . . . will not occupy a large portion of the zone of passage which would block or hinder fish migration under the most conservative environmental conditions (based on 7-day, 10-year low flow or water level and maximum water temperature);

4. The plume configuration will not cause fish to become vulnerable to cold shock or have an adverse impact on threatened or endangered species. *Id*. at 29.

For sites not classified as low potential impact for fish, the decision criteria require an applicant to demonstrate 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. *Id*. at 28-29; *see* Exh. B at 4-10.

For sites that are not low impact, the USEPA Manual lists information that an applicant should provide. USEPA Manual at 29-32, 60-61. The study requirements include appropriate sampling methods and gear "to provide a basis for identifying the Representative Important Species (RIS) of fish. . . ." *Id*. at 29; *see id*. at 60.

MBI says that fish are widely recognized as having the highest sensitivity to thermal enrichment and recommends listing them as a high potential impact. Exh. 5a at 6. MBI evaluated fish assemblages in the study area in 2016 by sampling at 17 instream sites. Exh. 7 at 18.

Fish Sampling Methods. MBI collected fish samples twice at each of the 17 sites using pulsed D.C. electrofishing units ranging from a Wisconsin AbP-3 battery-powered backpack unit to Smith-Root GPP generator powered units of 2500 or 5000 W capacity by giving deference to the most effective method based upon the prevailing site and water characteristics. *Id.* Sampling was standardized by reach distance of 200 meters for the generator powered methods, and 150 meters for the back pack method, and 50 meters each for the Robinson WWTP and Marathon Robinson 001 plumes. *Id.*

Upon capture, fish were placed in a livewell, bucket, or live net for later processing. Water was regularly replaced and/or aerated to maintain adequate dissolved oxygen levels in the water and to minimize mortality. MBI processed samples by enumerating and recording weights

by species and by life stage (young-of-the-year, juvenile, and adult) along with incidence of external anomalies using procedures outlined by Ohio EPA (2006, 2015) and refinements made by Sanders et al. (1999). *Id.* Fish were released back into the water after collection of the pertinent data.

Fish Distribution. Fish were found at all sample sites ranging from 3 species in an unnamed tributary (UT01) and 27 species in Lamotte Creek (LC01). Exh 7 at 53 citing Table 16. At the Robinson Creek and Sugar Creek sampling sites, MBI's fish survey found 10-20+ species with a trend of higher diversity downstream. *Id*. At the upstream site in Robinson Creek (RC10), 73% of the species collected were tolerant species. *Id*. Conversely, at the most downstream site at Sugar Creek (SC03) tolerant species were 17% of those collected. *Id*. The typical range for tolerant species was in the range of 30-40+% in Robinson and Sugar Creek. *Id*.

Fish Index of Biotic Integrity (fIBI). MBI determined the fish Index of Biotic Integrity (fIBI) for fish assemblage to assess the aquatic life use support with possible scores of full support (fIBI>41), non-support fair 20<fIBI<41), and non-support poor (fIBI<20). Exh. 7 at 53 citing Table 16. MBI notes that fIBI scores indicated full support at the upstream site at Lamotte Creek (LC01), and the most downstream site at Sugar Creek (SC03). *Id.* Additionally, the fIBI scores indicated that 13 sites were non-support fair, 2 sites were non-support poor, and 2 other sites had split values (RC05 and RC06). *Id.* MBI notes that the longitudinal pattern of the mean fIBI values indicates a "series of impacts beginning upstream from the Robinson WWTP, an initial and brief recovery interrupted by the entry of the Marathon 001 discharge, and a gradual recovery downstream through Robinson Creek and into Sugar Creek where full support was observed at the furthest downstream site (SC03)." *Id.* at 58 *citing* Fig. 21. Additionally, MBI asserts that a comparison of historical data from 1992, 2008, and 2013 with the 2016 data shows a consistent incremental improvement at each subsequent year through 2016. *Id.*

Deformities, Erosions, Lesions, and Tumors (DELTs). MBI says that external anomalies on fish measured by the occurrence of DELTs are an important indicator of sublethal stress on the fish assemblage. Exh. 7 at 58. MBI notes that the results from the 2016 study shows incidents of DELTs slightly above background levels of 0-1.3% in Robinson Creek upstream from Marathon Outfall 001 and 1.9-2.3% downstream of the outfall. Exh. 7 at 58. However, DELT frequency increased to 26.3% at RC06, and 27.1% at RC07. *Id.* The DELT frequency increased to 35.8%, 48.1%, 28.2%, and 25.9% during the second sampling pass between RC05 and RC08, a distance of 2.9 miles from Marathon's Outfall. *Id.* citing Table 17. MBI says that
DELT rates 10% above background is indicative of a chronic impact involving toxicity. *Id.* While the DELT rates were most pronounced downstream of Marathon's Outfall, they tended to return to upstream levels in lower Robinson Creek and Sugar Creek, which is further downstream. *Id.*

Summary of Biotic Category Identification

MBI notes that the results of the 2016 bioassessment show that significant biological impairment remains in Robinson Creek, including the reach within the City of Robinson, and the reaches downstream from the Robinson WWTP and the Marathon's Outfall as well as parts of

Sugar Creek, and several tributaries. However, MBI maintains that fIBI scores also show a consistent trend of incremental improvement since 1992 mainly because of reductions in the gross loadings of pollutants from the Robinson WWTP and the Marathon Refinery. Exh. 7 at 66. MBI asserts that the principal causes of the biological impairments are due to exceedances of chemical criteria, biological effect thresholds for water and sediment, and altered habitat attributes. *Id.*

Regarding the high rates of DELT anomalies, MBI asserts, based on similarly affected midwestern rivers, that such occurrence is a long-term existing problem. *Id.* While the longitudinal pattern in DELTs in Robinson Creek indicates Marathon Refinery as a potential source of impairments, MBI maintains that a more thorough and diverse investigation would be required to determine the impact of other major point sources and non-point sources discharging into Robinson Creek and its tributaries. *Id.* Such investigation would also need to evaluate which constituents are primarily responsible for the impairments. Marathon contends "that the observed biological response is to non-thermal causes based on the exceedance of specific biological effect thresholds for a number of non-thermal parameters within the City of Robinson and downstream from the Marathon 001 discharge, the characteristics of the specific biological responses indicating general toxicity, and the conclusions of the predictive 316(a) analysis (MBI 2017)." *Id.* Further, MBI asserts the 2016 bioassessment meets the USEPA Manual's test "for ruling out any negative interactions between the effects of chemical-caused impairments and elevated temperature in Robinson Creek." *Id.*

Board Finding on Biotic Category Analysis

The Board agrees with Marathon's position that Robinson Creek may be classified as low impact for habitat formers, phytoplankton, zooplankton and meroplankton, and other vertebrate wildlife. The Board notes that MBI's early screening assessment shows that habitat formers are not a significant concern in moderate and high gradient streams like Robinson Creek. Additionally, if present, they will be evaluated under the proposed field studies' habitat assessment. Regarding phytoplankton, the Board agrees with MBI that they are more of a concern for nutrient enrichment than thermal impact. Additionally, the study results indicate that the biota in Robinson Creek are currently impaired by multiple nonthermal stressors both upstream and downstream of Marathon's Outfall 001. Pet. at 13 citing Exh 4. Next, the Board notes that, according to the USEPA Manual, neither zooplankton nor meroplankton assemblages are a significant concern in a small stream like Robinson Creek. Finally, the Board agrees with MBI's assessment that other vertebrate life like birds, mammals, amphibians, and reptiles need not be included in the RIS because they are not adversely affected by thermal stressors. Thus, the Board finds that Robinson Creek is a low potential impact area for habitat formers, phytoplankton, zooplankton and meroplankton, and other vertebrate wildlife.

Next, the Board finds that MBI's 2016 study (Exh. 7) adequately characterizes the aquatic assemblages as high impact during the early screening, i.e., fish, macroinvertebrates, and shellfish. The Board notes that MBI's study followed the detailed study plan, including methodologies approved by IEPA, IDNR and USEPA in conducting the field biological assessment. Further, the Board agrees with IEPA that one-year data collection by MBI was sufficient because the conditions in the subject waterways were typical during the monitoring

period in 2016. While the Board generally agrees with MBI that the 2016 study results indicate that the subject waterways are affected by multiple stressors both upstream and downstream of Marathon's Outfall, the Board will address the issue of thermal impact on Robinson Creek under the Type II Predictive/RIS analysis below.

Temperature Regime in Robinson Creek

Marathon's demonstration characterizes the ambient temperature regime in Robinson Creek by conducting in-stream temperature monitoring in 2016-2017 at selected locations upstream and downstream from Marathon Refinery's Outfall (Marathon 001). Exh. 4 at 31-36. Additionally, Marathon's consultant, TTI, performed hydrothermal modeling to characterize the ambient temperature regime for the period of 2011-16 using the instream temperature data collected in 2015 and 2016. Exh. 6. The results of ambient monitoring were synthesized with the modeling results to establish the in-stream temperature regime. The characterization of the temperature regime is reviewed in the following sections.

Ambient Temperature Monitoring

Marathon monitored in-stream water temperatures at four locations to collect temperature data: "(1) the current downstream monitoring station, RC09 (BFC-10), located 3.9 miles downstream of the Marathon Refinery Outfall; (2) a historical downstream monitoring station, RC07 (BFC-11), located 1.7 miles downstream of the Marathon Outfall, (3) immediately downstream of the Marathon Refinery Outfall, RC05 (EMZ), and (4) an upstream monitoring station, RC04 (BFC-25) located between Robinson POTW and Marathon Refinery Outfall." Exh. 6 at 15. In-stream temperature was continuously monitored using HOBO recorders at RC04, RC05, RC07, and RC09 from June 2016 through February 2017. Marathon collected grab sample data when effluent temperature was above the seasonal thresholds of 60°F in the winter and 90°F in summer at a maximum frequency of twice per week. *Id.* Also, in 2015, Marathon "collected 20-minute temperature data from August 7, 2015 through August 10, 2015, and 5-minute temperature data from November 4, 2015 through January 5, 2016 at RC04 and RC09." *Id.* Finally, Marathon collected 10-minute temperature data at RC04, RC05, and RC09 by deploying Datasondes from January through December of 2016. *Id.*

Both the Datasonde and HOBO results at downstream locations (RC07 and RC09) show frequent exceedances of the 5°F delta when compared with the data from upstream monitoring location, RC04, which serves as the control site. Exh. 4 at 9 citing Table 2 and 3. Additionally, the data show exceedance of the 60°F maximum during the winter months of December-March as well as the transition months from winter to spring and fall to winter. *Id.* The graphical representation of selected Datasonde and field grab sampling results show that the exceedances of the Board's temperature standards were the greatest and most frequent immediately downstream from Marathon's Outfall 001 (RC05) and generally dissipating with distance downstream. *Id.*, Pet. at 18. The increases over temperatures at RC04 illustrate the effect of the thermal loading from the refinery.

Hydrothermal Modeling

TTI used the hydrodynamic and temperature model, Environmental Fluid Dynamics Code (EFDC) to develop a hydrodynamic model for Robinson Creek to quantify the sources of the increase in temperature between the upstream and downstream of the Refinery's discharge. Exh. 6 at 1. The modeling characterized "the ambient temperature regime for the period 2011 – 2016 using HOBO data collected in 2015 and 2016 by Marathon and Datasonde data collected by MBI in 2016 as the calibration dataset and the Refinery Outfall 001 effluent as the verification dataset." Pet. at 18 citing Exh.4 at 9. The thermal sources considered included Robinson POTW, the Refinery, tributary inputs, and meteorological inputs. Exh. 6 at 1. TTI says, "[t]he EFDC hydrodynamic and temperature model was simulated for a 6-year period from October 1, 2010 through December 31, 2016." Exh. 6 at 15.

Model Inputs. TTI notes that the EFDC hydrodynamic and temperature model requires extensive data inputs, including stream hydrologic data, point source data, and meteorological inputs. These data were obtained from several sources including Marathon, United States Geological Survey (USGS), National Climatic Data Center (NCDC), and Weather Bureau Army Navy (WBAN). Exh. 6 at 3, Table 3-1.

Hydrological Data. Robinson Creek is an approximately 8.3-mile-long creek beginning from 1.2 miles upstream of Washington Park Deer Run Golf Course and flowing easterly towards Sugar Creek, which drains into the Wabash River in Indiana 5 miles downstream of the Robinson Creek-Sugar Creek confluence. Exh. 6 at 1. There are two tributaries draining into Robinson Creek: Quail Creek, a 2.8-mile-long tributary discharging into the upper portion of Robinson Creek, and a 2.2-mile-long unnamed tributary discharging in the downstream portion of Robinson Creek. *Id.* The prime dischargers into Robinson Creek are the Robinson Publicly Owned Treatment Works (POTW) Outfall (National Pollutant Discharge Elimination System [NPDES] Permit # IL0030732), with a discharge of 6.25 million gallons per day (MGD), and the Marathon Refinery (NPDES Permit # IL0004073), with discharge of 2.66 MGD. *Id.* at 1 and Rec. at 2. The Robinson POTW discharges approximately 1.5 miles upstream of the Marathon Refinery Outfall. The Marathon Refinery discharges to Robinson Creek approximately 0.75 miles below the Quail Creek-Robinson Creek confluence.

Bathymetric Data. According to TTI, no bathymetric data was available for Robinson Creek. Exh. 4 at 4. TTI used the National Elevation Dataset in 1/3 arc-second resolution (10 meters) to estimate the elevations at the upstream and downstream points of the model grid. *Id*. Using those estimates and the length of the creek, an initial estimate of the slope of the creek was established. *Id*. The estimated water depth of the creek was established by using the knowledge of local Marathon staff and aerial imagery. *Id*. The bottom elevations were calculated using the estimated slope and initial water. *Id*. The estimated slope was then adjusted based on the model results. *Id*. The typical depth of Robinson Creek "was reported to be 1 foot to 2 feet deep" by Marathon. Exh. 6 at 4.

Weather and Climate Data. Meteorological data from weather stations near Robinson Creek were used to develop atmospheric conditions and wind time series files for the EFDC model (Figure 3-2). The data included precipitation, pressure, air temperature, relative humidity, wind speed and direction, and cloud cover. Exh. 6 at 6. The time series used the reported data or were calculated from the reported data. The Meteorological Data Analysis and Preparation Tool

(MetADAPT), a weather processing tool developed by TTI, was used to develop the meteorological input files to the Robinson Creek EFDC model.

Tributary and Watershed Flows. There are two tributaries draining into Robinson Creek: Quail Creek, a 2.8-mile-long tributary discharging into the upper portion of Robinson Creek, and a 2.2-mile-long unnamed tributary discharging in the downstream portion of Robinson Creek. *Id.* at 1. There are no United States Geological Survey (USGS) monitoring gages located in the Robinson Creek Watershed to measure the flows. Exh. 6 at 12. However, TTI utilized the closest USGS gage to Robinson Creek, USGS 03343820, located in Kickapoo Creek, 40 miles northwest of Robinson Creek. *Id*. TTI says the gage was chosen because of its proximity, as well as the watershed having a similar area, and land use compared to Robinson Creek. *Id*.

Discharges from Point Sources. Accounting for sources of flow into Robinson Creek, TTI noted that the two main dischargers are the Robinson POTW and the Marathon Refinery. Exh. 6 at 1. The Robinson POTW has a design average flow of 2.5 MGD to Robinson Creek approximately 1.5 miles upstream of the Robinson Refinery Outfall 001. Exh. 6 at 1; Rec. at 7. The 7Q10 flow[7] in Robinson creek upstream of the Robinson POTW Outfall is zero (0) cubic feet per second. Exh. 6 at 36. The Refinery has an average flow of 2.666 million gallons per day to Robinson Creek. Rec. at 2. The 7Q10 flow in Robinson Creek upstream of Marathon's Outfall is 1.4 cubic feet per second (approx. 0.9 MGD). Exh. 6 at 1; Rec. at 2.

Tributary and Watershed Temperatures. Because there were no USGS monitoring gages located in the Robinson Creek watershed, TTI relied on water temperature data that was collected from the Kickapoo Creek USGS gauge 03343820 from July 2014 through October 2015. Exh. 6 at 12. TTI created an initial temperature data time series for Robinson Creek watershed using the following equation: Watershed Temperature = Air Temperature x Potency Factor + Base Temperature. *Id*. TTI presumed a potency factor of 0.5 when calculating watershed temperature. *Id*. TTI used a general contour map of mean earth temperature for the State of Illinois to establish the base temperature for the Robinson Creek watershed. Exh. 6 at 12. Because water temperatures at USGS 03343805 were lower in the winter, a lower base temperature was used for winter. *Id*.

In-Stream Temperature Data. TTI used the in-stream temperature data collected by Marathon and MBI described above under ambient monitoring.

Model Calibration, Validation and Verification. TTI notes that the EFDC hydrodynamic model was calibrated using the 2016 Datasonde data collected at 10-minute intervals. Exh. 6 at 15. The calibration results indicated that the model was capable of reproducing, with high precision, the temperature variations observed in the evaluated stations in 2016, and calibration can be classified as Good or Very Good based on modeling statistical standards. *Id.* at 18 *citing* Donigian 2002 and McCutcheon et al. 1990. TTI notes that the

[7] 7Q10 flow is the lowest 7-day average flow that occurs on average once every 10 years. Exh. 6 at 36.

"calibration statistics were overall Very Good at all four stations, with the difference in temperatures in the range of 0.5 – 3 °F, average percent errors less than 3.5%, and high indices of agreement and R^2 values." *Id.* citing Table 4-3.

Additionally, the model was validated using Marathon's in-stream grab samples collected between 2011 and 2015 at a maximum frequency of twice per week. Exh. 6 at 15. Based on the validation results at RC04 and RC09, TTI asserts that the model performed very well, both statistically and visually, when compared with the in-stream grab sample data by successfully capturing the seasonal variations in the temperatures. *Id.* at 18. TTI noted that the slightly higher modeled in-stream temperatures during the summer periods is not due to over stimulation because "the grab samples were taken in the mornings, usually between 8:00 am – 10:00 am, while the highest daily summer temperatures occurred in afternoons between 3:00 pm – 7:00 pm." *Id.*

Finally, TTI contends that the model was verified using 2015 - 2016 continuous HOBO data collected at either a frequency of 5-minutes and 20-minutes in 2015 or at a frequency of 10 minutes in 2016. Exh. 6 at 15. The verification results (Figure 4-6, Figure 4-10, and Figure 4-18) at RC04, RC05, and RC09 demonstrate that the model performed well compared to the continuous HOBO data except at RC05, where statistically the percent errors were higher and the R2 was poor. This may be because of dilution characteristics of the stream modeled in the model and the differences in time steps. However, during this same period, the model performed very well compared to the Datasonde data, which indicated that there are differences between in-stream temperature measurements using the different data collection tools. The differences between the two datasets was frequently less than 1°F, but this can affect statistical comparison results. The differences may be because of the instrument error recorded in HOBO probes when compared to the Datasonde or due to the locations of the probes in the stream.

Model Results. TTI notes that Marathon's permit requires the maximum temperature in Robinson Creek downstream of the Marathon Refinery not to exceed the upstream in-stream temperature by more than 5°F. Exh. 6 at 30. This means that the maximum temperature increase, which is referred to as the temperature delta, between upstream and downstream (edge of mixing zone) monitoring locations of Marathon's discharge must be less than 5°F. TTI compared the temperature deltas between temperature monitoring locations RC04 (upstream) and RC09 (downstream) and RC04 and RC07 (downstream) to evaluate the ability of the model to represent measured temperature deltas between the same locations. *Id.* This comparison, TTI asserts, shows that the modeled deltas at both RC09 and RC07 during both summer and winter periods were within range of the measured delta except for few periods. TTI notes that a shift in modeled delta peaks by a few hours was observed when compared to the measured deltas, "which was likely due to the model simulating in-stream temperature peaks by one to three hours later than measured peaks." *Id.*

TTI says that while the model matches the trends in the measured deltas throughout the five-year period, it also shows exceedances of 5°F delta throughout the modeling period. *Id.* TTI notes that the "calibrated modeling results indicated that temperatures in the Robinson Creek may have had deltas greater than 5°F approximately 3.7% of the time from 2011 – 2016 at the

current downstream sampling location, RC09 (Figure 4-24), and 15.2% of the time from 2011 – 2016 at the historical downstream sampling location, RC07 (Figure 4-25)." *Id.*

Regression Analysis. To determine the causes of the downstream temperature increases at RC07 and RC09 and the associated deltas, TTI performed a multivariate regression analysis. Exh. 6 at 34. TTI analyzed input variables, including "the Robinson POTW effluent temperatures, Marathon Refinery effluent temperatures, ambient air temperatures, solar radiation, and the percentage of Marathon Refinery effluent flow." *Id.* The analysis indicated that all five variables were statistically significant in determining the temperatures as well as the deltas at RC09 and RC07. *Id.* citing Tables 4-5 and 4-6. TTI notes that while the strongest predictors of temperature at RC07 included "the percentage of Marathon Refinery effluent flow, ambient air temperature, followed by Marathon Refinery effluent temperature," the temperature deltas were strongly correlated to the percent Marathon flows and Marathon Refinery temperature. TTI concludes that while in-stream temperatures at RC07 were influenced by a combination of meteorological conditions along with Marathon inputs, the in-stream deltas at RC07 were highly influenced by the Marathon Refinery. *Id.* At RC09, TTI notes the strongest predictors of in-stream temperature and in-stream deltas were the ambient air temperature followed by the Marathon Refinery's effluent temperature. *Id*.

Model Scenarios. Finally, TTI modeled four different scenarios to investigate in-stream temperatures and deltas at three locations downstream of the Marathon Refinery: (1) RC05 - immediately downstream of Marathon's Outfall 001; (2) RC07 - 1.7 miles from Outfall 001 (edge of mixing zone); and (3) RC09 – 3.2 miles from Outfall 001. Exh. 6 at 36. The modeled scenarios were: (1) calibrated model with flow contributions from watershed, Robinson POTW, and Marathon Refinery; (2) the 7Q10 model (the lowest 7-day average flow that occurs on average once every 10 years) with no watershed flow, i.e., flow contributions limited to Robinson POTW and Marathon Refinery; (3) without Marathon's refinery flow in the calibrated model; and (4) Marathon Winter/Summer Temperature model with five constant end of pipe effluent temperatures from the Marathon Refinery for winter and summer periods (60°F/90°F, 55°F/85°F, 50°F/80°F, 45°F/75°F and 35°F/60°F). TTI says that the results from the modeling scenarios provide information on the impacts of the watershed flows, and the refinery flows on in-stream temperatures as well as the end of pipe winter/summer temperature necessary for maintaining a delta temperature of 5°F or less at each downstream station. *Id.* TTI drew the following conclusions based on the results from the calibrated model and the scenario runs:

- Under current operating conditions, from 2011 through 2016, deltas greater than 5°F likely occurred more than 15.2% of the time in Robinson Creek at the historic monitoring location RC07. Under current operating conditions, from 2011 through 2016, deltas greater than 5°F likely occurred more than 3.7% of the time in Robinson Creek at the current monitoring location RC09.

- RC09 had the lowest occurrence of deltas greater than 5°F compared to the two other downstream monitoring locations, RC07 and the RC05, because the in-stream temperatures typically decrease farther from the Marathon Refinery discharge location.

- A combination of factors contribute to the in-stream deltas at RC07 and RC09, including the Robinson POTW effluent temperatures relative to the Marathon Refinery effluent; the Marathon Refinery effluent temperature relative to in-stream temperature; ambient air temperature relative to Marathon Refinery effluent temperatures; solar radiation; and in-stream flow distribution between the Marathon Refinery, the Robinson POTW, and tributary. *Id.* at 45.

Additionally, TTI says that the Marathon Refinery effluent would need to be cooled to less than 35°F in the winter, and 60°F in the summer for deltas to be less than 5°F more than 99% of the time at monitoring stations RC07 and RC09. *Id.* Further, under current operating conditions, TTI notes that in-stream temperatures of 90°F or greater occurred 0.5% at RC07 and 0.1% at RC09 during the summer, and 60°F or greater occurred at RC04 (upstream) and all downstream monitoring stations during the winter. Also, when in-stream temperatures are greater than 60°F at RC04 and ambient air temperatures are high, the downstream in-stream temperatures would be greater than 60°F more than 1% of the time at RC07 and RC09 even if the refinery effluent was cooled to 35°F. *Id.*

Summary of the Monitored and Modeled Ambient Temperature Regimes

The Datasonde and HOBO data and the modeling predictions for 2011-16, 2012, and 2016 are summarized in tables below to show "the frequency of exceedances of the Illinois maximum temperature criterion on an annual basis, the May-November summer period, and the December-March winter period along with the true summer period (June 16-September 15) average and % greater than 86°F for each of the four Robinson Creek locations." Exh. 4 at 10, Table 7.

Comparison of selected exceedance thresholds for 2016 Datasonde and HOBO temperature data.						
Datasonde (Jan. - Dec. 2016)						
Site	**Location**	**%>86F**	**Average**	**%max All**	**%max Summer**	**%max Winter**
RC04	Ust. MPC[8] 001	0.0%	75.5°F	1.1%	0.0%	3.2%
RC05	Dst. MPC 001	46.5%	85.8°F	14.2%	4.8%	30.8%
RC07	IL Rt. 1	20.8%	82.9°F	5.2%	1.5%	11.6%
RC09	Co. Rt. 1150E	2.9%	79.2°F	2.5%	0.0%	6.8%
	HOBO (July 2016-Feb. 2017)					
RC04	Ust. MPC 001	0.0%	75.8°F	0.0%	0.0%	0.0%
RC05	Dst. MPC 001	36.4%	84.7°F	2.1%	2.8%	1.1%
RC07	IL Rt. 1	Insufficient data	Insufficient data	0.0%	ND	0.0%
RC09	Co. Rt. 1150E	NA	NA	0.0%	0.0%	0.0%

Comparison of selected exceedance thresholds for modeled temperature

[8] MPC = Marathon Petroleum Company.

2011-16, 2012, and 2016						
Site	**Location**	**Jan. - Dec. 2011-16**				
		%>86F	**Average**	**%max All**	**%max Summer**	**%max Winter**
RC04	Ust. MPC 001	0.8%	73.3°F	1.1%	0.0%	3.2%
RC05	Dst. MPC 001	14.7%	81.4°F	4.3%	0.3%	12.6%
RC07	IL Rt. 1	5.4%	76.7°F	1.9%	0.4%	5.0%
RC09	Co. Rt. 1150E	2.1%	74.6°F	1.2%	<0.1%	3.5%
		Jan. - Dec. 2012				
RC04	Ust. MPC 001	1.5%	73.9°F	5.1%	<0.1%	15.3%
RC05	Dst. MPC 001	25.3%	83.5°F	8.2%	0.2%	23.9%
RC07	IL Rt. 1	9.1%	78.0°F	6.3%	0.1%	17.0%
RC09	Co. Rt. 1150E	4.4%	75.8°F	5.0%	0.5%	14.0%
		Jan. - Dec. 2016				
RC04	Ust. MPC 001	0.1%	74.3°F	0.1%	0.0%	0.1%
RC05	Dst. MPC 001	23.9%	83.7°F	5.9%	1.0%	15.8%
RC07	IL Rt. 1	8.4%	79.6°F	2.3%	0.8%	5.4%
RC09	Co. Rt. 1150E	2.9%	76.6°F	1.2%	<0.1%	3.4%

While the data show less frequent exceedances of the summer (April-November) thresholds, they show frequent exceedances of the winter (December-March) period. Further, based the temperature differences between RC04 (upstream of Marathon's Outfall 001) and RC09 (downstream of Outfall 001 and one mile upstream from the mouth of Robinson Creek), MBI maintains that the thermal alteration is largely confined to Robinson Creek. *Id.* Finally, MBI notes that the results of monitored and modeled instream temperatures were used in the predictive analyses to support Marathon's ATEL petition "to determine if the magnitude and duration of temperature exceedances could be harmful to aquatic life focused on the seasonal period (i.e., during the true summer period of mid-June to mid-September) during which sustained high temperatures would present the greatest risk of harm." *Id.*

Board Finding on the Temperature Regime in Robinson Creek

The Board finds that Marathon collected sufficient in-stream data to establish the ambient temperature regime in Robinson Creek. The Board notes that the time periods chosen by Marathon for temperature monitoring and modeling are adequate to establish the ambient temperature regime for Robinson Creek. The Datasonde and HOBO data show the extent of thermal alterations in the receiving stream caused by Marathon's thermal discharge from Outfall 001. As noted by MBI, the monitoring results show exceedances of the Board's maximum temperature criteria were the greatest and most frequent immediately downstream from Outfall 001 (RC05) and generally dissipated with distance downstream. Exhibit 4 at 9 *citing* Figure 4. These modeling results show the impact of Marathon's thermal discharge on Robinson Creek. Additionally, like measured values, modeled temperature results also show exceedances of the 5°F delta as well as the Illinois maximum summer criterion of 90°F and winter maximum

temperature criterion of 60°F. The Board agrees that the frequency of exceedances was higher during winter months than summer. Finally, the Board finds that the temperature regime established for Robinson Creek is sufficient for use in the predictive analysis.

Type II Demonstration (Predictive/Representative Important Species)

Marathon relies on Type II (Predictive/Representative Important Species) demonstration conducted by MBI to show that the requested alternative thermal effluent limitations will assure the protection and propagation of the BIC in Robinson Creek. Marathon asserts that a Type II demonstration is consistent with the USEPA Manual because the biota in Robinson Creek are currently impaired by multiple nonthermal stressors both upstream and downstream of Marathon's Outfall 001. Pet. at 13 *citing* Exh 4. IEPA agrees that the "impaired status of Robinson Creek precludes a Type I thermal demonstration (no prior appreciable harm), as additional stressors confound the ability to make a determination on the presence or absence of prior appreciable harm due to thermal loadings." Rec. at 4.

Marathon argues "[t]he recognition that a Type II demonstration would be pursued was duly described in the Early Screening submittal…" 8/15/18 Marathon Resp. at 10. Marathon's Early Screening submittal stated that the proposed field studies would help to "[d]ocument the trajectory of any changes in biological and chemical/physical conditions as compared to available historical data from Illinois EPA FRSS and Basin Surveys. Marathon proposes to accomplish this by building on the Facility Related Stream Surveys (FRSS) conducted by Illinois EPA in six prior assessments dating to 1978 (1978, 1986, 1992, 2008 and 2013)." Exh. 5a at 7. IEPA approved Marathon's Early Screening submittal in March 2016. Exh. 5b.

Marathon notes that predictive analysis, which was performed by MBI, consisted of developing a list of Representative Important Species ("RIS") for Robinson Creek. Exh. 4 at 12. This list was used in the Fish Temperature Modeling System (FTMS) to determine summer average and maximum temperatures that are protective of both short and long-term survival requirements of the most sensitive of RIS. *Id*. Finally, the risk of precluding the full recovery of the aquatic biota to attain the General Use aquatic life thresholds in the affected reach of Robinson Creek was assessed using the current temperature regime described above. *Id.*

Representative Important Species (RIS) Demonstration

A Type II Predictive Demonstration must show that RIS "will not suffer appreciable harm as a result of the heated discharge." USEPA 316(a) Manual at 35.

If a site is not one of low potential impact for all the biotic categories, the Section 316(a) demonstration must address a RIS demonstration, a predictive demonstration, or a demonstration based on biological, engineering, and other data. USEPA Manual at 34, 52.

"RIS" means "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); USEPA Manual at 78-79. The USEPA Manual analyses RIS with the following assumptions:

1. It is not possible to study in great detail every species at a site; there is not enough time, money, or expertise.

2. Since all species cannot be studied in detail, some smaller number will have to be chosen.

3. The species of concern are those causally related to power plant impacts.

4. Some species will be economically important in their own right, *e.g.*, commercial and sport fishes or nuisance species[9], and thus 'important.'

5. Some species, termed 'representative,' will be particularly vulnerable or sensitive to power plant impacts or have sensitivities of most other species and, if protected, will reasonably assure protection of other species at the site.

6. Wide-ranging species at the extremes of their ranges would generally not be considered acceptable as 'particularly vulnerable' or 'sensitive' representative species but they could be considered as 'important.'

7. Often, all organisms that might be considered 'important' or 'representative' cannot be studied in detail, and a smaller list (*e.g.*, greater than 1 but less than 15) may have to be selected as the 'representative and important' list.

8. Often, but not always, the most useful list would include mostly sensitive fish, shellfish, or other species of direct use to man or for structure or functioning of the ecosystem.

9. Officially listed 'threatened or endangered species' are automatically 'important.' USEPA Manual at 35-36.

The USEPA Manual lists the following considerations in selecting RIS "[w]here information pertinent to species selection is adequate:"

1. Species designated in state water quality standards as requiring protection;

2. Species identified in consultation with the USEPA Director, other governmental agencies, and other appropriate persons;

3. Any present threatened or endangered species;

[9] Under the USEPA Manual, a nuisance species can become a RIS if the change in thermal is likely to cause a shift towards those species in the ecosystem. *See example* USEPA Manual at 55.

4. 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;

5. Commercially or recreationally valuable species;

6. Far-field and indirect effects on the entire water body, including the additive or synergistic effects of heat combined with other existing thermal or other pollutants; and

7. Species critical to structure and function of ecological system. USEPA Manual at 36-38.

In its definition of "RIS," the USEPA Manual includes the third, fifth, and seventh of these considerations. The USEPA Manual's definition also specifically includes species that are "[p]otentially capable of becoming localized nuisance species," those "[n]ecessary in the food chain for the well-being of species" considered RIS under other factors, and those "[r]epresentative of the thermal requirements of important species but which themselves may not be important." USEPA Manual at 78-79.

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. The Board's procedural rules require the petitioner to inform Illinois EPA of its proposed RIS list and data and information supporting it. 35 Ill. Adm. Code 106.1115(a)(4), 106.1120(b)(5). The USEPA Manual advises that the permitting authority consult "with the Regional Director of the FWS [U.S. Fish and Wildlife Service] and representatives of the NMFS [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 Manual at 15. Also, the Board's procedural rules require the petitioner to serve a copy of its petition on both the IEPA and IDNR. *See* 35 Ill. Adm. Code 106.1125.

Petitioners must collect thermal effects data for each RIS including the following:

1. high temperature survival for juveniles and adults;

2. thermal shock tolerance of selected life-history stages;

3. optimum temperature for growth;

4. minimum, optimum, and maximum temperatures allowing completion of early development;

5. normal spawning dates and temperatures; and

6. special temperature requirements for reproduction. USEPA Manual at 43-45; *see id*. at 65 (Decision Criteria).

A CWA Section 316(a) demonstration must show "that the RIS will not suffer appreciable harm as a result of the heated discharge." *Id.* at 35.

RIS Selection. On behalf of Marathon, MBI selected 27 RIS during early screening. Exh. 4 at A-14. The final list consists of 21 RIS, selected from data collected by IEPA and IDNR in streams of the Wabash Faunal Region, by IEPA in Robinson and Sugar Creeks in the 2008 and 2013 Facility Related Stream Surveys (FRSS), and by MBI in Robinson and Sugar Creek in 2016. Exh. 4 at 58, Exh. 7. In addition, MBI selected three non-RIS that were retained for an alternate FTMS scenario. Exh. 4 at 58.

MBI says that the RIS selection process emphasized fish because they are regarded as the most thermally sensitive assemblage when compared to macroinvertebrates. *Id.* Also, mussels were not included because only relict shells of a single species were found at three sites in Robinson Creek and 3 individuals of a second species were found in Lamotte Creek. *Id. citing* Exh. 7. MBI developed the RIS for Robinson Creek by considering the following factors:

1. species that represent the full range of response and sensitivity to environmental stressors;

2. species that are commercially and/or recreationally important;

3. species that are representative of the different trophic levels;

4. rare, threatened, endangered, and special status species;

5. species that are numerically abundant or prominent in the system including the consideration of historical data;

6. potential nuisance species; and,

7. species that are indicative of the ecological and physiological requirements of representative species that lack thermal data. Exh. 4 at 13

Additionally, MBI notes that RIS selection sites were limited to watersheds less than 15 square miles, which corresponds to the watershed size range of Robinson Creek. *Id.* Further, species that are common in larger catchments like shortnose gar, smallmouth buffalo, shorthead redhorse, black redhorse, white crappie, and spotted bass were not included in the RIS, except smallmouth buffalo, white crappie, and spotted bass were retained as RIS for an "alternate" FTMS scenario for sensitivity analysis. *Id.* Also, MBI notes that two *Moxostoma* (redhorse)

species were not included because they are not well represented in small streams of the IEPA/IDNR Wabash Faunal Region dataset. *Id.*

MBI notes that species in the study area with thermal effects data are sufficiently representative of those RIS that lack such data. Therefore, "representative" species outside of the study area were not included to replace species in the study area that lack thermal data in the final RIS. *Id.* at 14. Also, the 15 square miles restriction resulted in fewer species on the final RIS list than the initial RIS list in the Early Screening demonstration. Based on this selection methodology, 25 species met the occurrence criteria of which four lacked thermal data. *Id.*, *citing* Table 8. Thus, MBI selected 21 species for the final RIS. Additionally, as mentioned above, MBI retained 3 non-RIS species for an alternate FTMS output scenario. *Id.* The final RIS is presented in Table 1, below.

RIS Thermal Tolerance Thresholds. MBI relied on the primary thermal effects database of the FTMS to derive the thermal parameters for the RIS. This database includes thermal data compiled from literature sources for 127 freshwater fish species, 3 hybrids, and 28 macroinvertebrate taxa. Exh. 4 at 14 citing App. B. The thermal parameters used for the RIS include optimum maximum weekly average temperature (either physiological or behavioral, laboratory or field derived), MWAT for growth (calculated based on relationship developed by Brungs and Jones 1977), upper avoidance temperature (UAT) (field or laboratory derived) and an upper incipient lethal temperature (UILT) (laboratory derived) at an appropriate acclimation temperature. *Id.* at 14 citing Table 9 and App. B. MBI used acclimation temperatures of 77°F-80.6°F (25°-27°C) for Robinson Creek. *Id.* at 14. MBI notes that the thermal parameters for the RIS were chosen from the FTMS database to ensure "two of the most important considerations in selecting a thermal effect threshold", i.e. geographical representativeness and relevant acclimation temperature. *Id.* The thermal effects parameters for the RIS is summarized in Table 1. Exh. 4, Table 9.

Table 1
RIS for Robinson Creek with Temperature Thresholds

Robinson Creek RIS	MWAT[a] Optimum		MWAT Growth		UAT[b]		UILT[c]	
	°F	°C	°F	°C	°F	°C	°F	°C
Gizzard Shard	86.0	36.0	89.5	31.9	89.6	32.0	96.4	35.8
Quillback	86.0	36.0	90.3	32.4	93.7	34.3	99.0	37.2
White Sucker	73.6	23.1	80.7	27.0	88.9	31.6	94.8	34.9
Common Carp	91.4	33.0	95.0	35.0	97.0	36.1	102.2	39.0
Emerald Shiner	80.6	27.0	85.1	29.5	88.0	31.1	94.1	34.5
Bigeye Chub[10]	84.0	28.9	88.3	31.3	91.4	33.0	96.8	36.0
Striped Shiner	87.1	30.6	90.4	32.5	93.0	33.9	97.2	36.2

[10] Bigeye Chub was not included in Marathon's initial TSD. See Marathon Second Addendum to TSD, Exh. 1, 3/15/19 Marathon Reply to IDNR Resp. to IEPA Rec. Temperature thresholds for Bigeye Chub were determined in 2019, in response to IDNR's concerns. *See infra* Marathon's Position on Bigeye Chub, pg. 49-51.

Spotfin Shiner	87.1	30.6	90.3	32.4	91.4	33.0	96.8	36.0
Redfin Shiner	87.1	30.6	90.4	32.5	93.0	33.9	97.2	36.2
Red Shiner	87.1	30.6	90.4	32.5	91.2	32.9	97.2	36.2
Creek Chub	86.2	30.1	89.5	32.0	93.0	33.9	96.3	35.7
Central Stoneroller	82.8	28.2	87.3	30.7	91.4	33.0	96.3	35.7
Bluntnose Minnow	81.5	27.5	86.5	30.3	91.4	33.0	96.6	35.9
Silverjaw Minnow	84.9	29.4	88.3	31.3	90.9	32.7	95.0	35.0
Western Mosquitofish	89.6	32.0	93.8	34.3	96.8	36.0	102.2	39.0
Blackstripe Topminnow	86.9	30.5	91.6	33.1	95.0	35.0	100.9	38.3
Yellow Bullhead	83.1	28.4	87.9	31.1	91.6	33.1	97.5	36.4
Largemouth Bass	81.5	27.5	87.9	31.0	91.4	33.0	100.6	38.1
Bluegill	86.2	30.1	89.7	32.1	91.4	33.0	96.8	36.0
Green Sunfish	87.3	30.7	91.6	33.1	91.4	33.0	100.2	37.9
Longear Sunfish	86.0	30.0	90.7	32.6	92.7	33.7	100.0	37.8
Johnny Darter	76.1	24.5	83.3	28.5	91.6	33.1	97.5	36.4

a – Maximum weekly average temperature (MWAT)
b - Upper Avoidance Temperature (UAT)
c – Upper Incipient Lethal Temperature (UILT)

The Fish Temperature Modeling System (FTMS)

MBI says that the FTMS is "designed to provide summer average and maximum temperatures that are protective of both short and long-term survival requirements of the most sensitive of Representative Important Species (RIS) that are specific to a region, a river or stream, or a reach of a river or stream." Exh. 4 at 12 citing Yoder 2008. MBI notes the FTMS is used to determine the potential adverse thermal impacts during the true summer period (June 16 to September 15) when such impacts are of greatest concern and thus the principal focus of the 316(a) demonstration. *Id.* at 17. For the other non-summer months, the temperature criteria are set to be consistent with the seasonal temperature regime for the subject stream because fish can tolerate temperatures higher than non-summer season ambient temperatures.

MBI notes that the FTMS input variables are selected from a thermal effects database compiled from the literature. This database includes thermal thresholds derived from both laboratory and field studies for a large number of for both cold and warmwater fish species and selected macroinvertebrates. *Id.* at 12. The primary FTMS thermal tolerance input variables, optimum and growth MWAT, upper avoidance temperature (UAT), and upper incipient lethal temperature (UILT) are selected from the FTMS database for each of the RIS based on geographical relevance and experimental variables such as the acclimation temperature of a particular tolerance endpoint. *Id.* MBI notes that the FTMS approach has been used to develop river and basin specific monthly and bi-monthly average and maximum temperature criteria for several rivers and streams, including the Lower Des Plaines River in Illinois. *Id.* citing Yoder and Rankin 2006.

FTMS Methodology. MBI used the four thermal endpoints (MWAT optimum and growth, UAT and UILT) for each RIS listed in Table 1 as primary input variables for the FTMS. *Id.* at 15. MBI notes that it selected the RIS for Robinson Creek in the base FTMS MasterFile, which includes all of the possible fish species in the master thermal tolerance database and used the Excel data sort function to produce a MasterFile specific to Robinson Creek. Then the FTMS system uses a Visual Basic Routine to calculate "the four thermal endpoints for temperatures that are within 100%, 90%, 75%, and 50% of the short-term survival thresholds (i.e., the UILT) for all RIS as the first output." *Id.* MBI notes that this method was used to calculate the thermal endpoints separately for the "core" RIS (21 species).

In addition, MBI also performed an "alternate" FTMS scenario by adding three additional non-RIS species (smallmouth buffalo, white crappie, and spotted bass) to the "core" RIS. *Id.* These species, which are present in the lower reaches of Sugar Creek, Lamotte Creek, and Wabash Faunal Region streams were added to address the thermally sensitive species excluded because of the 15 square miles[11] restriction. Exh. 4 at 14, also see Table 1 above.

FTMS Output. MBI notes that the FTMS produces an output for each scenario by ranking the RIS by the temperature at which a RIS tolerance value exceeds each of the four primary thermal tolerance values. Exh. 4 at 15. Additionally, the FTMS creates a summary table of temperatures at which 100%, 90%, 75% and 50% of the RIS are within the four thermal effect categories. MBI says that these percentage values indicate the proportion of the RIS that would be protected at a given set of true summer (June 16-September 15) average and maximum temperatures. *Id.* The FTMS also calculates a long-term survival temperature for protection of the RIS as a summer period average by deducting 3.6°F (2°C) from the short-term survival temperature (UILT) for the most sensitive RIS. MBI notes that the short-term survival temperature (UILT) represents the daily maximum within the true summer period. The FTMS results for the two modeled scenarios are presented in Table 2. Additionally, FTMS generates a listing of each RIS for each of the four FTMS thermal endpoints (optimum, MWAT for growth, UAT, and UILT) in ascending order from most thermally sensitive to most thermally tolerant by the temperature at which an endpoint is exceeded. This listing, MBI says, allows an evaluation of FTMS criteria for determining if true summer average and maximum temperatures are also reasonably protective for non-lethal effects for a particular RIS scenario. *Id.* MBI uses the FTMS results as a part of its demonstration that Marathon's current thermal discharge will not result in any appreciable adverse effects on the resident aquatic biota in Robinson Creek.

Table 2
FTMS Output Summary

Thermal End Point Category	Core RIS FTMS (21 species)				"Alternate" RIS FTMS (24 species)			
	100% RIS	90% RIS	75% RIS	50% RIS	100% RIS	90% RIS	75% RIS	50% RIS
	Temperature (°F)							

[11] MBI chose 15 square miles to represent the size of the Robinson Creek watershed. *Supra* at 40.

Optimum (MWAT)	75.8	80.2	82.4	86	73.6	79.2	82.2	86.0
Growth (MWAT)	80.6	84.9	87.6	89.8	80.6	83.7	87.6	89.7
Upper Avoidance Temp (UAT)	88.0	89.6	91.4	91.4	88.0	89.1	91.4	91.4
Survival - Long Term (UILT-3.6 °F)	90.5	91.4	92.8	93.4	87.1	91.2	92.8	93.2
Survival – Short Term (UILT)	94.1	95	96.4	97	90.7	94.8	96.4	96.8

Exh. 4 at 60, 62.

FTMS Temperature Thresholds. MBI used the guidelines recommended by Yoder (2008) to derive summer average (long term) and daily maximum (short term) temperature criteria that are protective of RIS during the "true" summer period. MBI notes that the temperature criteria must be consistent with the following factors:

Summer average:

1. 100 percent long-term survival of all RIS,

2. growth of commercially or recreationally important fish species,

3. growth of at least 50% of the non-game fish species,

4. 100% long-term survival of all endangered fish species, and

5. the observed historical ambient temperature record.

Daily maximum:

1. 100% short-term survival of all representative fish species, and

2. the observed historical ambient temperature record. *Id.* at 15-16.

Based on the above factors, MBI determined the 100 percent long and short-term survival temperatures for the 21 "core" RIS to be 90.5°F (32.5°C) and 94.1°F (34.5°F), respectively. Exh. 4 at 17 citing Table 10, See also Table 2 above. MBI notes that the long-term threshold meets the criteria for growth for only two of six recreationally important species and the upper avoidance temperature (UAT) of greater than 50 percent of non-recreational species. *Id.* citing Table 11. Additionally, MBI notes that a FTMS criterion for threatened or endangered fish species was not considered because such species are not present in Robinson Creek or other area streams.[12] *Id.* MBI contends that the long and short-term thresholds for the core RIS scenario exceed the initial screening summer average temperature value of 86°F used for long-term

[12] IDNR later identified that a threatened species did exist in Robinson Creek. *See supra* at 4.

adverse effects and are higher than the FTMS thresholds determined by MBI for larger streams and rivers.

The FTMS results of the "alternate" scenario with 24 RIS indicated long and short-term survival temperatures 87.1°F (30.6°C) and 90.7°F (32.6°F), respectively for 100 percent RIS survival. *Id.* citing Table 12, see also Table 2 above. MBI notes that the long-term threshold meets the criteria for growth for seven of nine recreationally important species and the UAT of 100 percent of the non-game species. *Id.* citing Table 13. MBI contends that the alternate scenario "more fairly represents the thermal sensitivity of the fish assemblage that could potentially exist in Robinson Creek with the successful abatement of non-thermal stressors" because the results "are more in line with prior FTMS applications and the 86°F screening value for initially evaluating potential long-term effects." *Id.*

FTMS - Potential Adverse Effects to RIS. MBI says that fish in Robinson Creek are not adversely affected during non-summer months by elevated temperatures above ambient or exceedances of the 5°F delta limitation and the 60°F maximum specified in Section 302.211. However, exceedances of the 90°F summer (April-November) maximum during the true summer period (June 15- September 15) are of greater concern because it is close to the upper lethal limit of tolerance for the most sensitive Robinson Creek RIS (alternate FTMS scenario). *Id.* at 17-18. In this regard, MBI asserts that the FTMS produces the true summer season average and the daily maximum to limit the exposure of the RIS to comparatively brief and intermittent periods of temperatures that approach or exceed the daily maximum and assure that recovery periods with lower temperatures over sufficient durations also exist during the summer period. *Id.* at 18. This dynamic is assured, MBI contends, by the inclusion of a true summer season average based on a long-term survival threshold as opposed to having a maximum only. *Id.* MBI argues that the frequency and magnitude of exceedances of the thresholds derived from FTMS can be used to determine if that temperature regime *"will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water.*" *Id. citing* USEPA Manual.

For this assessment, MBI relies on the results of the "alternate" RIS FTMS scenario temperature thresholds, i.e., long-term (87.1°F) and short-term (90.7°F) for the true summer season (June 16-September 15) in conjunction with the in-stream temperature regime established by TTI. Exh. 4 at 16. During this period, MBI notes, "the ambient temperatures are high and flows are low resulting in the potential for adverse exposure for the most sensitive RIS." *Id.* For the non-summer season, temperature criteria were derived from the monitored and modeled temperatures outside of the June 16 - September 15 period. *Id.* at 17.

Stress/Recovery Analysis

Next, MBI analyzed the exposure of the RIS to thermal stress along with time required for stress recovery to evaluate the potential adverse effects on the RIS. *Id.* at 18. MBI explains that fish adjust to and become tolerant of higher temperatures during summer as they acclimate to steadily increasing temperatures from winter/spring to summer. However, regardless of acclimation, adverse effects will occur beyond certain temperature thresholds. This aspect is considered when the thermal endpoints are selected for each RIS as the primary FTMS input

variables. *Id.* Another aspect that is considered is the time required for stress recovery following an exposure to stressful temperatures. MBI says that while not much is known about the recovery temperature, rate, and duration, "reasonable conclusions about an observed or predicted series of thermal stress and stress recovery periods are possible." *Id.*

MBI performed the stress/recovery analysis by using the daily HOBO monitoring results immediately downstream from Marathon's Outfall (RC05) between July 10 and September 15, 2016, and the EFDC modeled temperatures for June 16-September 15, 2012 and 2016 at RC05, RC07, and RC09. Exh. 4 at 18. MBI determined the duration of thermal stress at temperatures greater than the 90.7°F (RIS short-term survival or maximum criterion), and stress recovery at temperature less than the 87.1°F (RIS long term survival or summer average criterion) separately for the 2016 HOBO data and the 2012 and 2016 EFDC modeled results along with the total number of events. Exh. 4 at 18-19. The analysis of the 2016 HOBO results (RC05) indicated a total of eight thermal stress periods of 1.5 to 14.5 hours in duration for a total of 74.4 hours over the summer. *Id.* at 19. Each stress period was followed by one or two stress recovery periods of 1.5 to 302 hours duration for a total of 773.9 hours. *Id.*, Table 14. MBI notes that the first and last thermal stress periods occurred on July 24 (9.5 hrs.) and August 30 (9.5 hours), respectively. The highest maximum temperature of 92.3°F occurred on August 28. The longest thermal stress period of 14.5 hours occurred on August 10 and was followed by 12.2 hours on August 11, 5.5 hours on August 12, and 1.5 hours on August 13. While there was no significant recovery between August 10 and 13, a stress recovery period initiated on August 13 lasted for 302 hours (until August 26). *Id.*, Table 14.

MBI combined the EFDC modeling results for RC05, RC07 (Illinois Rt. 1) and RC09 (Co. Rt. 1150E) sites for the stress/recovery analysis. Exh. 4 at 19. The EFDC model predicted eleven thermal stress periods in 2012 and six in 2016, respectively. The thermal stress periods ranged from 1 hour to 7 hours with a total of 28 hours in 2012 (11 events) and 30 hours in 2016 (6 events). *Id.*, Table 14. MBI notes that the 2012 EFDC results tracked more closely with the 2016 HOBO results than the 2016 EFDC results. While the model predicted about 2.5 times fewer thermal stress hours, it also predicted higher maximum temperatures at RC07 of 94.7°F and 94.2°F on July 6 and July 18, 2012, and 94.7°F on June 25, 2016. These higher values exceed the 3°F allowance over the RIS maximum of 90.7°F. *Id.* While there were only two such instances in the dataset, MBI asserts that these higher modeled downstream temperatures occurred "with high solar insolation and high summer air temperatures that exceeded the MPC 001 effluent and RC05 instream temperatures." *Id*.

Demonstration of No Adverse Impacts from Marathon's Thermal Discharge

MBI argues that the stress/recovery analysis shows "that any exceedances of the 90.7°F short-term survival threshold were brief and interspersed with much longer durations of stress recovery temperatures." Exh. 4 at 20. Both monitored and modeled temperatures indicate that the periods of thermal stress are generally followed by longer periods of stress recovery. MBI contends that the 10.5:1 ratio of recovery to stress hours determined for the 2016 HOBO results "is sufficient to rule out any long-term adverse effects to the fish assemblage and the balance of the aquatic biota in Robinson Creek under that thermal regime." *Id.* Further, MBI contends that the non-summer season temperatures downstream from Outfall 001, including those that exceed

the December-March temperature thresholds (maximum of 60°F, 5°F delta, 3°F above maximum allowance, and the 1% frequency of exceedance), are not of concern for adverse effects. MBI argues that the gradual seasonal temperature changes allow fish to acclimate to both rising and falling temperatures.

MBI asserts that any exceedances of the FTMS short-term threshold of 90.7°F are brief and sufficiently offset by adequate recovery periods of sufficient duration and lower temperatures. *Id. citing* Bevelhimer and Bennet (2000). Additionally, MBI notes that summer period averages are well below the FTMS long-term survival threshold of 87.1°F and 100% of the upper avoidance temperatures (88°F) of the alternate RIS scenario RIS. *Id.* Also, only two recreational species exceed the MWAT for growth. *Id.* MBI maintains that these findings "support the conclusion that the current thermal regime is sufficiently protective of the RIS and the full assemblages by extension.". *Id.* Therefore, based on the determination of true summer season short and long-term protective thresholds and the analysis of the dynamics of the temperature regime downstream from Outfall 001 in Robinson Creek, MBI concludes that the demonstration meets the goal of Section 316(a) that the prevailing temperature regime *"will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water*", *i.e.,* Robinson Creek. *Id.*

Alternative Thermal Effluent Limitations (ATEL)

MBI asserts that the ATEL must allow for brief periods of high temperatures that are offset by subsequent periods of stress recovery when temperatures are well below the observed maximums to reflect contemporary thermal stress/recovery concepts. Exh. 4 at 23. Along these lines, MBI combined the temperature monitoring and modeling results with the outputs of the FTMS for Robinson Creek to derive ATELs that ensure that Marathon's thermal discharge from Outfall 001 does not pose an adverse risk to biological recovery to attain the Illinois General Use aquatic life use in Robinson Creek. *Id.* Marathon proposed the following ATEL based on MBI's recommendations:

> Water temperature in Robinson Creek downstream from the MPC 001 Outfall at a point in-stream in the vicinity of the IL Route 1 bridge shall not exceed the maximum limits in the following table during more than one (1) percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such location exceed the maximum limits in the following table by more than 3°F (1.7°C). (Robinson Creek temperatures are temperatures of those portions of the creek essentially similar to and following the same thermal regimes as the temperature of the main flow of the creek.) The average water temperature in Robinson Creek downstream from the MPC 001 Outfall at a point instream in the vicinity of the IL Route 1 bridge for the period June 16 – September 15 shall not exceed 87°F.

	Jan.	**Feb.**	**Mar.**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
°F	65	65	74	82	88	90	90	90	90	87	85	74
°C	18.3	18.3	23.3	27.8	31.1	32.2	32.2	32.2	32.2	30.6	29.4	23.3

Pet. at 12.

MBI argues that the proposed ATEL takes a conservative approach because the FTMS methodology supports higher limits (summer maximum of 90.7°F and summer average of 87.1°F). *Id.*

Board Finding

The Board finds that Marathon's decision to use a Type II Demonstration, as well as the methodology used by Marathon within the Type II demonstration, are acceptable for an ATEL. However, the Board notes that IDNR raised concerns about Marathon's demonstration, especially regarding the Bigeye Chub. These concerns are discussed below.

IDNR Concerns Regarding Marathon's Demonstration

On December 28, 2018, IDNR filed its reply to IEPA's recommendation along with the results of the UIUC Study concerning the Bigeye Chub. IDNR expressed serious concern regarding the protection of endangered Bigeye Chub and the RIS under the proposed ATEL. Both Marathon and IEPA responded to IDNR's reply between March and April 2019. On March 10, 2020, the Board filed questions noting "that additional information is warranted in determining, among other things, whether the requested mixing zone, absent any zone of passage, would assure the protection and propagation of the Bigeye Chub, and if the requested thermal limits protect the biotic life in Robinson Creek." Board Order (3/10/20). The Board received responses from Marathon, IEPA and IDNR in July 2020.

IDNR continues to have concerns regarding the presence of Bigeye Chub, an Illinois-listed threatened species[13] found in Robinson Creek. 7/7/20 IDNR Rep. at 6-8. These concerns relate to the protection of the endangered Bigeye Chub, effects of thermal discharge on fish in terms of DELTs, the need for an Incidental Take Authorization (ITA), and the requested mixing zone relief without a zone of passage. Marathon and IEPA disagree with IDNR and assert that Marathon's demonstration adequately addresses the protection of Bigeye Chub as well as the other RIS. The Board will discuss the parties' position on the issues raised by IDNR and make its findings in the following sections.

Protection of Bigeye Chub

The Board notes that Bigeye Chub (*Hybopsis amblops*) is a listed threatened[14] species in Illinois, and traditionally has a northern boundary of the drainages of Lake Erie and Ontario and a southern boundary of the Tennessee River drainage. 12/28/18 IDNR Rep. and 7/7/20 IDNR Rep., Attach A at 1. The Bigeye Chub was considered virtually extinct in Illinois based on the results of studies conducted in the 1980s. Pet. Exh. 4 addendum (Marathon 316(a) TSD Addendum) at 3. Its preferred habitat are clear, gravel-bottomed streams with a permanent flow and little silt. UIUC Study at 1. They are normally found at the base of riffles or in quiet pools.

[13] At the time of this filing, the Bigeye Chub was listed as an Illinois "endangered" species. The species has since been upgraded to a threatened species.
[14] At the time IDNR filed its 12/28/18 Reply, the Bigeye Chub was listed as endangered.

Id. For the most part, Bigeye Chub populations in the northern portion of its range have been declining. *Id.* at 2. This decline has been linked to bank siltation and fertilizer and pesticide runoff. *Id*. Recently there has been evidence of a resurgence of the Bigeye Chub in Illinois, specifically within the Vermilion, Little Vermilion, and Brouillets Creek, and the northern parts of the Kaskaskia, Embarras, and Little Wabash River basins (Robinson Creek is directly adjacent to these areas). Marathon 316(a) TSD Addendum at 3. In September 2016 specimens of the Bigeye Chub were found near Marathon's Outfall 001 and other parts of Robinson Creek. 2/27/18 Pet. Mot., Attach. IDNR Letter 1/26/18. Since the Bigeye Chub is a threatened fish species within the State of Illinois, special consideration must be afforded in the proposed ATEL demonstration to ensure that the species is not harmed or blocked from the waters of Robinson Creek.

UIUC Study. In response to concerns regarding the presence of Bigeye Chub in Robinson Creek, IDNR contracted with Dr. Cory Suski at the University of Illinois at Urbana-Champaign (UIUC) to study the thermal tolerance of Bigeye Chub. 12/28/18 IDNR Rep. at 3. UIUC issued its study findings on December 14, 2018, as "Suski Lab Technical Report Review No. 2018-003 Interim Report Thermal Tolerance Limits of Bigeye Chub." *Id.*, Attach. A (UIUC Study). The findings of the UIUC Report were peer reviewed and published in *Aquatic Biology* in October 2019 as "Effects of acclimation temperature on critical thermal limits and swimming performance of the state-endangered Bigeye Chub *Hybopsis amblops*". 7/7/20 IDNR Rep. at 6, Attach. A.

The UIUC study evaluated two thermal endpoints for thermal tolerance testing, the critical thermal maximum (CT_{MAX}), which is a when fish begin to lose equilibrium, and the upper avoidance temperature (AT_{MAX}), which is the temperature at which fish begin to exhibit avoidance behaviors. UIUC Study at 2. The study notes that to measure the direct and indirect impacts of thermal stressors on fish, determination of the CT_{MAX} is an advantageous method for two reasons: 1) it is a non-lethal method that uses relatively small sample sizes, and 2) it is an effective method to evaluate the effect of biotic and abiotic factors on thermal tolerance. *Id.* at 2. Swimming ability and other related indicators are used to evaluate the effect of temperature on the abilities of prey capture, predator avoidance, and reproduction in nature. *Id*. The study objectives were to quantify the upper critical limits, determine the influence of acclimation temperature on swimming performance, and to compare the Bigeye Chub's thermal tolerance to other Leuciscnae species. *Id*.

Methodology. The UIUC Study used 40 Bigeye Chub collected from the Middle Fork Vermilion River near Danville, Illinois and completed eight trials. The UIUC study's methodology used a gradual warming test tank where the temperature of the whole tank is raised gradually to evaluate the upper avoidance temperature. *Id.* at 4. The fish were acclimated gradually by 1°C per day until the tanks reached the design acclimation temperature of 21°C and 26°C respectfully. *Id.* The acclimation temperatures were chosen based on the mean temperatures from the sampling site in May (21°C) and August (26°C). *Id*. The fish were then split into 4 separate aquariums, 2 at each acclimation temperature with 10 individuals in each tank where they were held for 21 days before testing. *Id.*

The critical thermal limit testing was conducted after the 21-day acclimation period, and all fish fasted for 24 hours prior to reduce the impact of feeding on any behavioral responses. UIUC Study at 3. Testing occurred in a 75L tank filled with 55L of dechlorinated tap water. *Id.* A 1000W electrical immersion heater was used to increase the temperature within the tanks, 2 small aquarium tanks to mix the water within the tanks, and an air stone attached to a small compressor. *Id.* There were six individually numbered compartments attached to the side of the tank for the holding of fish during testing that were perforated in order to allow for the circulation of water while preventing free movement outside of the compartment during testing. *Id.* The fish were acclimated in the compartment for one hour at their respective acclimation temperature. *Id.* The air stone was then removed, and the temperature increased by 0.3°C per minute. *Id.* The fish were then closely observed for two different behavioral responses; first, the temperature at which the fish showed erratic behavior (AT_{MAX}), and second, when the fish lost body equilibrium (CT_{MAX}). *Id*. at 4. Once a fish lost its equilibrium, the fish was removed from the compartment into a nearby holding tank at acclimation temperature for recovery. *Id.* During testing, temperature was recorded once every minute and dissolved oxygen was maintained above 98 percent saturation. *Id.* A total of eight trial runs were conducted with twenty Bigeye Chub (n=20) for each acclimation temperature on the same day to ensure that holding time did not have an impact on results. *Id.* After testing, the fish were held for an additional 72 hours at acclimation temperature and fed to monitor for delayed mortality. *Id.*

Results. The thermal tolerance results in terms of avoidance behaviors (AT_{MAX}) and loss of equilibrium (CT_{MAX}) at acclimation temperatures of 21°C (69.8°F) and 26°C (78.8°F) is summarized below. *Id.* at 5.

Table 1: UIUC Study Thermal Tolerance of Bigeye Chub

Response	Acclimation temperature (°C)	Acclimation temperature (°F)	Mean °C (°F)	SD °C (°F)	Median °C (°F)
AT_{MAX}	21	69.8	30 (86)	1.3	30 (86)
	26	78.8	33 (91.4)	1.4	33 (91.4)
CT_{MAX}	21	69.8	33 (91.4)	0.4	33 (91.4)
	26	78.8	36 (96.8)	0.9	36.6 (96.8)

At both acclimation temperatures, the Bigeye Chub showed a loss of equilibrium (CT_{MAX}) at a significantly higher temperature than the level at which it exhibited avoidance behaviors (AT_{MAX}). UIUC Study at 5. The study notes that behavioral responses in thermal testing were not affected by compartment number or holding aquarium. However, behavior was influenced by trial number and conditioning factor. But changes in responses of CT_{MAX} and AT_{MAX} across trials were small, and no consistent or predictable changes in behavioral responses occurred over time. Therefore, the study notes that the data are "sound, robust and defendable." *Id.* at 6.

In comparison to other members of the Leuciscinae subfamily, the study places Bigeye Chub's thermal tolerance as moderate. *Id.* at 6. As an example, the sand shiner *Notropis*

stramineus, with individuals from the same sampling location and acclimation temperature, was observed to have similar thermal endpoints as the Bigeye Chub. *Id.* at 6-7. Additionally, relative to the other species within its subfamily, the Bigeye Chub is a strong swimmer. *Id*. at 7. With that in mind, the researchers suggest the swimming performance of the Bigeye Chub in the study may be an underestimation of their swimming ability in the natural environment. *Id.* A 1998 study by Boyd and Parsons suggests that swimming ability is better in fish swimming in schools than as individuals. *Id*.

In addition to critical thermal tolerance testing, the UIUC study also evaluated critical swimming speed (U_{crit}) and burst swimming. These tests were conducted for each acclimation temperature after a week of critical thermal tolerance testing in a 5-liter low-controlled swim tunnel respirometer. UIUC Study at 4. The burst speed testing was conducted at both acclimation temperature by subjecting the fish to rapidly increasing velocity. The results indicated that neither the critical swimming speed nor burst speed was significantly affected by the acclimation temperatures. *Id.* at 5.

Marathon's Position on the Bigeye Chub. Initially, Marathon addressed the presence of Bigeye Chub in Robinson Creek by noting that there was insufficient thermal tolerance data on Bigeye Chub to include it in the final RIS. 2/27/18 Marathon 316(a) Addendum TSD at 4-5. However, Marathon maintained that the Bigeye Chub' thermal tolerance falls under the intermediate range of thermal tolerance among the final RIS. *Id.* at 6-7. Thus, Marathon concluded that since the proposed ATEL are protective of the fish species in the final RIS, they are by extension protective of the Bigeye Chub. *Id.* However, Marathon's consultant, MBI, re-ran the Fish Temperature Modeling System (FTMS) by including Bigeye Chub as RIS and using the data from the UIUC study. *Id.* at 6-7. Even with the inclusion of the Bigeye Chub, the FTMS results indicate that "there were no changes to the true summer period (June 16-September 15) average of 87.1°F or the maximum temperature of 90.7°F that are needed to protect all of the RIS including Bigeye Chub." *Id.* at 7.

Marathon argues that caution should be exercised when considering 91.4°F as the "upper incipient avoidance temperature" derived by UIUC. 3/15/19 Marathon resp. at 4. Marathon says that 91.4°F may be used as the equivalent of an upper avoidance temperature only if the initial observations of fish excitement and burst swimming are accepted as surrogates for an upper avoidance temperature endpoint. *Id. citing* Coutant (1975). Marathon argues that more recent studies indicate that fish are able to avoid lethal temperatures because they become excited or agitated by non-lethal temperatures and thus can swim away in avoidance. *Id.* Marathon argues that the "upper incipient avoidance temperature" derived by UIUC is not consistent with more established avoidance testing procedures since UIUC 's procedure did not provide a gradient of thermal conditions. *Id.* at 4 *citing* Chery, D.S., et al. More importantly, Marathon asserts that the temperature tolerance limits derived by UIUC are higher than the proposed alternative thermal effluent limitations when averaged over the summer months (87°F). *Id.* 4-5.

In response to Board questions, Marathon asserts that the UIUC study does not show the Bigeye Chub would be adversely affected by the requested relief. 7/9/20 Marathon Rep. at 8. Marathon takes issue with IDNR's assertion that the Bigeye Chub is an especially "thermally sensitive species". 7/9/20 Marathon Rep. at 3. Marathon argues that the Bigeye Chub "is not

even the most thermally sensitive of the Representative Important Species". *Id*. According to Marathon, Illinois is at the northwest extent of Bigeye Chub's range, thus making it a peripheral species found in small numbers in the State. *Id*. Further, Marathon maintains that the Bigeye Chub is not especially thermally sensitive, but its distribution is affected by other factors like naturally occurring geology, winter or summer temperature extremes or other natural factors. *Id*. Therefore, Marathon argues that the Bigeye Chub is listed as a threatened species[15] "in Illinois in part because it is a peripheral species in the state." *Id.*

Additionally, Marathon contends that exposure to avoidance temperatures may have adverse effects on fish species only if exposure occurs long-term, i.e., weeks or months. However, under the requested relief, any exposure to avoidance temperature will be short-term (hours or days). 7/9/20 Marathon Rep. at 3. In this regard, Marathon notes that the temperature modeling results within the mixing zone at RC05 (463 feet downstream of Outfall 001) show that the maximum number of consecutive hours that exceeded the maximum stress threshold of 90.7°F without a recovery period was only 14.5 hours based on the 2016 HOBO, and only 5.0 hours based on the Environmental Fluid Dynamics Code (EFDC) modeling. 3/9/20 Marathon Rep. at 4 citing Addendum to TSD at 3, 5 (Feb. 27, 2018). Marathon contends that the minimal exceedances effectively demonstrate no appreciable adverse harm to the aquatic community at RC05 even with the inclusion of the Bigeye Chub in the RIS. 3/9/20 Marathon Rep. at 4

Further, Marathon notes that the upper avoidance temperature for Bigeye Chub of 91.4°F, and the critical thermal maximum as the equivalent upper lethal endpoint of 96.8°F based on the UIUC Study results are higher than the proposed summer period maximum of 90°F and a summer average of 87°F evaluated within the mixing zone at RC05. *Id.* Therefore, Marathon contends that the requested ATEL along with mixing relief are protective of the RIS considered in the demonstration, including Bigeye Chub. *Id.*

Finally, Marathon refutes IDNR's assertions that Marathon's petition is deficient because Marathon has not demonstrated that the proposed ATEL allows for the "protection and propagation" of the Bigeye Chub or for any of the other RIS. 3/15/2019 Marathon Rep. at 8-12 citing 12/28/19 IDNR Rep. at 5-6. Marathon contends that the burden of proof imposed by law requires Marathon to demonstrate the proposed alternative limitations "will assure" propagation relying on a Type II demonstration, which is a predictive demonstration that constitutes the best estimate of "what will happen" rather than "what is occurring." *Id.* at 9. Marathon says that "the analyses and observations in the Section 316(a) demonstration support the conclusion that the current thermal regime is sufficiently protective of the RIS and the full assemblages by extension." *Id.* at 9. Marathon also notes that IEPA agrees that Marathon's demonstration supports "the conclusion that the proposed limits are sufficiently protective of the RIS and the full assemblages by extension. *Id.*

IDNR's Position. IDNR disagrees with Marathon's claim that the UIUC study's methodology for testing avoidance thermal endpoints is not consistent with more established testing procedures. 7/7/20 IDNR Rep. at 4. IDNR asserts that the UIUC Study relied on "solid

[15] At the time of this filing the Bigeye Chub was listed as an Illinois "endangered" species. The species has since been upgraded to a threatened species.

research methodology" that is commonly seen in the literature. *Id.* IDNR notes that the UIUC study has been peer reviewed and published in the October 2019 issue of Aquatic Biology as "Effects of acclimation temperature on critical thermal limits and swimming performance of the state-endangered Bigeye Chub *Hybopsis amblops.*" *Id.* at 5-6, Attach. A. Regarding the study by Cherry, *et. al.*[16] (1975) cited by Marathon, IDNR notes that unlike the UIUC study, Cherry *et. al.* used a gradient tank with warm water at one end and cool water at the other end with medium temperatures in-between allowing fish to move freely throughout. *Id.* Therefore, IDNR says, a comparison between the two studies would be a comparison between the temperatures the Bigeye Chub can tolerate versus the temperatures the Bigeye Chub prefers, which would be inappropriate. *Id*. at 5.

Regarding UIUC study using Bigeye Chub specimens from a location other than Robinson Creek, IDNR says that while the results using specimens from Robinson Creek would be more reliable it would have been prohibitive because there are not many of the species present, and the large number of fish required for the study would endanger the local population (n=40). 7/7/20 IDNR Rep. at 7. Therefore, specimens were collected from the closest reasonable location for sampling, which was the Middle Fork of the Vermillion River. *Id.*

Lastly, IDNR asserts that the "presence" of a species is not a demonstration of "protection and propagation" of a species. 12/28/18 IDNR Rep. at 6. IDNR argues that Marathon has not demonstrated that requirement for the Bigeye Chub or for any of the other RIS. *Id.* In order to do that, IDNR says that Marathon would need to "document in their Section 106.1120 Detailed Plan of Study, or in their Section 106.1130(e) Results of Studies, the spawning activity and recruitment of individual species to the aquatic population through direct observations, or minimally, through documenting the presence of young-of-the year and/or multiple year classes of individual species." *Id.*

IEPA's Position. IEPA asserts that the most thermally sensitive species among the RIS is the Emerald Shiner with an upper incipient lethal temperature (UILT) of 94.1°F and not the Bigeye Chub. 7/9/20 IEPA Rep. at 2, *citing* Table 11, Pet. Exh. 4. IEPA also notes that for the summer thermal regime in Robinson Creek, the UIUC Study's acclimation temperature of 26°C (78.8°F) with values of AT_{MAX} (91.4°F) and CT_{MAX} (96.8°F) are appropriate for comparison with the proposed thermal effluent limits. *Id.* at 3. The temperature data collected over 3 to 4-day periods once a month in 2016 by the Datasonde continuous monitor indicates that the highest temperature recorded at monitoring site RC05 (downstream of Outfall 001) was 92°F. *Id.* See Table 2, Pet. Exhibit 4. Thus, the Bigeye Chub's AT_{MAX} (91.4°F) will be exceeded but not the CT_{MAX} (96.8°F). *Id.* at 3-4.

IEPA notes that the HOBO continuous temperature monitoring results from July to November 2016 also indicate similar outcome, i.e., the Bigeye Chub's AT_{MAX} (91.4°F) will be exceeded at RC05 but not the CT_{MAX} (96.8°F). *Id.* citing Pet. Exh. 4 Table 3. However, the EFDC Temperature modeling results indicate maximum temperatures as high as 92.6°F at RC05

[16] Cherry, D.S., Dickson, K.L. and Cairns Jr, J., 1975. Temperatures selected and avoided by fish at various acclimation temperatures. Journal of the Fisheries Board of Canada, 32(4), pp.485-491)

and 94.7°F at RC07. *Id*. IEPA notes that under the requested relief, the highest maximum temperature allowable would be 90°F at the Route 1 Bridge (RC07) and 93°F approximately 1% of the time. *Id*. Thus, IEPA maintains that while the AT_{MAX} for the Bigeye Chub would have been exceeded at RC05, the CT_{Max} for the Bigeye Chub and UILT for the RIS would not have been exceeded. Similarly, the AT_{Max} for the Bigeye Chub and the UILT for the RIS would have been exceeded at RC07, but not the CT_{MAX}. *Id.* Additionally, IEPA argues that the AT_{MAX} should not be compared to the maximum temperature because it is not a lethal endpoint. *Id.* at 4-5.

IEPA also addressed IDNR's position that Marathon failed to address the issue of "protection and propagation" of the Bigeye Chub as well as RIS. IEPA says that Marathon has adequately addressed IDNR's concerns, and "reiterates its belief that the Petitioner has met its burden of proof in accordance with Section 106.1160." 4/12/19 IEPA Resp. at 2 citing IDNR Resp. at ¶21 and Marathon's Reply at 7-12. Based on the spawning temperatures for the Bigeye Chub and the RIS provided by Marathon, IEPA asserts that the Bigeye Chub is protected by the proposed ATEL. *Id.* at 3. Further, IEPA notes that for propagation to occur, "the alternative thermal limits should allow for a seasonal regime that does not exclude the ranges of temperatures that resident or transient organisms would utilize for spawning." In this regard, IEPA maintains the proposed incremental increases (and decreases) of monthly temperature limits provide a more natural progression of temperatures compared to the General Use standard, and thus is much more amenable to spawning. *Id.* Finally, noting that the response temperatures for the Bigeye Chub were consistent with that of other cyprinids in Marathon's Fish Temperature Modeling System (FTMS), IEPA concludes that "the UIUC study has not changed the Agency's recommendation to grant the proposed alternative thermal effluent limit." *Id.* at 3 citing Pet. Exh. 4, Table 13.

Board Discussion. The Board agrees with IDNR that the UIUC Study is a valid peer reviewed study that may be relied upon in conjunction with the studies submitted by Marathon to determine whether the requested relief is adequately protective of the Bigeye Chub as well as the RIS. Based on the results of the study, IDNR has raised significant concerns regarding the adequacy of Marathon's demonstration to protect the Bigeye Chub. The combination of the proposed high temperature discharge and the other non-thermal impairments found in Robinson Creek may pose a significant threat to protection and propagation of the Bigeye Chub, which is an Illinois listed threatened species.

According to the UIUC Study, when acclimated to 26°C (78.8°F), the Bigeye Chub began to show avoidance behaviors (AT_{MAX}) at approximately 33°C (91.4°F), which is close to the 92°F measured at RC05 monitor located 463 feet downstream from Marathon's Outfall 001 (the point of discharge). 7/9/20 Marathon Rep.at 3. Additionally, the maximum temperature at Marathon's requested point of compliance at the IL Route 1 bridge (RC07) was 91.6°F in June as well as April-November 2016. Pet. Exh. 4, (Marathon 316(a) TSD, Table 2) at 33. Thus, under the proposed ATEL, there likely will be time periods when the Bigeye Chub will avoid this section of Robinson Creek. Also, as noted by IDNR, MBI's temperature modeling for the period 2011-2016 at compliance point RC07 located 1.7 miles downstream indicated that temperatures reach up to 94.7° F at the compliance point (RC07), close to CT_{max} value of 96.8°F. 12/28/18 IDNR Rep. to Rec., Attach B at 3 citing Exh. 3. Given effluent temperatures at the Outfall 001

recorded from 2002-2016 averaged 97° F with a maximum of 100.0°F, and temperatures could reach 94.7° F at the compliance point, temperatures will likely exceed the proposed ATEL within the 1.7-mile mixing zone.

In this regard, Marathon notes that the proposed ATEL, which are based on the FTMS results, are specifically intended to limit the exposure of the RIS to brief and intermittent periods of temperatures that approach or exceed the proposed short term survival limit while assuring sufficient recovery periods with lower temperatures during the summer period. Exh. 4 at 18. MBI explains that the stress recovery period "is a contemporary concept that challenges a sole reliance on maximum only criteria." Exh. 4 at 2; Pet. at 13. MBI explains that the FTMS use of a "true summer season average" and a daily maximum temperature threshold is based on:

1) limiting the exposure of the RIS to comparatively brief and intermittent periods of temperatures that approach or exceed the short-term survival temperature (which is the basis for the maximum criterion); and,

2) assuring that recovery periods with lower temperatures over sufficient durations also exist during the summer period. Exh. 4 at 18.

MBI argues, "[t]his is consistent with the concept that an aquatic assemblage subjected to artificially elevated temperatures will be sustained under such an altered thermal regime provided there are sufficient intervening periods of lower temperatures that provide periods of relief from periods of short-term thermal stress (Bevelhimer and Bennet 2000; Bevelhimer and Coutant 2007; Figure 9)." Exh. 4 at 18. MBI adds that this "is amply demonstrated in the [nearby] Wabash River results documented by Gammon (1973)." Exh. 4 at 9.

MBI found "[t]he duration and severity of thermal stress periods greater than the 90.7°F RIS short-term survival (or maximum criterion) and stress recovery periods less than the 87.1°F RIS long term survival (or summer average criterion) in hours were determined… There were a total of eight thermal stress periods of 1.5 to 14.5 hours in duration for a total of 74.4 hours over the summer or 3.4% of the time. Each was followed by one or two stress recovery periods for a total of 779.3 hours or 36.1% of the time for a summer period recovery to stress ratio of 10.5:1… The longest thermal stress period of 14.5 hours occurred on August 10 and was followed by a 12.2-hour stress period on August 12, and a shorter period on August 13 (1.5 hrs.)." Exh. 4 at 18-19. MBI concluded, "[e]xceedances of the FTMS short-term threshold of 90.7°F are brief and sufficiently offset by lower temperatures that provide for adequate recovery periods." Exh. 4 at 3.

The Board notes that MBI's analysis of the duration and severity of thermal stress periods described above refers to temperatures recorded at the R07 sampling point approximately 1.7 miles downstream of Outfall 001, which is near the proposed location for compliance sampling and the edge of the mixing zone in Marathon's petition. Exh. 4, Table 14, Fig. 10 at 65-66. MBI also provided daily temperature profiles during the summer of 2016 for Robinson Creek at the RC05 sampling point, approximately 463 feet downstream from Outfall 001 and within the proposed mixing zone. The temperature profiles show the number of hours and days when temperatures at RC05 were above and below 90°F. Exh. 4, Table 14, Fig. 10 at 65-66; Exh. 6,

Figure 5-1. For the summer of 2016, Figure 10 shows that actual temperatures based on HOBO deployment at RC05 were above the 90°F standard for as long as 4 days at a time, which is considerably longer than the exceedance duration of 14 hours estimated by Marathon at RC07. Exh. 4 at 65-66.

EA Engineering and MBI say that any stress or avoidance by Bigeye Chub of Marathon's thermal discharge would be short term, on the order of hours or days, and "that the short-term avoidance is [of] no biological consequence." Rec. Att. B; Marathon's Resp. to IDNR 3/29/18 letter, EA Engineering August 13, 2018 document at 4. Under such circumstances, EA argues that avoidance would not constitute harassment. If avoidance were long term, on the order of weeks or months, precluding Bigeye Chub from favored feeding, nursery or spawning areas, EA says that avoidance could represent harassment. Rec. Att. B; Marathon's Resp. to IDNR 3/29/18 letter, EA Engineering August 13, 2018 document at 4.

The Board notes that the UIUC Bioassay demonstrated that the erratic behavioral responses of Bigeye Chub to temperatures approaching the AT_{max} and CT_{max} temperatures occurred quickly, within one minute. As explained in the UIUC Bioassay Report, each trial was conducted within one day and the rate of temperature increase was 0.3°C (0.54°F) per minute. To pinpoint the temperatures at which the specimen Bigeye Chubs began to show erratic behavioral responses and loss of equilibrium, the UIUC Bioassay relied on the one-minute time and temperature interval. 12/28/18 IDNR Reply at 2, Att. A.

Although IEPA stated that the maximum temperature limits requested by Marathon do not exceed the Upper Incipient Lethal Temperatures of the RIS (4/12/19 IEPA Reply at 3), the Board again notes that this is only the case outside the mixing zone. As pointed out by IDNR, temperatures within the mixing zone have reached 100°F. Exh. 3; 12/28/18 IDNR Reply Att. B at 3.

Additionally, the Board notes that the sampling frequency of two grab samples per week in Marathon's current NPDES Permit would not be able to discern temperature peaks that might adversely affect fish. The two grab samples per week is significantly less frequent than the daily frequency and continuous sample types for other NPDES discharges for which the Board has considered thermal relief or Alternative Thermal Effluent Limitations. *See* Coffeen Power Station, NPDES Permit No. IL0000108 (PCB 09-38); Dresden, NPDES Permit No. IL0002224 (PCB 15-204, IEPA Rec. Att. 1); Quad Cities, NPDES Permit No. IL0005037 (PCB 14-123, Exh. 1, App. A at A-10; Exelon Ans. Exh. 1; Southern Illinois Power Co-op, NPDES Permit No. IL0004316 (PCB 18-75, Exh. A); Midwest Generation Will County Generating Station, NPDES Permit No. IL0002206 (PCB 18-58, Exh. 5).

Board Finding. The Board finds that Marathon's proposed ATEL, based on FTMS thresholds, would limit exposure of the RIS to brief and intermittent periods of temperatures that may exceed the proposed short-term survival limit at the edge of the mixing zone. However, the Board shares IDNR's concerns regarding the protection of RIS, especially Bigeye Chub, within the proposed 1.7-mile mixing zone without a zone of passage. *See* discussion below. Given IDNR's position, the Board will require Marathon to file a conservation plan with IDNR as its

application for an ITA to ensure the protection of Bigeye Chub and other RIS. See discussion below.

Deformities, Eroded Fins, Lesions, & Tumors (DELTs)

IDNR notes that when fish undergo stress, such as low oxygen or presence of a predator, their bodies have mechanisms to overcome these stressors. 7/7/20 IDNR Rep. Attachment C at 1. However, chronic stress results in negative physiological consequences including a depressed immune system which leads to an increase in susceptibility to pathogens and incidence of DELTs. *Id*. IDNR recommended that "a bioassay of representative fish species is warranted to identify the character and likely causes of observed DELTs and to determine whether granting the Alternative Thermal Effluent Limits is likely to increase the incidence and/or severity of DELTs on fish in the receiving waters." 4/12/18 IEPA Mot., Attach. A at 4. Relying on its consultants' (MEI and EA Engineering) responses, MBI responded that occurrence of DELTs in fish in Robinson Creek "are the result of non-thermal pollution influences and the thermal regime of Robinson Creek does not play a direct or synergistic role in the observed biological assemblage impairments." 8/15/18 Marathon Resp. at 11, and Resp. Exh. 2 at 3.

IDNR Position. IDNR disagrees with MBI's assertion that temperature stress does not exacerbate DELTs. 7/7/20 IDNR Rep. at 7. IDNR argues that the relationship between DELTs and thermal stress has been observed across multiple studies, including one that observed the effect of thermal stress from a North Carolina cooling reservoir on the incidence of a bacterial infection that caused red lesions on largemouth bass. *Id*. To emphasize the significance of thermal stress on DELTs, IDNR points to the Sylvester (1972) finding, "[i]n the presence of domestic and industrial wastes, a slight increase in sublethal temperature could cause fish mortalities through synergism." *Id.* MBI attempts to compare the prevalence of DELTs to point-measures of temperature recorded during fish surveys in Illinois and Ohio. *Id*. IDNR argues that MBI's conclusion that high temperatures do not correspond with relatively high frequency of DELTs is irrelevant due to the synergistic relationship between Marathon's thermal discharge and non-thermal pollutants in Robinson Creek that produce the DELTs. *Id.* In this regard, IDNR lists several observational and experimental study designs to characterize potential causes of DELTs in Robinson Creek. 7/7/20 IDNR Rep, Attachment C at 1.

Additionally, the team from the UIUC study says that a combination of laboratory and field studies would be needed to quantify the relationship between thermal stress and the incidence of DELTs in Robinson Creek. 7/7/20 IDNR Rep. Attachment C at 1. The field studies would consist of wild fish and water sampling along a gradient both upstream and downstream over several seasons. *Id*. Fish would then be collected and assessed for DELTs. *Id*. These assessments include plasma cortisol to quantify stress, white blood cell counts to determine levels of infection and immune system function, tissue collection to evaluate oxidative stress, and measurements of nutrient levels. *Id*. Additionally, fish that have lesions or tumors would need to be swabbed for bacterial cultures. *Id*. The laboratory studies would consist of a group of fish held under conditions consistent with the temperatures in Robinson Creek and a group of fish held in water with contaminants found in Robinson Creek under normal temperatures. *Id*. These fish would also be examined for DELTs using the same methods used in the field studies. *Id*.

Marathon's Position. Marathon counters IDNR by noting that none of the Bigeye Chub specimens found in Robinson Creek exhibited DELTs. 7/9/20 Marathon Rep. at 14. They also state that MBI disagrees with IDNR's stance on the relationship between thermal stress and DELTs because they could only find one study that shows a link between the two. *Id*. Marathon asserts that IDNR's response relies only on generalized literature of conceptual or theoretical analyses as opposed to measurements or direct observation. *Id*. Marathon adds that none of the literature cited by IDNR is relevant to Robinson Creek because the temperatures in those studies were much higher than those requested in this proceeding. *Id*.

IEPA's Position. IEPA did not address the issue of DELTs in any of its filings.

Board Discussion. While IDNR has raised valid concerns regarding DELTs, the Board agrees with Marathon that there is no actual evidence in the record indicating an increased incidence of DELTs in fish in Robinson Creek due to Marathon's thermal discharge. Due to the presence of other non-thermal pollutants in Robinson Creek and the contested thermal regime in this proceeding, it is important to determine whether there is a risk of DELTs due to the proposed temperature limits. As noted by IDNR, there may be additive interaction between the non-thermal pollutants and the thermal discharge that could result in an increased incidence of DELTs.

Board Finding. The Board finds that the record does not contain adequate information to determine if the synergistic effect of Marathon's thermal discharge and non-thermal stressors in Robinson Creek is causing an increased incidence of DELTs. Given that the proposed ATEL includes a mixing zone without a zone of passage, the Board will require as a condition to the ATEL that Marathon must conduct a study as suggested by IDNR (7/7/20 IDNR Rep., Attach C) to determine whether Marathon's thermal discharge is causing an increased incidence of DELTs in fish in the Robinson Creek. This study must be completed within twelve months of the date of this order.

Incidental Take Authorization (ITA)

The Illinois Endangered Species Protection Act (IESPA) defines "Take" in reference to animals and animal products as "to harm, hunt, shoot, pursue, lure, wound, kill, destroy, harass, gig, spear, ensnare, trap, capture, collect, or to attempt to engage in such conduct." *See* Section 2 of IESPA, 520 ILCS 10/2. The IESPA prohibits any person or entity to "possess, ***take***…, or otherwise dispose of any animal… which occurs on the Illinois List [of endangered or threatened species]". 7/7/20 IDNR Rep. at 2-3, emphasis added. However, under Section 3 of the IESPA, a "take" may be authorized by IDNR if it is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity". This authorization is based upon IDNR's review and approval of a conservation plan submitted by an applicant under Section 5.5(b) of the IESPA. 7/7/20 IDNR Rep. at 3. Under an ITA submission, IDNR reviews the conservation plan for deficiencies and presents alternatives in order to aid in the protection of the listed species. *Id.* at 4. The Board notes that IDNR recommends that Marathon "seek an ITA to avoid potential violation of the IESPA through the take of a State-listed endangered Bigeye Chub at their Robinson plant outfall without prior authorization." *Id.* at 2-3.

IDNR's Position. IDNR says that while Marathon is not required to pursue an ITA, it is recommended to prevent a violation of the IESPA. *Id.* at 3. IDNR argues that Marathon is at a high risk for a "take" in the form of harassment where "the fish is forced to evacuate aquatic habitat areas in the thermal effluent of Robinson Creek beginning at 33 degrees C (91.4 degrees F)". 12/28/18 IDNR Rep. at 4-5. Marathon would also be at risk for a "take" in the form of harm where "the fish is unable to properly swim, avoid predators, and is at increased risk of mortality beginning at 96.8 degrees F for fish acclimated to 26 degrees C (78 degrees F)." *Id.* At RC05, the modeled temperatures reach 92°F during the summer period and the UIUC study observed the Bigeye Chub begins to show avoidance behaviors at approximately 91.4°F. 7/9/20 IEPA Rep. at 3; 7/7/20 IDNR Rep. at 5. Thus, IDNR contends that it is likely that Marathon's proposed ATEL may result in a "incidental take" that would require an authorization from IDNR under Section 3 of the IESPA.

IDNR says that neither Marathon nor IEPA has provided any information in their responses, dated 3/15/19 and 4/12/19 respectively, that would change IDNR' s recommendation that Marathon submit a Conservation Plan as its application for an ITA based on the potential for taking an Illinois listed species incidental to performing an otherwise legal action. 7/7/20 IDNR Rep. at 2.

Marathon's Position. Marathon asserts that the ATEL demonstration shows that the requested relief is adequately protective of the Bigeye Chub and the rest of the RIS. 7/9/20 Marathon Rep. at 11-12. Marathon notes that at RC05, which is located at 463 feet from Outfall 001, the maximum number of consecutive hours temperatures exceeded the short-term survival threshold for the most sensitive RIS of 90.7°F was 14.5 hours according to the 2016 HOBO continuous monitoring data and 5.0 hours based on the EFDC modeling data. *Id*. at 12. In contrast, Marathon asserts that the upper avoidance temperature for the Bigeye Chub is 91.4°F and the upper lethal endpoint is 96.8°F. Given this low frequency of exceedance of the short-term threshold, Marathon argues that "it is highly unlikely that prolonged "erratic behavior" or a "near loss of equilibrium could ever happen over the full length of the 1.7 miles of the proposed mixing zone." *Id.* citing Table 14 of the TSD.

Additionally, Marathon contends that because the longest consecutive period of stress temperatures was only 14.5 hours in 2016 within 0.1 mile of Outfall 001, "duration of stress exceedance of the short-term survival threshold would be much less and likely closer to zero for the majority of the 1.7 miles." *Id*. at 10. Marathon also notes that the "[r]ecovery temperatures were 10 times more frequent than stress temperatures and were of longer duration at RC05, which is sufficient for all RIS including Bigeye Chub to traverse Robinson Creek downstream and upstream of Outfall 001." *Id.* at 11. Therefore, Marathon maintains that the proposed thermal regime is protective of the Bigeye Chub and an ITA is not required. *Id*. at 12. Marathon asserts that IDNR has not provided any regulation, statue, or case law to support its stance that avoidance behavior constitutes a take. *Id.* Further, Marathon argues that not seeking an ITA is justified because IEPA also agrees that the requested relief is sufficiently protective of Bigeye Chub. *Id*.

IEPA's Position. IEPA did not address the issue of "take" in any of its filings.

Board Discussion. The Board notes that the temperature monitoring data and the EFDC modeling results indicate that the avoidance temperature (AT_{MAX}) of Bigeye Chub derived by the UIUC Study will likely be exceeded within the proposed mixing zone (RC05) and at the edge of the mixing zone (compliance point RC07). Further, the avoidance behavior of the Bigeye Chub and other RIS is likely because Marathon is proposing a mixing zone without a zone of passage, which would provide refuge to fish during periods of excess thermal stress. However, a significant concern is that the entire 1.7-mile mixing zone may not provide adequate refuge for the Bigeye Chub, an Illinois threatened species, as well as other RIS. The Board notes that in other alternative thermal effluent limitations granted by the Board, thermal refuge was available for fish by descending a few feet into deeper waters below the warmer surficial thermal plume. *See* PCB 18-75 Southern Illinois Power Cooperative, (July 25, 2019) slip op. at 35; PCB 14-123 Exelon Generation LLC (September 18, 2014) slip op. at 43.

The Board also notes that the level of protection both IDNR and the academic researchers at UIUC afforded to the Illinois threatened Bigeye Chub illustrates the importance of protecting the species. UIUC's Institutional Animal Care and Use Committee would not approve lethal testing on even a few of the 40 Bigeye Chub test specimens. And while IDNR recognized that a lethal endpoint could benefit this area of science, IDNR came to its own conclusion that such an extreme would not be necessary to determine the likelihood of 'take' since 'take' includes non-lethal 'harm and harassment.'" 12/28/18 IDNR Reply, Att. B at 2. Additionally, the academic researchers at the UIUC laboratory took care during the testing to quickly remove a fish test specimen from the thermal test compartment as soon as it lost equilibrium, placing in into a nearby holding tank with water at its acclimation temperature where it was fed and monitored for delayed mortality. Researchers also documented that no mortality was attributed to the thermal testing. 12/28/19 IDNR Reply Att. A at 6.

The Board notes that it has considered an Incidental Take Authorization Permit and a Habitat Conservation Plan as necessary components of a previous ATEL decision. In the PCB 14-123 Thermal Demonstration for Exelon Generation's Quad Cities Nuclear Station, the US Fish and Wildlife Service required Exelon collaborate with it and prepare a Habitat Conservation Plan to protect a federally endangered species. In granting the alternative thermal effluent limitation in PCB 14-123, the Board considered the Incidental Take Authorization Permit and Habitat Conservation Plan for the federally endangered Higgins eye pearlymussel and the candidate species Sheepnose mussel as a necessary part of the demonstration to show that the alternative thermal effluent limitations would ensure the protection and propagation of the balanced, indigenous population. PCB 14-123 Pet. Exh. 1, App. C at C-12; PCB 14-123. Exh. 4 at 17-18; PCB 14-123 slip op. at 12 (September 18, 2014).

In PCB 14-123 the Board found, "that the proposed thermal discharge to Pool 14 of the Mississippi River, taking into consideration of the Habitat Conservation Plan and Incidental Take Permit, meets the decision criteria of the Draft USEPA 316(a) Manual for habitat formers." PCB 14-123 slip op. at 21 (September 18, 2014). "With the Habitat Conservation Plan and Incidental Take Permit in place, it is reasonable to expect that the proposed thermal loading will not cause appreciable harm to the balanced and indigenous population. The Board finds that the proposed thermal discharge to Pool 14 of the Mississippi River, in combination with the Habitat

Conservation Plan and Incidental Take Permit, meet the decision criteria of the Draft USEPA 316(a) Manual for macroinvertebrates and shellfish." PCB 14-123 slip op. at 28-29 (September 18, 2014). The Board made similar findings for mussels. (PCB 14-123 slip op. at 43 (September 18, 2014). Additionally, the effectiveness of the Incidental Take Authorization Permit was tied to the Board granting the alternative thermal effluent limitation, "[t]he Incidental Take Permit becomes effective on the date the Board grants the alternative thermal effluent limitations and expires on August 15, 2034." PCB 14-123 slip op. at 27 (September 18, 2014)

As noted by IDNR, an ITA would ensure that Marathon will "assess current habitat conditions and improve[] such conditions to minimize impact to the species, or if impossible, brings conservation benefit to the species elsewhere, or some combination of these elements." 07/09/20 IDNR Rep. at 4. This process allows "the State of Illinois, and the public through review, to consider the potential loss of individual aquatic species due to Marathon's actions and to determine whether or not the taking will reduce the likelihood of survival or recovery of the species in the wild in Illinois (per IESPA)." *Id.*

Board Finding. The Board agrees with IDNR that Marathon must address Bigeye Chub under the IESPA. Having made the finding that the proposed ATEL with a 1.7-mile mixing zone and no zone of passage may not be protective of Bigeye Chub during certain periods in summer months, the Board believes that the ITA process will allow IDNR oversight to ensure that Marathon implements measures to minimize the thermal effects to Bigeye Chub and other RIS. Therefore, the Board will require Marathon, as a condition of the ATEL, to seek an ITA from IDNR under 17 Ill. Adm. Code 1080 by filing a conservation plan within six months from the date of today's order.

Request for Mixing Zone Relief

As part of its proposed alternative thermal effluent limitations, Marathon requested relief from the mixing zone rules as follows: "In lieu of 35 Ill. Adm. Code § 302.102(b)(8), the following shall apply: the area and volume of mixing shall extend from Outfall 001 to a point instream in the vicinity of the IL Route 1 bridge." Pet. at 12, 22. Marathon requests relief from the mixing zone regulation outlined in 35 III. Adm. Code 302.102(b)(8) without providing a zone of passage. 7/9/20 Marathon Rep. at 1.

IDNR's Position. Due to the absence of a zone of passage within Marathon's requested mixing zone, IDNR expresses concern regarding the temperatures *within* the mixing zone being higher than the thermal endpoints discussed in the UIUC study rather than the temperatures at the *edge* of the mixing zone. 7/7/20 IDNR Rep. at 6. Additionally, IDNR says that providing a zone of passage may or may not address their concerns regarding the Bigeye Chub. 7/7/20 IDNR Rep. at 7. IDNR cautions that while "providing a zone of passage for aquatic life could potentially result in compliance with the requirements of 35 Ill. Adm. Code 302.102(b)(8)", Marathon may be subject to Section 302.108(b)(4) that prohibits mixing in waters containing endangered species habitat. *Id.* Further, IDNR contends that allowing a mixing zone with a zone of passage less than 50% would still constitute an inhospitable thermal habitat for the Bigeye Chub. *Id.*

Marathon's Position. Marathon argues that the provision of a zone of passage is impossible in Robinson Creek due to its size. 7/9/20 Marathon Rep. at 5. Marathon contends that the depth in Robinson Creek ranges from as little as 2 inches in riffle areas to 20 inches in pools in some areas of the stream. *Id*. Further, the stream is only 23 to 31 feet wide. *Id*. Marathon argues these physical limitations, along with the amount of effluent released by Marathon, cause complete mixing very quickly, making it impossible to provide a zone of passage. *Id*. Modeling shows that fully mixed conditions would occur immediately downstream of discharge due to these physical characteristics. *Id.*

Marathon also clarifies that the full 1.7-mile mixing zone is not needed to meet the ATEL at the edge of the mixing zone. 7/9/20 Marathon Rep. at 6. However, Marathon chose the proposed compliance point because the access is not on private property, or impeded by wooded areas, and the location is consistent with its draft NPDES permit. *Id*. Marathon adds that moving the compliance point further upstream from the Route 1 bridge would decrease accessibility and make it more difficult to perform equipment maintenance and sampling. *Id*. at 6. Marathon argues the absence of a zone of passage does not affect the conclusions of the demonstration that the generally applicable requirements are more stringent than necessary to protect the balanced indigenous community in the Robinson Creek. *Id.* at 2.

Marathon concedes, "long term-avoidance may be detrimental to a species if it is of sufficient duration or at critical time period so as to prevent that species from feeding properly, from gaining access to needed spawning areas, or not allowing access to important nursing areas." 7/9/20 Marathon Rep. at 3. However, Marathon contends these effects only occur if these avoidance behaviors occur over weeks or months and not the hours or days that may occur as a result of the requested relief. *Id.* Marathon further asserts the habitat within the mixing zone is not unique to this stretch of Robinson Creek. *Id*. Further, Marathon asserts that neither the Bigeye Chub nor the rest of the RIS are migratory. *Id*. at 4. While Marathon admits that a fraction of the Bigeye Chub population is likely to move beyond their home range, it argues that this movement is not migration in the classic sense in which USEPA seeks to protect in the 316(a) guidelines. *Id*. at 9. Further, Marathon says that it is not aware of any truly migratory species in Robinson Creek, and that therefore "movements are discretionary rather than obligatory". *Id*. at 4.

Regarding the temperature within the mixing zone, Marathon argues that at the temperature monitoring station RC05 (located 463 ft from the point of discharge) in the 2016 HOBO data shows that there was only a maximum of 14.5 consecutive hours without a recovery period. *Id*. Marathon contends that exclusion from unacceptably large areas is addressed by ensuring the maintenance of long-term survival temperatures of the most sensitive RIS via the summer period average. *Id*. at 8. Marathon maintains that the RIS would only avoid the 463 feet around Outfall 001 approximately 3.4% of hours during the true summer period (June 15-September 15) per the 2016 HOBO analysis. *Id.* Because these avoidance hours occurred during multiple disjunct events, Marathon argues that they "would not result in the exclusion of unacceptably large areas of Robinson Creek to the RIS, including Bigeye Chub." *Id.* Further, sufficient recovery periods are available during critical summer period to allow "the movement of fish both upstream and downstream from Outfall 001." In other seasons, "fish movement

would be completely unhindered as temperatures both within and outside of the mixing zone would be well below long-term avoidance thresholds." *Id.*

IEPA Position. IEPA agrees with Marathon regarding thermal stress periods being followed by sufficient recovery periods. 7/9/20 IEPA Rep. at 5. IEPA says that it did not give special consideration to the Bigeye Chub when recommending that the Board grant the requested mixing zone relief. *Id.* at 2. However, the IEPA argues that Marathon is not requesting an increase to the current thermal discharge, therefore there should not be any changes in the stream's thermal regime. *Id.* IEPA clarifies that it has not granted mixing zone relief without a zone of passage "except as authorized under 35 III. Adm. Code 302.102(b)(6) where a zone of passage is not required in receiving streams that have zero flow for least seven consecutive days recurring on average in nine years out of 10." *Id.* However, IEPA argues that under Subpart K the Board has the authority to do so in this case[17]. *Id*. Additionally, IEPA clarifies that "alternate effluent limits only apply at the edge of the mixing zone." *Id*. at 3.

Additionally, IEPA says that Robinson Creek would not exceed the CT_{MAX} for the Bigeye Chub but would exceed its AT_{MAX}. 7/9/20 IEPA Rep. at 4-5. Moreover, there would be no refuge within the mixing zone for the fish in Robinson Creek outside of moving up or downstream to avoid the higher temperatures. *Id*. at 5. The Agency agrees it is reasonable to assume that areas within the mixing zone will have more periods of thermal stress than recovery and therefore, will exclude some fish on a temporary basis due to high temperatures. *Id.* at 6. Lastly, IEPA says that providing a mixing zone with a zone of passage may not be feasible because Marathon's effluent (2.66 MGD) would readily mix with the upstream flow from the Robinson treatment facility (2.5 MGD) that has the approximately same volume. 7/9/20 IEPA Rep. at 6. However, if the Board were to determine a zone of passage is necessary, IEPA says that Marathon would need to model whether a zone of passage is possible and if it affects the size of the mixing zone. *Id.*

Board Discussion. As noted by IEPA, under 35 Ill Adm Code 104.Subpart K, the Board has the authority to grant a mixing zone without a zone of passage consistent with the Clean Water Act. The Board notes that the USEPA allows the use of mixing zones as a mechanism to deal with thermal discharges in establishing ATELs, provided that the mixing zone assures the protection and propagation of the biological indigenous community:

> It should be mentioned here that "mixing zones" in the generic sense *can* be used "as a mechanism for dealing with thermal discharges pursuant to section 316(a) of the Act." *In Re Sierra Pac. Power Co.*, U.S. EPA, Decision of the Gen. Counsel No. 31, at 2 (Oct. 14, 1975). Although "mixing zone" is a term of art under the CWA that specifically refers to a tool used in the application of State water quality standards, *see* 40 C.F.R. § 131.13, the legislative history of CWA § 316(a) indicates that Congress felt that mixing zones in the generic sense could be used in designing permit limitations based on a CWA § 316(a) variance from applicable technology standards. *See Sierra Pac.*, Decision of the Gen. Counsel No. 31, at 2. Of course, to satisfy § 316(a), any such mixing zone would have to be designed to assure the protection and propagation of the BIP. *See* 39 Fed. Reg.

[17] IEPA cites PCB 18-58 as a case where the Board granted a zone of passage of 50%.

> at 36,178. [October 8, 1974; available at https://www.loc.gov/item/fr039196/] USEPA, "Clean Water Act NPDES Permitting Determinations for the Thermal Discharge and Cooling Water Intake Structures at Merrimack Station in Bow, New Hampshire, NPDES Permit No. NH 0001465", June 25, 1992, at 23.

Further, the Board rules at Section 302.102(b)(6) do not require a zone of passage in receiving streams that have zero flow for at least seven consecutive days recurring on average in nine years out of 10. This provision was adopted by the Board along with other revisions to the mixing zone rules in R07-9[18]. The Agency's proposal and testimony in R07-9 explained that allowing mixing zones without a "zone of passage" was intended to cover receiving streams that are "very small in high watersheds," which "typically dry up during periods of little rainfall and then fill with water again when rainfall returns." The more often a stream is dry, the more hostile that habitat will be to aquatic life." R07-9, 3-7-07 Tr. at 17-19. In adopting the mixing revisions in R07-9, the Board noted,

> "these streams have zero flow during dry weather and contain high velocity flow during rainfall or snowmelt events. Usually, effluent discharge into these streams coincides with wet weather flows in the streams. The Agency asserts that this change is necessary given the elimination of the TDS standard to allow mines to mix effluent under wet weather conditions." R07-9 (September 20, 2007) slip op. at 26-27.

Robinson Creek at Marathon's Outfall 001 does not match the situation described by IEPA for mixing zones that cannot physically include a zone of passage in receiving streams that are "very small in high watersheds," which "typically dry up during periods of little rainfall and then fill with water again when rainfall returns." R07-9, 3-7-07 Tr. at 17-19.

Marathon requests using 100% of Robinson Creek for mixing without providing a zone of passage for aquatic life for a segment 1.7 miles downstream of Outfall 001. Pet. at 22; Rec. at 6. IEPA recognizes that, "[t]he regulations dictate that no more than 50% of the volume of stream flow shall be used in streams where the dilution ratio is less than 3:1, to provide a zone of passage for aquatic life. *See* 35 Ill. Adm. Code 302.102(b)(8). Marathon's compliance point for the proposed effluent limitations would be approximately 1.7 miles downstream of the outfall and would utilize the entire volume of stream flow. Pet. at 22. This relief is larger than what could be typically granted by the Agency." Rec. at 6.

According to the UIUC study, the Bigeye Chub when acclimated to 26ºC (78.8ºF) begins presenting avoidance behaviors at approximately 33ºC (91.4ºF). UIUC Study at 5. At

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[18] R07-9 In the Matter of: Triennial Review of Sulfate and Total Dissolved Solids Water Quality Standards: Proposed Amendments to 35 Ill. Adm. Code 302.102(b)(6), 302.102(b)(8),302.102(b)(10), 302.208(g), 309.103(c)(3), 405.109(b)(2)(A), 409.109(b)(2)(B), 406.100(d); Repealer of 35 Ill. Adm. Code 406.203 and Part 407; and Proposed New 35 Ill. Adm. Code 302.208(h)

monitoring station RC05, which is located 463 feet from the point of discharge (Outfall 001), temperatures have been found to be as high as 92°F. Marathon 316(a) TSD at 32. Additionally, at their requested point of compliance (RC07), 1.7 mi from the point of discharge, there have been temperatures measured as high as 91.6. Marathon 316(a) TSD at 33. This means that it is likely the Bigeye Chub would avoid the 1.7-mile stretch of Robinson Creek extending from Outfall 001 to the compliance point at the Route 1 bridge. Regarding the rest of the RIS, Marathon asserts that the Bigeye Chub is not even the most thermally sensitive of the RIS. 7/9/20 Marathon Rep. at 8. If the Bigeye Chub is likely to present avoidance behaviors at times with the currently requested relief and it is not the most thermally sensitive of the RIS, it is likely the more thermally sensitive species would be affected as well. Therefore, IDNR validly questions the requested mixing zone with no zone of passage.

For the Board to grant the mixing zone without a zone of passage, the primary criterion would be the protection and propagation of Bigeye Chub and the RIS within the mixing zone. 35 Ill. Adm. Code106.1170(a). Board regulations state:

> "[T]he Board may order the Agency to include thermal discharge effluent limitations or standards in the petitioner's NPDES permit that are less stringent than those required by applicable standards and limitations if the thermal component of the discharge, taking into account the interaction of such thermal component with other pollutants, will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water." *Id*.

In this regard, IDNR has raised valid concerns that granting the proposed ATEL with a mixing zone with no zone of passage may pose a threat to the Illinois Listed Threatened Species, Bigeye Chub, as well as the RIS. However, as noted by Marathon, the Board recognizes that it may not be possible to provide a zone of passage due to the physical characteristics of Robinson Creek, and the flow volumes of Marathon's effluent.

While the Board recognizes that requiring Marathon to seek an ITA may not be an alternative to having a zone of passage, an ITA would at least ensure that current habitat conditions are assessed, and improvements are made to minimize any impact to the Bigeye Chub or bring conservation benefit to that species elsewhere. This requirement, when coupled with Marathon's true summer (June 15 - September 15) demonstration, ensures adequate protection to the Bigeye Chub and the RIS within the 1.7-mile mixing zone. The demonstration shows the thermal stress periods for the RIS are followed by sufficient recovery periods to allow the movement of fish for both upstream and downstream from Outfall 001. The Board also notes that allowing a mixing zone without a zone of passage should not result in any changes in the stream's existing thermal regime because Marathon is not seeking an increase to the current thermal discharge.

To ensure the correct placement of the monitoring location, the Board is amending the proposed language from, "i.e. the point of compliance, be located at a point instream at or upstream of the IL Route 1 bridge," to, "i.e. the point of compliance, be located at a point instream ~~at or upstream of~~either at the IL Route 1 bridge or upstream and near the IL Route 1 bridge.

Board Finding. The Board notes that other than requiring new modeling of Marathon's discharge to evaluate the feasibility of including a zone of passage, the record does not include any alternative options for not including a zone of passage. In light of this, the Board will grant the requested mixing zone, but will require Marathon to file a conservation plan as its application for an ITA with IDNR to ensure the protection and propagation of the Bigeye Chub as well as the other RIS. *See* 35 Ill. Adm. Code 106.1170(b).

Board Findings on Marathon's Demonstration (i.e., Master Rationale)

The Board finds that Marathon's 316(a) Demonstration along with the conditions specified in this order successfully address each of the applicable 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 Marathon'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.

The Board notes that Marathon has addressed each of the biotic category criteria that must be considered for a successful demonstration through its Type II Predictive/Representative Important Species Demonstrations. Exh. 4 at 4-26. Marathon's 316(a) Demonstration followed the elements of the USEPA 316(a) Manual by assessing each of the six biotic categories as well as a detailed study of categories identified as high impact: shellfish, macroinvertebrates; and fish. Exh. 4, 5 and 7. After that, Marathon used Type II Predictive Demonstration in which it relied on assessment of RIS and fish temperature modeling system to demonstrate that the proposed ATEL is protective of both short and long-term survival requirements of the RIS. Exh. 4. Again, the Board notes that this finding is based on the inclusion of specific conditions pertaining to the Bigeye Chub.

No Appreciable Harm to the Balanced, Indigenous Community

Marathon's request for thermal relief is for its existing discharge and not for an increase in the temperature of its effluent. Rec. Att. B; Marathon's Resp. to IDNR 3/29/18 letter, EA Engineering August 13, 2018 document at 3. Marathon relies on a Type II (predictive/ Representative Important Species) demonstration conducted by MBI to show that the requested alternative thermal effluent limitations will assure the protection and propagation of the BIC in Robinson Creek. MBI developed a list of RIS for Robinson Creek that was used in the Fish Temperature Modeling System (FTMS) to determine summer average and maximum temperatures that are protective of both short and long-term survival requirements of the most sensitive of RIS. Exh. 4 at 12. Based on IDNR's concerns regarding Bigeye Chub, MBI re-ran the FTMS by including the Bigeye Chub as an RIS and incorporating the thermal tolerance data in the UIUC study. 3/15/19 Marathon Resp. at 6-7. Marathon maintains that the data provided by the UIUC Bioassay, as included in the FTMS, further supports that Marathon's proposed alternative thermal effluent limitations will assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on Robinson Creek.

However, as discussed above, IDNR continues to have concerns regarding the Bigeye Chub and other RIS given the 1.7-mile-long mixing zone without a zone of passage. IDNR also expressed concerns regarding the incidence of DELTS. Therefore, the Board requires Marathon to seek an Incidental Take Authorization (ITA) by filing a conservation plan with IDNR; and conduct an additional study to assess the incidence of DELTS. Additionally, in response to the Board's question regarding monitoring, Marathon says that the renewal NPDES permit for the refinery will include a continuous, in-stream temperature monitoring requirement, which will be adequate to determine temperature peaks that might affect RIS, including Bigeye Chub, within the proposed allowed mixing zone. 7/9/21 Marathon Resp. at 11. Thus, the Type II demonstration together with the additional requirements ensures that Marathon's thermal discharge is not expected to cause appreciable harm to the balanced, indigenous population in Robinson Creek under the proposed alternative thermal effluent limitations.

Upper Temperature Limits

Marathon argues that "the analyses and observations in the Section 316(a) demonstration support the conclusion that the current thermal regime is sufficiently protective of the RIS and the full assemblages by extension." 3/15/2019 Marathon Rep. at 8-12 citing 12/28/19 IDNR Rep. at 9. Marathon also notes that IEPA agrees that Marathon's demonstration supports "the conclusion that the proposed limits are sufficiently protective of the RIS and the full assemblages by extension. *Id.* Further, the temperature monitoring results show that the extent of thermal alteration resulting from Marathon's discharge do not extend beyond the mouth of Robinson Creek. In this regard, the proposed summer season short- and long-term thresholds and the temperature regime downstream from the Marathon Outfall in Robinson Creek indicate that the thermal discharge should not preclude recovery of the resident biota to meet the Illinois General Use standards for aquatic life outside the mixing zone.

Nuisance Organisms

The presence of nuisance species was one of the factors that was considered by MBI in developing the RIS. Exh. 4 at 13. However, MBI's biological assessment of Robinson Creek did not identify any nuisance species. Exh. 7.

Zone of Passage

According to USEPA guidance, an ATEL demonstration must show that "[a] zone of passage will not be impaired to the extent that it will not provide for the normal movement of population RIS, dominant species of fish, and economically (commercial or recreational) important species of fish, shellfish, and wildlife." USEPA 316(a) Manual at 71. As discussed above in detail, Marathon's proposed mixing zone does not include a zone of passage. While Marathon made several arguments to support its proposal, IDNR raised valid concerns regarding the potentially impaired movement of Bigeye Chub and other RIS within the mixing zone. Therefore, the Board grants the requested mixing zone with a condition that Marathon file a conservation plan as its application for an ITA with IDNR to ensure the protection and propagation of the Bigeye Chub as well as the other RIS.

Threatened or Endangered Species

As discussed above, Marathon's petition identified the presence of Bigeye Chub in Robinson Creek and its tributary. Pet. Exh. 7. At the time of filing of Marathon's petition, the Bigeye Chub was an Illinois state-listed endangered species. However, on May 28, 2020, the status of the Bigeye Chub was changed from endangered to threatened. *See supra* at 8-9. The Board notes that an endangered and threatened species would be treated the same under consideration of an illegal take. *See supra* at 8-9, 16-17. In response to concerns raised by IDNR, Marathon re-ran the FTMS by including the Bigeye Chub in the RIS and using the thermal tolerance data from the UIUC study to show that the proposed ATEL is protective of the modified RIS at the edge of the mixing zone.

However, as noted above, IDNR continues to have concerns regarding the protection and propagation of the Bigeye Chub and the RIS within the mixing zone with no zone of passage and recommended that Marathon seek an ITA by submitting a conservation plan. 7/9/20 IDNR Rep. to Board Questions at 2. IDNR explains that an "ITA would ensure that Marathon assess current habitat conditions and improves such conditions to minimize impact to the species, or if impossible, brings conservation benefit to the species elsewhere, or some combination of these elements." *Id.* at 3. Based on this factor, the Board is requiring Marathon to seek an ITA by filing a conservation plan as a condition of the ATEL to ensure the protection of the Bigeye Chub and the RIS.

Unique or Rare Habitat

Marathon did not identify any unique or rare habitat as needing special protection. Again, the Board notes that an ITA would require Marathon to further assess habitat conditions in Robinson Creek.

Biocides

As to the last element of the Master Rationale, Marathon's petition does not indicate the use of biocides in its wastewater treatment plant. Therefore, detrimental impacts to aquatic life from biocides are not expected.

Board Finding that Applicable Effluent Limits are More Stringent Than Necessary

Marathon requests alternative thermal effluent limitations for the Refinery's discharge from Outfall 001 to Robinson Creek in lieu of those that are based on the Board's temperature standards under Sections 302.211 (d) and (e), and mixing zone requirement under Section 302.102(b)(8), because they are more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the receiving waters (Robinson Creek). Thus, Marathon must demonstrate that the effluent limits applicable under Sections 302.211 (d) and (e) and 302.102(b)(8) are more stringent than necessary to assure the protection and propagation of the balanced, indigenous population in and on the Robinson Creek. *See* 33 U.S.C. § 1326; 35 Ill. Adm. Code 106.1160(b). For the reasons below, the Board finds that Marathon has made this demonstration.

Numeric Temperature Water Quality Standards

Section 302.211(d) specifies that the maximum temperature rise above natural temperatures must not exceed 2.8° C (5° F). 35 Ill Adm Code 302.211(d). Marathon's demonstration notes that the FTMS derived summer period maximum of 90.7°F and average of 87.1°F are sufficiently protective to serve as alternatives to the current 90°F maximum and the 5°F limitations. Pet. at 20. MBI's evaluation of the frequency of thermal stress and recovery periods in conjunction with the current 5°F effluent limitation indicates that the limitation is more stringent than necessary to protect the balanced indigenous community of Robinson Creek at the edge of the mixing zone. Additionally, the 3°F allowance above the maximum and 1% exceedance provisions of the current effluent limitations serve to preclude excessive exceedances of the maximum FTMS thresholds. *Id*. at 3.

Section 302.211(e) limits daily maximum water temperatures to 60°F (December–March) and 90°F (April–November). 35 Ill. Adm. Code 302.211(e). Marathon's Type II Predictive /Representative Important Species Demonstration, with hydrothermal modeling and biological assessment, shows that the proposed numeric effluent limitations (less stringent than if based on standards for December–March) would be within the thermal tolerances of the representative important species, including the Bigeye Chub at the edge of the mixing zone. The concerns regarding the protection of RIS and the Bigeye Chub within the mixing zone have been addressed by requiring Marathon to file an ITA with IDNR.

Under these circumstances, the Board finds Marathon has demonstrated that effluent limitations based on the temperature water quality standards under Section 302.211 (d) and (e) are more stringent than necessary to assure the protection and propagation of a balanced, indigenous population in and on Robinson Creek.

Mixing Zone - Zone of Passage

The Board notes that 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*. Marathon requests a mixing zone extending from Outfall 001 to a point 1.7 miles downstream in the vicinity of the IL Route 1 bridge with no zone of passage. For the reasons discussed in detail above (*supra* at 60-65), the Board finds that Marathon has demonstrated that the 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 Robinson Creek.

CONCLUSION

Based on the record before it, the Board finds that Marathon has demonstrated, for the discharges from Outfall 001 of its Robinson Refinery, the thermal effluent limitations based on the Board's temperature water quality standards under Sections 302.211(d) and (e), and the mixing zone requirement under Section 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 Robinson Creek. Further, the Board finds that Marathon's alternative thermal effluent limitations based on its Type II Predictive/Representative Important Species Demonstration along with the conditions specified in the order below assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on Robinson Creek.

In granting alternative thermal effluent limitations, the Board "may impose such conditions as may be necessary to accomplish the purposes of the Act." 35 Ill. Adm. Code 106.1170(b). As discussed above, the Board grants Marathon's request for alternative thermal effluent limitations subject to the following conditions: 1) that Marathon seek an Incidental Take Authorization from IDNR by filing a conservation plan to address the Bigeye Chub and the RIS; and 2) conduct a study to assess the impact of Marathon's thermal discharge on fish in Robinson Creek in terms of DELTs. Accordingly, the Board grants Marathon's requested alternative thermal effluent limitations consistent with 33 U.S.C. § 1326(a), 35 Ill. Adm. Code 304.141(c), and 35 Ill. Adm. Code 106.Subpart K, effective today subject to the conditions in the order below.

This opinion constitutes the Board's findings of fact and conclusions of law.

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 from Marathon Petroleum Company LP's Robinson Creek Refinery's (Marathon) Outfall 001 to Robinson Creek:

1. Temperature

   a. Instead of thermal effluent limitations based on the temperature water quality standards in 35 Ill. Adm. Code 302.211(e), the following daily maximum temperature effluent limitations apply:

Month	Daily Maximum Temperature (°F)	Daily Maximum Temperature (°C)
January	65	18.3
February	65	18.3
March	74	23.3
April	82	27.8
May	88	31.1
June	90	32.2
July	90	32.2
August	90	32.2
September	90	32.2
October	87	30.6
November	85	29.4
December	74	23.2

   b. Instead of the water temperature requirements of 35 Ill. Adm. Code 302.211(d) and (e), the effluent temperatures must not exceed the daily maximum temperature limitations in paragraph (1)(a) during more than 1% of the hours (87.6 hours) in the 12-month period ending with any month. Moreover, the effluent temperature must never exceed the daily maximum limitations in paragraph 1(a) by more than 3°F (1.7°C).

   c. The average water temperature for the period starting from June 16 and ending on September 15 must not exceed 87°F (30.6°C).

   d. For purposes of paragraph (1), Robinson Creek temperatures are temperatures of those portions of the creek essentially similar to and following the same thermal regimes as the temperature of the main flow of the creek

2. Mixing Zone. The alternative thermal effluent limitations in paragraphs (1)(a), (1)(b), and (1)(c) apply at the edge of the mixing zone that extends from Marathon Outfall 001 to monitoring location located at a point instream either at the IL Route 1 bridge or upstream and near the IL Route 1 bridge.

3. Zone of Passage. Instead of 35 Ill. Adm. Code 302.102(b)(8), the mixing zone identified in paragraph (2) may include the entire cross-sectional area and volume of flow of the Robinson Creek.

4. Marathon must seek an Incidental Take Authorization with the Illinois Department of Natural Resources (IDNR) by filing a Conservation Plan for the Bigeye Chub by October 7, 2022, six months from the date of this order.

5. Marathon must conduct a study as suggested by the IDNR in its July 7, 2020 response to the Board's questions (see 7/7/20 IDNR Rep., Attach C) to determine whether Marathon's thermal discharge is causing an increased incidence of deformities, eroded fins, lesions and tumors (DELTs) in the representative important species, including the Bigeye Chub in Robinson Creek. This study must be completed by April 7, 2023, twelve months from the date of this order and submitted to the Illinois Environmental Protection Agency (IEPA), the Illinois Department of Natural Resources (IDNR) and the Board.

6. The IEPA must expeditiously modify Marathon's NPDES permit for the Robinson Creek Refinery so that it is consistent with this opinion and order.

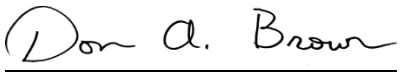
IT IS SO ORDERED.

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) (2020); *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.

Names and Addresses for Receiving Service of Any Petition for Review Filed with the Appellate Court	
Parties	**Board**
Marathon Petroleum Company, LLC Attn: Melissa S. Brown; HeplerBroom LLC 4340 Acer Grove Drive	Illinois Pollution Control Board Attn: Don A. Brown, Clerk James R. Thompson Center

Springfield, Illinois 62711 Melissa.Brown@heplerbroom.com	100 West Randolph Street, Suite 11-500 Chicago, Illinois 60601
Illinois Environmental Protection Agency Attn: Sara G. Terranova, Asst. Counsel 1021 N. Grand Ave. E. PO Box 19276 Springfield, Illinois 62794-9276	

I, Don A. Brown, Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above opinion and order on April 7, 2022, by a vote of 5-0.



Don A. Brown, Clerk
Illinois Pollution Control Board